External imbalances in the eurozone

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SUMMARY

The paper examines the extent to which current account imbalances of euro area countries are related to intra-euro area factors and to external trade shocks. We argue that the traditional explanations for the rising imbalances are correct, but are incomplete. We uncover a large impact of declines in export competitiveness and asymmetric trade developments vis-à-vis the rest of the world – in particular vis-à-vis China, Central and Eastern Europe, and oil exporters – on the external balance of euro area debtor countries. While current account imbalances of euro area deficit countries vis-à-vis the rest of the world increased, they were financed mostly by intra-euro area capital inflows (in particular by the purchase of government and financial institutions' securities, and cross-border interbank lending) which permitted external imbalances to grow over time.

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International Monetary Fund; International Monetary Fund and CEPR

1. INTRODUCTION

After its first decade of existence, the eurozone has come under severe pressure. Triggered by adjustments in the fiscal accounts of Greece, the crisis initially spread to Ireland and Portugal, before becoming a threat to the eurozone's existence after Italy and Spain's sovereigns began to experience funding pressures. The crisis reflects intertwined public debt and banking sector fragilities made worse by weak growth prospects, but also substantial gross and net external liabilities – for example, net external liabilities of close to 100% of GDP in Greece, Ireland, Portugal and Spain. This paper focuses on the external dimension of the eurozone crisis and aims at characterizing the factors that contributed to the growing balance of payments imbalances in the eurozone. We focus on the five largest 'net debtors' in the eurozone (Greece, Ireland,

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Italy, Portugal, and Spain) while acknowledging the significant differences between these countries.[1]

We argue that the large current account imbalances of individual eurozone countries reflected to an important extent the asymmetric impact of trade shocks originating outside the eurozone, as well as sustained cheap financing from core eurozone countries to the largest net debtors. In particular, the rise of China generated strong demand for machinery and equipment goods exported by Germany while exports from eurozone debtor countries were displaced from their foreign markets by Chinese exports. In addition, the terms of trade shock associated with higher oil prices contributed to rising trade deficits but higher income in oil producing countries also generated strong demand for machinery and equipment exported by Germany. Finally, German firms continued their outwards integration by setting up production platforms in emerging Europe to take advantage of a higher return on capital and lower wage costs which boosted competitiveness and exports of emerging Europe to the eurozone debtor countries. The continued easy financing (until the crisis erupted) allowed deficit countries to sustain appreciating real effective exchange rates, which were also driven by the nominal appreciation of the euro, and delayed the adjustment needed to end the growing divergence of trade performance within the monetary union.

We differ from the existing literature along two main dimensions. First, we emphasize the role of trade linkages and relative price dynamics between eurozone countries and the rest of the world. We document that, while relative price movements within the eurozone contributed to the debtor countries' real exchange rate appreciations, the lion's share of the appreciation between 2000 and 2009 was accounted for by the nominal appreciation of the euro vis-à-vis other currencies, even for the countries such as Greece and Portugal that entered the euro at a potentially overvalued real exchange rate. We present econometric evidence that this appreciation adversely affected the export performance of the debtor countries, over and above the average impact on eurozone exports. We also show that trade shocks originating outside the eurozone contributed to the widening of eurozone imbalances. We document the contribution of bilateral trade vis-à-vis China, oil exporters, and emerging Europe to the growing surplus of Germany and the growing deficits of the debtor countries. We also present econometric evidence suggesting that the asymmetric effects of these trade shocks on eurozone countries had a causal impact on trade performance, and were related to differences in the elasticities of exports to specific markets (emerging Europe, China, and oil exporting countries) within the eurozone, and to displacement effects by China's exports affecting several debtor countries in their foreign export markets. In particular, we present sectoral export regressions that control for all unobserved home country factors that may have affected export performance.

[1] For example, Italy's external imbalances are a much more modest share of GDP than those of the other four countries.

Second, we show that the external deficits of eurozone debtor countries (vis-à-vis eurozone and non-eurozone countries) were financed by capital inflows from within the eurozone, in particular from France and Germany, while investors from the rest of the world purchased primarily financial instruments issued by other eurozone countries, in particular French and German debt securities. These intra-eurozone capital flows financed government debt (in Greece), financial sector borrowing (in Spain or Ireland), or a combination of both (in Portugal or Italy). This pattern of capital flows suggests, *inter alia*, that eurozone investors viewed securities issued by 'peripheral' European countries as closer substitutes for securities issued by the eurozone core to a larger extent than investors from outside the eurozone.

Our analysis of current account deficits and external positions of the debtor countries also helps clarify the link between public debt and external liabilities. In particular, we document how the rise in current account deficits and external liabilities between the inception of the euro and the global crisis primarily reflected a worsening of private-sector balance sheets, with households' net debt rising significantly. This worsening of private sector balance sheets was financed directly or indirectly (and to a varying extent, depending on the country) by foreign purchases of domestic government debt, previously held by the domestic private sector, as well as by increased recourse of debtor countries' banks to external finance. As a result, foreign ownership of government debt increases substantially, particularly in Greece, even though there was no increase in debtor countries' government debt in percentage of GDP during the period 2000–2008.

Overall, the observed combinations of external terms of trade shocks and financing patterns suggest that, following monetary union, key adjustment mechanisms of the external balance of debtor countries were not operating.[2] Indeed, while trade shocks would have required real effective exchange rate depreciations in debtor countries to restore external sustainability in the long run, intra-eurozone capital inflows and the trend in the euro nominal exchange rate contributed instead to further real appreciation, which further affected export performance.

The rest of the paper is organized as follows. Section 2 presents a set of stylized facts which emphasize trade and financial linkages between the eurozone and the rest of the world and suggests their importance in explaining intra-eurozone imbalances. Section 3 presents econometric evidence on the asymmetric impact of world trade shocks on different eurozone countries. Section 4 characterizes the structure of external financing by sectors, instruments and destination/source for the countries in our sample. Section 5 concludes and discusses policy implications.

[2] The existing literature often focused on the differential inflation performances in a monetary union, and the reinforcing mechanisms of common monetary policy on demand booms (for instance Mongelli and Wyplosz, 2008). Lane (2006a, b) reviews the effects of heterogeneity in a monetary union.

2. EUROZONE IMBALANCES AND THE REST OF THE WORLD: NEW STYLIZED FACTS

Current account balances in Greece, Ireland, Italy and Spain worsened significantly during the first decade of European Monetary Union, while Portugal's deficit remained at the very high levels it had reached early in the decade (Table 1). As a result of the increasing recourse to external financing, net external liabilities of these countries rose sharply, reaching levels close to or above 100% of GDP by the end of 2010 in Greece, Ireland, Portugal, and Spain (Figure 1). During this period, Germany and a number of other smaller countries in Northern Europe progressively built large current account surpluses, with the current account for the eurozone as a whole remaining in broad balance throughout the period.[3]

The two traditional (and complementary) explanations for rising external imbalances of eurozone debtor countries relate to (1) financial integration and expectations of convergence within the eurozone, and (2) 'over-optimism' and wage/price rigidities in borrowing countries resulting in strong growth in domestic demand with domestic prices and labor costs rising faster than in other eurozone countries (the so-called 'intra-eurozone competitiveness' problem).[4] We refer the reader to Chen *et al.* (2012) for a review of this literature, which emphasizes traditional neoclassical implications of reduced borrowing constraints and the elimination of currency risk as well as over how optimistic expectations of convergence can lead to credit booms, with increases in domestic prices and unit labour costs inconsistent with underlying productivity gains and with the external budget constraint.

