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The North-South Divide, the Euro and the World

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Abstract

The European north-south divide has been an issue of a long-standing debate. We employ a Global VAR model for 28 developed and developing countries to examine the interaction between the global trade imbalances and their impact within the euro-area framework. The aim is to assess the propagation mechanisms of real shocks, focusing on the interconnections among the north euro area and the south euro area. We incorporate theory-based long-run over-identifying restrictions and examine the effects of (i) non-export real output shocks, (ii) expansionary shocks and (iii) real exchange rate shocks. An expansionary policy of the north euro area and increased competitiveness in the south euro area could alleviate trade imbalances of the debtor euro area economies. From the south euro area perspective, internal devaluation decreases output but at the same time, it also reduces current account deficits. North euro area origin shocks to domestic output exert a dominant influence in the rest of the Europe and Asia.

1 Introduction

"And if a house be divided against itself, that house cannot stand."
— Mark 3:25 New Testament

The global financial crisis of 2008 and the subsequent recession (accompanied by the collapse of the global trade activity[1]) revived questions about the adopted economic policies and their macroeconomic implications. With the debate still open, trade imbalances have been suggested as a contributor to the global financial crisis. An intuitive view is that current account surpluses of emerging economies supported deficit countries which, in turn, fuelled the risk-taking behaviour of advanced economies, thereby showing the seeds of the inter-

[1] The global financial crisis of 2008 has been followed by an unprecedented slowdown in world trade. In fact, imports and exports in major economies dropped more than 20% from 2008Q2 to 2009Q2 (see https://voxeu.org/article/great-trade-collapse-what-caused-it-and-what-does-it-mean for more details). Among the vast literature on the subject, Baldwin and Taglioni [2] trace the causes of the reduction in world trade to the decreased world demand, while Ahn et al. [1] point out the contribution of financial factors to the phenomenon.

national financial crisis (see Obstfeld and Rogoff [52]).[2] In this context, it is important to investigate the sources and the patterns of these disparities in the trade relationships. In the European context, this theme is reflected in the disparities between the north and the south euro area; the former with an export-oriented economy and the latter depending more on domestic demand.[3]

On the one hand, North Euro-Area (NEA) countries such as Germany, Austria, Finland, Netherlands and Belgium have organised coordinated market economies which are built on institutions and policies that promote the Export-Led-Growth (ELG) policies.[4] Northern euro-zone economies tend to benefit from a high production of exported goods which leads to increased savings and external lending. On the other, South Euro-Area (SEA) economies like Italy, Spain, Greece and Portugal, rely more on increased domestic consumption as a mechanism of economic growth. This divergence of the two growth models and the adjunct asymmetries that emerge has been pointed as the main source of the lingering recovery in the euro-zone (see Regan [58]). The heterogeneous economic structures led to cumulative disparities of the euro area. Since the inception of the Economic and Monetary Union (EMU) in 1999, SEA current account deficits (on average 4.6 % of GDP) are mirrored to the NEA surpluses (on average 3.4 % of GDP, see Figure 1).[5]

The existence of the Economic and Monetary Union (EMU) has made it difficult for the two growth paradigms to co-exist without the formation of trade imbalances. Two complementary points could explain the co-existence of these countervailing policies and the subsequent trade imbalances in the euro area. First, the "over-optimism"in the SEA was driving strong growth in domestic demand and an appreciation of the real exchange rate. Second, financial integration and the expectation of convergence within the euro area has helped to finance the current account deficits in the SEA. There is a vivid discussion on the policy front that favours an expansionary policy of the NEA through the channel of real imports to stimulate real exports and economic recovery in the SEA and accelerate the current account adjustment. For example, the US Treasury [62] argues that Germany's huge current account surplus is harmful, creating "a deflationary bias for the euro area, as well as for the world economy". Furthermore, Krugman [49] claimed that "The narrowing of trade imbalances should have been symmetric, with Germany's surpluses shrinking along with the debtors'deficits". What made this possible in a monetary union was the devaluation of German Real Effective Exchange Rate (REER) through the decline of Unit Labour Cost (ULC).[6] The counter-argument raised by Jaumotte and Sodsriwiboon [43] suggests a menu of policy options for the confrontation of European trade imbalances such as fiscal policies that aim to increased government savings, internal devaluation through a reduction of unit

[2]Borio and Disyatat [9], by looking at gross instead of net capital flows and the silent trends in international banking system, show that the link between the financial crisis and current account imbalances was rather weak.

[3]The Financial Times on the 20th of August 2018 report that "Germany is on course to have the world's largest current account surplus for the third year in a row a situation likely to put more international pressure on Berlin to re-balance its economy" and "Berlin has also argued that Germany's ageing population prefers to save significant amounts of income rather than spending it on imported goods", see https://www.ft.com/content/07610a3a-a492-11e8-926a-7342fe5e173f.

[4]The most prominent effects of exports are increased productivity, benefits from economies of scale, greater utilisation of resources and expanded aggregate demand. Furthermore, the export sector of the economy can create positive externalities to the non-export sector of the economy (Feder [29]). However, a neglected factor of the ELGH is the constructive effect of imports on growth, also known as the import-led growth hypothesis (ILGH).

[5]See also Figure A.1 in Appendix.

[6]The IMF showed that the German REER was devalued by 10-20 % while ULC fell by 16%. For more details see https://www.economist.com/briefing/2017/07/08/the-good-and-bad-in-germanys-economic-model-are-strongly-linked.

labor cost, increased productivity and tightening financial policies to curb credit and improve the quality of loans.

The aim of our study is to evaluate the view that an expansionary policy from NEA accompanied by an improvement of competitiveness of SEA could potentially accelerate current account adjustment in euro area and alleviate the observed trade imbalances. We do so by simulating numerous scenarios based on the Generalized Impulse Response Functions (GIRFs) as proposed by Koop et al. [48] and developed further by Pesaran and Shin [53]. We examine the regional trade interdependencies between the NEA countries, the SEA countries, USA and the rest of the world by implementing the Global VAR (GVAR) framework proposed by Pesaran et al. [56] and developed further by Dees et al. [26]. This approach enables us to simultaneously assess the global nature of the macroeconomic factors and inter-linkages of the different regions under consideration.[7, 8] Note that the multi-country dimension of the problem has been overlooked by existing studies. For example, papers such as Chinn and Prasad [19] used panel regression where the countries included in their analysis were treated as independent units, ignoring any dynamic or static interdependence.

This study deviates from the existing literature in two ways. First, we consider the implications of the export-led growth model and impose long-run restrictions that correspond to the distinct features of each country/region. The latter allows us to identify "equilibrium" relationships and extract shocks that consolidate the theory.[9] Second, we divide the euro area into two different regions and assess the linkages and transmission of shocks between the NEA and SEA, within a global framework. There is a gap in the literature concerning trade imbalances between the northern and the southern euro area and this study attempts to fill it. Our focus is on the spillover effects that shocks, emanating from northern and southern euro area, have on domestic output, trade and competitiveness.

First, we evaluate the impact of a positive output shock proxied by an increase of non-export real output shock to the NEA on the SEA macroeconomic variables.[10] The aim is to investigate the view that a growth shock in NEA can be used as a tool to eliminate trade imbalances between NEA and SEA. Second, we investigate the effects of a positive shock to real imports both of the NEA and the SEA. We treat import shocks as a complementary positive demand shock, which can not be captured by output shocks due to the low values of the intertemporal rate and the elasticity of substitution effects between domestic and foreign goods. In a third scenario, we simulate the response of the global economy to a real exchange rate depreciation of the SEA. In doing so, we can assess the view that global imbalances in general and in the euro area specifically were associated with the appreciation of the real exchange rate in the SEA. Note that the implications of all three scenarios are consistent with the view that expansionary policy from NEA accompanied by improvements of competitiveness in the SEA can accelerate current account imbalances in the euro area.

The analysis is conducted using quarterly data from 1980 until the end of 2016 for a

[7] Applications of the GVAR methodology can be found in the areas of international financial spillovers (Galesi and Sgherri [32]), macroeconomic modelling (Dees et al. [25]; Pesaran and Smith [55]) and assessment of the global trade linkages and imbalances (Bussière et al. [13]; Greenwood-Nimmo et al. [38]; Bettendorf and León-Ledesma [8]; Bettendorf [7]), among others. Pesaran [54] provides a detailed review of the empirical GVAR applications.

[8] Alternatives to the GVAR modelling approach are the Factor Augmented VAR (FAVAR) or the Panel VAR (PVAR) models. However, while in the former model is difficult to identify the unobserved factors, the latter approach in certain cases becomes operational by imposing restrictions on Dynamic, Static Interdependences (DI) and on cross-sectional heterogeneity. For further details see Pesaran [54] and Canova and Ciccarelli [14].

[9] Garratt et al. [33] show that, in the context of macroeconometric modelling, there is a broad consensus concerning the nature of long-run restrictions.

[10] We assume that output shock can be either demand or supply driven.

multi-country framework that consists of 28 developed and developing economies. The results of the GVAR model support the argument that current account adjustment in the euro-zone should be symmetric. Although positive demand shocks, in both regions, have positive effects on exports and investment, current accounts deteriorate or at best remain stable. However, there is evidence that a devaluation of the real effective exchange rate in the SEA leads to an increase in exports without affecting imports. Our results support the argument that demand shocks in NEA accompanied by an improvement in the competitiveness of SEA could help the adjustment of trade imbalances within the euro-zone. Finally, we assess the global impact of the previous shocks with a particular focus on the spillovers effects from the NEA and SEA to the rest of the world.

The paper is structured as follows: Section 2 outlines the empirical literature on trade models, imbalances and the theoretical background. Section 3 presents the GVAR model and section 4 contains the model specification and estimation. Section 5 discusses the empirical results, while the last one concludes.

2 Global Trade Imbalances: A Brief Discussion of the Literature

The variations of external positions in the major economies, particularly after the 2000s, have set the premises for the formation of global trade imbalances. Although the latter has a wider meaning, it is common to associate excess current account deficits/surpluses with the distortions in the global financial and macroeconomic system. Global current account imbalances can be traced historically and some of them still persist to the present (Belke and Schnabl [5]). In this context, the persistent current account deficits of the USA and other developed economies are accompanied with current account surpluses in China, oil-exporting countries and many East Asian countries (Hong Kong, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand). The backdrop is similar in the case of the EMU; northern euro area countries have seen a significant melioration in their external trade position whereas southern euro area countries support their current account deficits through external borrowing.[11] This section attempts to highlight briefly the determinants of such divergence in global trade.[12]

An abundance of factors is related to the rise in external imbalances; Bracke et al. [11] separate the determinants of global imbalances into structural and cyclical. The former factors mainly focus on the impact of financial market imperfections on the magnitude and direction of capital flows at a global level. Bracke et al. [11] argue that if the global imbalances are mainly driven by structural factors, a rapid unwinding is rather unlikely to occur. Alternatively, cyclical or "macroeconomic policy-induced" factors have fired trade imbalances. In particular, if economic agents question the sustainability of macroeconomic policies then an overreaction might unfold global economic imbalances. Therefore, one of the objectives of our analysis is to gauge the impact of cyclical factors on trade imbalances.

Bracke et al. [11] separate cyclical factors into two groups: i) those factors that have a cyclical impact on private aggregate demand such as an increase of permanent income and of financial wealth and ii) those factors affecting the demand of public sector. The literature

[11]For a better illustration of the global imbalances' formation over the last 20 years, see also Figure A.1 in Appendix.

[12]For a thorough discussion of the relevant literature on trade imbalances see Bracke et al. [11].

concerning the first set of factors indicates that there is a positive but rather weak correlation between private consumption and current account.[13] An ample literature of the factors affecting public aggregate demand focus on explaining the "twin deficit" or "twin divergence hypothesis".[14] Most of the studies which investigate the impact of fiscal policy on current account argue that there is a negative but moderate effect of fiscal deficit on the trade balance. For example, Chinn and Prasad [19], Gruber and Kamin [40] and Bussière et al. [12] found very low response of trade balance to fiscal deficit. However, Kim and Roubini [46] provide significant evidence of a positive relationship between the fiscal deficit and trade balance known as the "twin divergence" hypothesis. In contrast to the prediction of most theoretical models, Kim and Roubini [46] show that a fiscal policy shock improves the current account and depreciate the real exchange rate. They explain that a boost in government spending will increase the real interest rate which in turn will reduce consumption and will lead to the depreciation of the exchange rate. Note that an increase of the real interest rate will raise savings and reduce investments. In doing so, an expansionary fiscal policy can improve the current account.

Although the argument of Kim and Roubini [46] can explain the "twin divergence" hypothesis in the US, this might not be consistent with the empirical evidence for the euro area.[15] For example, Chen et al. [18] show that the key adjustment mechanism of the euro area debtor countries was not operating. In particular, while trade deficits in debtors required a depreciation of the real exchange rate, the euro nominal exchange rate led to further real appreciation which, in turn, deteriorated export performance.[16, 17] Furthermore, Chen et al. [18] point that euro area current account imbalances depict the asymmetric response of the member countries to foreign (from a euro area perspective) trade shocks, possibly due to variations in foreign income export elasticities. Alternatively, Jaumotte and Sodsriwiboon [43] underline the role of decreased private savings in the SEA countries as a driver for the trade imbalance in the euro area. Utilising current account regressions, they link declined current accounts with the financial liberalisation of the EMU that depressed saving rates and funded less productive sectors.[18] Jaumotte and Sodsriwiboon [43] suggest a menu of policy options for the confrontation of European trade imbalances such as fiscal policies that aim to increased government savings, internal devaluation through a reduction of unit labour cost, increase productivity and tightening financial policies to curb credit and improve the quality of loans.[19]

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[13] Note that an increase of private consumption can be driven by productivity shocks which increase permanent income and by a rise of financial wealth as reflected by an increase of assets prices. Glick and Rogoff [36] show that a 1% increase in productivity in the US decrease the current account by 0.15%. Furthermore, Bussière et al. [12] have shown that a 10% increase in equity wealth in the US could deteriorate the trade balance by 1%.

[14] The "twin deficit" argument postulates that the fiscal deficit is the main force that generates current account deficit.

[15] The majority of the literature has focused on the imbalances originating from the U.S. and the relationship between U.S. external position and Asian surpluses. Interestingly, some studies attempt to assess the intra-eurozone imbalances and the structural gaps between core euro-zone economies and the periphery.

[16] Chen et al. [18] document that while the relative price movement within the euro-zone contributes to the appreciation of the real exchange rate of the debtor countries, the lion share of the appreciation between 2000 and 2009 was accounted for by the nominal appreciation of the euro vis-a-vis other countries.

[17] Chen et al. [18] also show that the external deficit of the euro-zone debtor countries was financed by capital flows from the core euro area countries such as Germany and France leading to weaker real exchange rate adjustment mechanisms.

[18] Jaumotte and Sodsriwiboon [43] claim that the introduction of the euro lowered current accounts in both NEA and SEA through the maintenance of high levels of investment.

[19] The appealing properties of a decreased real exchange rate in the debtor countries of the euro-zone are also highlighted by Belke and Dreger [4].

