Int Econ Econ Policy (2009) 6:115–133
DOI 10.1007/s10368-009-0135-2

ORIGINAL PAPER

Global current account adjustment: trade implications for the euro area countries

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Published online: 9 June 2009

Abstract Although the euro area is not one of the major players in current global imbalances, the rebalancing of the current global imbalances is coupled with a significant appreciation of the euro against. In this paper, I present estimations of trade equations for individual euro area countries using a vector error correction model. Each euro area member has got a different trade elasticity, in the short as well as in the short run. Results show that exchange rate innovations affect individual euro area countries at different rates, complicating the response of the euro area's one-size-fits-all monetary policy.

Keywords Exports · Imports · Elasticities · Euro area · Divergences

JEL classifications F17 · F31 · F41

1 Introduction

The USA's current account deficit peaked to an all-time high in 2006. It measured almost 7% of GDP in 2006, which is an annual amount of about 810 billion U.S. dollars that the Americans are spending more than their economy actually produces. For 2007 and 2008 the current account deficit is estimated to be just below 800 billion USD, which is about five and a half per cent of the U.S. GDP.[1]

As this deficit is financed by rising surpluses elsewhere in the world, the economic growth of some big economies such as China or Germany are becoming more dependent on exports.

[1] IMF world economic outlook.

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If some shock (a demand shock in the USA for instance/an increase in the U.S. savings rate) were to rebalance the global imbalances, the exchange rate innovation could cause a severe problems in the euro area. This motivated me to look at the trade responses to the exchange rate innovations of the euro area countries in more detail.

With the nominal exchange rate being eternally fixed at one rate and a single authority being in charge of the monetary policy for the entire area; certain mechanisms and instruments are not available to the euro area members to deal with an exchange rate shock to facilitate individual preferences.

Furthermore, although the euro area members are highly integrated with each other, there is still divergence existing, as substantial and persistent inflation differentials show.[2] With nominal exchange rates unable to adjust, prices have to adjust instead, leading to diverging inflation rates, and hence to diverging real interest rates and real exchange rates. These in turn cause divergences in economic performance.[3]

Most research agrees that the current global imbalances will eventually have to readjust, requiring an exchange rate change. If the dollar depreciated against the euro the nominal exchange rate change causes the same shock to all EMU (Economic and Monetary Union) countries. However, the individual members will be affected asymmetrically as their economies are involved in the global imbalances to very different degrees. A negative demand shock will have effects of varying magnitudes in the euro area, possibly contributing to further divergences.

This paper aims to look at the trade effects resulting from an exchange rate innovation. As every euro area member state has a different degree of openness, exchange rate pass-through[4] and intensity of extra euro area trade; the impact of an exchange rate change on net exports will be different for each country. Asymmetric effects in trade and hence output in the tradable goods sectors and output performances in general are consequences of this.

This paper presents the exchange rate elasticities of exports and imports held with external trade partners of the individual euro area states for each euro area member. This will give an insight of how an exchange rate innovation would affect the euro area trade pattern and how differently the euro area members' exports and imports are expected to react.

[2] Honohan and Lane (2003 and 2004) identify slightly greater inflation dispersion in the euro area than among the U.S. states combined with a significant impact of exchange rate movements on inflation movements indicating inflation differentials due to different trade patterns and exchange rate pass through behaviour. Angeloni and Ehrmann (2004) examine the correlation between output gaps and inflation differentials caused by exchange rate changes. However, they found that exchange rate changes caused inflation differentials only by a small extent. ECB (2003) found inflation dispersion in the euro area to be about twice as big as across the German Bundesländer, the Spanish Autonomous Communities and the Italian cities.

[3] Since the beginning of the 1990s, the average business cycle synchronization of each euro area country with respect to the others has improved in all cases. Some smaller countries have more idiosyncratic business cycles than larger countries or countries that trade more intensely with larger neighbours. (Benalal et al. 2006)

[4] A lower exchange rate pass through to trade prices may mute the responsiveness of the nominal trade balance. See Gust and Sheets (2006), Campa and Gonzalez Minguez (2006)) and Faruqee (2004) for more research done on the subject of exchange rate pass through in the euro area.

The next section of this paper will briefly look at the current state of global imbalances. Section 3 will examine the involvement of the individual euro area states in the global imbalances, as well as the necessary theoretical background, followed by the econometric methodology and data description in Section 4. Section 5 presents and interprets the estimation results. Section 6 concludes.

2 The euro area and its burden of global imbalances

Although the euro area's current account is roughly balanced the euro currency might still be strongly affected by rebalancing global current accounts. The magnitude of the global readjustment's impact on the exchange rate depends strongly on Asia and the Middle East as the literature discussed below showed.

A theoretical paper by Obstfeld and Rogoff (2005) describes the effects of the current account rebalancing on the dollar exchange rate in a three country model of the USA, Europe and Asia.[5] They consider three scenarios resulting in differently sized negative effects for Europe and Asia, simulating the model using a potential demand shock that drives the global current account rebalancing. The first scenario describes all current account imbalances being narrowed to zero. In the second scenario, China clings to the dollar peg and Europe absorbs all changes in the U.S. and Asian current accounts. In the third scenario, Europe absorbs the entire current account improvement of the USA and the Asian current account is held constant (Asia allows its currency to adjust only to maintain a constant current account). In the first scenario the real bilateral exchange rate depreciates by about 35% against Asia and by 28% against Europe. In the second scenario Asia has to widen its current account surplus. Here the real euro appreciates by almost 50% against the dollar and by 50% against Asian currencies. In the third scenario, Europe's real exchange rate against the dollar would appreciate by about 45%.

Blanchard et al. (2005) also compute the necessary exchange rate adjustment in order to close the global imbalances, using a two country model with imperfect substitution between U.S. and foreign goods, between U.S. and foreign assets and consideration of the valuation effect.