These explanations for eurozone imbalances fit the stylized facts on current account and real exchange rate developments, but rely primarily on intra-eurozone factors. The popularity of such explanations for the current account deficits and surpluses reflects both the fact that the eurozone as a whole ran a broadly balanced current account throughout the period and the importance of trade and financial ties between eurozone economies. However, the eurozone as a whole is a very open economy, with sizeable trade and financial flows vis-à-vis the rest of the world. We now provide a number of new stylized facts that suggest that trade and financial linkages between the eurozone and the rest of world also played an important role in explaining external imbalances of individual eurozone countries.

2.1. Real exchange rate appreciation

At the time of euro accession, Greece and Portugal had a real effective exchange rate (REER) above historical average as well as already large current account deficits

[3] See the Working Paper version of this article (Chen *et al.*, 2012) for a more detailed set of stylized facts, including on cross-country differences in the dynamics of saving and investment.

[4] See, for instance, Blanchard and Giavazzi (2002) and Blanchard (2007).

Table 1. Saving-investment balance (as a percentage of GDP)

		1999–2001 (%)	2007–2008 (%)	Change 1999:01–2007:08 (%)
Greece[a]	**Current account**	**−6.8**	**−14.5**	**−7.7**
	Investment	22.9	21.6	−1.4
	Savings	16.2	7.1	−9.1
	Public savings	−0.7	−3.0	−2.3
	Private savings	16.9	10.1	−6.7
	Household savings	2.0	0.3	−1.7
	Corporate savings	13.8	9.8	−4.0
Ireland	**Current account**	**−0.3**	**−5.3**	**−5.0**
	Investment	23.4	23.9	0.5
	Savings	23.2	18.7	−4.5
	Public savings	8.3	−0.8	−9.1
	Private savings	14.8	19.4	4.6
	Household savings	...	...	...
	Corporate savings	...	...	...
Italy	**Current account**	**0.0**	**−2.9**	**−3.0**
	Investment	20.4	21.5	1.0
	Savings	20.5	18.5	−1.9
	Public savings	1.3	1.5	0.2
	Private savings	19.2	17.0	−2.2
	Household savings	10.8	10.2	−0.5
	Corporate savings	8.4	6.8	−1.6
Portugal	**Current account**	**−9.5**	**−10.8**	**−1.2**
	Investment	27.5	22.3	−5.3
	Savings	18.0	11.5	−6.5
	Public savings	0.9	−0.5	−1.3
	Private savings	17.1	11.9	−5.2
	Household savings	7.3	4.4	−2.9
	Corporate savings	9.8	7.5	−2.2
Spain[a]	**Current account**	**−3.6**	**−9.8**	**−6.2**
	Investment	25.9	30.1	4.2
	Savings	22.3	20.3	−2.0
	Public savings	2.3	2.9	0.6
	Private savings	20.1	17.5	−2.6
	Household savings	7.4	7.7	0.2
	Corporate savings	12.5	9.8	−2.7
France	**Current account**	**2.2**	**−1.6**	**−3.9**
	Investment	19.9	22.2	2.3
	Savings	22.0	20.6	−1.5
	Public savings	2.1	5.1	3.0
	Private savings	19.9	15.4	−4.5
	Household savings	10.0	10.2	0.3
	Corporate savings	9.9	5.2	−4.8
Germany	**Current account**	**−1.0**	**7.2**	**8.1**
	Investment	20.9	18.8	−2.2
	Savings	19.9	25.9	6.0
	Public savings	0.9	2.5	1.5
	Private savings	19.0	23.5	4.4
	Household savings	10.6	11.6	1.0
	Corporate savings	8.4	11.8	3.4

[a]Households and corporate savings data start in 2000.
Sources: Eurostat, IFS, and staff calculations.

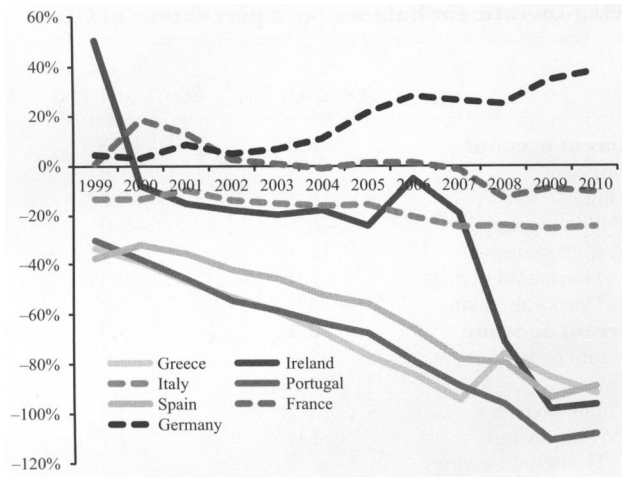

Figure 1. Net foreign asset positions 1999–2010, as a percentage of GDP

Source: IFS data.

(Table 2), while Ireland, Italy, and Spain had REERs close to their historical average and no meaningful current account imbalances.

Figure 2 shows changes in relative prices since 2000. Specifically, it decomposes the real exchange rate appreciation in individual eurozone countries into two components: (1) movements in domestic prices (or unit labour costs) relative to those of trading partners; and (2) movements of the euro nominal exchange rate. It shows that the real appreciation primarily reflected the strengthening of the euro in all five current account deficit countries. In Spain and Ireland, which experienced housing booms, domestic consumer prices (or relative unit labour costs) contributed more significantly to the appreciation of the real exchange rate than in Greece, Italy, and Portugal. In comparison, the REER appreciation reflected exclusively nominal effective exchange

Table 2. Real effective exchange rate and current account balances at the start of EMU

	REER in 1999 relative to 1980–99 average (%)	Current account balance inclusive of capital transfers, 1999 (%)
Greece	9.4	−3.7
Ireland	−5.7	0.9
Italy	−3.4	0.9
Portugal	12.3	−6.2
Spain	−1.0	−1.8
France	−3.6	3.2
Germany	−2.4	−1.3

Source: IMF staff calculations based on IFS data.

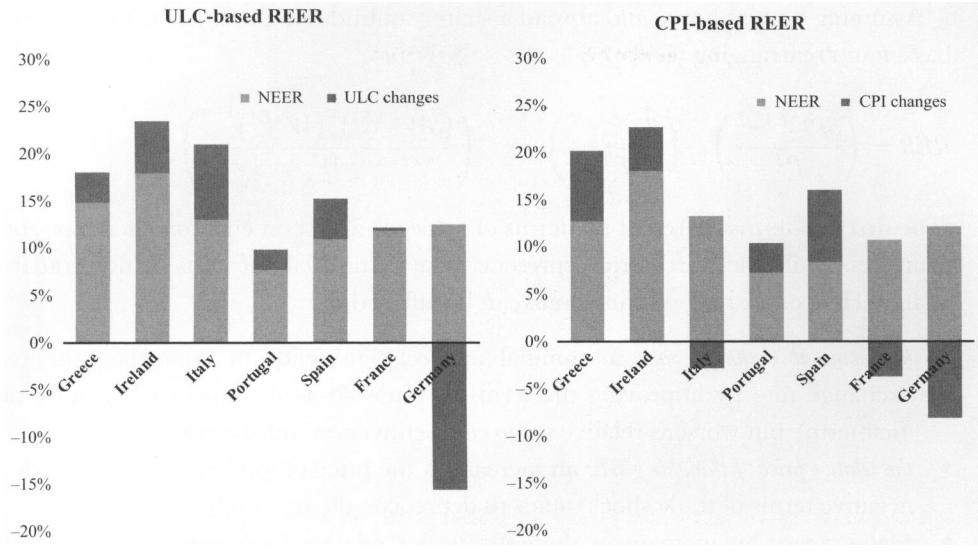

Figure 2. Decomposition of real effective exchange rates, percentage change from 2000 to 2010

Sources: Eurostat (ULC–based REER, 36 trading partners) and IMF (CPI–based REER).

rate appreciation in France, while in Germany the REER remained stable throughout the decade, with the nominal appreciation offset by a decline in unit labour costs relative to trading partners.