3 Econometric Methodology

The global financial crisis has illustrated that the linkages among economies have become increasingly complex. It is imperative, for the methodology employed, to account for the global interactions of macroeconomic factors. A fundamental problem of global macroeconomic models is the curse of dimensionality, which arises when the number of variables is large compared to the time dimension. To overcome the curse of dimensionality Pesaran et al. [56] (PSW hereafter) developed a global VAR for the analysis of global interdependencies and the propagation of shocks across the world economy. The GVAR methodology consists of two steps. In the first, country-specific VARX* models are estimated, which account for the outside economy via the cross-section average of foreign variables known as the "star" variables.[20] In the second step, the estimated country-specific VARX*s are stacked in a GVAR.[21]

There are also alternative approaches for modelling a large number of variables such as FAVAR, PVAR and large Bayesian VAR. Factor models have been used as data shrinkage procedures, which summarise the information of a large number of variables in a small number of selected factors. However, the economic interpretation of the extracted factors is a rather difficult task.[22] Alternatively, PVARs or large-scale Bayesian VARs solve the problem of dimensionality by restricting the parameter space. In particular, the PVAR imposes restrictions on the dynamic and static interdependence and on the cross-sectional homogeneity. [23] Even though the GVAR model provides a coherent framework to model the global economy and to assess both global shocks and shocks that emanate from a specific country, to the best of our knowledge there are only three papers that apply GVAR to the issue of international trade and global imbalances, namely Greenwood-Nimmo et al. [38], Bussière et al. [13] (BCS hereafter) and Bettendorf [7].[24], [25], [26]

Their results can incite the discussion regarding the determinants of the underlying trade imbalances at a European level. In this respect, particular focus shall be given to the dynamics observed between NEA and SEA countries, focusing also on an international perspective. The global dynamics of international trade relationships and patterns can be fully utilised un-

[20]Dees et al. [26] (DdPS hereafter) motivate the GVAR approach as an approximation to the global factor model. DdPS use the cross-sectional average of the foreign variables to reflect the unobserved common factors of the global economy. Chudik and Pesaran [21] motivate the GVAR approach as an approximation to a large system where all variables are determined endogenously. Note that the foreign variables were assumed to be weakly exogenous.

[21]The GVAR has been widely applied in many fields such as global financial spillovers (PSW; Galesi and Sgherri [32]; Chudik and Fratzscher [20]; Favero [28]), international transmission of macroeconomic shocks and global business cycles (DdPS; Eickmeier and Ng [27]; Garratt et al. [34]), global inflation linkages (Galesi and Lombardi [31]), forecasting of economic and financial variables (Pesaran et al. [57]) and common fiscal policies assessment in the EU (Hebous and Zimmermann [41]; Ricci-Risquete and Ramajo-Hernández [60]).

[22]Unlike the FAVAR, the GVAR models allow for country-specific dynamic explicitly and account for cointegration relationships.

[23]Canova and Ciccarelli [14] show that a PVAR shrinks the parameter space by assuming that the unknown parameters can be decomposed into a component that is common across cross-sectional units, across all variables, a variable specific component, lag specific component and idiosyncratic effects.

[24]Greenwood-Nimmo et al. [38] benefit from a larger set of data with 33 countries (26 regions) and conduct several probabilistic forecasting exercises with a particular focus on the USA, China, the euro area and Japan based on the model of DdPS.

[25]BSC point that a positive shock to the output of US leads to increased output and exports in almost all the countries, while also they highlight the importance of the German economy in the European business cycles.

[26]Bettendorf [7] investigates the impact of a German wage moderation shock on the European current account imbalances and concludes that German labour market reforms cannot be the lone driver of the European trade imbalances.

der the GVAR framework, as described in the following sections.

3.1 The Global VAR Modelling

We consider a world that consists of N countries, indexed by $i = 0,\dots,N-1$ where $i = 0$ stands for the numeraire country (USA in our case). We assume that x_{it} is a $k_i \times 1$ vector of country-specific endogenous variables and $x^*_{it} = \sum_{j=1}^{N} w_{ij} x_{jt}$ is a $k^*_i \times 1$ vector of the country-specific foreign variables, where $w_{ij} \geq 0$ are the set of trade weights with $\sum_{j=1}^{N} w_{ij} = 1$ and $w_{ii} = 0$. Note that $w_{ij} \geq 0$ represents the share of country j to the total share of country i. The first step in the GVAR methodology is to specify and estimate the individual country-specific VARX*(p_i, q_i) models. We consider the case of VARX*(2, 1):

$$x_{it} = a_{i0} + a_{i1}t + \Phi_{i1}x_{i,t-1} + \Phi_{i2}x_{i,t-2} + \Lambda_{i0}x^*_{it} + \Lambda_{i1}x^*_{i,t-1} + \delta_{i0}\mathbf{d}_t + \delta_{i1}\mathbf{d}_{t-1} + u_{it} \qquad (1)$$

where Φ_{il} for $l = 1,2$ are $k_i \times k_i$ matrix of lagged coefficients and Λ_{i0} and Λ_{i1} are $k_i \times k^*_i$ matrices of the corresponding foreign variables coefficients.[27] Also, d_{it} is a $m_d \times 1$ vector of global variables (such as oil price), a_{i0} is a $k_i \times 1$ vector of intercept terms and a_{i1} is a $k_i \times 1$ vector of trend coefficients. The vector of country-specific shock is given by u_{it}, where $E(u_{it}u_{js}) = \Omega_{\mathbf{ij}}$ for $t = s$ and $E(u_{it}u_{js}) = \mathbf{0}$ for $t \neq s$. Equation (1) indicates that spillover effects across countries can occur through three distinct but interrelated channels: i) direct and lagged impact of $x^*_{\mathbf{it}}$ on x_{it}; ii) dependence of country-specific variables on common global exogenous variables (i.e. d_{it}); and iii) non-zero contemporaneous dependence of shocks via cross covariances Ω_{ij}. Equation (1) can be written as:

$$A_i z_{it} = B_{i1} z_{i,t-1} + B_{i2} z_{i,t-2} + \phi_{it} + u_{it} \qquad (2)$$

where $z_{i,t-1} = (x^{'}_{i,t-1}, x^{*'}_{i,t-1})^{'}$ is a $k_i + k^*_i$ dimensional vector, $A_i = (I_{ki}, -\Lambda_{i0})$, $B_{i1} = (\Phi_{i1}, \Lambda_{i1})$, $B_{i2} = (\Phi_{i2}, 0)$ and $\phi_{it} = a_{i0} + a_{i1}t + \delta_{i0}d_t + \delta_{i1}d_{t-1}$.

The second step of the GVAR model consist of staking the N country-specific VARX*(2,1) models in one global VAR. In particular, collecting all the country-specific variables in a $k \times 1$ vector $\tilde{x} = (x^{'}_{0t}, x^{'}_{1t}, \dots, x^{'}_{Nt})^{'}$ where $k = \sum_{i=0}^{N} k_i$ and using the $(k_i + k^*_i) \times k$ link matrices $W_i = [E^{'}_i, \widetilde{W}_i]$, where E_i and $\widetilde{W}_i$ are $k \times k_i$ and $k \times k^*_i$ dimensional selection matrices respectively, we can write:

$$z_{it} = \begin{pmatrix} x_{it} \\ x^*_{it} \end{pmatrix} = W_i \tilde{x}_t \; i = 0,\dots,N-1 \qquad (3)$$

Substituting (3) into (2) yields:

$$A_i W_i \tilde{x}_t = B_{i1} W_i \tilde{x}_{t-1} + B_{i2} W_i \tilde{x}_{t-2} + \phi_{it} + + u_{it} \qquad (4)$$

And by stacking each country-specific model in (4), we obtain the GVAR(2) model for all the endogenous variables x_t:

$$H\tilde{x}_t = F_1 \tilde{x}_{t-1} + F_2 \tilde{x}_{t-2} + \phi_t + u_t \qquad (5)$$

[27] Any further generalisation to different lags of domestic and foreign variables is straightforward.

where $H = \begin{pmatrix} A_0 W_0 \\ A_1 W_1 \\ \vdots \\ A_{N-1} W_{N-1} \end{pmatrix}$, $F_1 = \begin{pmatrix} B_{01} W_0 \\ B_{11} W_1 \\ \vdots \\ B_{(N-1)1} W_{N-1} \end{pmatrix}$, $F_2 = \begin{pmatrix} B_{02} W_0 \\ B_{12} W_1 \\ \vdots \\ B_{(N-1)2} W_{N-1} \end{pmatrix}$, $\phi_t = \begin{pmatrix} \phi_{0t} \\ \phi_{1t} \\ \vdots \\ \phi_{(N-1)t} \end{pmatrix}$

and $u_t = \begin{pmatrix} u_{0t} \\ u_{1t} \\ \vdots \\ u_{(N-1)t} \end{pmatrix}$.

The reduced form of the GVAR(2) solution is obtained from:

$$\tilde{x}_t = G_1 \tilde{x}_{t-1} + G_2 \tilde{x}_{t-2} + \tilde{\phi}_t + \widetilde{u}_t \tag{6}$$

where $G_1 = H^{-1} F_1$, $G_2 = H^{-1} F_2$, $\tilde{\phi}_t = H^{-1} \phi_t$ and $\widetilde{u}_t = H^{-1} u_t$. The GVAR model (6) is solved recursively and used for the impulse response function analysis.

4 Data and Model Specification

The employed dataset is of vital importance for this study. We do not consider countries with data that are unavailable, unreliable or have a short time span. Our analysis consists of quarterly data from 1980Q1 to 2016Q4 (148 observations in total) for 28 developed and developing countries. In line with our objectives and theoretical framework, we group the euro area countries into two sub-regions: NEA (Austria, Belgium, Finland, Germany and the Netherlands) and SEA, (Greece, Italy, Portugal and Spain). There are a number of reasons to justify this. For example, the SEA has experienced higher inflation, unemployment rates and government debt than the NEA. Another distinction emerges from the current account imbalances between the NEA and SEA economies. We choose not to include France and Ireland to any of the above regions as there is no clear evidence for their insertion in one or another sub-region (they are included in the GVAR model as separate entities though).[28] All the remaining countries are treated as independent entities. Thus, the constructed GVAR model consists of 21 entities (see Table 1). These countries/regions cover on average 80% of the nominal world GDP over the last five years. In comparison to the work of BCS, we broaden the sample of countries included in the analysis (28 countries relative to 21 in BCS) and extend the sample with 9 additional years. Furthermore, we increase the number of endogenous variables in the GVAR model to five as we extend the set of exports, imports, output and real exchange rate in the BCS analysis with the gross capital formation.

In particular, we construct a country-specific VARX* including 5 endogenous variables; domestic output (ny_{it}), gross capital formation (gcf_{it}), exports (ex_{it}), imports (im_{it}) and the real effective exchange rate ($reer_{it}$). Domestic output for country i is proxied by the difference between the real GDP and the real exports of goods and services at time t. We also include the real oil price as an exogenous global variable ($poil_t$).[29] In addition to the 5 endogenous variables, we consider three foreign variables ($ny^*_{it}, gcf^*_{it}, reer^*_{it}$). We exclude foreign variables of exports ex^*_{it} and imports im^*_{it} from the individual models due to the pos-

[28] See also Gros [39] who argues that France "exhibits a mixed feature, surplus over the period 2000-2005 and deficit afterwards".

[29] All variables are referring to natural logarithms of real values and are seasonally adjusted.

sibility of collinearity.[30, 31] Therefore, the vectors of country specific domestic and foreign variables are:[32, 33]

$$x_{it} = (ny_{it}, gcf_{it}, ex_{it}, im_{it}, reer_{it})' \text{ for } i = 1, \ldots, N-1 \text{ and}$$

$$x^*_{it} = (ny^*_{it}, gcf^*_{it}, reer^*_{it}, poil_t)' \text{ for } i = 1, \ldots, N-1$$

For the case of the USA (where $i = 0$), we follow Dees et al. [26] and treat the oil price as an endogenous variable. Thus, the USA vectors of domestic and foreign variables are:

$$x_{0t} = (ny_{0t}, gcf_{0t}, ex_{0t}, im_{0t}, reer_{0t}, poil_t)' \text{ and}$$

$$x^*_{0t} = (ny^*_{0t}, gcf^*_{0t}, reer^*_{0t})$$

To construct the foreign variables, we used fixed trade weights that correspond, for each country in the sample, to the trade shares of foreign countries in total export and imports over the period 2012-2016.[34, 35] The regional variables of the NEA and SEA were constructed using a weighted average scheme for each individual country. Following the relevant strand of the literature, we employ average PPP-GDP weights over the period 2012-2016.

4.1 Long-Run Over-identifying Relationships in the GVAR analysis

We adopt the approach of Garratt et al. [33] and allow the short-run dynamics to be estimated flexibly within a VARX framework, while also we impose theory-consistent long-run restrictions. This will enable us to develop a model with theoretically coherent foundation, in the otherwise unrestricted country-specific models. Garratt et al. [33] argue that economic theory is typically more informative about the long-run relationships than it is on the short-run period.[36] Garratt et al. [33] also argue that there is a degree of consensus regarding the long-run properties of macroeconomic models whether they have been developed within the Simultaneous Equation Models (SEMs), structural VAR or the DSGE approaches. Alternatively, there is less agreement on how to model short-run dynamic adjustment. Based on the

[30] As Greenwood-Nimmo et al. [38] point out, the assumption of weak-exogeneity between the foreign trade variables and the domestic endogenous trade variables can not be sustained in a model that takes into account the majority of the world trade, as $ex_{it} = im^*_{it}$ and vice-versa.

[31] For a detailed description of the data sources see Table A.1 in the Appendix.

[32] The estimation and dynamic analysis of the GVAR model is conducted using the GVAR toolbox 2.0 created by Smith and Galesi [61].

[33] Due to data unavailability, we exclude from the VARX* model the real gross capital formation of China as an endogenous variable. Therefore, the corresponding domestic variables vector for China is: $x_{it} = (ny_{it}, ex_{it}, im_{it}, reer_{it})'$.

[34] Although the choice of weights for the construction of foreign variables is a subject of discussion, Forbes and Chinn [30] argue that bilateral trade is one of the most important determinants of the linkages among countries. Moreover, PSW point out that trade weights show the extent that one country/region is linked to another. We utilise a 21×21 trade weights link matrix using bilateral trade, based on data from the Direction of Trade Statistics. Table 2 reports the trade weight matrix for the countries/regions of major interest.

[35] The model has been estimated using also time-varying trade weights, covering the entire sample period (1980 - 2016) and allowing the weights to change in a rolling window of five years. The estimated parameters of the model, as well as the results of the dynamic analysis were similar to those when employing fixed trade weights. In order to maintain the model as much parsimonious as possible, we selected the latter case.

[36] This is because economic theory is frequently silent concerning the sequence of economic decisions, the structure of information sets across agents and the nature of rigidities that arise from transaction costs.

GVAR literature, we estimate a VECMX* representation of the following equation:

$$\begin{aligned}\Delta x_{it} &= c_{i0} - \alpha_i \beta_i^{'}[z_{i,t-1} - \mu_i d_{i,t-1} - \gamma_i (t-1)] \\ &+ \Gamma_i \Delta x_{i,t-1} + \Lambda_i \Delta x_{it}^{*} + \delta_{i0}^{*} \Delta d_t + \delta_{i1}^{*} \Delta d_{t-1} + u_{it}\end{aligned} \tag{7}$$

where α_i is a $k_i \times r_i$ matrix of rank r_i and $\beta_i = (\beta_{ix}^{'}, \beta_{ix^*}^{'}, \beta_{id}^{'})^{'}$ is a $(k_i + k_i^* + m_d) \times r_i$ matrix of rank r_i. The country-specific VECMX* in (7) allows for cointegration between domestic and foreign variables. The identification of the long-run equilibrium is not trivial because there are many linear combinations of the cointegrating vectors that are observationally equivalent and link the level of domestic output (GDP net of exports) with the levels of capital, exports and imports of goods and services, and the REER in an economy.[37]

Hence, we consider among our variables several suitable long-run relationships. To start, assuming a Cobb-Douglas production function that depends on imported goods and exports, we can show that domestic output net of export is given by:

$$ny_{it} = c_{it} + c_{1i} gcf_{it} + c_{2i} ex_{it} + c_{3i} im_{it} \tag{8}$$

We consider equation (8) as a long run representation of the ELGH theory. This suggests that the volumes of domestic output, capital, exports and imports would cointegrate. If there is no evidence that equation (8) holds in an entity of our model, we also consider the "enhanced" trade equations as they suggested by BCS. The "enhanced" trade equations allow for cointegration among exports and imports along with the traditional demand and price variables. Finally, we test for cointegration between the volumes of exports and imports for each country. The following table summarises the long-run relationships considered in our GVAR analysis.