Under imperfect substitutability individuals hold a share of domestic and foreign assets depending on the rate of return and on other factors.[6] For imperfect substitutability in the goods market, an unexpected dollar depreciation would increase the value of foreign assets held by foreigners, decreasing the U.S. net debt position through an improvement in the trade balance and through asset revaluation. The dynamics of the model depend on the degree of substitutability. For lower

[5] The model features the production of non-tradable goods and home bias towards domestically produced goods. A transfer effect describes the link between an international current account change on the nominal and real exchange rate. In the real exchange rate effect the current account movement affects the prices of non-traded goods. The revaluation effect caused by the exchange rate changes and a redistribution of international indebtedness is also accounted for. Another key parameter in the model is the substitutability among traded goods and between traded and non-traded goods.

[6] Under these circumstances the exchange rate is not responding to news (demand shock) about the current account as strongly as under perfect substitutability, but to changes in the world distribution of wealth or in portfolio preferences.

substitutability, a shift of preferences towards foreign goods causes the initial depreciation to be smaller and the anticipated depreciation to be larger. For higher substitutability, the initial depreciation is larger followed by a smaller depreciation.

A shift of preferences towards U.S. assets would cause an initial dollar appreciation increasing the trade deficit and lowering net debt position initially. Over time the net debt increases and the exchange rate depreciates. It is necessarily lower than before the shift. The lower the substitutability is, the higher the initial appreciation and hence the larger the anticipated depreciation. The reverse is the case with higher substitutability, where the initial appreciation is smaller and therefore the lower the anticipated depreciation.[7]

The literature on current account reversals is vast and shows different scenarios and outcomes, but the one thing they almost all agree on is that the U.S. current account deficit will shrink eventually, even if not back to zero, but to a sustainable level. Similar studies were undertaken by Faruqee et al. (2005) and Lane and Milesi-Ferretti (2006).[8]

3 Differences among the euro area member states

3.1 Sizable current account surpluses and deficits

The individual current account balances of the euro area's member states in Table 1 reveal that each euro members contributes to the global imbalances to vastly different degrees.[9]

Over the last 6 years Germany developed a surplus of 120 billion U.S. dollars, accounting for 4% of Germany's GDP. Spain in contrast developed a deficit which exceeded 100 billion dollars in 2006 (8% of Spain's GDP). France and Italy had a deficit of about 40 and 26 billion U.S. dollars in 2006—accounting for 2 and 1% of GDP, while the Netherlands' surplus reached 50 billion in 2006 (8% of GDP) surplus. Portugal's deficit grew to 10% of GDP; Greece's to 8%, while Luxembourg drives an 8% surplus. Ireland had a deficit of 3% of GDP in 2006, while Belgium had a 3% surplus. Austria was almost balanced with a 2% surplus. If those figures are added, the euro area as an entity looks rather balanced. Among the euro area members however, there are nearly balanced, high surplus and high deficit countries.[10,11]

[7] As for China, Blanchard et al. (2005) argue that in case the Chinese dollar peg was abandoned, the Chinese central banks would stops intervening, which means a loss of a big investor with extreme dollar preferences. Hence the effective euro exchange rate would depreciate even if the bilateral exchange rate appreciates.

[8] Edwards (2005) gives a detailed overview of research done on the U.S. current account and the dollar.

[9] See EC (2005) and Ahearne and von Hagen (2006) for a more detailed analysis of the euro area's involvement in the global imbalances.

[10] The current account balances considered here are also against other euro area members, not just against external trading partners.

[11] EC (2006) and Ahearne et al. (2007) deliver further insight into euro area internal and external imbalances.

Table 1 Current account balances (in billion USD and percent of GDP)

	1995	2000	2003	2006
Austria	−6	−5	−1	5
	−3	−3	0	2
Belgium	15	9	13	11
	6	4	4	3
Finland	5	11	11	10
	4	9	6	5
France	17	18	8	−39
	1	1	0	−2
Germany	−30	−33	46	121
	−1	−2	2	4
Greece	−1	−10	−12	−20
	−1	−9	−7	−8
Ireland	2	0	0	−6
	3	0	0	−3
Italy	24	−6	−20	−26
	2	−1	−1	−1
Luxembourg	2	3	2	3
	12	13	6	8
Netherlands	26	7	29	50
	6	2	5	8
Portugal	0	−12	−9	−19
	0	−10	−6	−10
Spain	0	−23	−32	−101
	0	−4	−4	−8
Euro Area	56	−41	34	−10

Source: IMF

positive figures = surplus, negative figures = deficit

3.2 The trade link to the USA

Looking closer at the individual bilateral trade intensities with the USA[12] shows that the euro area's trade with the USA grew before and after the euro was introduced, even at times when the euro area's total trade balance was shrinking.[13]

Even when total net exports of the euro area fell, the euro exports to the USA still exceeded the imports. Figure 1 shows that most countries have gained in net exports to the USA.

[12] Due to data availability problems the focus is on trade in goods. This can also be justified by looking at the U.S. trade balance decomposed into goods and services. The U.S. services balance is in a slight surplus for the last 20 years and dwarfs compared to the large deficit in the goods balance. (BEA)
[13] ECB Monthly Bulletin April 2006 and December 2001.

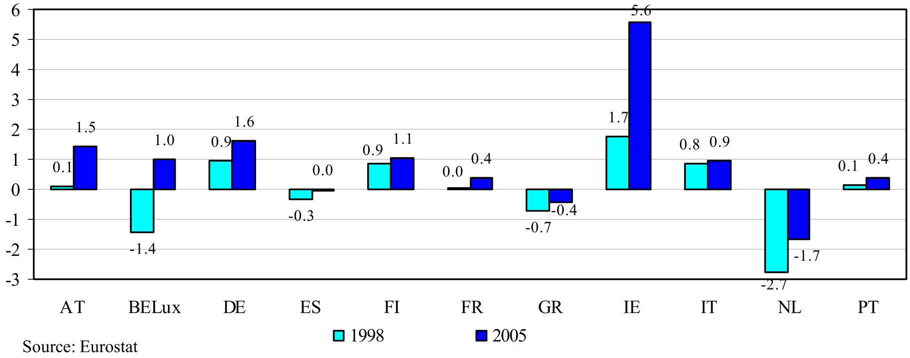

Fig. 1 Trade balances of goods with the USA as a percentage of GDP in 1998 and 2005

All euro area countries have increased their exports to the USA in relation to their imports from the USA. Even countries that were running a trade deficit with the USA in 1998, such as Spain, Greece, the Netherlands and Belgium/Luxembourg; by 2005, their deficits had declined or turned into a surplus. Ireland and Belgium/ Luxembourg's growth of exports relative to imports is noticeable. For these countries the net exports grew considerably. Ireland's surplus even exceeded 5% of GDP.[14] On the other hand Spain, Portugal, Greece and France all have a rather moderate trade link to the USA.