Of course the euro appreciation could have also reflected general optimism on the part of investors outside the eurozone on the economic prospects of the eurozone periphery. However, as discussed in more depth in Section 4, investors from outside the eurozone invested primarily in core eurozone countries, such as France and Germany. This suggests that at least part of the appreciation of the euro and the ensuing loss in competitiveness was an 'external shock' for countries in the eurozone periphery.

A simple 'accounting' decomposition of the CPI-based REER provides a useful theoretical apparatus to clarify our discussion of various factors affecting the external balance.[5] In a three-country environment (home, rest of the eurozone and rest of the world), the real exchange rate is given by:

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

where S is the euro exchange rate, P^{*NEA} is the price level in non-eurozone trading partners, P^{*EA} is the price level in eurozone trading partners, α is the share of trade with non-eurozone countries and P is the domestic price level.

[5] We are grateful to the discussants for suggesting this decomposition.

Assuming both at home and abroad a share γ of tradable goods in the consumption basket and rearranging yields:

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

The first two terms represent the terms of trade vis-à-vis non-eurozone and eurozone countries, while the third term represents relative unit labour costs in non-tradable sectors. Hence, the real exchange rate can be affected by:

- *the nominal exchange rate:* a nominal appreciation tends to appreciate the real exchange rate by improving the terms of trade vis-à-vis non-eurozone countries (first term), but worsens relative wage competitiveness (third term);
- *the relative price of tradable goods:* an increase in the price of foreign imported goods (a negative terms of trade shock) tends to depreciate the real exchange rate;
- *relative wages:* an increase in domestic wages relative to foreign wages tends to appreciate the real exchange rate.

Our previous empirical decomposition suggests that nominal exchange rate factors dominate price effects due to relative tradable prices and relative wages. In the next section, we estimate empirically the impact of the nominal appreciation on export performance and show also that trade shocks (including from oil prices) and non-price shocks to trade played an important role in explaining the evolution of trade balances.

2.2. Trade developments with non-eurozone countries

Table 3 shows the trade balance, import and export to GDP ratio vis-à-vis eurozone and non-eurozone countries at the inception of the euro and at the eve of the global financial crisis. The first stylized fact is that trade with the rest of the world accounts for a large share of imports and exports for all debtor countries, as well as for Germany and France. The trade balance in goods of Greece, Italy and Spain worsened during the decade. In Greece, Italy and Spain, the worsening trade balance was associated with a rapid increase in imports from non-eurozone countries. Ireland's trade surplus grew at a slower rate than GDP, in particular vis-à-vis eurozone countries. Portugal had, in contrast, a stable trade deficit to GDP ratio, but a rising trade deficit vis-à-vis non-eurozone countries (driven mostly by a terms of trade deterioration). At the same time, its export to GDP ratios vis-à-vis eurozone and non-eurozone countries were stable or declining. During the same period, Germany built a significant trade surplus mainly vis-à-vis non-eurozone countries driven by a rapid increase in exports.

Table 4 provides a snapshot of exports and imports of our sample of eurozone countries vis-à-vis emerging Asia, oil and commodity exporters, and coun-

Table 3. Trade balance, goods, as a percentage of GDP (by region)

		Trade balance		Imports		Exports	
		1999–2000 (%)	2008–2009 (%)	1999–2000 (%)	2008–2009 (%)	1999–2000 (%)	2008–2009 (%)
Greece	World	−13.2	−15.1	21.3	21.9	8.1	6.7
	Eurozone	−7.8	−7.7	11.4	10.6	3.6	2.9
	ROW	−5.3	−7.5	9.8	11.3	4.5	3.8
Ireland	World	25.7	19.8	50.7	29.9	76.5	49.7
	Eurozone	19.9	13.1	10.0	7.5	29.9	20.6
	ROW	5.8	6.7	40.7	22.4	46.6	29.1
Italy	World	0.7	−0.5	19.8	21.8	20.5	21.3
	Eurozone	−0.2	−0.4	10.3	9.8	10.1	9.4
	ROW	0.9	−0.1	9.6	12.0	10.4	11.9
Portugal	World	−12.4	−12.4	32.1	32.8	19.6	20.4
	Eurozone	−8.6	−9.0	21.8	21.6	13.2	12.7
	ROW	−3.8	−3.5	10.3	11.2	6.5	7.7
Spain	World	−5.7	−6.8	23.3	23.0	17.7	16.2
	Eurozone	−2.6	−2.5	13.3	11.6	10.7	9.2
	ROW	−3.0	−4.4	10.0	11.4	7.0	7.0
France	World	0.0	−3.2	23.2	23.0	23.2	19.9
	Eurozone	−1.2	−3.5	12.9	13.3	11.7	9.8
	ROW	1.2	0.3	10.3	9.8	11.6	10.1
Germany	World	2.9	6.5	23.9	30.2	26.9	36.7
	Eurozone	1.8	1.9	10.4	13.8	12.2	15.7
	ROW	1.1	4.6	13.6	16.4	14.7	21.0

Source: Direction of Trade Statistics, IMF.

tries in Central and Eastern Europe. A striking stylized fact is the dramatic increase in Germany's exports to these regions. These exports were higher in relation to GDP when compared to other eurozone countries already in 2000, and then doubled as a ratio of German GDP in the space of 8 years. The German trade balance vis-à-vis commodity exporters improved despite the dramatic increase in commodity prices over this period. In contrast, exports to these three regions from Greece, Spain and France increased only modestly, and their trade balance deteriorated substantially. Italy experienced an increase in exports to these regions, but imports grew faster, causing a deterioration of the trade balance. Portugal experienced a similar increase of exports and imports as a percentage of GDP.

The shifts in external demand highlighted by Table 4 were also reflected in the terms of trade: Figure 3 documents that Italy, Portugal and Greece experienced a very significant decline in their terms of trade during the period 1999–2008. It also shows that a large component of the terms of trade shock came from the steady and substantial increase of real crude oil prices (over 400% between 1999 and 2008). The lower panel of the figure depicts the evolution of export prices relative to unit labour costs (ULC). It shows that until 2006, ULC grew as fast as export prices with the exception of Germany and Spain. After 2006, Italy and Ireland had ULC rising faster than export prices.

Table 4. Exports and imports of eurozone countries vis-à-vis emerging Asia, commodity exporters and CEE countries

		Imports (ratio of GDP)		Exports (ratio of GDP)	
		1999–2000 (%)	2007–2008 (%)	1999–2000 (%)	2007–2008 (%)
Greece	Emerging Asia	1.4	2.6	0.2	0.1
	Commodity exporters	2.2	4.3	0.6	0.5
	CEE	0.9	1.5	1.4	1.6
	Total	4.5	8.3	2.1	2.3
Ireland	Emerging Asia	4.5	2.3	3.5	2.7
	Commodity exporters	1.3	1.0	2.7	1.7
	CEE	0.6	0.5	1.0	0.9
	Total	6.4	3.8	7.2	5.3
Italy	Emerging Asia	1.1	2.2	0.9	1.2
	Commodity exporters	1.9	3.2	1.3	2.4
	CEE	1.0	1.8	1.4	2.4
	Total	4.0	7.2	3.5	6.0
Portugal	Emerging Asia	1.1	1.4	0.2	0.9
	Commodity exporters	2.3	3.6	0.8	1.8
	CEE	0.4	0.7	0.2	0.6
	Total	3.7	5.7	1.2	3.3
Spain	Emerging Asia	1.4	2.4	0.4	0.5
	Commodity exporters	1.9	3.4	0.8	1.1
	CEE	0.3	0.9	0.5	0.8
	Total	3.7	6.6	1.6	2.4
France	Emerging Asia	1.2	1.6	0.9	1.3
	Commodity exporters	1.6	2.4	1.4	1.7
	CEE	0.4	1.1	0.7	1.1
	Total	3.2	5.1	3.0	4.1
Germany	Emerging Asia	1.9	3.1	1.3	2.7
	Commodity exporters	1.5	2.7	1.4	3.2
	CEE	2.1	3.7	2.3	4.7
	Total	5.5	9.6	5.0	10.6

Source: International Monetary Fund, Direction of Trade Statistics, and World Economic Outlook.