The Long-Run Relationships in the GVAR Analysis

Export-Led-Growth Hypothesis		$ny_{it} - c_{1i} k_{it} - c_{2i} ex_{it} - c_{3i} im_{it} \sim I(0)$
"Enhanced" Trade Equations	Exports Equation	$ex_{it} - a_{1i} im_{it} - a_{2i} ny_{it}^{*} - a_{3i} reer_{it} \sim I(0)$
	Imports Equation	$im_{it} - \beta_{1i} ex_{it} - \beta_{2i} ny_{it} - \beta_{3i} reer_{it} \sim I(0)$
Stationarity of the Trade Balance		$ex_{it} - im_{it} \sim I(0)$

4.1.1 Modelling Strategy of the country-specific VARX* models

We estimate an unrestricted VARX*(p_i, q_i) by selecting the lag order of the domestic variables p_i based on the Akaike information criterion with $p_{(i,max)} = 2$. Due to data limitations, we include one lag for the foreign variables where $q_i = 1$. Table 3 presents the unrestricted estimation of the country-specific VARX* models, including the number of cointegrating relationships, the number of selected lags, as well as the set of endogenous and exogenous variables that employed in each model.

It is worth noting that possible misspecification of the cointegrating vectors will have implications for the stability of GVAR, the behaviour of impulse response functions and the shape of the persistence profiles. Here, we follow a quite similar modelling strategy as

[37]Note that we can choose any non-singular $r \times r$ matrix Q such as $\alpha_i \beta_i^{'} = \alpha_i Q^{-'} Q \beta' = \alpha_i^* \beta_i^{*'}$. The new coefficient matrices α_i^* and $\beta_i^{*'}$ are observationally equivalent to $\alpha_i \beta_i^{'}$ respectively.

suggested by BCS, given that the estimation of the long-run cointegrating vectors is very sensitive to the number of selected lags. To be concrete, our estimation strategy includes four steps. First, we estimate an unrestricted VAR including both country specific and foreign variables. However, because the number of cointegrating vectors might be sensitive to the number of lags, in the second step, we estimate a smaller-scale (i.e four variables) VARs.[38] If the number of cointegrating vectors remains unchanged then, in the third step, a cointegrating vector from the small-scale model was imposed only if the estimated coefficients satisfy the theory-based restrictions. We test for all four theory-based restrictions.[39] Note that we impose only the restrictions which are consistent with our priors, ensuring that the number of cointegrating vectors in the VARX* models is equal to the number of long-run restrictions imposed.[40] In the final step, the theory-based long-run relations were imposed in the in the country-specific VARX*. Modification of the existing long-run relationships could potentially lead to different results. Therefore, a series of tests for the validity of the implied overidentifying restrictions were also implemented The tests of overidentifying restrictions were based on a likelihood-ratio test using bootstrapped critical values at the 1% significance level. Finally, we impose only the long-run relations that satisfy the likelihood-ratio test and at the same time exhibit satisfying Persistence Profiles (PPs)[41], impulse responses and stability of the estimated coefficients. The estimated (theory-based) cointegrating vectors were then imposed in the full country-specific VARX*. Tests for the validity of the implied overidentifying restrictions were also implemented in the latter.

Table 4 presents the final choice for the number of the estimated cointegrating vectors of our model, the long run relationships which are imposed in the GVAR analysis, as well as the likelihood-ratio test results. We observe that all the imposed overidentifying restrictions hold as the null hypothesis can not be rejected.[42] Table 4 also shows that for the cases of NEA and France cointegrating vectors provide evidence of export-oriented growth strategy pursued by these countries. The estimated cointegrating vectors for the SEA and the UK satisfy the import equation. Finally, there is evidence that the export equation and the trade balance are stationary for the USA and China respectively.[43]

4.2 The Impact Elasticities between the Domestic and the Foreign Variables of the Model

An informative aspect of our analysis is the contemporaneous effects of the foreign variables on their domestic counterparts, which can be interpreted as the impact elasticities of the former variables to the latter. These are derived from the country-specific VECMX* estimations. High impact elasticities would reflect the connectedness of the global economy and the

[38] In order to estimate the corresponding long run unrestricted coefficients of the cointegrating relationships, we employed smaller scale VAR(q) models, separately for each of the 21 entities of the model.

[39] In particular, we impose and estimate the appropriate long-run restrictions in smaller scale VAR(q) models in order to retrieve the long run unrestricted values of the $c_{1i}, c_{2i}, c_{3i}, a_{1i}, a_{2i}, a_{3i}, \beta_{1i}, \beta_{2i}$ and β_{3i} parameters, as previously described based on the long run relationships that our analysis takes into account.

[40] For example, for the NEA, there was only one cointegrating vector but the estimated coefficients were consistent both with ELGH and the "enchanced" import equation. We decide to impose the former relationship because there is a consensus that the NEA countries pursued an export-led growth model.

[41] See Figure A.2 in the Appendix.

[42] In general, we include overidentifying restrictions for 15 of the 21 entities of our model. For the countries that we could not establish a long-run relationship (Brazil, Japan, Mexico, South Africa, Sweden, Switzerland), we imposed the cointegrating vectors that suggested by the unrestricted VARX* models, as illustrated in Table 3.

[43] The implementation of the GVAR analysis requires tests for unit root, structural breaks, pairwise correlation and test for weak exogeneity. All these tests are presented and discussed in the Appendix.

interdependence of the domestic variables across countries. Table 5 presents the impact elasticities between domestic and foreign variables along with the associated heteroscedasticity consistent Newey and West *t*-ratio's.

Most of the impact elasticities are high in magnitude and statistically significant. For example, we observed that in most countries/regions, the elasticity of real net export output, as captured through the impact of ny_{it}^* on ny_{it}, is positive and significant. In particular, in SEA and China there is evidence that a 1% change in the foreign real net export output (i.e. ny_{it}^*) is linked with positive and statistically significant effects by 0.28% and 0.29% respectively on their domestic counterparts (i.e. ny_{it}); UK and France will observe an impact increase in their domestic output by 0.36% and 0.17% respectively. Interestingly, the Korean domestic output has the greatest impact elasticity (1.42) which is aligned with the outward-oriented structure of the Korean economy. On the contrary, the non-export output in the US and the NEA is not affected by the foreign activity in a statistically significant manner.[44]

Table 5 also provides evidence that the impact elasticity of real effective exchange rate ($reer_{it}$ and $reer_{it}^*$) is negative and significant in export-oriented economies such as NEA, the UK, Japan and Ireland. This implies that a global appreciation is associated with a domestic depreciation of the exporting economies, which has positive effects on their competitiveness. When we examine the response of gross capital formation (gcf_{it} and gcf_{it}^*), we observe that in most of the countries it is positive and mainly significant, especially for the developed economies.[45]

5 Empirical Analysis

This section examines the dynamic behaviour of the estimated GVAR model. We focus on the global transmission mechanisms of real demand-side shocks and real expansionary shocks with a particular focus on the degree of regional interdependencies between NEA and SEA. We also assess the domestic and international effects of changes in real competitiveness based on different simulations of real effective exchange rate shocks. To investigate the dynamic properties of the model, we employ the GIRFs, as proposed by Koop et al. [48] and developed further by Pesaran and Shin [53]. We do so because of (i) the absence of strong prior information and (ii) the multi-country setting that includes 105 endogenous variables. These two factors make the identification of structural shocks in the underlying structural model particularly challenging.

Unlike the conventional orthogonalised impulse response functions, the GIRFs are order-invariant. Although they reflect the impact of a unit shock and not the impact of an unobserved structural shock, they can still provide useful information concerning the dynamic properties of the model.[46] Alternatively, we could impose either a recursive structure or sign restrictions on the endogenous variables of a core country-region assuming that shocks across countries are correlated.[47] Note that while recursive identification based on exclusion restrictions has been severely criticised as being atheoretical, the sign-identified VAR models

[44] This is consistent with the argument that the US is a relatively closed economy.

[45] Exception to this is capital elasticities for the Asian economies (Japan, Korea, India and Indonesia) which are negative, indicating a trade-off in the allocation of investments between the Western and the Asian economies.

[46] Indeed, in practice real demand, output and trade shocks are likely to be highly correlated across the different regions of the model. All shock responses refer to mean estimates of 2000 bootstrap replications along with the corresponding 90% error bounds.

[47] The former approach has been followed by Dees et al. [25], while the latter from Eickmeier and Ng [27] and Georgiadis [35].

are only set identified. In particular, there is a wide range of structural models that satisfy the identifying sign- restrictions.[48] It is clear that there is no consensus of which statistic to report about the identification of theory-consistent structural shocks. Therefore, we focus on the implication of GIRFs which provide useful information about the dynamic properties of country-specific shocks, which are assumed to be correlated across countries and regions. We also consider identification through Orthogonalised Impulse Response Functions (OIRFs) under the GVAR framework, as implemented by Dees et al. [26], in order to conduct a robustness check complementary to the GIRFs analysis. The results are qualitatively similar in the two approaches. For more information regarding the OIRFs analysis see subsection A.1 and Figure A.3 in the Appendix.[49]

We focus on the interaction of shocks emanated from the NEA and SEA respectively. In doing so, we also estimate a small-scale GVAR including only the two regions (i.e. NEA and SEA) and we test for exogeneity of the endogenous variables. Evidence of exogeneity will help to identify the spillover of shocks across the two regions.[50] Table A.3, in the Appendix, presents exogeneity test among the NEA and SEA variables. There is a strong evidence that when we estimate a GVAR including only NEA and SEA for the large majority of the cases, we can not reject the null of exogeneity. An exception to this is the capital formation which found to be endogenous in most cases. This implies that shocks across the two regions are exogenous while they are endogenous within regions.

In what follows, we examine the time profile of shocks to macroeconomic variables. In particular, we simulate the following scenarios: i) the impact of a positive non-export real output shock to the NEA on SEA variables; ii) the effects of a positive shock to real imports of both the NEA and the SEA; iii) the response of global economy to a real exchange rate depreciation shock of the SEA.

5.1 Positive Real Output shock to the NEA

Figure 2(a) illustrates the impact of a positive one standard-deviation shock to the non-export real output of the NEA. Both in the NEA and the SEA, there is a significant increase of output that remains positive, in the medium and the long-run.[51] In response to a positive output shock, investments in the NEA increase and current account deteriorates.[52] The counter-cyclical movement of the current account is consistent both with the traditional and modern theories of current account model. The traditional theories claim that an increase in output will increase demand for foreign goods and this worsens the current account. Modern theories argue that an increase of output might reflect a positive productivity shock which, in turn, will have a positive impact on investments.[53] Therefore, an increase of output driven by a positive and persistent productivity shock will increase investment and worsen the current account.[54] It is worth noting that the response of real exchange to output shock is not

[48] Kilian and Murphy [45] and Inoue and Kilian [42] argue that the posterior median response function can be very misleading about the most likely dynamic response in the sign-identified models. Inoue and Kilian [42] show that the most likely structural model can be computed by the model of the joint distribution of admissible models.

[49] The full set of results regarding the OIRFs analysis, is available upon request.

[50] Note that identification of individual shocks will still require sign or zero restrictions.

[51] On impact, output increases by 0.35% and 0.05% in NEA and SEA respectively.

[52] Note that investments are proxied by gross capital formation.

[53] Mendoza [50] shows that an increase of real interest rate is a likely response to a positive and persistent productivity shock.

[54] Current account is given by $CA = (Y + rB - T) - C - I + (T - G)$ or *CA = Private Saving - Investment - Budget Deficit*. Note that I denotes investment and private saving is the sum of GDP (i.e. Y) plus income on net foreign

significant. This might be due to the low elasticity of substitution between tradables goods of NEA and SEA. More formally, Corsetti et al. [24] show that under financial autarky the real exchange rate of tradable goods is given by:

$$RER = \frac{2\alpha_H - 1}{1 - 2\alpha_H(1-\omega)}(\widehat{Y_H} - \widehat{Y_F})$$

where $\widehat{Y_H}$ is domestic output, $\widehat{Y_F}$is the foreign output, α_H is the share of domestically produced goods in domestic consumption and ω is the elasticity of substitution between domestic and foreign tradables goods. For low values of ω, the relationship between RER and relative output can be negative or even equal to zero.[55]

There is also evidence that in the SEA, there is a deterioration of the trade balance as exports decline significantly while the response of imports is not statistically significant. King and Rebelo [47] show that productivity shocks will lead to an increase in the real interest rate and an appreciation of the real exchange rate which, in turn, will affect exports negatively. Furthermore, the response of investment is not significantly different from zero due to a significant appreciation of the real exchange rate. Note that an appreciation of the real exchange rate might reflect either an deterioration in terms of trade (i.e. a decline of foreign prices) or an increase in unit labour cost (ULC).[56,57] An appreciation of the real exchange rate driven by an increase of ULC might reflect capital misallocation in SEA. [58] This is consistent with evidence provided by Gopinath et al. [37] and Jaumotte and Sodsriwiboon [43]. However, Chen et al. [18] show that appreciation of the real exchange rate in the SEA is mainly due to an appreciation of the nominal exchange rate. In summary, a positive output shock in NEA has a negative impact on the trade balance of both NEA and SEA.

Figure 2(b) indicates the spillovers effects of a positive shock to the non-export real output of the NEA to the real output of the rest of the economies available in our sample. In general, there is a positive and significant response in European economies such as France, Switzerland and Sweden while non-export output in the USA respond in an insignificant manner. Finally, there is a noticeable positive impact on Asian economies including China, India and Japan.

5.2 Positive Expansionary shock to the NEA

Figure 3(a) depicts the impulse responses of NEA and SEA variables to a positive one-standard-deviation shock to the NEA real imports. There is evidence of a strong positive

assets (i.e. rB minus taxes and (i.e. T) and consumption (i.e. C) while budget deficit is the difference between government spending and taxes (i.e. G-T).

[55]In particular, for $\omega < \frac{2\alpha_H - 1}{2\alpha_H}$ the real exchange rate appreciates in response to a home positive supply shock.

[56]Chen et al. [18] show that we can decompose the real exchange rate into three components:

$$RER = \left(\frac{SP^{*NEAT}}{P^T}\right)^{\alpha\gamma}\left(\frac{P^{EA-T}}{P^T}\right)^{\gamma(1-\alpha)}\left(\frac{(SW^{NEA})^{\alpha}(W^{*EA})^{1-\alpha}}{W}\right)^{1-\gamma}$$

where S is the nominal exchange rate defined as domestic prices relative to foreign prices. Note that in our empirical estimation, we used data defined the other way around. P^{*NEA-T} is the price level of non-eurozone trading partners, P^{*EA-T} is the euro-zone trading partners, α is the share of trade with the non euro-zone countries, γ indicates the share of tradable goods and P is the domestic price level. An appreciation of nominal exchange rate will improve the terms of trade as reflected by the first term while worsens the relative wage competitiveness proxied by the third term.

[57]Appreciation of real exchange rate is also consistent with Corsetti et al. [23].