4 Methodology of estimating trade elasticities

4.1 Econometrical background

This paper focuses on the trade effects of the individual euro area countries motivated by the danger of an exchange rate change due to global readjustments in current accounts. The estimations of trade equations exhibit the individual trade elasticities for exports and imports respectively. In order to find out how the exchange rate change is going to affect the exports and imports, the following model (Chinn 2005) will be applied.[15]

On the euro area import market, the euro area country (euro) imports goods which are supplied by the foreign country (*):

$$M^{D^{euro}} = f^{euro}\left(Y^{euro}, P^{M^{euro}}\right) \tag{1}$$

$$X^{S*} = g^{*}\left(P^{X*}\right) \tag{2}$$

[14] Comparing this to the overall current account balance, the difference is quite striking. Ireland is in the special position of running a rather larger trade deficit in services (almost 7% of GDP). As Ireland is a clear outlier, I will not discuss the trade in services here. For a more detailed description of Irish trade in goods and services see Lane and Ruane (2006).

[15] Other studies conducted estimating the income and exchange rate elasticities are Marquez, J. (Marquez 1990, 2005), Hooper et al. (1998), Lee and Chinn (1998) and Boyd et al. (2001).

Equation 1 reflects the import demand M D of the euro area country (euro), determined by the domestic income Y ^{euro} and the price level of imports P. Equation 2 expresses the export supply XS* equation of the foreign country for exports to the euro area $_{X\,*}$ member, which is determined by the foreign export price level P . Respectively the import demand equation of the foreign country for the euro area goods and the export supply of the euro state to the foreign country are expressed in Eqs. 3 and 4:

$$M^{D*} = f^{*}\left(Y^{*}, P^{M^{*}}\right) \tag{3}$$

$$X^{S^{euro}} = g^{euro}\left(P^{X^{euro}}\right) \tag{4}$$

In the equilibrium on the euro area import market for foreign goods, the price of the foreign exports equals the price of the imports to the country (euro) adjusted by the nominal exchange rate E^{euro} [16]:

$$P^{X^{*}} = P^{M^{euro}} \times E^{euro}.$$

The real exchange rate Q , which is: $\text{Q}^{\text{euro}} = \text{E}^{\text{ euro}}$ (P^{euro}/P), adjusts the relative foreign export price and the relative euro area member import price:

$$\left(P^{X^{*}}/P^{*}\right) = Q^{euro}\left(P^{M^{euro}}/P^{euro}\right). \tag{5}$$

The equilibrium condition—that demand equals supply—delivers import and export equations (here in log-linearised form[17]):

$$m_t = \alpha_0 + \alpha_1 q_1 + \alpha_2 y_t^{euro} + \varepsilon_{1t} \tag{6}$$

$$x_t = \beta_0 + \beta_1 q_1 + \beta_2 y_t^{*} + \varepsilon_{2t}, \tag{7}$$

where $\alpha_1 > 0, \alpha_2 > 0, \beta_1 < 0, \beta_2 > 0.$

Equation 6 combines relationship between the import price and the import volume the expressed in Eq. 1 (as well as the relationship between income and imports) and the relationship between the real exchange rate and the relative prices stated in Eq. 5. This also applies for Eq. 7.

The estimations of trade equations exhibit the trade elasticities which can be used to draw conclusions about expected behaviour of imports and exports and hence about the divergence of trade effects in the euro area when an exchange rate innovation hits the euro area. Therefore, a plausible econometric model is needed. I will again follow Chinn (2005).

Supply and demand are presumed to be equal to one another in the long run, while deviations occur in the short run. As the time series of the variables were found to be cointegrated, a Vector Auto Regression (VAR) model was estimated including an error correcting term. Vector error correction models (VECM) are

[16] Here the exchange rate is expressed using indirect quotation, i.e. expressing the foreign currency in terms of the domestic currency. Thus a rise in the value of the exchange rate reflects an appreciation of the currency.

[17] The lower case letters stand for the logarithms of the respective variable.

designed for the use of non stationary time series that are known to be cointegrated. The cointegration restriction is built into the VECM. It restricts the long-run behaviour of the endogenous variables to converge to their cointegrating relationship while allowing for short run adjustment dynamics. The following VECM for imports was estimated, after having tested for the cointegration order and having identified the cointegrating vector with the Johansen maximum likelihood procedure.

$$\begin{aligned}\Delta m_t^{euro} &= \gamma_{10} + \delta_1\left(m_{t-1}^{euro} - \beta_1 q_{t-1}^{euro} - \beta_2 \gamma_{t-1}^{euro}\right)\\ &\quad +\gamma_{11}\Delta m_{t-1}^{euro} + \gamma_{12}\Delta q_{t-1}^{euro} + \gamma_{13}\Delta\gamma_{t-1}^{euro} + \varepsilon_{1t}\\ \Delta q_t &= \gamma_{20} + \delta_2\left(m_{t-1}^{euro} - \beta_1 q_{t-1}^{euro} - \beta_2 \gamma_{t-1}^{euro}\right)\\ &\quad +\gamma_{21}\Delta m_{t-1}^{euro} + \gamma_{22}\Delta q_{t-1}^{euro} + \gamma_{23}\Delta\gamma_{t-1}^{euro} + \varepsilon_{2t}\\ \Delta y_t^{euro} &= \gamma_{30} + \delta_3\left(m_{t-1}^{euro} - \beta_1 q_{t-1}^{euro} - \beta_2 \gamma_{t-1}^{euro}\right)\\ &\quad +\gamma_{31}\Delta m_{t-1}^{euro} + \gamma_{32}\Delta q_{t-1}^{euro} + \gamma_{33}\Delta\gamma_{t-1}^{euro} + \varepsilon_{3t}\end{aligned} \tag{8}$$