2.3. Capital flows

Discussions of external imbalances in individual eurozone countries have typically emphasized the role of capital flows and financial integration among eurozone countries, also in light of the fact that the current account and the financial account of the eurozone as a whole have remained broadly balanced since the inception of the euro. However, it is important to point out that financial integration between the eurozone as a whole and the rest of the world was high from the inception of the euro, and has increased substantially over the past decade. Figure 4 presents the net and gross international investment position of the eurozone as a whole vis-à-vis the rest of the world. While the net position has been fairly stable between the beginning of the decade and the onset of the global financial crisis, gross external assets and liabilities have risen substantially as a percentage of eurozone GDP, reflecting buoyant inward and outward financial flows.

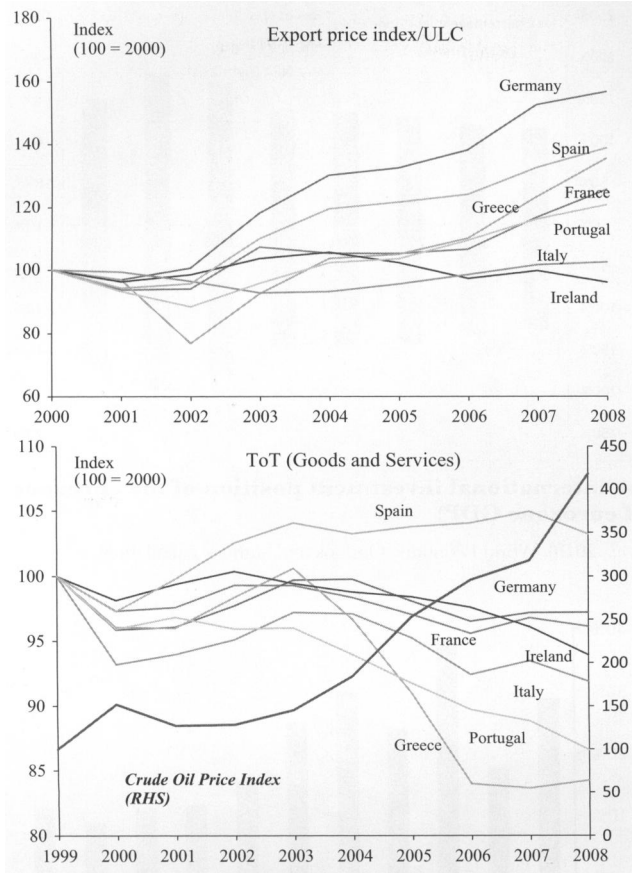

Figure 3. Terms of trade and unit labour costs

Sources: Eurostat and IMF, World Economic Outlook database.

In light of the larger deficits incurred by eurozone debtor countries vis-à-vis the rest of the world documented in the previous subsection, one could conjecture that investors from the rest of the world provided significant external financing to eurozone debtor countries. However, Figure 5 provides suggestive evidence against this conjecture: on the eve of the global financial crisis investors from outside the eurozone held their portfolio debt claims primarily in 'core' eurozone countries, rather than in deficit countries. This suggests a more in-depth investigation of how the financing of eurozone imbalances took place, which we undertake in Section 4.

3. ECONOMETRIC EVIDENCE OF THE ASYMMETRIC IMPACT OF TRADE SHOCKS ON EXPORT COMPETITIVENESS

This section explores further the extent to which trade shocks originating from outside the eurozone contributed to the build-up in current account imbalances for eurozone countries, in particular through an asymmetric impact on Germany and eurozone

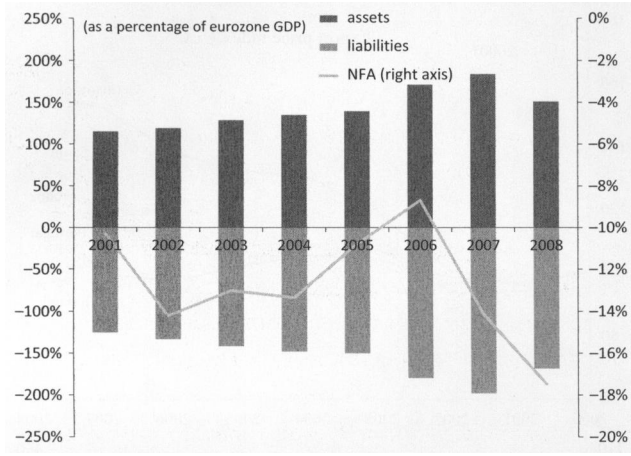

Figure 4. The international investment position of the eurozone 2001–2008 (as a percentage of eurozone GDP)

Sources: Waysand *et al.* (2010), World Economic Outlook and authors' calculations.

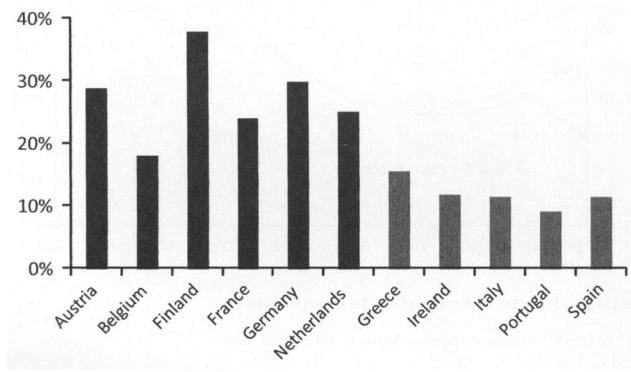

Figure 5. Share of outstanding debt securities held outside the eurozone (2008)

Source: Authors' calculations based on IMF, Balance of Payments Statistics and Coordinated Portfolio Investment Survey.

debtor countries. Various microeconomic studies have found that some southern European countries' exports lost competitiveness vis-à-vis their trading partners over the past decade on the basis of a range of structural indicators (see Baumann and di Mauro, 2007; di Mauro and Foster, 2008; Bennett *et al.*, 2008; IMF, 2010). However, the trade literature has often focused on explaining the evolution of intra-eurozone trade (Rose, 2000; Micco *et al.*, 2003; Schmitz and von Hagen, 2009; Baldwin *et al.*, 2005; Flam and Nordstrom, 2006b).

3.1. Hypothesis

Our hypothesis is that three important external shocks during the past decade may have affected eurozone exports differentially:

- *The rise of China (and more generally of emerging Asia)* may have displaced southern European countries exporting goods from some of their foreign markets (see also Di Mauro *et al.*, 2010). Also, rapid growth in China may have boosted the demand for goods, such as machinery and equipment, exported by Germany, but may have had more limited benefits for southern European countries exporters.
- *Higher oil prices* may also have affected eurozone countries' trade balance asymmetrically. While the oil trade balance worsened in all countries as a result of higher oil import prices, fast income growth in commodity-exporting countries may have benefited countries such as Germany exporting goods in high demand by oil producers.
- *The integration of Central and Eastern European countries* with the production chain of the eurozone may have benefited exporters in countries such as Germany which undertook large direct foreign investment to take advantage of a higher return on capital and lower wage costs (Marin, 2010), but may have resulted in higher imports of countries in southern Europe.