[58]Note that the non-significant response of real exchange rate in NEA might be due to the reduction of ULC which offset an appreciation of the nominal exchange rate, for further details see Chen et al. [18].

response of real import and cross-capital formation in both regions (i.e. NEA and SEA). Assuming that a positive shock on imports reflects a demand shocks such as temporary tax decrease, a positive response of investment might be driven by an increase of capital return. For example, Baxter [3] argues that a temporary fiscal expansion leads individuals to smooth consumption (i.e. decrease consumption) and increase labour supply which in turn will lead to an increase of capital return and investments. We also observe a depreciation of real exchange rate which has positive effects on exports due to substitution and wealth effects.[59]

The response of output in the SEA is insignificant while there is an initial decline in output in NEA for two quarters following the shock. The frail response of output to an import shock might be driven by boosted exports as observed in Figure 3(b). However, exports in both regions (i.e. NEA and SEA) increase less than imports following the import shock in NEA. Therefore, an expansionary demand shock in NEA leads to a deterioration of the NEA and SEA current account, albeit the deterioration is rather marginal.

We next focus on the impact of real NEA import shocks to the exports of the countries included in our sample. Figure 3(b) indicates that an expansionary shock in NEA yields a statistically significant increase in the global real exports highlighting the importance of the trade linkages in the transmission of shocks around the world.[60] Furthermore, Figure 3(b) also shows that import expansion in NEA has a positive impact on the exports of France, UK, Sweden, Norway and Switzerland. This implies that increasing imports in NEA might be used as an adjustment mechanism for the trade imbalances in euro area.

5.3 Positive Expansionary shock to the SEA

The third shock examines whether SEA relies on domestic consumption as a mechanism of economic growth. Therefore, Figure 4(a) shows the impact of a positive one standard-deviation shock to the real imports in the SEA. In general, there is a positive and significant response of all SEA variables (imports, output, gross capital formation and real exchange rate), while in NEA there is a significant increase only for real imports. An appreciation of real exchange rate and a positive response of investment in SEA is consistent with Obstfeld and Rogoff [51] who argue that due to the limited integration of capital market there is home bias on demand shocks. Therefore, a positive demand shock will appreciate the terms of trade and improve the real return of domestic investments.[61, 62]

Figure 4(b) illustrates that there is a positive and significant increase of exports both in NEA and SEA.[63] While the response of export in NEA crowding out the response of import

[59]Note that Corsetti et al. [24] show that a depreciation of terms of trade has positive impacts on the foreign demand of domestic goods due to income and substitution effects:

$$\frac{\partial C_H^*}{\partial \delta_t} - SE(Y_F, \alpha_H, \omega) + IE(Y_F, \alpha_H, \omega)$$

[60]Concerning the response of real exports in NEA and SEA we observed an increase of 0.6% and 0.4% respectively.

[61]An appreciation of real exchange rate will reduce the cost of investment as investment goods consists of imported goods. A lower investment cost will increase the capital return of domestic investments.

[62]The terms of trade is given by $\frac{P_D}{P_F}$ where P_D is the price of domestically produced goods while P_F is the price of goods produced in foreign countries. Corsetti and Müller [22] show that the return to investment in real terms is given by: Real Return to investment = (Marginal product in terms of domestic goods)$\times \frac{P_D}{P}$ where P denotes the price of domestic consumption. Therefore, an increase in the ratio due to an expansionary fiscal shock and home bias will have a positive impact on the real return of domestic investments.

[63]The effect on other European economies is also statistically significant with French, the UK and Swedish exports increasing by approximately 0.25% after one year. There is also evidence of a positive effect on Chinese,

the reverse is true in the SEA. Our results provide support of the view that the co-existence of two growth strategies led to the accumulation of trade imbalances between NEA and SEA. In particular, NEA countries have built on institutions and policies that promote the ELG policies. Alternatively, SEA economies, rely on increased domestic demand as a mechanism of growth promotion. This structure generated cumulative current account surpluses and incited external lending in NEA (mirrored by current account deficit and net borrowing in SEA).

5.4 Real Depreciation of the SEA

This part examines the view that improving competitiveness in the SEA will accelerate the current account adjustment. Note that although demand shocks both in NEA and SEA have a positive impact on investments and exports of SEA, the current account adjustment was incomplete. In particular, there is a deterioration of the current account due to a higher increase of imports than exports following a demand shock as proxied by a shock on imports. Therefore, we investigate the role of the real exchange rate as a mechanism of current account adjustment. In so doing, we provide information concerning the argument that demand shocks accompanied by an improvement in competitiveness can help to eliminate trade imbalance within the euro-zone. To this end, we consider the impact of a one-standard-deviation negative shock (i.e. a depreciation) to the SEA real effective exchange rate on both the real exchange rates and on the real exports of the rest of the countries in our sample.[64] Figure 5(a) provides evidence that for most of the euro-area countries real exchange rate depreciates but by less than the depreciation of the real exchange rate in SEA.[65] For example, while the real exchange rate in SEA depreciates by 0.8%, it is marginally significantly different from zero in NEA and insignificant for the UK and Switzerland. Alternatively, for the non euro area countries real exchange rates appreciate but in most cases, appreciation is not statistically different from zero.[66]

Figure 5(b) indicates that a depreciation of the real effective exchange rate increased real exports in SEA by 0.7% per quarter while the response of real imports is not significant. We also observed that a depreciation has a negative impact on real output and investment but are significant only in the short-run (i.e. 2 quarters following the shock). This might be due to the negative impact that a depreciation has on the real return of domestic investment.[67] Alternatively, the response of NEA variables to a depreciation shock of the real exchange rate of the SEA is rather frail. Only the real output decreases significantly but only a few quarters. This finding is in line with Belke and Dreger [4] who suggest the depreciation of the real exchange rate of debtor euro-zone countries as a tool to current account adjustment.

5.4.1 Implications of SEA's Real Depreciation for Productivity

Although depreciation of real exchange rate can be used as an adjustment mechanism of current account imbalances, it might also undermine domestic economic growth by reducing

Turkish and Japanese exports.

[64] We measure the nominal exchange rate as the ratio of foreign prices to domestic prices. Therefore, a decrease of real exchange rate reflects a depreciation of domestic currency.

[65] This might reflect a reduction of ULC imposed by structural reforms in SEA after the financial crisis of 2008.

[66] In particular, the real exchange rates in the USA and China appreciate statistically significant by a 0.3% and 0.4% respectively after 4 quarters. There is also evidence of appreciation in Japan, Turkey and emerging Asian economies. Note that in all cases appreciation was not statistically significant.

[67] For further details see Corsetti et al. [23].

investments. Therefore, it is consequential to analyse the two main channels through which a depreciation of real exchange rate can be achieved.

First, a reduction of real wages can lead to lower domestic prices and depreciation of real exchange rates. However, a reduction of real wages will have also negative direct and indirect income effects. The indirect income effects show, as stressed by Corsetti et al. [23], that if the the substitution effects between domestic and foreign tradables is low, then a depreciation of the terms of trade will have a negative impact on the consumption of domestic tradables. The latter is currently the main driving mechanism of European growth.[68] Furthermore, a depreciation of real exchange rate will not only reduce domestic prices but also foreign prices by lowering the costs of intermediate goods used in the production of foreign goods. Therefore, depreciation through reduction of real wages might not improve the competitiveness of domestic goods. In this setting, a deprecation of real exchange rate will have short-run impact on current account.

Second, depreciation via an improvement of productivity can have a positive impact on current account without threatening the sustainability of economic growth. Cette et al. [17] show that labour and market regulation in Europe impair the diffusion of innovation related to the production and use of information technology. For example, Cette and Lopez [16] show that the U.S. benefited from the use of highest level of information and communication technologies, which requires a high level of post-secondary education among the working age population and less restrictive product and labour regulation. However, Borio et al. [10] and Cecchetti and Kharroubi [15] show that credit booms might damage the economy because financial institutions' high dependence for skilled labour crowed out more productive sectors, such as manufacturing industries that are either R&D intensive or hold less tangible assets.

A number of studies find that allocation of resources worsen in SEA but not in NEA. An inefficient use of resources in Southern Europe reduced the total factor productivity (TFP).[69] Reis [59], Gopinath et al. [37] and Cette et al. [17] argue that the main driving force of capital misallocation in SEA was the low real interest rate and abundant capital inflows after the inception of euro lead to inefficient use of resources and lower TFP. This mechanism blend with a boom of consumption of imported tradables while non-tradables were produced by small and inefficient firms led to lower TFP in SEA.[70] Furthermore, Gopinath et al. [37] show that missalocation measured by the standard deviation of marginal labour product has increased within manufacturing industries.

6 Conclusion

The global imbalances that emerged after the 2000s have been blamed as a contributor to the recent financial crisis of 2008. Obstfeld and Rogoff [52] argue that current account surpluses from emerging economies have been used to fund deficits in developed economies, which in turn has fuelled the risk-taking behaviour of the latter countries, thereby showing the seed of

[68] Corsetti et al. [24] show that a depreciation of terms of trade have positive substitution and negative income effects. They also show that if the elasticity of substitution between domestic and foreign goods is low, then the impact of the latter effects will out-weight the former.

[69] Cette et al. [17] show that since the inception of euro the TFP in Spain, Portugal and Italy has been close to zero or even negative.

[70] Kalantzis [44] and Benigno et al. [6] show that the share of non-tradables in domestic production increase after episodes of capital inflows.

the global financial crisis.[71] Therefore, it is important to investigate sources and patterns of trade imbalances. The aim of our study is to analyse trade imbalances within the euro-zone, accounting for the global macroeconomic environment. The co-existence of two growth models within the euro-zone made inevitable the development of trade imbalances between the north and the south euro area: the former with an export-oriented economy, while the latter based on domestic consumption.

There is a view supported by the US Treasury [62] and Krugman [49] that the current account adjustment within the euro-zone should be symmetric, in the sense that NEA surpluses should shrink along with the SEA deficits. The counter-argument of this view endured by Jaumotte and Sodsriwiboon [43] is that the SEA should pursue policies that increase government saving, productivity and competitiveness through internal devaluation. Our paper contributes to the debate by evaluating the view that an expansionary policy from NEA accompanied by an increased competitiveness in SEA can accelerate the adjustment of trade imbalances within the euro area.

We do so by using a GVAR model for 28 countries including the NEA, SEA regions, the USA, China and other European and non European countries. The GVAR model provides a framework that allows investigating the spill-over effects of demand or competitiveness shocks emanating from any country in our sample. Here, we focus on the spillover effects of demands shocks from NEA and SEA across the two regions. In doing so, we can provide information on the argument that expansionary policy from NEA can be used as a mechanism to boost economic growth and current account adjustment in the SEA. However, current account adjustment driven mainly by demand forces is likely to unwind if the economy moves to a different phase of business cycle. For example, although an expansionary policy pursued during expansion might improve the current account of SEA countries, it will have unwelcome effects once the economy slows down and move into a recession. Therefore, we also investigate the impact of competitiveness shocks as reflected by a devaluation of the real effective exchange rate of the SEA on the current account of both regions.

Empirical results support the argument that current account adjustment in euro-zone should be symmetric. In particular, we observe that although positive demand shocks, in both regions, as proxied by an increase in imports has positive effects on exports and investment, current accounts deteriorate or at best remain stable. However, there is evidence that a devaluation of the real effective exchange rate in SEA leads to an increase in exports without affecting imports. Therefore, our results highlight that the imperative external adjustment of the SEA sub-region should be composed of two coordinated policies: First, increased consumption of the NEA, which will stimulate the demand for imported goods in the sub-region and thus, will expand the export sector of the SEA. Second, a devaluation of the real exchange rate in the SEA, possibly through the mechanism of labour costs, should provide a valuable policy tool for competitiveness and current account adjustment in the sub-region.

Our results should be translated with caution. From the perspective of the SEA if one has to choose a policy then an internal devaluation will have a positive effect on their exports and negative on their output and on their imports. The alternative policy would be an expansionary shock to the NEA. This would affect SEA exports positively (not as much as in the previous scenario though) and their imports positively. A combination of the two policies emerges as the preferred option. The cautionary note that should not be underestimated here

[71] Alternatively, Borio and Disyatat [9] argue that from a macro-prudential point of view the main factor that drives the international crisis of 2008 was the phenomenal increase of gross capital flows. They show that the link between the financial crisis and trade imbalances was rather weak.

is that the devaluation in the SEA might have a negative impact on investment and economic growth (see Corsetti et al. [23]).

Table 1: Countries and Regions in the GVAR Model

China	**South Europe**	*Scandinavia*	*Rest of the World*
France	Greece	Norway	India
Japan	Italy	Sweden	Indonesia
UK	Portugal		Korea
USA	Spain		South Africa
			Turkey
North Europe	*Other Developed Economies*	*Latin America*	
Austria	Australia	Brazil	
Belgium	Canada	Mexico	
Finland	Ireland		
Germany	Switzerland		
Netherlands	New Zealand		

Table 2: Trade Weights of the GVAR model

Country/Region	China	France	Japan	NEA	SEA	Sweden	UK	USA
China	0.00	0.02	0.14	0.13	0.04	0.01	0.03	0.25
France	0.06	0.00	0.02	0.44	0.20	0.02	0.07	0.08
Japan	0.33	0.02	0.00	0.08	0.02	0.00	0.02	0.22
NEA	0.12	0.17	0.03	0.00	0.16	0.04	0.12	0.12
SEA	0.07	0.18	0.02	0.37	0.00	0.02	0.08	0.08
Sweden	0.06	0.06	0.02	0.43	0.07	0.00	0.09	0.07
UK	0.09	0.07	0.02	0.32	0.09	0.02	0.00	0.13
USA	0.20	0.03	0.07	0.10	0.03	0.01	0.04	0.00

Note: Trade weights based on data from IMF, Direction of Trade Statistics.

Table 3: The specification for the country-specific unrestricted VARX* models

Country/Region	**Individual VECMX*models specification**					
	p_i	q_i	**Deterministics Case**	***r***	**Endogenous Variables**	**Exogenous Variables**
USA	2	1	IV	3	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}, poil\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}\}$
North Europe	2	1	III	1	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
South Europe	2	1	III	1	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
UK	1	1	III	1	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
France	2	1	III	1	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
China	2	1	III	1	$\{ny_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Japan	2	1	IV	2	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Korea	2	1	IV	2	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Canada	2	1	IV	3	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Australia	1	1	III	1	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Ireland	2	1	III	1	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Sweden	2	1	III	1	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Switzerland	2	1	IV	3	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Norway	2	1	IV	2	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
New Zealand	2	1	III	1	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Mexico	2	1	III	2	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Brazil	2	1	IV	3	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Indonesia	2	1	III	2	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
India	2	1	III	0	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
Turkey	2	1	III	2	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$
South Africa	2	1	III	1	$\{ny_{it}, k_{it}, ex_{it}, im_{it}, reer_{it}\}$	$\{ny^*_{it}, k^*_{it}, reer^*_{it}, poil\}$

Notes: Deterministics case IV indicates constant and restricted trend in the VECMX* estimation. Case III indicates only constant. r refers to the number of cointegrating relationships as indicated by the Johansen's test.