For exports I estimated an analogous system of equations:

$$\begin{aligned}\Delta x_t^{euro} &= \gamma_{40} + \delta_4\left(x_{t-1}^{euro} - \varphi_1 q_{t-1}^{euro} - \varphi_2 \gamma_{t-1}^{*}\right)\\ &\quad +\gamma_{41}\Delta x_{t-1}^{euro} + \gamma_{42}\Delta q_{t-1}^{euro} + \gamma_{43}\Delta\gamma_{t-1}^{*} + \varepsilon_{4t}\\ \Delta q_t &= \gamma_{50} + \delta_5\left(x_{t-1}^{euro} - \varphi_1 q_{t-1}^{euro} - \varphi_2 \gamma_{t-1}^{*}\right)\\ &\quad +\gamma_{51}\Delta x_{t-1}^{euro} + \gamma_{52}\Delta q_{t-1}^{euro} + \gamma_{53}\Delta\gamma_{t-1}^{*} + \varepsilon_{5t}\\ \Delta y_t^{*} &= \gamma_{60} + \delta_6\left(x_{t-1}^{euro} - \varphi_1 q_{t-1}^{euro} - \varphi_2 \gamma_{t-1}^{*}\right)\\ &\quad +\gamma_{61}\Delta x_{t-1}^{euro} + \gamma_{62}\Delta q_{t-1}^{euro} + \gamma_{63}\Delta\gamma_{t-1}^{*} + \varepsilon_{6t}\end{aligned} \tag{9}$$

The system of Eqs. (8) and (9) contain the error correcting terms $\left(m_{t-1}^{euro} - \beta_1 q_{t-1}^{euro} - \beta_2 y_{t-1}^{euro}\right)$ and $\left(x_{t-1}^{euro} - \varphi_1 q_{t-1}^{euro} - \varphi_2 y_{t-1}^{*}\right)$, which in the long run equilibrium equal zero. This means, if δ is significantly different from zero, there is a mechanism which assures that the equilibrium on the exports and imports market will be achieved in the long run, although for short term deviations from the equilibrium.

4.2 Data

For the estimations quarterly data from 1980 (q1) to 2005 (q2) was used. Real export- and import- data was obtained from the IMF and OECD. The real GDP- data was obtained from Ecowin. The extra euro area real effective exchange rate and the foreign income series were calculated in the following manner.

4.2.1 The euro area member states' extra euro area real effective exchange rate

For calculating the extra euro area real effective exchange rates (REERs) it is common procedure to weight the currencies by their trade weights. As the interest lies in the external effective exchange rates of the euro area countries, the weights are obtained from the exports and imports with the ten biggest trading partners outside the EMU by referring to annual trade data in 2004. The trade weights are defined as:

$$w_{it} = \frac{X_{it} + M_{it}}{(X+M)_t}, \tag{10}$$

where *Xit* and *Mit* are exports and imports to and from the trading partner i, in period t, and $(X+M)_t$ is the total amount of exports and imports with the ten biggest trading partners. The trade data was obtained from the IMF Directions of Trade Statistics (DOTS) via Ecowin. On the basis of annual trade data these trade weights are applied for each quarter in further calculations.[18]

The real exchange rate is the product of the nominal exchange rate and the domestic price level relative to the foreign price level. Here again, the indirect quotation for the exchange rate is used, which means that the foreign currency is expressed in terms of the domestic currency. Thus an increase in the value of the real exchange rate is an appreciation of the currency. The bilateral real exchange rate is defined as:

$$q_{it} = e_{it}\frac{P_t}{P_{it}^*}, \tag{11}$$

where e_{it} is the bilateral nominal exchange rate of country i in period t, P_t the price level of the home country and P_{it}^* the price level of trading partner i in t. The prices are the Consumer Price Indices (CPI) which were obtained from Ecowin. The nominal exchange rates were also retrieved from the Ecowin data base, provided by the OECD Main Economic Indicators (MEI). Trading partners China and Turkey were included from 1987 when data was available. Eastern European countries such as Russia and the Czech Republic have been included in the REER since 1994.

Once the bilateral real exchange rates are calculated and rebased the weighted real exchange rate is calculated with the logarithms of the rebased real exchange rate. The REER then, is the sum of the bilateral weighted real exchange rates that are expressed here in logarithms:

$$REER_t = \sum_{i=1}^{n} w_{it}\, ln(q_{it}). \tag{12}$$

4.2.2 The foreign income of the euro area member states' trading partners

Another variable that had to be calculated is the foreign income of the euro area member states' trading partners.

The income of the euro area's main trading partners y* is calculated for each quarter of the period from 1980 (q1) to 2005 (q2).

For calculating y*, the foreign real GDPs of the top ten extra-EMU trading partners (of the euro area countries), is expressed in index form and weighted with the respective export weights. As our interest lies in the response of the euro area exports to the exchange rate movement, the weights are obtained from the exports to the ten biggest trading partners referring to annual trade data in 2004. The export weights are defined as:

$$w_{it} = \frac{X_{it}}{(X)_t}, \tag{13}$$

[18] As there was no trade data available for 2005 at the time the trade weights were calculated, the trade weights of 2004 are applied for the first two quarters in 2005.

where X_{it} is exports to the trading partner i in period t, and X_t is the total amount of exports to the ten biggest trading partners. The trade data is obtained from the IMF DOTS. GDP data was obtained from Ecowin.

On the basis of annual data these trade weights are applied for each quarter in further calculations.