Before turning to the regression analysis, Table 5 presents some descriptive statistics of bilateral exports at a disaggregated level where exports at the 5-digit sectoral classification have been grouped into five categories (High Technology, Medium-High, Medium-Low, and Low Technology goods, as well as goods not classified, which include raw and processed agricultural goods as well as mining). The table shows that Germany and Italy are the two countries with a significant specialization in medium high-tech goods at the beginning of the period. It also shows that, to a large extent, the very strong performance of Germany's exports throughout the period was accounted for by the rapid increase in exports of Medium-High Technology goods, with almost a third of such increase reflecting exports to emerging Asia, oil exporters and CEE countries. Among other countries in our sample, only Italy experienced a strong performance of exports of medium-high tech goods. This evidence is indicative that the three regions might have been a significant pull factor for exports of medium-high tech goods.

3.2. Econometric analysis: asymmetric effects of trade shocks and nominal exchange rate on eurozone countries

In this section, we investigate quantitatively the importance of several channels through which the asymmetric trade shocks identified in the previous section affected the trade performance of eurozone debtor countries during the last 10 years. Specifically, we estimate bilateral export and import-displacement effect regressions for the period 1990–2009 and for a set of reporter countries and their trading partners – listed in the appendix. We make use of estimated coefficients to quantify the implied contributions to the cumulative trade deficits of each type of shock. We also estimate

Table 5. Bilateral exports, by sectors (as a percentage of GDP)

		High		Medium-High		Medium-Low		Low		Not classified	
		1999 (%)	2008 (%)	1999 (%)	2008 (%)	1999 (%)	2008 (%)	1999 (%)	2008 (%)	1999 (%)	2008 (%)
Greece	**Total**	**0.4**	**0.6**	**0.8**	**0.9**	**1.5**	**1.6**	**2.2**	**1.4**	**0.6**	**1.1**
	1. Emerging Asia	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
	2. CEE	0.2	0.0	0.1	0.2	0.2	0.4	0.2	0.3	0.1	0.1
	3. Commodity exporters	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.0	0.1
	1 + 2+3	0.2	0.1	0.2	0.3	0.3	0.6	0.4	0.5	0.1	0.2
Italy	**Total**	**1.7**	**1.7**	**6.1**	**7.5**	**2.9**	**4.2**	**4.9**	**4.5**	**0.3**	**0.3**
	1. Emerging Asia	0.1	0.1	0.3	0.5	0.1	0.2	0.2	0.3	0.0	0.0
	2. CEE	0.1	0.1	0.4	0.8	0.2	0.4	0.3	0.4	0.0	0.0
	3. Commodity exporters	0.1	0.1	0.5	1.0	0.2	0.4	0.3	0.5	0.0	0.0
	1 + 2+3	0.3	0.3	1.1	2.3	0.4	1.0	0.8	1.2	0.0	0.1
Portugal	**Total**	**1.6**	**1.2**	**3.8**	**4.3**	**1.9**	**3.3**	**7.0**	**5.0**	**0.2**	**0.4**
	1. Emerging Asia	0.0	0.1	0.1	0.0	0.01	0.03	0.1	0.05	0.00	0.02
	2. CEE	0.0	0.0	0.1	0.2	0.0	0.1	0.0	0.1	0.00	0.00
	3. Commodity exporters	0.0	0.1	0.1	0.6	0.1	0.4	0.3	0.5	0.01	0.01
	1 + 2+3	0.1	0.3	0.3	0.8	0.1	0.5	0.4	0.6	0.01	0.02
Spain	**Total**	**1.2**	**1.2**	**4.6**	**4.2**	**2.5**	**2.6**	**3.4**	**2.8**	**1.1**	**0.9**
	1. Emerging Asia	0.1	0.0	0.6	0.1	0.1	0.2	0.1	0.1	0.01	0.01
	2. CEE	0.0	0.1	0.1	0.2	0.0	0.1	0.1	0.1	0.03	0.05
	3. Commodity exporters	0.1	0.08	0.2	0.3	0.2	0.3	0.2	0.2	0.0	0.0
	1 + 2+3	0.1	0.2	0.9	0.6	0.4	0.6	0.3	0.3	0.06	0.09
Germany	**Total**	**3.0**	**4.2**	**8.0**	**12.6**	**2.7**	**4.9**	**2.5**	**3.1**	**0.1**	**0.2**
	1. Emerging Asia	0.2	0.3	0.5	1.2	0.1	0.3	0.1	0.1	0.0	0.0
	2. CEE	0.2	0.4	0.7	1.6	0.3	0.7	0.3	0.3	0.0	0.0
	3. Commodity exporters	0.2	0.3	0.4	1.2	0.1	0.1	0.1	0.2	0.0	0.0
	1 + 2+3	0.6	1.0	1.6	4.0	0.5	1.1	0.5	0.6	0.02	0.04
France	**Total**	**3.0**	**2.7**	**5.1**	**5.1**	**2.3**	**2.8**	**3.4**	**3.0**	**0.4**	**0.3**
	1. Emerging Asia	0.2	0.2	0.2	0.3	0.1	0.1	0.1	0.2	0.0	0.0
	2. CEE	0.1	0.1	0.2	0.4	0.1	0.2	0.1	0.1	0.0	0.0
	3. Commodity exporters	0.2	0.3	0.3	0.5	0.1	0.2	0.2	0.2	0.0	0.0
	1 + 2+3	0.5	0.6	0.6	1.1	0.2	0.5	0.4	0.5	0.03	0.03

Sources: IMF staff calculations based on UN COMTRADE data; sectoral trade classification from OECD (2005).

the impact of the nominal exchange rate on exports and displacement effect, allowing for a different effect for the debtor countries. The approach of the trade regression analysis follows the literature, in particular Goldstein and Khan (1985), where export

and import volumes are explained by domestic and foreign real economic activity and relative prices.[6]

3.2.1. Export regressions. *Empirical specifications.* Export regressions have the following specification:

$$\log(Exports_{ijt}) = \alpha + \beta \cdot \log(RER_{ijt}) + \delta \cdot \log(DomDemand_{jt}) + F_{ij} + T_t + \varepsilon_{ijt}$$

where $Export_{ijt}$ is total bilateral exports of reporting country i to trading partner j during year t, RER_{ijt} is the bilateral real exchange rate between country i and country j during year t, $\mathrm{DomDemand}_{jt}$ is total domestic demand of trading partner j during year t, F_{ij} is a fixed effect for the country pair (i,j) T_t is a time fixed effect, and ε_{ijt} is a residual. We also estimate the regressions by replacing the bilateral real exchange rate with the bilateral nominal exchange rate and relative CPI to separate the nominal exchange rate effects (relevant vis-à-vis countries outside the eurozone) from those of relative prices. We also introduce a control for trade specialization of the reporting country (defined as the share of low-technology goods in total exports) interacted with domestic demand of the trading partner considered (see di Mauro *et al.*, 2010). Finally, in (unreported) robustness tests, we also include country specific time trends T_{it} that absorb the effect of any country-specific factors (external or domestic) affecting trade in a linear fashion over time.

The coefficient of interest is the elasticity vis-à-vis the domestic demand of trading partner δ. We first estimate an average elasticity, and next allow the elasticity to vary according to the region of the trading partner (emerging Asia, CEE country or commodity exporter) and the reporting country (Germany, or eurozone debtor country). We are also interested in the real or nominal exchange rate elasticity β – we estimate an average elasticity first, and then an elasticity specific to eurozone debtor countries. We rely on this specification to assess whether demand elasticities vary across reporting countries and trading partners. In particular, we test whether demand elasticities of exports of the eurozone debtor countries to China, CEE, or oil exporters are significantly different from the eurozone average. We are also interested in testing whether exchange rate elasticities of debtor countries' exports are significantly different from the eurozone average.