Table 4: Over-identified Long Run Restrictions in the GVAR model

Country/ Region	**Imposed Restrictions**	**Theoretical equation**	***r***	**LLR(df)**	**99% CV**
Australia	$ny_t - 0.90k_t - 0.38ex_t + 0.47im_t$	ELGH	1	16.96(8)	31.34
Brazil			3		
Canada	$ex_t - im_t$	TB ∼ I(0)	1	51.72(9)	53.83
China	$ex_t - im_t$	TB ∼ I(0)	1	24.15(7)	32.65
France	$ny_t - 1.54k_t - 0.58ex_t + 1.18im_t$	ELGH	1	27.05(8)	34.92
Indonesia	$im_t - 0.38ex_t - 1.01ny_t - 0.44reer_t$	Imports Equation	1	26.85(8)	33.60
India	$ex_t - im_t$	TB ∼ I(0)	1	12.69(8)	42.05
Ireland	$ny_t - 0.55k - 0.60ex_t + 0.53im_t$	ELGH	1	16.29(8)	31.75
Japan			2		
Korea	$ex_t - im_t$	TB ∼ I(0)	1	29.00(9)	46.09
Mexico			2		
North Europe	$ny_t - 3.14k_t - 3.38ex_t + 5.02im_t$	ELGH	1	10.68(8)	29.92
Norway	$ny_t - 2.29k_t - 0.35ex_t + 3.03im_t$	ELGH	1	46.08(9)	53.41
New Zealand	$ex_t - 0.69im_t - 0.25ny_t^* + 0.67reer_t$	Exports Equation	1	14.98(8)	29.81
South Africa					
South Europe	$im_t - 0.86ex_t - 0.94ny_t - 1.02reer_t$	Imports Equation	1	22.61(8)	34.73
Sweden			1		
Switzerland			3		
Turkey	$ny_t - 0.55k_t - 1.72ex_t + 1.67im_t$ $ex_t - 0.85im_t - 0.41ny_t^* + 0.17reer_t$	ELGH Exports Equation	2	46.95(14)	53.78
UK	$im_t - 0.57ex_t - 1.40ny_t - 0.24reer_t$	Imports Equation	1	28.85(8)	31.78
USA	$ex_t - 0.47im_t - 0.82ny_t^* + 1.6reer_t$	Exports Equation	1	10.62(9)	31.77

Notes: Imposed restrictions refer to the theory-based equations that imposed to the cointegrating vector β_i of each individual VECMX*model. *r* refers to the number of cointegrating vectors imposed. Log-Likelihood Ratio test was based on 2000 bootstrapped replications.

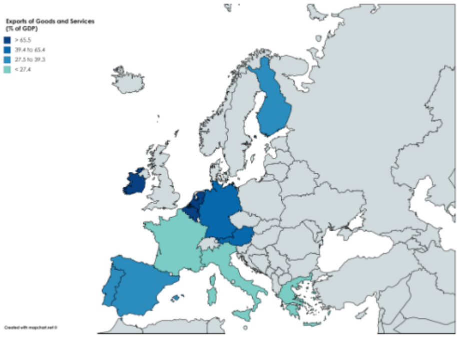
Table 5: Impact Elasticities between Domestic and Foreign Variables

Country/Region	Domestic Variables		
	ny	*k*	*reer*
USA	0.07	0.60	0.11
	[0.56]	[3.28]	[0.52]
North Europe	0.19	0.54	-0.44
	[0.82]	[3.56]	[-2.85]
South Europe	0.28	0.54	0.31
	[3.11]	[3.66]	[1.22]
UK	0.36	0.45	-1.78
	[2.58]	[1.86]	[-3.78]
France	0.17	0.42	1.09
	[2.92]	[3.28]	[5.90]
China	0.29		0.30
	[2.10]		[0.59]
Japan	0.30	-0.06	-0.92
	[1.65]	[-0.47]	[-4.42]
India	0.27	-0.08	0.45
	[1.86]	[-0.65]	[2.13]
Korea	1.42	-0.04	0.08
	[2.16]	[-0.10]	[0.30]
Canada	0.35	0.45	0.03
	[1.72]	[2.02]	[0.19]
Australia	0.23	0.57	0.26
	[1.71]	[2.21]	[0.72]
Ireland	-0.47	0.40	-0.82
	[-0.85]	[1.18]	[-2.97]
Sweden	0.46	0.93	0.08
	[3.31]	[5.94]	[0.21]
Switzerland	1.50	-0.25	-0.64
	[1.19]	[-0.44]	[-1.93]

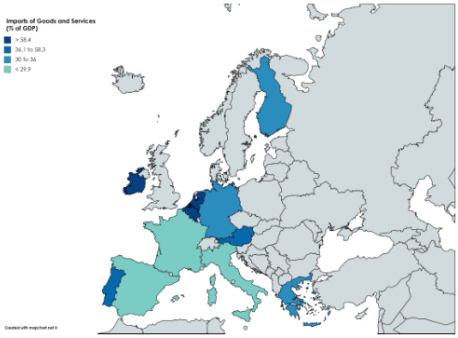
Note: Newey-West t-ratio's in brackets.

Figure 1: Trade Imbalances in the Euro Area (Average values from 1999 - 2016)

(a) Exports of Goods and Services (% of GDP)



(b) Imports of Goods and Services (% of GDP)



(c) Current Account Balance (% of GDP)

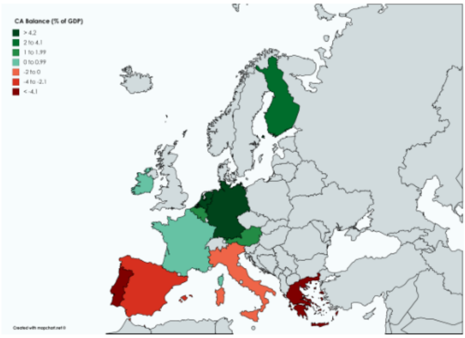
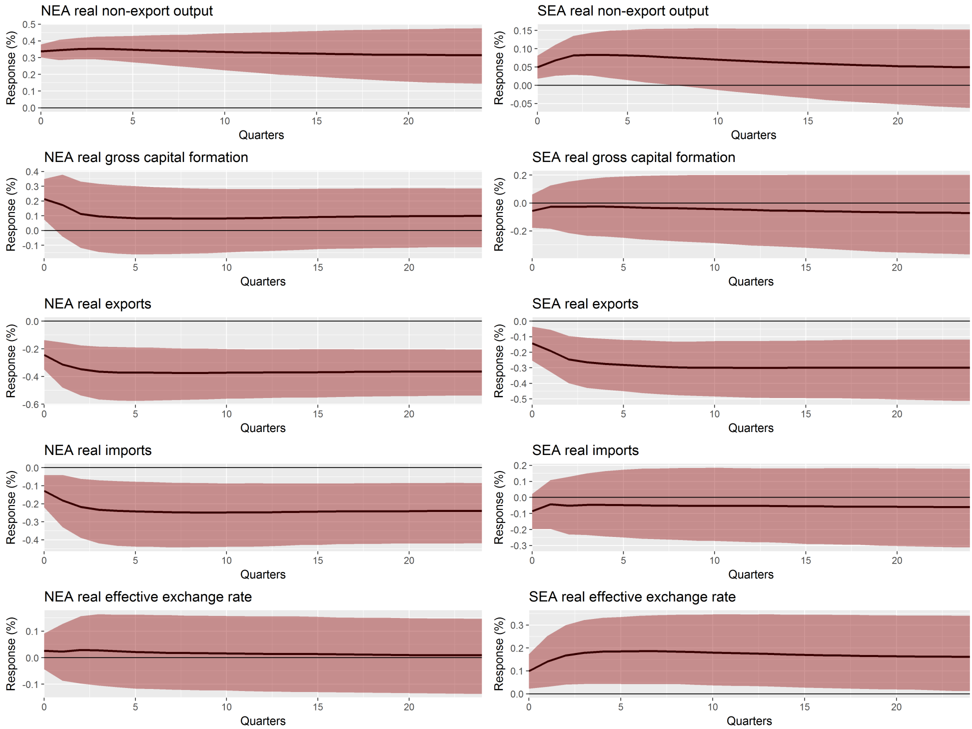
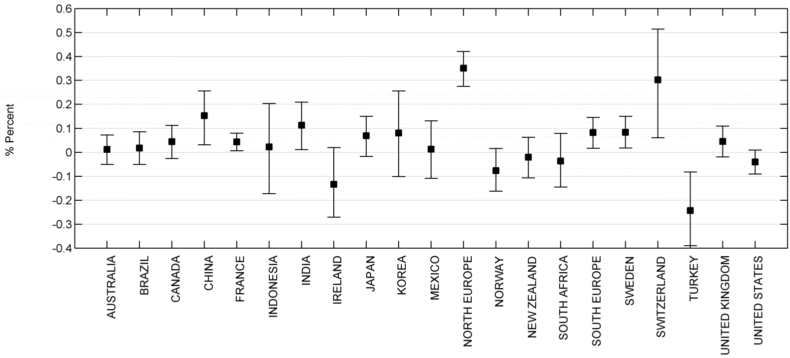


Figure 2: Generalized Impulse Responses of a Positive one s.d. shock to North Euro Area Non-Export Real Output*

((a)) response of Euro-area variables



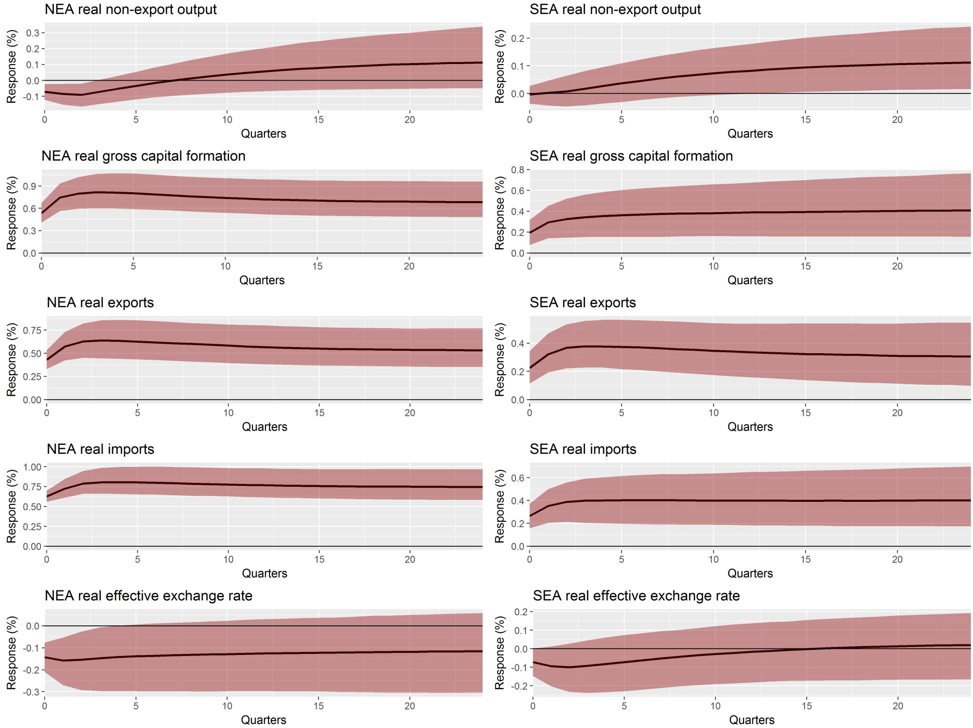
((b)) Effects on real domestic demand after 4 quarters



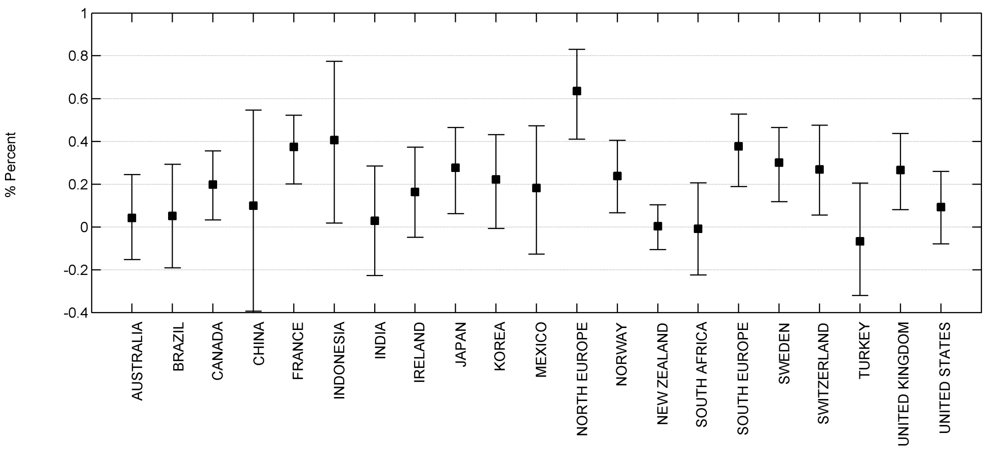
*Bootstrap mean estimates with 90% bootstrap error bounds.

Figure 3: Generalized Impulse Responses of a Positive one s.d. shock to North Euro area Real Imports*

((a)) response of Euro-area variables



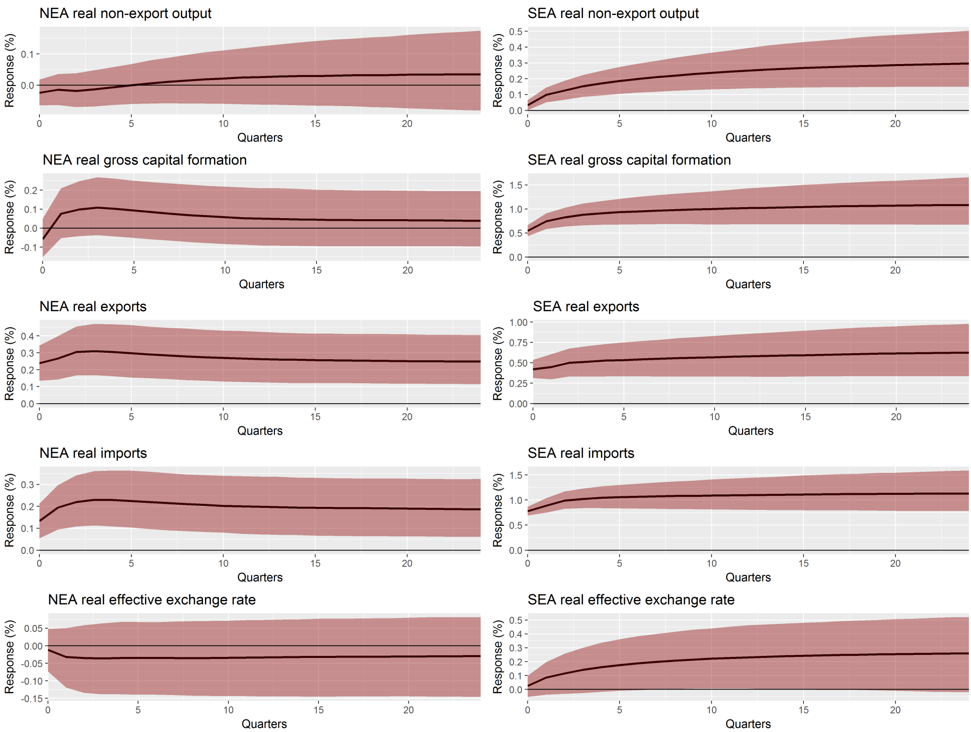
((b)) Effects on real exports after 4 quarters



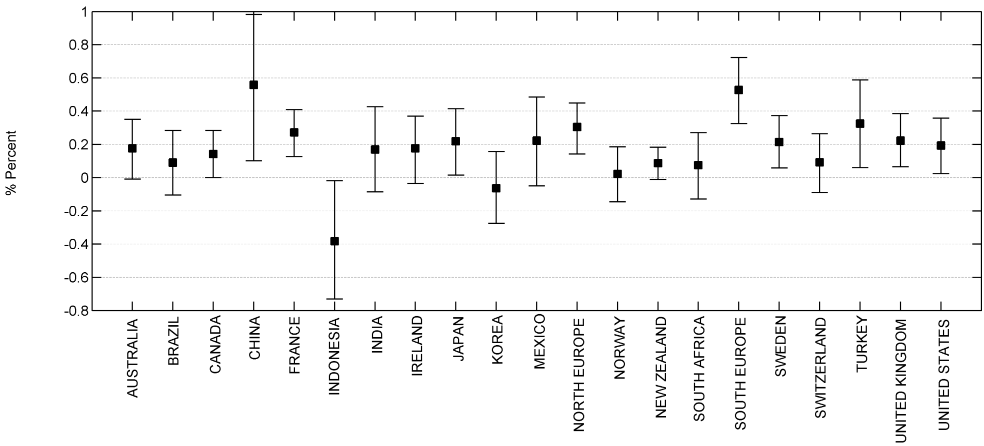
*Bootstrap mean estimates with 90% bootstrap error bounds.