In order to calculate the foreign GDP, the geometric mean of the individual GDP indices is formed. The real GDP indices are rebased and weighted with their corresponding export weight. Foreign GDP, then, is the sum of the individual weighted foreign real GDPs that are expressed here in logarithms:

$$y_t^* = \sum_{i=1}^{n} w_{it}\, ln\left(y_{it}^*\right). \tag{14}$$

5 Estimation results

5.1 Long-run relationships, the cointegrating relationship

The estimations cover a period from 1980 (q1) to 2005 (q2). For each euro area member (except Belgium and Luxembourg who are jointly considered) and for the euro area as an entity, models for exports and imports were estimated. Using the cointegration procedure developed in Johansen (1991) and Johansen and Juselius (1990), the long run relationship in Eqs. 8 and 9 is tested. In order to apply the Johansen procedure the determination of the lag length for the VAR model for each country is required, as well as the order of integration of the variables entering the VAR estimations. Using the Augmented Dickey Fuller Test for all variables shows that all variables are integrated of order one. The lag length is determined by the minimum AIC for the unconstrained VAR and varies from one to three lags in the export equations, and two to four lags in the import equations.

The results for the cointegration tests are reported in Table 2. The Johansen cointegration test and the cointegrating vectors are shown, normalised on x for the export equation. The normalisation yields the estimates of the long-run elasticities. There is at least one cointegrating relationship found for each country. In the case of Ireland the trace test only rejects the null hypothesis of no cointegration at a 10% marginal significance level. For each country, the long run coefficients for foreign economic activity (y*) and REER (q) have the correct signs. As the error correcting term equals zero in the long run and the cointegrating vector is normalised to one in the exports (x) the vector can be rewritten as an equation where x is a function of q and y*. In the case of Austria for instance, x equals (−0.92q + 1.65 y*). Hence a one unit increase in foreign income raises exports by 1.65 units in the long run. A one unit increase in q lowers x by 0.92 in the long run.

The long run elasticity of foreign income varies from −0.9 for Portugal to −3.75 for Ireland. For most other countries the elasticities are between −1.5 and −2.5. They are significantly different from zero for all countries.

As for the external real effective exchange rate (*q*), for Greece and Portugal, there is no significant long term influence found. Ireland and Italy show the highest long

Table 2 Results from cointegration test and the cointegrating vectors—export equation

	Lags	Number of cointegration relationships		Normalised cointegrating vector[a]		
		Tace test	Max Eig. test	x	q	y*
Austria	1	1	1	1	0.92*	−1.65**
Be/Lux	2	1	1	1	0.93***	−1.98***
Finland	1	1	1	1	1.03***	−1.93***
France	1	1	1	1	1.04***	−1.86***
Germany	2	1	1	1	0.80***	−1.78***
Greece	1	2	2	1	0.31	−1.69***
Ireland	2	0	1	1	1.77***	−3.75***
Italy	3	1	0	1	1.70***	−1.87***
Netherlands	1	1	1	1	1.55***	−2.50***
Portugal	3	1	1	1	0.02	−0.92***
Spain	3	1	1	1	1.19***	−2.15***
Euro Area	2	1	1	1	1.00***	−1.56***

[a] H_0: $\varphi_1 = 0$ and $\varphi_2 = 0$; *, **, ***10, 5 and 1% significance level

run elasticities of 1.8 and 1.7, while Germany and Austria shows the lowest of 0.8 and 0.92

The cointegrating vectors show more variability in the import equations than in the export equations. Table 3 reports the results from the Johansen cointegration test and the cointegrating vectors, normalised on m for the import equations.

Table 3 Results from cointegration test and the cointegrating vectors—import equation

	Lags	Number of cointegration relationships		Normalised cointegrating vector[a]		
		Tace test	Max Eig. test	m	q	y
Austria	2	1	1	1	0.40***	−3.58***
Be/Lux	3	1	1	1	0.21	7.32***
Finland	3	2	2	1	1.36***	−2.36***
France	3	1	0	1	1.80***	−2.81***
Germany	3	1	0	1	1.09***	−2.41***
Greece	3	1	1	1	1.21**	−1.59
Ireland	3	2	1	1	0.41**	−1.00***
Italy	4	1	1	1	−0.13	−2.88***
Netherlands	3	3	3	1	0.08	−1.92***
Portugal	3	1	1	1	−0.26**	−1.42***
Spain	3	1	1	1	−0.87***	−2.29***
Euro Area	3	2	2	1	−0.30**	−3.05***

[a] H_0: β_1=0; β_2=0; *, **, ***10, 5 and 1% significance level

There is also at least one cointegrating relationship found for each country. In the case of Germany the maximum eigenvalue test does not reject the null hypothesis of no cointegration, not even at a 10% marginal significance level. For each country domestic economic activity (y) is positively related to the import volume (m), although the long run elasticity varies from −1 for Ireland to −3.6 for Austria. For Belgium/Luxembourg the elasticity has the wrong sign and is rather high with a value of over 7.3. The euro area, France and Italy have long run income elasticities of about −3, the remaining countries lie in between −1.4 and −2.4. Except for Greece the elasticities are significantly different from zero.

As for the external real effective exchange rate (q) most countries show a long run elasticity with the wrong sign, which would imply that an appreciation of the euro lowers imports from outside the euro area. Only for Italy, Spain, Austria, Greece and Portugal, the sign is correct. The values are insignificant for Italy, as well as for Belgium/Luxembourg and the Netherlands.

5.2 Short-run dynamics

To recall from Eqs. 8 and 9 the lagged error correction term represents the residual from the cointegrating regression equation, which equals zero in the equilibrium. If the coefficients δ_1 and δ_2 are significantly different from zero and have a negative sign, there is a mechanism closing the gap when the system has deviated from the equilibrium.

Table 4 shows that the responsiveness of the dependent variable in each period to departures from the equilibrium varies strongly among the euro members. For Austria, France, Germany and Spain the responsiveness is not found to be significantly different from zero. Finland shows the highest speed of readjusting to the equilibrium, where about 50% of the readjustment occurs in one quarter, while it is only about 8% for Portugal. For the remaining countries the cointegrating coefficient varies from about 0.17 to 0.36.