We also estimate bilateral trade regressions at the sectoral level (at the level of aggregation described in the previous paragraph). In these regressions, we control for country- and sector-specific time dummies. This allows us to control for all unobserved characteristics at the country or sectoral level that may explain our findings. In particular, this allows us to ascertain that our findings are not driven by demand conditions of the reporting country. Specifically, we estimate the following regression:

[6] See also Marquez (1990), Bayoumi (1999), Flam and Nordstrom (2006a), Chinn (2006), and Bayoumi *et al.* (2011).

$$\log(\text{Exports}_{\text{ijkt}}) = \alpha + \beta \cdot \log(RER_{ijt}) + \delta_k \cdot \log(DomDemand_{jt}) + \phi \cdot \log(DomDemand_{it}) + F_{ij} + T_{kt} + \varepsilon_{ijt}$$

where $k \in$ {High_Tech;Medium_High_Tech;Medium_Low_Tech,Low_Tech, Non_Classified} and $DomDemand_{it}$ is total domestic demand of reporting country i during year t. In this specification, the coefficient of interest is the sector-specific elasticity of foreign demand δ_k. As in the aggregate bilateral regression, we first estimate an average elasticity, and next estimate a differential elasticity (from the average) by region of trading partner, and by reporting country. Since each time we control for the average elasticity, the crossed trading partner-reporting country elasticity can be read as a differential elasticity relative to the eurozone average for the trading partner considered.

Regression results. Export regression results for a sample of 11 eurozone reporting countries during 1990–2009 are reported in Table 6. A first noticeable finding is that bilateral price elasticities are non-negligible – for example, they suggest that the 36% appreciation of the euro relative to the US dollar from the end of 1999 to mid-2008 implied a 12–15% decrease in exports of eurozone countries to the US on average, and a 20–25% decrease in exports of the debtor countries on average.

The overall *differential* impact (relative to the eurozone average) of the euro appreciation on debtor countries' exports can be derived from the appreciation of the nominal effective exchange rates of these countries and their specific coefficient reported in column (4). The estimated coefficient implies that, during 2000–10, the cumulative loss of export levels of Greece, Italy, Portugal and Spain (in difference from a eurozone average effect) was respectively 2.7%, 2.8%, 1.5% and 1.7%.[7] The *total* loss of exports (obtained by adding the eurozone average effect) from the nominal effective exchange rate appreciation was respectively 7%, 7.3%, 4% and 4.6% for Greece, Italy, Portugal and Spain.

The elasticity of export demand is also non-negligible: a 1% increase in trading partners' domestic demand is associated with a 1.25% increase in exports.

Columns 5 to 12 report regressions in which the demand elasticity is allowed to vary across trading partner (CEE countries, China, oil exporters) and both trading partner and reporting country (Greece, Italy, Portugal, Spain and Germany). First we explore whether elasticities of export demand by CEE countries differ from the average elasticities, and differ in trade specialization and across eurozone reporting countries (columns 5 to 7). We find that demand elasticities of exports to CEE countries are significantly larger than average elasticities (by about 0.6). There is also significant heterogeneity across eurozone reporting countries: demand elasticities of exports are significantly smaller than the eurozone average for Greece and Italy, but significantly

[7] During 2000–10, the nominal effective exchange rate appreciation was 13%, 13%, 7% and 8% respectively for Greece, Italy, Portugal and Spain.

Table 6. Export regressions

	(1)	(2)	(3)	(4)	(5) P = CEE	(6) P = CEE	(7) P = CEE	(8) P = China	(9) P = China	(9) P = China	(10) P = Oil	(11) P = Oil	(12) P = Oil
Nominal exchange rate			0.404***	0.304***	0.343***	0.204***	0.348***	0.406***	0.310***	0.412***	0.385***	0.325***	0.404***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Relative CPI			−0.437***	−0.405***	−0.378***	−0.294***	−0.381***	−0.442***	−0.414***	−0.447***	−0.428***	−0.408***	−0.441***
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Nominal exchange rate × (R = GIPS)				0.211***		0.306***			0.203***			0.134*	
				(0.000)		(0.000)			(0.000)			(0.019)	
Relative CPI × (R = GIPS)				−0.0852		−0.200**			−0.0761			−0.0549	
				(0.162)		(0.002)			(0.216)			(0.368)	
Real exchange rate	0.425***	0.366***											
	(0.000)	(0.000)											
Real exchange rate × (R = GIPS)		0.141**											
		(0.009)											
PartnerDemand	1.294***	1.296***	1.268***	1.261***	1.209***	1.203***	1.219***	1.228***	1.220***	1.232***	1.295***	1.290***	1.286***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PartnerDemand × LowTechShare(r)							−0.0132*			−0.00967			−0.00855
							(0.028)			(0.119)			(0.143)
PartnerDemand × P					0.594***	0.632***	0.603***	0.372***	0.370***	0.356**	0.169*	0.113	0.171**
					(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.010)	(0.069)	(0.009)
PartnerDemand × R(R = Deu) × P					−0.0845	−0.0868	−0.0833	0.0678	0.0747	0.0700	0.227*	0.231**	0.231**
					(0.414)	(0.413)	(0.424)	(0.628)	(0.580)	(0.622)	(0.011)	(0.008)	(0.010)
PartnerDemand × R(R = GIPS) × P					−0.664***	−0.740***		−0.483**	−0.458*		−0.679***	−0.537***	
					(0.000)	(0.000)		(0.007)	(0.011)		(0.000)	(0.000)	
PartnerDemand × R(R = Grc) × P							−1.572***			−0.0160			−2.208***
							(0.000)			(0.965)			(0.000)

Table 6. (Continued)

	(1)	(2)	(3)	(4)	(5) P = CEE	(6) P = CEE	(7) P = CEE	(8) P = China	(9) P = China	(9) P = China	(10) P = Oil	(11) P = Oil	(12) P = Oil
PartnerDemand × R(R = Its) × P							−0.778*** (0.000)			−0.858*** (0.000)			−0.353* (0.016)
PartnerDemand × R(R = Prt) × P							0.754*** (0.000)			−0.144 (0.753)			−0.657** (0.008)
PartnerDemand × R(R = Esp) × P							0.948*** (0.000)			−0.336 (0.159)			−0.323** (0.007)
Observations	5802	5802	5802	5802	5802	5802	5802	5802	5802	5802	5802	5802	5802
R-squared	0.981	0.981	0.981	0.981 0.982	0.982	0.982	0.981	0.982	0.981	0.982	0.982	0.982	

Notes: The dependent variable is annual bilateral export volume of 11 euro countries with their top 50 trading partners from 1990 to 2009. The 11 euro countries are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain. The independent variables include the nominal exchange rate, relative CPI (reporter CPI/Partner CPI), real exchange rate, partner demand (trading partner's domestic demand), and interactions of trading partner's domestic demand with the reporter's export shares in low-tech goods as well as various country pair dummies. R is the dummy for reporter country, and P is the dummy for partner country (definition for P is listed in the column header). For example, the coefficient of −1.572 for 'PartnerDemand × R(R = Grc) × P' in column (4) indicates the marginal difference in demand elasticity for exports from Greece to CEE countries.

Robust p value in parentheses, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. All regressions include a full set of country fixed effects and time fixed effects.

larger for Spain and Portugal. However, we do not find any compelling evidence that Germany benefits from higher export demand elasticities than other eurozone countries. On the trade specialization side, countries with higher export shares in low-tech goods tend to have smaller demand elasticities from CEE countries.