Figure 4: Generalized Impulse Responses of a Positive one s.d. shock to South Euro Area Real Imports*

((a)) response of Euro-area variables



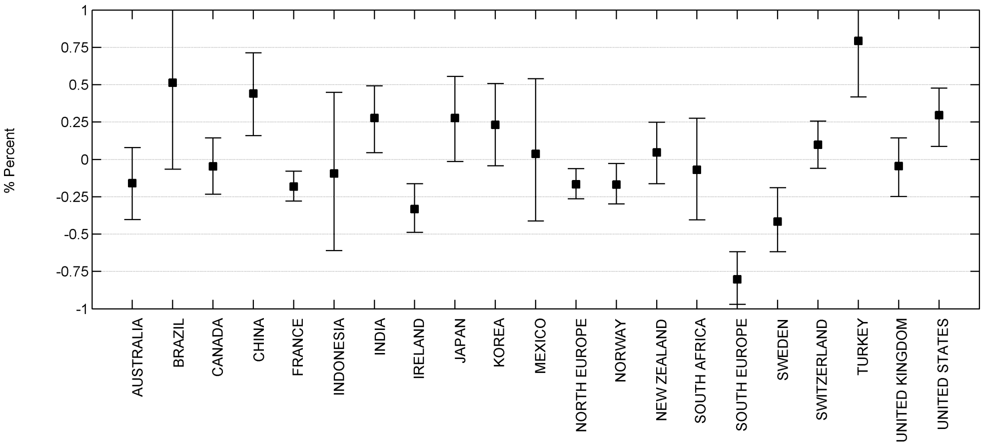
((b)) Effects on real exports after 4 quarters



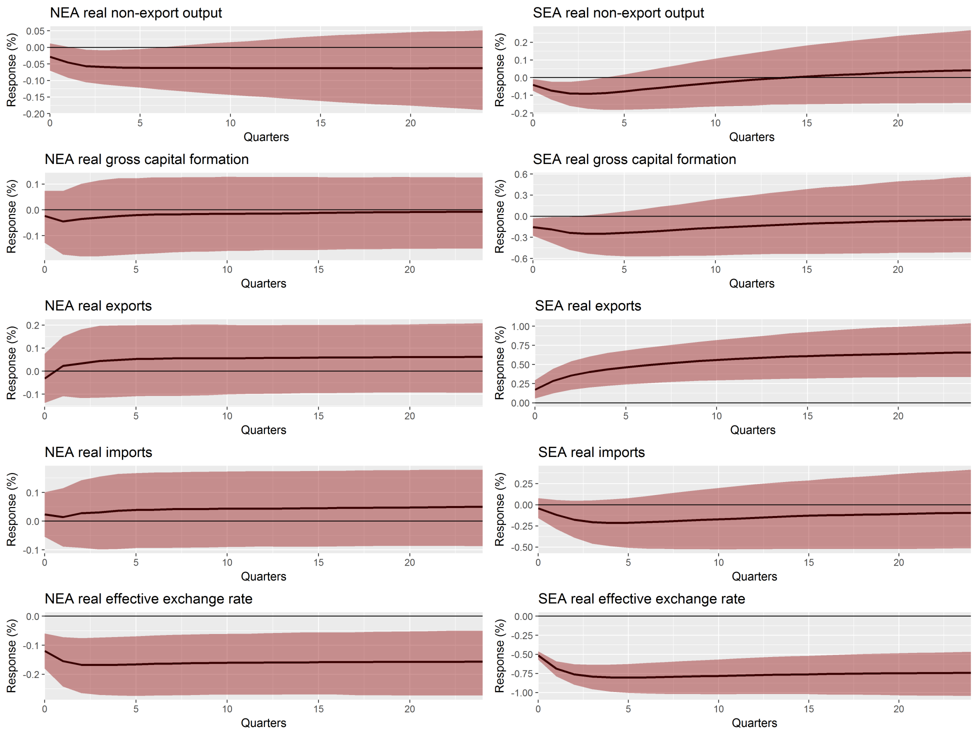
*Bootstrap mean estimates with 90% bootstrap error bounds.

Figure 5: Generalized Impulse Responses of a Negative one s.d. shock to South Euro Area Real Exchange Rate*

((a)) Effects on real effective exchange rates after 4 quarters



((b)) response of Euro-area domestic variables



*Bootstrap mean estimates with 90% bootstrap error bounds.

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Appendix

A.1 Unit Root Tests

The implementation of the GVAR requires that the variables included in a country-specific VARX*(p_i, q_i) are integrated of order one (*I(1)*). We test for unit root using the weighted-symmetric Augmented Dickey-Fuller (WS ADF) introduced by Park and Fuller (1995).[72] Table A.2 summarises the results from the unit root tests. In this respect, results suggest that the null hypothesis of a unit root in not rejected for the vast majority of the domestic variables.[73] Results also demonstrate that all foreign "star" variables and the oil price are *I(1)* processes.

A.2 Weak Exogeneity Test

The main assumption underlying the estimation of a VARX*(p_i,q_i) is that the country-specific foreign variables are x^*_{it} are weakly exogenous. Weak exogeneity of x^*_{it} in the VECMX* (p_i,q_i) model implies that domestic variables x_{it} do not affect foreign variables x^*_{it} in the long run, without ruling out any short-run feedback between the two set of variables.[74] If the weak exogeneity assumption is not rejected then x^*_{it} is considered as a "long-run forcing" for x_{it}.[75] Following the approach of DdPS, we employed a test for the weak exogeneity based on Johansen (1992) and Harbo *et al.* (1998) who suggested an F-test to check whether the estimated error correction terms are statistically significant in the marginal distribution of x^*_{it}. In particular, for each variable l of $x^*_{it}$the following auxiliary model is estimated:

$$\Delta x^*_{it,l} = \alpha_{i,l} + \sum_{j=1}^{r_i} \theta_{ij,l} ECM_{ij,t-1} + \sum_{s=1}^{p^*_i} \phi_{is,l} \Delta x_{i,t-s} + \sum_{s=1}^{q^*_i} \psi_{is,l} \Delta \hat{x}^*_{i,t-s} + e_{it,l}$$

where $ECM_{ij,t-1}$, $j = 1,\ldots,r_i$ are the estimated error correction terms which correspond to the r_i cointegrating relations (overidentifying restricted when long run relations imposed) for the *i-th* country model. Note that, $\Delta \hat{x}^*_{i,t} = (\Delta x^{*'}_{it}, \Delta poil_t)$ where $\Delta poil_t$ is the global variable of the oil price. The test for weak exogeneity is a joint test that $\theta_{ij,l} = 0$ for $j = 1,2,...r_i$.

Results from the F-test are summarised in Table A.4 and indicate that the null hypothesis is rejected for 16 out of the 83 foreign variables (19% of the cases), at the 5% significance level.[76] It is worth noting that when we increase the lag order of the VARX*(p^*_i, q^*_i) to $p^*_i = 4$ and $q^*_i = 4$, the null hypothesis is rejected only in 7 out of the 83 foreign variables (8%).[77] Overall, weak exogeneity can not be rejected.

[72]The lag length of the test was determined by the Akaike Information Criterion (AIC).

[73]However, some minor exceptions do exist. Real domestic output in Brazil and Ireland found to be *I(2)* while in Mexico found *I(0)*. Moreover, real exports are *I(0)* in the case of Japan and Switzerland (the Swiss imports also found *I(0)*). In addition, the real effective exchange rate in Mexico and Sweden appears to be a *I(0)* process.

[74]The lag orders of the test for the domestic p^*_i and foreign q^*_i variables need not be the same with the estimated VARX*(p^*_i, q^*_i) models. For this reason, we conduct the tests for weak exogeneity based on both the lag structure determined by the AIC (where $p^*_i = 1$ and $q^*_i = 1$) and the lags of the underlying estimated VARX* models. We also use a larger set of lags ($p^*_i = 4$ and $q^*_i = 4$) in order to capture any sensitivity effects of the model.

[75]This implies that the error-correction term does not provide any information about the marginal distribution of x^*_{it}.

[76]Note that the null hypothesis is rejected for the foreign output of France and China and for the REER of the NEA and the USA.

[77]All exogeneity test have been implemented conditional on the theory-based overidentifying restrictions.

A.3 Average Pair-Wise Cross Section Correlations

An extension of the diagnostics concerning the weak-exogeneity of the foreign variables in the sense that $Cov(x^*_{it}, u_{it}) \to 0$ when $N \to \infty$ is provided by the average cross-section pair-wise correlations of the country-specific error terms. This informal test offers evidence of the degree at which the constructed foreign variables act to reduce cross-section correlations in the GVAR model.

Table A.5 presents the average pair-wise cross-sectional correlations for the level and the first difference of the endogenous variables, as well as the associated model's residuals.[78] Results show that the average cross-section correlations for the levels of endogenous variables are high with the exception of the real effective exchange rate. The highest correlations are observed in the trade variables with an average of 97% whilst the correlations for the cases of net trade output and capital formation vary between 75% and 83%. When the first difference of the variables is considered, the correlations fall substantially for all variables and for all countries.[79] Finally, the residual interdependencies for all VARX* models are relatively small which enhance the view that the weakly exogenous foreign variables successfully capture the common factors among the variables.

A.3 Structural Stability Tests

An issue that can arise in our empirical framework is the presence of structural breaks. We employ a battery of tests to determine the stability of the estimated parameters of the country-specific models. As the short-run parameters reflect the propagation of shocks across countries, we focus on the stability of the short-run coefficients in the VECMX* models. Following Ploberger and Cramer (1992) our set of structural stability tests is based on the cumulative sums of the OLS residual tests denoted by PK_{sup} and PK_{msq}. We also employed the Nyblom (1989) test for time-varying parameters and sequential Wald tests such as *QLR*, *MW* and *APW*.[80]

Table A.6 summarises the results obtained from the structural stability test at the 5% significance level under the null hypothesis of parameter stability. Evidence from structural stability tests are rather mixed. In particular, using the PK_{sup} and PK_{msq} tests the null hypothesis is rejected in 11 and 10 cases respectively out of the possible 105. However, results obtained from the non-robust version of sequential Wald tests indicate a high rejection rate of the null hypothesis varying from 40% to 50%. These results could be rather worrying but the heteroscedasticity-robust version of these tests provide a different outcome with the rejection rate being halved in most cases.[81] Furthermore, the rejection of the null hypothesis

[78]For example, the average pair-wise correlation of real output of country i is given by:

$$\overline{ny}_i = (1/N)\sum_{j=1}^{N} \rho_{ij}(ny_{ij})$$

where ρ_{ij} is the correlation of the real output of country i with country j, N is the number of countries included in our sample. The residuals are obtained after estimating all country-specific $VARX^*$ (p_i, q_i) models.

[79]For example, the average cross-section correlations have declined in net export real output and gross capital formation to 3% and 7% respectively.

[80]Note that PK_{sup} and PK_{msq} refer to maximal OLS cumulative sum (CUSUM) statistics. *QLR* refers to the likelihood ratio statistic proposed by Quant (1960) while *MW* refers to a Wald statistic based on Hansen (1992) and Andrews and Ploberger (1994). *APW* is an exponential average statistic based also on the work of Andrews and Ploberger (1994). For further details on structural stability test statistics see Dees *et al.* (2007).

[81]It is worth noting that results vary across the different endogenous variables. For example, the rejection rate for the trade variables is slightly higher than the other domestic variables which might be due to the collapse of global trade in 2009.

was mainly driven by breaks in the error variance and not on the parameter coefficient. We account for the problem of possible variation of error variances by using robust standard errors when investigating the impact of the foreign variables.

A.4 Identification Through Orthogonalized Impulse Response Functions

In this part, we employ OIRFs for the GVAR model under the framework suggested by Dees *et al.* (2007). We consider an identification scheme for the shocks stemming from the euro area domestic variables under the ordering $x_{it} = (reer_{it}, ex_{it}, im_{it}, gcf_it, ny_{it})$. Greenwood-Nimmo *et al.* (2015) also consider a similar ordering of domestic variables regarding the derivation of generalized connectedness measures based on a GVAR approach. In order to identify euro area shocks, the corresponding ordering for countries/regions is the following: the first countries/regions in our ordering are NEA, SEA, France and Ireland which represent the euro area. Next, the remaining countries of our model follow based on their average real GDP in 2010 US dollars, namely i = USA, China, Japan, UK,. . . , New Zealand. The results are similar to those of the GIRFs. See Figure A.3 for a brief description of the results. The full set of the OIRFs analysis results, is available upon request.

A.5 Generalized Forecast Error Variance Decomposition

A complementary extension of the impulse response functions is the traditional analysis of forecast error variance decomposition. Under the GVAR model, the estimated GIRFs correspond to Generalised Forecast Error Variance Decompositions (GFEVDs) as explained by DdPS. In this case, GFEVDs show the proportion of the n-step ahead forecast error variance of the *i-th* element of x_t accounted for the innovations in the *j-th* element of x_t. Note that this approach allows for contemporaneous correlations, the shocks across countries are not orthogonal, and are invariant to variable ordering. Hence, GFEVDs need not sum to unity.

This section presents the GFEVDs of some selected scenarios of interest, focusing on euro area real trade flows. Table A.7 shows the proportion of forecast error variance for the top 12 determinants of the NEA real imports and the SEA real exports and imports, for the first 12 quarters. Total sum indicates the sum of GFEVDs contributions across all countries. The results point out that NEA real imports depend primarily on domestic variables such as imports, exports and gross capital formation which account for the half variation during the first year. The real exchange rate and non-export real output of NEA have a minor impact while the oil price and SEA domestic variables hold a respectable contribution, especially after 2 quarters. SEA real exports depend on domestic variables as well, where the contributions of real imports and real exchange rate are important in explaining SEA real exports variations. This confirms the import dependence of exports in the SEA and the significant role of competitiveness. Interestingly, NEA real trade flows explain approximately 10% of the SEA export variation after one year while the contribution of the non-export output of NEA and oil price is similar. In addition, a major contributor of the SEA real imports (except the variable itself) is the domestic gross capital formation followed by domestic real exports and non-export real output. Despite the heterogeneity in the dispersion of contributions, we also trace an important influence by the NEA real trade flows. The GFEVDs analysis for the euro area real trade variables confirms the GIRFs outcome that there is a strong relationship between NEA and SEA real trade flows. As expected, domestic variables are the main determinants of the variation of the GFEVDs in each region.

Table A.8 contains the GFEVDs results for the real imports of the two major global importers, China and the USA. For the case of U.S. real imports, the contribution can be attributed to domestic variables (imports, gross capital formation, exports and non-export real output) as they account for the 57% of the total variation during the first year. With respect to foreign variables, NEA, French and Swedish originated exports and real exchange rates are also significant determinants of the U.S. import forecast error variance decomposition. Moreover, Canadian real trade flows are among the top determinants of U.S. real imports which is in align with the strong relationship between the two economies. The case of Chinese real imports offers heterogeneous results, as we can not trace a particular geographical pattern to the top determinants of the Chinese import forecast error variance decomposition. A fact that stands out is the confirmation of the trade balance stationarity; Chinese exports account for the 20% variation in the long-run import performance (after 3 years).