The coefficients of the foreign income are relatively large, indicating a high responsiveness of the export volume to a change in foreign income. An absolute outlier is Greece with a foreign income elasticity of over 10. Portugal and Italy also show high elasticities with a coefficient of over 6. Ireland then follows with a coefficient of 4.5. All other countries' coefficients lie between 3 and 4. Belgium/Luxembourg shows the lowest coefficient of 2.65, which is not found to be significant.

The elasticities for the external real effective exchange rate (q) are also rather ambiguous among the euro countries, however all have the expected negative sign, implicating that an appreciation of the euro means a loss in competitiveness and hence a decline in exports to extra euro area destinations. Portugal has the highest coefficient of over −0.8, followed by Austria (−0.7). For the Netherlands, Finland and Greece the coefficients are insignificant; for the remaining countries the elasticities lie between −0.4 and −0.66. Ireland's responsiveness to changes in the real effective exchange rate is borderline significant.

The coefficients for the cointegrating equations of the import equations are again not as convincing as in the export equations. The results are presented in Table 5. Portugal has the highest coefficient of over −0.85, meaning a strong tendency to readjust to the equilibrium after deviating from it. Germany and Spain show a rather

Table 4 Regression results for error correction models, exports; 1980q1–2005q2

Country	Lags	CI-Eq.	Δx_{t-1}	Δq_{t-1}	Δy^*_{t-1}	R-squared	Akaike AIC
Austria	1	0.01	−0.47***	0.72***	2.83***	0.25	−2.87
Be/Lux	1	−0.36***	−0.31***	−0.43**	2.65*	0.39	−2.62
	2		−0.03	−0.62***	1.14		
Finland	1	−0.52***	−0.43***	−0.14	3.49***	0.54	−2.19
France	1	0.00	−0.73***	−0.64***	3.11***	0.54	−2.95
Germany	1	−0.09	−0.61***	−0.53***	3.55***	0.49	−3.11
	2		−0.05	−0.68***	0.41		
Greece	1	−0.36***	−0.41***	−0.07	10.11***	0.42	−0.09
Ireland	1	−0.18**	−0.40***	−0.40*	4.48***	0.43	−2.74
	2		0.17	0.27	−1.24		
Italy	1	−0.20***	−0.78***	−0.65***	6.28***	0.68	−2.59
	2		−0.47***	−0.72***	2.69		
	3		−0.43***	0.04	0.79		
Netherlands	1	−0.17**	−0.38***	−0.26	2.88***	0.29	−2.95
Portugal	1	−0.08**	−0.78***	−0.84***	6.65***	0.56	−2.26
	2		−0.60***	0.19	2.82		
	3		−0.43***	−0.31	0.84		
Spain	1	0.05	−0.88***	−0.66**	1.8	0.65	−1.94
	2		−0.50***	−1.12***	3.30**		
	3		−0.45***	−0.97***	−1.12		
Euro Area	1	−0.27***	−0.58***	−0.47***	3.91***	0.64	−3.56
	2		0.04	−0.36**	0.81		

*, **, ***10, 5 and 1% significance level

low coefficient of −0.14 and -0.18, while for Finland, the Netherlands, France and Ireland either positive or insignificant coefficients are found, indicating further diverging from the equilibrium or no adjustment at all. The cointegration seems to work in the import equations only for the Mediterranean countries.

The coefficients for the domestic income also show great dispersion. For Austria, Finland, and the Netherlands the coefficients are negative, implicating that an increase in domestic income would trigger a fall in imports from outside the euro area. Greece's and Portugal's coefficients are insignificant. Ireland shows the largest coefficient of over 7, while Germany's is just below 1.

The coefficients for the external real effective exchange rate are mainly negative, which would mean that a euro appreciation would lower imports from outside the euro area. Germany is the only country with a positive and significant coefficient of 0.3. Italy, Spain and the Netherlands show no responsiveness to changes in the exchange rate.

5.3 Impulse response functions

Looking at the impulse response functions shows graphically how an innovation in the exchange rate transmits into current and future export and import values. A one

Table 5 Regression results for error correction models, imports; 1980q1–2005q2

Country	Lags	CI-Eq.	Δm_{t-1}	Δq_{t-1}	Δy_{t-1}	Constant	R-squared	Akaike AIC
Austria	1	−0.33***	−0.29***	−0.35*	−0.7	0.04***	0.37	−2.75
	2		0.08	−0.45**	−2.46***			
Be/Lux	1	−0.23***	−0.45***	−0.50**	1.00*	0.02**	0.59	−2.66
	2		−0.61***	−0.42*	0.84			
	3		−0.48***	−0.68***	−0.13			
Finland	1	0.07**	−0.76***	−0.25	0.09		0.44	−1.82
	2		−0.31**	−0.27	−0.52			
	3		−0.30***	−0.11	−2.17**			
France	1	0.04*	−0.82***	−0.23	2.55**		0.7	−3.12
	2		−0.74***	−0.41**	2.12*			
	3		−0.77***	−0.07	2.00*			
Germany	1	−0.14**	−0.40***	−0.21	0.91**		0.49	−3.23
	2		−0.03	−0.25	0.79**			
	3		−0.33***	0.33**	0.24			
Greece	1	−0.27**	−0.73***	−0.29	−32.19*	0.13**	0.54	0.33
	2		−0.47***	−0.11	28.41			
	3		−0.25***	−0.77	−11.79			
Ireland	1	0.00	−0.56***	−0.50**	7.43**		0.45	−2.7
	2		−0.38***	−0.29	−1.67			
	3		−0.56***	−0.53**	−3.2			
Italy	1	−0.41***	−0.32**	−0.27	3.50***		0.74	−2.68
	2		−0.25*	−0.2	0.74			
	3		-0.33***	−0.1	0.69			
	4		0.28***	−0.07	1.19			
Netherlands	1	0.19***	−0.71***	−0.16	−0.29	0.06***	0.36	−2.45
	2		−0.57***	−0.45*	−0.63**			
	3		−0.53***	0.25	−0.66**			
Portugal	1	−0.85***	−0.21***	−0.65**	−0.34		0.56	−1.88
	2		−0.15***	−0.70**	0.63			
	3		−0.14***	−0.76**	0.32			
Spain	1	−0.18**	−0.61**	−0.06	1.59**		0.78	−2.23
	2		−0.35***	−0.37	2.16***			
	3		−0.57***	−0.17	3.05***			
Euro Area	1	−0.32***	−0.55***	−0.08	3.88***		0.78	−3.61
	2		−0.37***	−0.37***	3.45***			
	3		−0.57***	0.01	1.86***			

*, **, ***10, 5 and 1% significance level.