Turning to exports to China (columns 8–9), we find that the average export demand elasticity from China is significantly higher (by over 0.3) from the average export demand elasticity from all trading partners of eurozone countries. Moreover, the export demand elasticities of Italy vis-à-vis China is significantly lower than the eurozone average's elasticity.

Results for export demand elasticities vis-à-vis oil exporters are in columns 10–12. Export demand elasticities for goods exported by Greece, Italy, Portugal and Spain are significantly below the eurozone average, after accounting for elasticities specific to oil exporters (which are significantly higher than all trading partners, by about 0.2). Overall, export demand elasticities varied across eurozone countries and southern European countries experienced export demand shortfalls resulting from these differences in export demand.

Appendix Table A1 reports export regressions estimated at the sectoral level, allowing us to control for reporting countries' domestic demand, country pair dummies, and sectoral time dummies to allay reverse causality concerns and omitted variable bias. Our regression specification includes a variety of interaction terms to control for possible sources of heterogeneity. First, as in the previous set of regressions, we allow for export demand elasticities that are specific to trading partners (CEE countries, emerging Asia or oil exporters). Second, we allow these trading partners' export elasticities to vary across sectors.[8] After accounting for trading partner and sector elasticities, we then allow the sectoral elasticities to differ across eurozone countries reporting countries (Germany and the debtor countries). Hence, for each trading partner (CEE, emerging Asia, and oil exporters) the coefficients on these variables can be read as differential elasticities relative to the sectoral average for the eurozone.

We find that, on average, export demand elasticities are higher for High Tech and Medium-High Tech sectors than for other sectors for each of the trading partner regions (CEE countries, China and oil exporters). For example, in the case of China (columns 5–6), export demand elasticities for Medium-High Tech goods are about 0.05 higher than average while they are about 0.09 below average for Low Tech goods. After accounting for these sectoral specific factors, we find that export demand elasticities of Medium-High Tech and Medium-Low Tech goods exported by Germany are higher than the average for eurozone reporting countries. For example, export demand elasticities are about 0.17 above the sectoral average of eurozone countries for goods exported to China.

[8] In these regressions, the omitted sector is the 'un-classified' (e.g. agriculture and mining).

By contrast, while estimated elasticities vary across countries and sectors, we find in general strong evidence that sectoral export demand elasticities are significantly below the sectoral average for many sectors and many eurozone debtor countries. For example, in the case of Greece, the sectoral elasticities (excluding the 'un-classified' group) are all significantly below average for all three trading partner regions. In the case of Italy, sectoral export demand elasticities are below average for trade with CEE countries or oil exporters but above average for exports of Medium-High Tech goods to China.

3.2.2. Import regressions – displacement effect. *Empirical specifications.* Next, we estimate the following augmented import regression to test whether Chinese goods may displace other countries' exports in common market:

$$\log\left(Import_{ijt}\right) = \alpha + \beta \cdot \log\left(RER_{ijt}\right) + \delta \cdot \log(DomDemand_{it}) + \mu \cdot \log\left(Import_{iChina,t}\right) + f_{ij} + T_t + \varepsilon_{ijt}$$

where $Imports_{iChina,t}$ are total imports of country i from China during year t. A positive (resp. negative) coefficient μ means that, conditional on bilateral real exchange rates and total domestic demand, imports of country i from country j are positively (resp. negatively) correlated with its imports from China. If there is a displacement effect, we expect the coefficient μ to be negative, as higher imports from China should result in lower imports from other trading partners. To control for trade specialization, we introduce in some specification the control variable low_tech_j * log $(Imports_{iChina,t})$ where low_tech_j is the share of low technology goods in the exports of country j. We also estimate exchange rate elasticities specific to the debtor countries as a robustness test of our previous regressions.

We also estimate this specification at the sectoral level, controlling for the trading partner j domestic demand, sector specific dummies, and country-specific dummies to absorb the impact of any unobserved sectoral or reporting country specific shocks, and estimate the sector-specific elasticity μ_k of eurozone exports to market i to Chinese exports to the same market.

Regression results. To explore whether exports of eurozone countries may have been displaced by Chinese exports, we consider a sample of 17 major trading partners of eurozone countries during 1999–2009 and estimate various versions of the regression specification reported in Table 7.

Columns 1 to 7 report regressions estimated on the complete sample of reporting countries, and columns 8 and 9 regressions estimated on the sample of eurozone reporting countries. On average, bilateral imports vis-à-vis any trading partner are positively correlated with bilateral imports from China, even after controlling for total domestic demand of the trading partner. In the full sample of reporting countries, the estimated coefficient implies that a 10% rise in bilateral imports is associated with a

Table 7. Displacement effect

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) only euro	(9) only euro	(10) only euro
Nominal exchange rate			0.318***	0.341***	0.342***	0.333***	0.352***	−0.247***	−0.272***	
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
Relative CPI			−0.354***	−0.399***	−0.400***	−0.392***	−0.413***	0.168**	0.193***	
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.000)	
Real exchange rate	0.341***	0.423***								−0.134*
	(0.000)	(0.000)								(0.041)
Real exchange rate × GIPS		−0.622***								−0.264**
		(0.000)								(0.003)
ReporterDemand	1.803***	1.763***	1.853***	1.436***	1.437***	1.436***	1.458***	1.125***	1.119***	1.044***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Import from China				0.241***	0.240***	0.239***	0.214***	0.137***	0.134***	0.116***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Import from China × LowTechShare(p)					0.00227	0.00116	0.000948	−0.0160*	−0.0189**	−0.0183**
					(0.717)	(0.853)	(0.880)	(0.021)	(0.006)	(0.007)
Import from China × P(P = Euro)				−0.0512***	−0.0513***	−0.0515***				
				(0.000)	(0.000)	(0.000)				
Import from China × P(P = GIPS)				−0.0418**	−0.0421**			−0.0201		
				(0.004)	(0.004)			(0.143)		
Import from China × P(P = Grc)						−0.129***	−0.151***		−0.126***	−0.148***
						(0.000)	(0.000)		(0.000)	(0.000)
Import from China × P(P = Ita)						−0.0657***	−0.0881***		−0.0462**	−0.0531***
						(0.000)	(0.000)		(0.002)	(0.000)
						−0.151***	−0.173***		−0.116***	−0.109***

Table 7. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) only euro	(9) only euro	(10) only euro
Import from China × P(P = Prt)						(0.000)	(0.000)		(0.000)	(0.000)
Import from China × P(P = Esp)						0.0759***	0.0535*		0.107***	0.103***
						(0.001)	(0.017)		(0.000)	(0.000)
Observations	3751	3751	3751	3751	3751	3751	3751	2270	2270	2270
R-squared	0.982	0.982	0.982	0.983	0.983	0.983	0.983	0.987	0.988	0.988

Notes: The dependent variable is the annual bilateral import volume of 17 countries with their top 50 trading partners from 1990 to 2009. The 17 countries are United States, United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden, Switzerland, Japan, Spain, Turkey, Russian Federation, Czech Republic, and Poland, which are the major countries importing from the eurozone. The independent variable 'Import from China' is the reporter country's import from China. Other specifications are consistent with Table 6. For example, −0.0512 for 'Import from China × P(P = Euro)' in column (3) means the marginal effect of imports from China on the reporter country's imports from euro countries. Column (7) and (8) use the sub-sample where trading partners are only euro countries.