Table A.1: Data Sources

Country	Real GDP	Real GCF	Real exports	Real imports	REER
Australia	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Austria	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Belgium	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Brazil	$WDI^{(3)*}$	$WDI^{(3)*}$	$WDI^{(3)*}$	$WDI^{(3)*}$	$IFS^{(4)}$
Canada	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
China	$WDI^{(3)*}$		$WDI^{(3)*}$	$WDI^{(3)*}$	$IFS^{(4)}$
Finland	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
France	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Germany	$OECD^{(2)}$	$WDI^{(3)*}$/ $OECD^{(1)}$	$OECD^{(2)}$	$OECD^{(2)}$	$IFS^{(4)}$
Greece	$OECD^{(2)}$	$WDI^{(3)*}$/ $OECD^{(1)}$	$OECD^{(2)}$	$OECD^{(2)}$	$IFS^{(4)}$
India	$WDI^{(3)*}$	$WDI^{(3)*}$	$WDI^{(3)*}$	$WDI^{(3)*}$	$OECD$
Indonesia	$WDI^{(3)*}$	$WDI^{(3)*}$	$OECD^{(2)}$/ $WDI^{(3)*}$	$OECD^{(2)}$/ $WDI^{(3)*}$	$OECD$
Ireland	$OECD^{(2)}$	$OECD^{(1)}$/ $WDI^{(3)*}$	$OECD^{(2)}$	$OECD^{(2)}$	$IFS^{(4)}$
Italy	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Japan	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Korea	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD$
Mexico	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Netherlands	$OECD^{(1)}$)	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
New Zealand	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Norway	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Portugal	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
South Africa	$OECD^{(2)}$	$OECD^{(1)*}$	$OECD^{(2)}$	$OECD^{(2)}$	$IFS^{(4)}$
Spain	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Sweden	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Switzerland	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
Turkey	$OECD^{(2)}$	$OECD^{(1)*}$	$OECD^{(2)}$	$OECD^{(2)}$	$OECD$
UK	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$
USA	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$OECD^{(1)}$	$IFS^{(4)}$

Notes: $^{(1)}$ Economic Outlook No 101. $^{(2)}$ Quarterly National Accounts. $^{(3)}$World Development Indicators. $^{(4)}$ IMF, International Financial Statistics. $^{(*)}$Interpolated from annual data. REER indicates real effective exchange rate.

Table A.2: Unit Root Tests

Country		***ny***			***k***			***ex***			***im***			***reer***	
	Level	*D*	D^2	*Level*	*D*	D^2	*Level*	*D*	D^2	*Level*	*D*	D^2	*Level*	*D*	D^2
Australia	-2.62	**-6.64**	**-13.23**	-3.12	**-7.48**	**-9.55**	-1.72	**-9.40**	**-10.55**	**-3.42**	**-6.26**	**-8.37**	-2.12	**-7.90**	**-10.02**
Brazil	-1.35	-2.29	**-8.97**	-1.28	**-3.81**	**-10.18**	-0.97	**-5.87**	**-7.21**	-0.67	**-3.38**	**-9.73**	-3.10	**-5.23**	**-10.14**
Canada	-1.55	**-5.60**	**-8.80**	-3.11	**-7.28**	**-10.21**	-1.08	**-4.29**	**-9.22**	-1.23	**-6.74**	**-9.18**	-2.13	**-6.75**	**-10.02**
China	-2.33	**-3.08**	**-7.80**				-0.28	**-4.71**	**-8.30**	-1.34	**-5.93**	**-7.45**	-0.25	**-6.55**	**-8.72**
France	-1.06	**-4.26**	**-14.04**	-3.11	**-5.09**	**-15.07**	-1.42	**-6.60**	**-8.49**	-2.01	**-6.07**	**-7.71**	-2.76	**-6.47**	**-9.50**
Indonesia	-1.96	**-7.72**	**-10.50**	-1.64	**-4.74**	**-9.42**	**-3.46**	**-9.48**	**-10.48**	-3.17	**-8.01**	**-8.50**	-1.88	**-8.21**	**-10.70**
India	0.53	**-4.63**	**-10.94**	-0.57	**-4.22**	**-11.57**	0.05	**-3.86**	**-9.91**	-0.97	**-4.34**	**-9.74**	-0.86	**-5.59**	**-10.04**
Ireland	-2.09	-2.34	**-6.28**	-1.23	**-5.45**	**-8.52**	-1.81	**-6.81**	**-8.41**	-1.52	**-5.88**	**-8.74**	-1.60	**-4.99**	**-9.52**
Japan	-0.05	**-4.55**	**-9.34**	-1.14	**-6.29**	**-8.63**	**-3.97**	**-7.15**	**-8.91**	-2.25	**-7.32**	**-14.43**	-1.53	**-5.45**	**-8.20**
Korea	-0.59	**-4.86**	**-9.09**	-1.31	**-7.68**	**-11.28**	-0.86	**-6.12**	**-9.59**	-1.87	**-8.23**	**-10.34**	-3.19	**-6.50**	**-9.60**
Mexico	**-3.78**	**-7.96**	**-9.29**	-2.32	**-7.10**	**-8.49**	-1.94	**-9.81**	**-10.24**	-2.18	**-5.72**	**-8.75**	**-4.12**	**-6.01**	**-15.00**
NEA	0.54	**-5.27**	**-8.90**	-2.82	**-4.90**	**-8.23**	-2.81	**-6.36**	**-7.86**	-2.18	**-6.16**	**-8.34**	-2.61	**-6.45**	**-8.70**
Norway	-1.83	**-11.32**	**-11.11**	-2.64	**-8.56**	**-10.43**	-0.56	**-11.77**	**-11.33**	-2.14	**-7.70**	**-10.72**	-2.21	**-8.56**	**-11.07**
New Zealand	-1.86	**-6.30**	**-9.36**	**-3.30**	**-9.11**	**-10.39**	-0.85	**-9.99**	**-10.27**	**-4.18**	**-7.28**	**-8.03**	-2.51	**-4.97**	**-9.77**
South Africa	-1.71	**-9.85**	**-12.25**	-1.23	**-3.83**	**-8.94**	-1.56	**-7.38**	**-13.35**	-2.81	**-7.08**	**-10.67**	**-4.19**	**-6.32**	**-7.95**
SEA	-1.81	**-2.59**	**-8.29**	-1.33	**-5.99**	**-9.58**	-1.72	**-6.19**	**-7.44**	-1.39	**-5.75**	**-8.76**	-2.46	**-6.27**	**-9.73**
Sweden	-1.85	**-6.44**	**-10.04**	-2.70	**-5.72**	**-9.90**	-2.08	**-6.47**	**-11.02**	-3.14	**-6.43**	**-8.40**	**-3.62**	**-6.35**	**-9.79**
Switzerland	-3.19	**-8.28**	**-10.69**	-3.12	**-8.43**	**-13.05**	**-4.75**	**-7.43**	**-9.48**	**-4.76**	**-8.33**	**-10.80**	-2.76	**-6.71**	**-9.21**
Turkey	-2.49	**-8.14**	**-9.07**	-1.99	**-4.36**	**-9.77**	-0.05	**-5.04**	**-8.38**	**-3.98**	**-7.94**	**-8.65**	-1.37	**-8.52**	**-10.21**
UK	-1.75	**-6.38**	**-10.18**	-2.69	**-5.88**	**-9.81**	-1.82	**-9.56**	**-10.24**	-1.33	**-6.46**	**-10.06**	-3.19	**-7.19**	**-9.53**
USA	-1.66	**-4.31**	**-7.77**	-2.08	**-6.54**	**-9.09**	-1.63	**-6.14**	**-9.44**	-1.67	**-5.24**	**-8.27**	-2.34	**-5.53**	**-9.29**

Notes: Unit root tests based on weighted-symmetric ADF test (WS). Lag Length chosen based on AIC. Values in bold indicate rejection of the null hypothesis. D and D^2 indicate first and second differences of the levels respectively.

Table A.3: Weak Exogeneity Test among NEA's and SEA's Variables

chosen lags $p^* = 1, q^* = 1$					
	South Euro Area Variables				
	ny^{south}	k^{south}	ex^{south}	im^{south}	$reer^{south}$
North Euro Area Model	4.90*	0.97	1.00	1.94	0.03
	North Euro Area Variables				
	ny^{north}	k^{north}	ex^{north}	im^{north}	$reer^{north}$
South Euro Area Model	0.36	5.81*	0.02	1.92	0.13
chosen lags $p^* = 2, q^* = 1$					
	South Euro Area Variables				
	ny^{south}	k^{south}	ex^{south}	im^{south}	$reer^{south}$
North Euro Area Model	1.12	4.35*	1.26	3.57	0.32
	North Euro Area Variables				
	ny^{north}	k^{north}	ex^{north}	im^{north}	$reer^{north}$
South Euro Area Model	0.02	7.29*	0.11	3.53	1.42

Notes: This table refers to weak exogeneity tests for the NEA's variables on SEA's region-specific VECM model and vice-versa. Weak exogeneity test is based on the works of Johansen (1992) and Harbo *et al*. (1998). See subsection 4.3 for more information. * denotes rejection of the test's null hypothesis.

Table A.4: Weak Exogeneity Test of the Country Specific Foreign Variables and Oil Price

Country/Region		**Foreign Variables**			
		ny^*	k^*	$reer^*$	*poil*
USA	F(1,134)	0.72	1.08	7.65*	
North Europe	F(1,134)	0.82	1.15	6.84*	2.81
South Europe	F(1,134)	0.01	4.93*	0.36	2.72
UK	F(1,134)	0.68	3.01	0.72	1.38
France	F(1,134)	14.32*	1.85	0.41	0.57
China	F(1,135)	8.58*	3.96*	0.37	1.76
Japan	F(2,133)	0.09	2.78	0.53	1.59
Korea	F(1,134)	0.70	0.33	0.69	2.08
Canada	F(1,134)	7.84*	1.07	1.45	0.45
Australia	F(1,134)	4.97*	1.03	0.00	0.00
Ireland	F(1,134)	0.22	0.39	0.03	0.19
Sweden	F(1,134)	0.43	0.50	0.01	1.42
Switzerland	F(3,132)	0.46	0.68	0.42	4.15*
Norway	F(1,134)	16.68*	1.98	2.00	1.42
New Zealand	F(1,134)	0.06	18.90*	12.62*	0.15
Mexico	F(2,133)	0.17	0.74	5.47*	0.31
Brazil	F(3,132)	0.74	0.46	1.13	0.23
Indonesia	F(1,134)	4.46*	0.06	1.31	4.51*
India	F(1,134)	1.34	1.90	1.38	0.02
Turkey	F(2,133)	0.33	0.29	5.18*	0.11
South Africa	F(1,134)	1.05	2.21	0.13	0.06

Note: (*) indicates rejection of the null hypothesis of the test.

Table A.5: Average pair-wise cross section correlations

Country/Region	***ny***		***k***		***ex***		***im***		***reer***	
	Levels	1st Diff.	Levels	1st Diff.	Levels	1st Diff.	Levels	1st Diff.	Levels	1st Diff.
USA	0.83	0.08	0.85	0.14	0.98	0.25	0.97	0.27	-0.06	-0.14
North Europe	-0.14	0.05	0.83	0.12	0.98	0.23	0.98	0.26	0.03	-0.01
South Europe	0.76	0.09	0.73	0.14	0.98	0.27	0.95	0.27	0.02	0.04
UK	0.83	0.06	0.83	0.05	0.99	0.17	0.98	0.19	-0.06	-0.03
France	0.83	0.09	0.87	0.14	0.98	0.30	0.98	0.28	0.15	0.04
China	0.81	0.00			0.98	0.14	0.97	0.08	0.17	-0.04
Japan	0.75	0.03	0.44	0.08	0.98	0.28	0.96	0.25	-0.25	-0.18
Korea	0.78	0.05	0.84	0.04	0.98	0.12	0.98	0.11	0.19	0.09
Canada	0.79	0.06	0.87	0.13	0.96	0.20	0.98	0.25	0.27	0.14
Sweden	0.78	0.09	0.84	0.15	0.98	0.24	0.98	0.29	0.15	0.06
Switzerland	-0.41	0.03	0.79	0.01	0.96	0.11	0.97	0.09	-0.17	-0.06

Table A.6: Structural Stability Tests, number of rejections of the null hypothesis

Structural Stability Tests	**Domestic Variables (rejection %)**						**Numbers of rejections(%)**
	ny_{it}	k_{it}	ex_{it}	im_{it}	$reer_{it}$	*poil*	
PKsup	2(9.5)	1(5)	6(28.5)	2(9.5)	0(0)	0	11(10.4)
PKmsq	3(14.2)	1(5)	5(23.8)	1(4.8)	0(0)	0	10(9.5)
Nyblom	6(28.5)	7(35)	9(42.8)	6(28.5)	8(38)	1	37(35.2)
Robust-Nyblom	2(9.5)	4(20)	5(23.8)	5(23.8)	7(33)	1	24(22.8)
QLR	7(33)	9(45)	10(47.6)	13(61.9)	12(57.1)	1	52(49.5)
Robust-QLR	7(33)	6(30)	6(28.5)	3(14.2)	4(19)	0	26(24.7)
MW	7(33)	7(35)	9(42.8)	8(38)	10(47.6)	1	42(40)
Robust- MW	6(28.5)	5(25)	6(28.5)	4(19)	8(38)	0	29(27.6)
APW	9(42.8)	10(47.6)	9(42.8)	14(67)	12(57.1)	1	55(52.3)
Robust- APW	6(28.5)	5(25)	6(28.5)	4(19)	7(33)	0	28(27)

Note: All tests are conducted at the 5% significance level.