S.D. exchange rate innovation has different effects considering magnitude and readjustment pattern in exports and imports in the euro area countries. Figure 2 illustrates how countries such as Spain and Italy initially react strongly to the exchange rate change, while countries such as Austria, France and the Netherlands

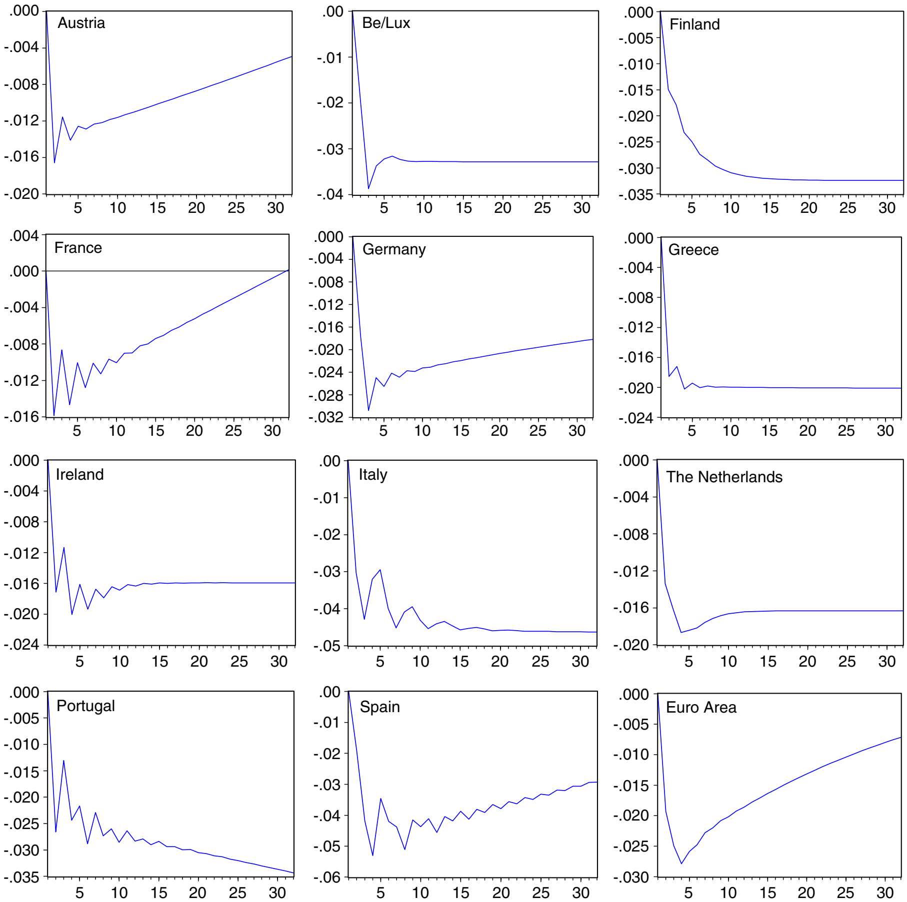

Fig. 2 Response of exports (lnx) to Cholesky one S.D. exchange rate (lnq) innovation

show an initial response of less that half the size of Spain's or Italy's export response. Also at the lower end of impulse responses are Greece, Ireland and the euro area as an entity. In between, Belgium/Luxembourg, Finland and Portugal are situated.

The impulse response functions in Fig. 2 are calculated for 32 quarters. For France, Austria and the euro area the effects of the exchange rate innovation on exports dies out to zero, or about one third of the initial shock. Spain and Germany's impulse response in exports almost dies out to half the initial shock in the same time. Ireland, Belgium/Luxembourg and the Netherlands show only very little readjustment to zero, but a levelling out at a non-zero value. Finland, Greece and Italy do not readjust to the initial equilibrium, but level out at a new one. Portugal does not seem to approach a new equilibrium.

Figure 3 shows the impulse response functions for the import equations. Here responses deviate quite strongly. Greece shows the strongest initial response to a one S.D. innovation in the exchange rate. Finland shows a rather small initial response in

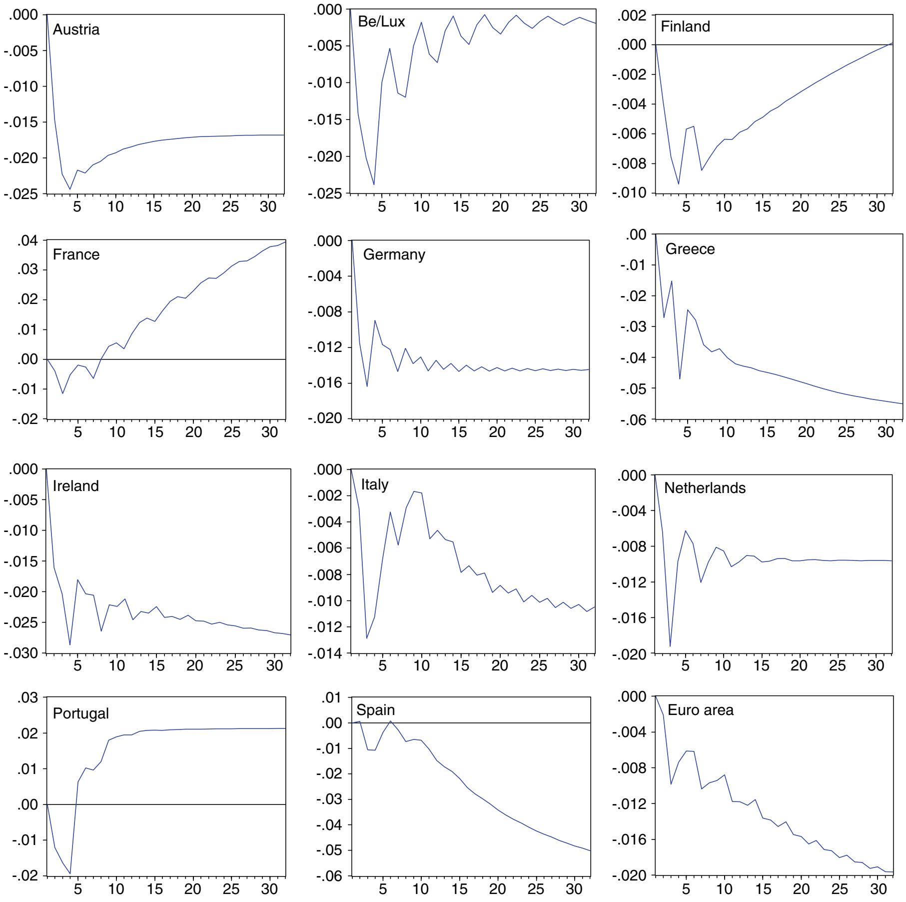

Fig. 3 Response of imports (lnm) to Cholesky one S.D. exchange rate (lnq) innovation

imports and the effects of the impulse are dying out gradually in the 32 quarters. Germany's, Italy's and Portugal's imports show a rather low initial response; Austria's Belgium/Luxembourg's and Ireland's show a strong reaction.

For Austria, Germany and the Netherlands the impulse response is dying out at a lower level than the initial response, but it does not die out to zero. For Portugal it dies out at a level where the initial shock is reversed. Belgium/Luxembourg's impulse response dies out to zero in an oscillating pattern. For Italy the impulse seems to have an initial effect and after adjusting to zero after about ten quarters the imports seam to react stronger again. For Ireland and Greece the imports seem to react strongly initially and worsen afterwards. Spain and the euro area as an entity show rather small initial responses, and does not appear to approach an equilibrium. For France an exchange rate innovation also shows permanent responses in the imports but in the opposite direction. All in all, the impulse responses for imports are not consistent.

6 Conclusion

The euro area as an entity is not showing great external imbalances. When looking at individual members, the differences are serious. Half the euro area countries have surpluses; the other half are in deficit.

With global imbalances due to readjust a euro exchange rate shock can be expected, which will have varying impacts on the individual euro area member states. The intensity of the impact depends on the euro area country's extra EMU trade pattern. With the estimation of export and import equations, using a VECM, the exchange rate elasticities show how the responsiveness to the exchange rate change varies among the euro area members in the short and long term.

The exports of Austria, Greece and Portugal show no significant long term influence by the external real effective exchange rate, while Irish and Italian exports show the highest long run exchange rate elasticities. Germany shows the lowest. In the short run however, Portugal is found to have the highest elasticity, followed by Austria. The Netherlands, Finland and Greece show no insignificant short term influence.

As for the readjustment to the equilibrium in the export market Finland shows the highest speed of readjusting to equilibrium, while Portugal has the lowest adjustment speed.

The impulse response functions show this graphically. Spain and Italy's exports initially react strongly to an exchange rate change, while Austria, France and the Netherlands' exports react half as intensely.

France, Austria and the euro area's exports re-achieve the initial equilibrium in the long run, or at least approach it. Spain and Germany's impulse response in exports almost dies out to half the initial shock in the same time. Ireland, Belgium/Luxembourg, the Netherlands, Finland, Italy, Portugal and Greece readjust to a new equilibrium.

The import equations led to rather inconclusive results. As for the external real effective exchange rate most countries show a long-run elasticity with the wrong sign, which would imply that, an appreciation of the euro would cause lower imports from outside the euro area. Only for Italy, Spain, Austria, Greece and Portugal the sign is correct. The values are insignificant for Italy, as well as for Belgium/Luxembourg and the Netherlands.

The coefficients for the external real effective exchange rate are mainly negative, which would mean that a euro appreciation would lower imports from outside the euro area. Germany is the only country with a positive and significant coefficient. Italy, Spain and the Netherlands show no responsiveness to changes in the exchange rate.

Portugal has the strongest tendency to readjust to the equilibrium after deviating from it. Germany and Spain show a rather low readjustment speed, while Finland, the Netherlands, France and Ireland show either positive or insignificant coefficients. The cointegration seems to work in the import equations only for the Mediterranean countries.

The impulse response functions for the imports also show quite strong deviations among the euro area countries. Greece shows the strongest initial response to an exchange rate change. Finland, Germany, Italy and Portugal's imports show a rather low initial response while Austria, Belgium/Luxembourg and Ireland's imports show a stronger reaction.

For Austria, Germany and the Netherlands the impulse response is dying out at a lower level than the initial response, but it does not die out to zero. For Portugal it dies out at a level where the initial shock is reversed. Belgium/Luxembourg's impulse response does not reach zero. For Italy the impulse seems to have an initial effect and after adjusting towards zero after about ten quarters the imports react stronger again. Irish and Greek imports seem to react strongly initially and worsen afterwards. Spain and the euro area as an entity show rather small initial responses, and do not approaching an equilibrium. For France an exchange rate innovation also shows permanent responses in the imports but in the opposite direction.

These results show that an exchange rate change causes diverging reactions among the euro area members' exports and imports. For some countries the shock is reversed, others show a permanent reaction. This in turn makes the one-size-fits-all monetary policy of the ECB less capable of dealing with the exchange rate shock.

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