Table A.7: GFEVD of the NEA and SEA real trade flows

Proportion of forecast error variance		***n*-step quarters ahead**						
		0	2	4	6	8	10	12
		North Euro Area Real Imports (%)						
North Euro Area	im	83.23	73.53	70.67	69.60	69.09	68.84	68.75
North Euro Area	ex	26.47	36.38	37.30	36.94	36.71	36.25	35.84
North Euro Area	k	27.80	28.67	27.42	26.42	25.60	25.01	24.62
North Euro Area	reer	7.78	7.93	8.41	8.63	8.83	8.87	8.87
Mexico	im	6.72	6.12	6.20	6.25	6.33	6.42	6.47
Oil Price		3.26	6.06	6.42	6.63	6.64	6.58	6.51
North Euro Area	ny	3.42	4.64	5.15	5.49	5.74	5.94	6.15
South Euro Area	im	3.75	5.02	5.23	5.18	5.12	5.03	4.93
China	ny	1.23	3.49	4.71	5.27	5.42	5.38	5.22
Japan	ex	1.36	3.47	3.81	3.81	3.72	3.61	3.51
Total Sum		232	253.3	258.	258.7	258.6	257.9	257.2
		South Euro Area Real Exports (%)						
South Euro Area	ex	80.23	72.94	68.87	66.29	63.98	61.93	60.18
South Euro Area	im	23.28	22.48	23.15	23.86	24.40	24.91	25.45
South Euro Area	rer	3.78	8.69	11.73	14.27	16.48	18.21	19.63
North Euro Area	ex	9.41	13.21	13.10	12.40	11.42	10.44	9.52
North Euro Area	im	6.67	10.42	11.46	11.71	11.51	11.29	11.02
France	ex	9.47	10.07	9.87	9.67	9.40	9.11	8.79
Japan	ex	8.46	10.26	10.09	9.63	9.12	8.60	8.14
North Euro Area	rer	2.54	5.24	6.78	7.71	8.44	8.88	9.21
Canada	im	6.22	6.96	7.01	6.96	6.94	6.85	6.79
North Euro Area	ny	2.60	4.14	5.22	5.80	6.23	6.53	6.73
Total Sum		259.2	280.5	287.6	290.6	291.0	290.0	288.6
		South Euro Area Real Imports (%)						
South Euro Area	im	78.18	70.10	67.37	66.16	65.62	65.36	65.10
South Euro Area	k	31.01	36.58	37.47	37.96	38.32	38.44	38.51
South Euro Area	ex	22.09	17.03	14.51	13.14	12.30	11.68	11.18
South Euro Area	ny	1.61	11.50	14.49	15.80	16.55	16.99	17.34
North Euro Area	im	9.06	10.12	9.91	9.70	9.52	9.39	9.27
North Euro Area	ex	7.53	9.65	9.34	8.85	8.43	8.12	7.76
Sweden	im	6.93	7.41	7.42	7.35	7.31	7.29	7.30
France	ex	3.32	5.20	5.42	5.42	5.37	5.34	5.25
Japan	ex	4.67	5.61	5.24	4.85	4.62	4.39	4.20
Canada	im	4.77	4.81	4.55	4.43	4.37	4.36	4.28
Total Sum		268.6	288.7	287.5	285.0	283.3	281.4	279.4

Table A.8: GFEVD of the USA and China Real Imports

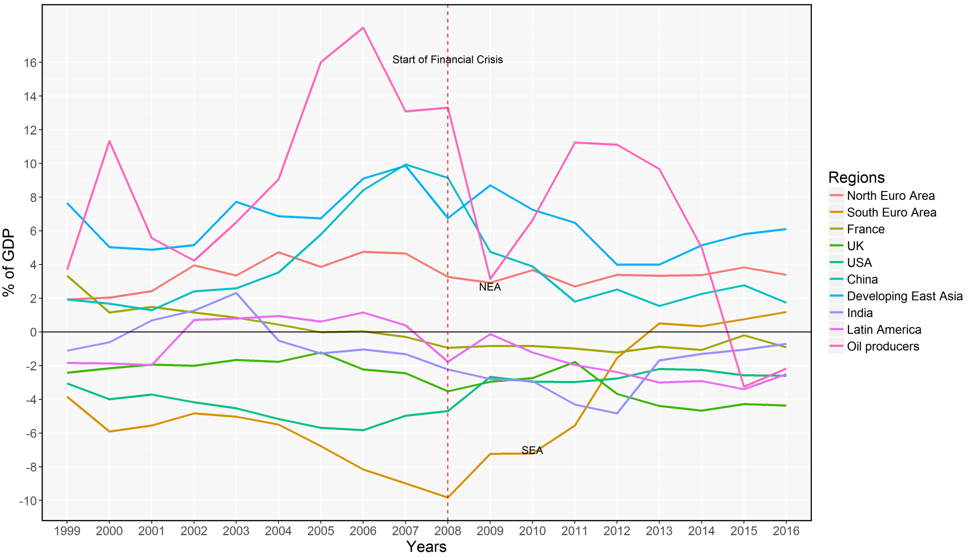
Proportion of forecast error variance		***n*-step quarters ahead** 0	2	4	6	8	10	12
		USA Real Imports (%)						
USA	im	85.81	74.45	70.04	67.14	64.62	62.43	60.54
USA	k	32.08	43.79	44.04	43.73	43.17	42.30	41.33
USA	ny	12.59	34.74	38.00	39.41	39.79	39.62	39.36
USA	ex	12.24	17.82	17.85	17.66	17.29	16.77	16.28
France	ex	6.25	7.27	7.59	7.79	7.95	7.91	7.87
North Euro Area	rer	3.15	4.06	4.51	5.21	5.87	6.44	6.98
Canada	im	5.16	3.76	3.67	3.66	3.64	3.62	3.59
Sweden	ex	3.40	4.02	4.03	3.83	3.65	3.43	3.21
Sweden	rer	2.06	3.80	4.09	3.99	3.77	3.57	3.34
North Euro Area	ny	1.99	2.98	3.44	3.77	4.02	4.22	4.36
China	ny	0.77	2.90	4.05	4.42	4.31	3.97	3.66
Canada	ex	4.17	3.35	3.23	3.28	3.42	3.54	3.66
Total Sum		257.1	297.6	300.5	301.3	300.3	298.2	296.2
		China Real Imports (%)						
China	im	95.58	89.70	84.62	80.77	77.93	75.81	74.15
China	ex	22.69	30.38	36.77	41.68	45.14	47.57	49.29
China	ny	5.23	6.27	7.15	8.10	9.22	10.07	10.91
Turkey	k	7.74	6.17	5.61	5.33	5.12	5.01	4.94
Norway	ny	5.28	5.48	5.41	5.29	5.16	5.05	4.96
Switzerland	k	5.31	5.19	4.68	4.22	3.86	3.59	3.40
South Africa	im	3.59	4.17	4.42	4.48	4.48	4.44	4.36
Brazil	ex	3.44	3.81	4.09	4.23	4.31	4.32	4.32
South Africa	ex	3.64	3.76	3.85	3.87	3.76	3.69	3.60
Canada	ex	4.03	3.95	3.71	3.50	3.31	3.17	3.08
Korea	ny	4.04	3.69	3.35	3.12	2.94	2.79	2.68
Switzerland	ex	5.27	4.07	3.36	2.89	2.54	2.29	2.13
Total Sum		255.2	253.5	253.3	253.7	254.3	254.8	254.7

Table A.9: Response % of Trade Balance in Countries of Interest based on GIRFs

Positive shock to NEA non-export input												*Response Significance*
		NEA	*SEA*	*China*	*France*	*India*	*Japan*	*Sweden*	*Switzerland*	*UK*	*USA*	Statistically Insignificant
Real domestic demand	1 year	**0.35**	**0.08**	**0.15**	**0.04**	**0.11**	0.07	**0.08**	**0.30**	0.05	-0.04	**Statistically Significant (Bold)**
	3 years	**0.33**	0.07	**0.19**	0.04	**0.12**	**0.13**	0.06	**0.28**	0.04	-0.06	
Exports	1 year	**-0.37**	**-0.28**	-0.37	-0.14	0.00	**-0.18**	**-0.39**	-0.18	**-0.03**	**-0.02**	
	3 years	**-0.37**	**-0.30**	-0.47	-0.15	0.04	**-0.03**	**-0.40**	-0.15	**-0.04**	0.02	
Imports	1 year	**-0.07**	0.16	0.04	**-0.07**	0.16	0.07	**-0.09**	0.13	0.02	**-0.08**	
	3 years	**-0.09**	0.18	0.10	**-0.08**	0.05	0.22	**-0.11**	0.15	0.02	**-0.11**	
Trade Balance (Ex-Im)	1 year	**-0.30**	**-0.28**	**-0.41**	**0.07**	-	**-0.18**	**-0.30**	-	**-0.03**	**0.06**	
	3 years	**-0.28**	**-0.30**	**-0.58**	**0.08**	-	**-0.03**	**-0.29**	-	**-0.04**	**0.13**	
Positive shock to NEA real imports												
		NEA	*SEA*	*China*	*France*	*India*	*Japan*	*Sweden*	*Switzerland*	*UK*	*USA*	
Real domestic demand	1 year	-0.05	0.03	-0.11	0.01	-0.01	-0.06	0.00	-0.10	**-0.08**	**0.07**	
	3 years	0.06	0.08	-0.05	0.04	0.01	-0.06	0.03	0.03	-0.06	**0.08**	
Exports	1 year	**0.63**	**0.38**	0.10	**0.37**	0.03	**0.28**	**0.30**	**0.27**	**0.27**	0.09	
	3 years	**0.57**	**0.34**	-0.08	**0.30**	-0.04	0.13	0.18	0.20	**0.19**	0.05	
Imports	1 year	**0.81**	**0.40**	-0.06	**0.29**	0.04	**0.16**	**0.39**	0.16	**0.11**	**0.23**	
	3 years	**0.77**	**0.40**	-0.04	**0.21**	-0.05	0.10	**0.27**	0.14	0.08	**0.21**	
Trade Balance (Ex-Im)	1 year	**-0.17**	**-0.02**	-	**0.08**	-	**0.11**	**-0.09**	0.27	**0.15**	**-0.23**	
	3 years	**-0.20**	**-0.06**	-	**0.09**	-	-	**-0.27**	-	**0.19**	**-0.21**	
Positive shock to SEA Real Imports												
		NEA	*SEA*	*China*	*France*	*India*	*Japan*	*Sweden*	*Switzerland*	*UK*	*USA*	
Real domestic demand	1 year	-0.01	**0.17**	-0.07	**0.05**	-0.02	-0.05	-0.01	0.03	0.00	0.00	
	3 years	0.03	**0.25**	-0.01	**0.07**	0.00	-0.04	0.00	0.11	0.01	-0.01	
Exports	1 year	**0.31**	**0.53**	**0.56**	**0.27**	0.17	**0.22**	**0.21**	0.09	**0.22**	**0.19**	
	3 years	**0.26**	**0.58**	0.43	**0.24**	0.13	0.13	0.15	0.01	**0.18**	0.17	
Imports	1 year	**0.23**	**1.05**	0.39	**0.23**	0.14	0.04	**0.26**	**0.20**	**0.19**	0.10	
	3 years	**0.20**	**1.10**	0.48	**0.18**	0.12	-0.03	**0.20**	0.13	**0.17**	0.02	
Trade Balance (Ex-Im)	1 year	**0.08**	**-0.52**	**0.56**	**0.05**	-	**0.22**	**-0.05**	**-0.20**	**0.04**	**0.19**	
	3 years	**0.06**	**-0.52**	-	**0.06**	-	-	**-0.20**	-	**0.01**	-	
Negative shock to SEA Real Effective Exchange Rate												
		NEA	*SEA*	*China*	*France*	*India*	*Japan*	*Sweden*	*Switzerland*	*UK*	*USA*	
Real domestic demand	1 year	**-0.06**	-0.04	-0.03	**-0.04**	-0.01	-0.08	-0.04	-0.07	-0.03	0.03	
	3 years	-0.06	-0.05	-0.01	-0.03	0.01	-0.09	-0.01	-0.04	-0.03	0.06	
Exports	1 year	0.05	**0.44**	0.22	**0.17**	**0.28**	-0.09	**0.32**	0.00	0.09	-0.16	
	3 years	0.06	**0.58**	0.17	**0.18**	**0.32**	-0.17	**0.37**	-0.01	0.11	-0.19	
Imports	1 year	0.04	-0.21	0.16	0.10	**0.36**	0.04	0.09	-0.03	-0.02	0.06	
	3 years	0.04	-0.15	0.20	0.11	**0.32**	0.08	**0.16**	-0.01	0.00	0.15	
Trade Balance (Ex-Im)	1 year	-	**0.44**	-	**0.17**	**-0.08**	-	**0.32**	-	-	-	
	3 years	-	**0.58**	-	**0.18**	**0.00**	-	**0.21**	-	-	-	

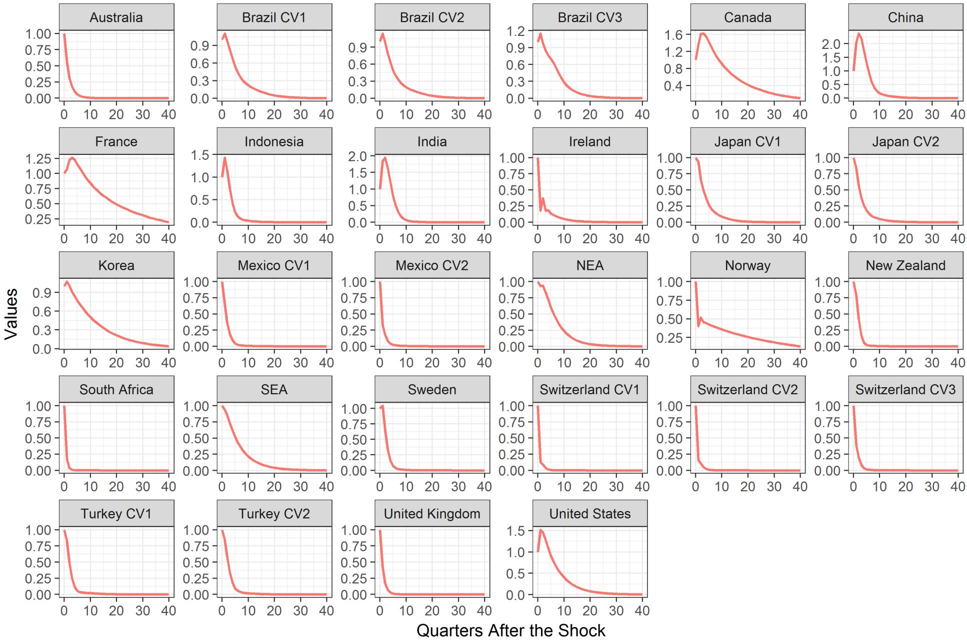
Note: Trade Balance was estimated after using only statistical significant shocks.

Figure A.1: Regional Current Account Balances as percent of GDP



Source: OECD, World Bank and authors' calculations.

Figure A.2: Bootstrap Means of Persistence Profiles



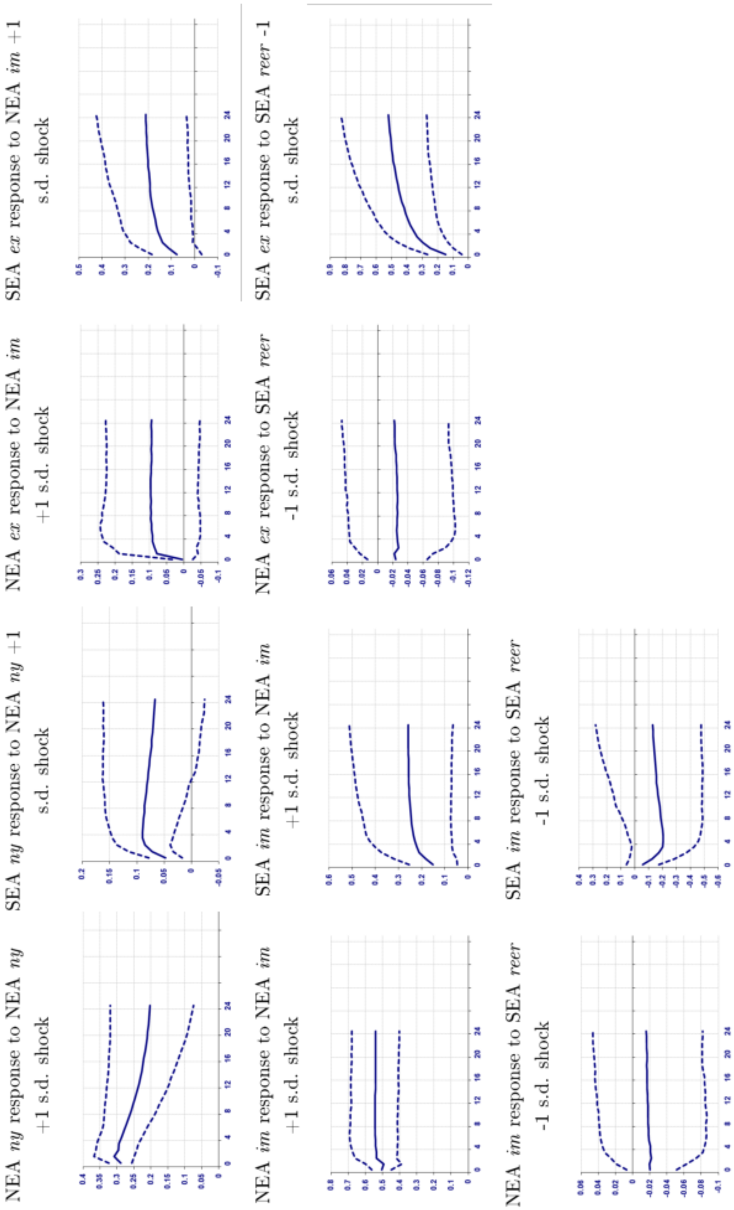


Figure A.3: Orthogonalized Impulse Response Functions Results

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