Robust p value in parentheses, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. All regressions include a full set of country fixed effects and time fixed effects.

rise in imports from China of about 2–2.5%. The estimated elasticity (1.1), however, is much smaller when estimated on eurozone countries only. This positive coefficient is not consistent with the possibility that, on average, Chinese goods may displace other countries' exports. A possible interpretation is that imports from China proxy for demand effects not captured by total domestic demand and that would raise all imports simultaneously.[9]

To test whether Chinese exports are closer substitutes to some countries' exports, we allow for different coefficients μ across trading partners of each reporting country and after controlling for partner countries' trade specializations. In columns 4 to 6, we estimate a coefficient specific to eurozone countries. Next, to test whether eurozone debtor countries differ significantly from the eurozone average, we estimate a coefficient specific to Greece, Italy, Spain and Portugal (columns 4, 5, and 8), and let it be country specific in columns 6, 7, 9, and 10. In columns 5–10, we control for the low-tech shares in partner countries' exports.

Interestingly, we find first that exports of eurozone countries to common markets are negatively correlated with Chinese exports to these markets (columns 4–6), suggesting that eurozone countries exports are more likely than average to be displaced by Chinese exports. The coefficient is even smaller for the debtor countries (columns 4, 5 and 8), suggesting that these exports are even more likely to be displaced by Chinese exports. However, we find no significant displacement effects due to trade specialization in low-tech goods except for the regressions that focus on eurozone reporting countries only, partially due to limited coverage on trade specialization in non-eurozone countries in our dataset. Finally, we confirm in columns (2) and (10) that the exchange rate elasticity of imports from the eurozone debtor countries is larger than the average exchange rate elasticity, implying a large decline in imports from these countries as a result of the effective appreciation of their nominal exchange rate.

Appendix Table A2 reports displacement effects regressions estimated at the sectoral level. In these regressions, we control for the trading partner's domestic demand and also include sector specific time dummies. Our main findings are on average robust to this sectoral specification. However, we now obtain a negative and large displacement effect for Spain, and smaller displacement effects for the other three countries.[10]

3.2.3. Estimates of asymmetric impact of world trade shocks. How economically significant are these estimated effects of differential export demand elasticities? To quantify the impact on exports as deviation from the eurozone average, we first com-

[9] For example, this could capture the effect of time variation in trade openness.

[10] Estimated displacement effects may be smaller when estimated with sectoral data if part of the displacement effect reflects pure sectoral patterns that are absorbed by the sector-specific time dummies. In contrast, for Spain we find a significantly larger displacement effect than with aggregate data. In that case, an aggregation bias may attenuate the estimated displacement effect (this could be the case, for instance, if a competitiveness loss in a third market is compensated by higher exports from another sector).

pute an average differential elasticity defined as $elast_j = \sum_k share_k \times elast_{j,k}$, where $share_k$ is the share of exports of sector k in total export and $elast_{j,k}$ is the differential elasticity of sector k (relative to the eurozone average) for exports to trading partner region j. The loss of exports to trading partner j at year t is then given by:

$$\left(\frac{export\_loss}{GDP}\right)_t = elast_j \cdot \%increase\_domestic\_demand_{j,(1999-t)} \cdot \left(\frac{export_j}{GDP}\right)_{1999} \cdot \left(\frac{GDP_{1999}}{GDP_t}\right)$$

The cumulative loss as a percentage of GDP between 2000 and 2008 is then given by the sum of the annual losses.

All in all, the total cumulative differential effects of trade developments vis-à-vis China, emerging Europe and oil exporters on the trade balance of eurozone debtor countries appear to be quite large, although the estimated impact varies according to the regression specification (Table 8). While export demand and displacement effects are estimated to be smaller with sectoral data in general, the displacement effect is instead larger in the case of Spain.

4. THE FINANCING OF EUROZONE DEBTOR COUNTRIES

4.1. Financial integration and NFA positions

In Section 2 we documented how investors from outside the eurozone held larger shares of debt issued by 'core' eurozone countries as opposed to debt issued by the periphery. In Figure 6 we provide a decomposition of net foreign assets for eurozone debtor countries, separating out to the extent possible the positions vis-à-vis other eurozone countries from those vis-à-vis the rest of the world (see Waysand *et al.*, 2010, for an analysis of bilateral positions of European Union countries). The figure shows that net liabilities vis-à-vis other eurozone countries account for the lion's share of the increase in net external financing for eurozone debtor countries since the beginning of the past decade. In addition, net liabilities vis-à-vis the United Kingdom (not shown in

Table 8. Total differential effects on the cumulative trade balance, 1999–2008 (as a percentage of GDP)

Differential effect	Greece (%)	Italy (%)	Portugal (%)	Spain (%)
Aggregate data				
Export demand	−6.8	−7.0	−1.5	0.0
Displacement of exports	−8.8	−17.1	−29.2	2.4
Total	*−15.6*	*−24.1*	*−30.7*	*2.4*
Sectoral data				
Export demand	−1.3	0.0	0.0	−0.5
Displacement of exports	−10.2	−7.4	5.9	−25.2
Total	*−11.5*	*−7.4*	*5.9*	*−25.7*

Source: Authors' calculations.

the chart) account for a meaningful part of net liabilities vis-à-vis the rest of the world. Given the importance of cross-border financial sector activity of affiliates of core eurozone banks domiciled in the UK, part of these liabilities are also likely to reflect positions vis-à-vis the core eurozone.

The mirror image of the debtor countries' net foreign liabilities are the net foreign assets of the other 'core' eurozone countries described in Figure 7; these are accumulated net foreign assets vis-à-vis the debtor countries, and net foreign liabilities vis-à-vis the rest of the world. We next focus on the two largest 'core' eurozone countries in

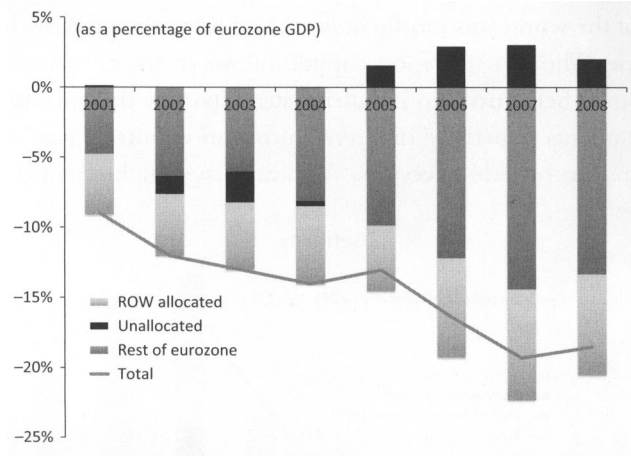

Figure 6. Net foreign assets of eurozone debtor countries (as a percentage of eurozone GDP)

Source: Waysand *et al.* (2010) and authors' calculations.

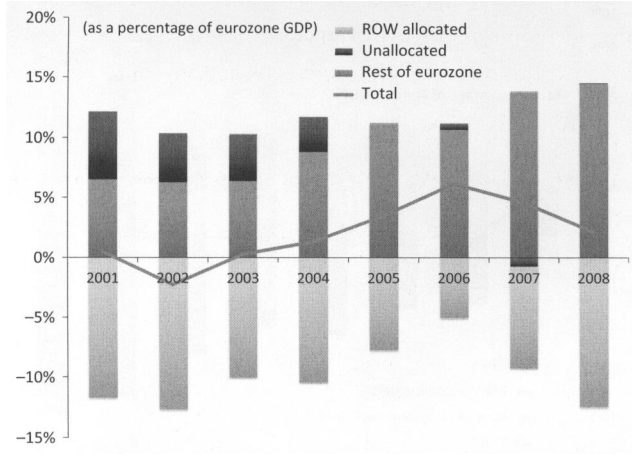

Figure 7. Net foreign assets of 'core' eurozone countries (as a percentage of eurozone GDP)

Source: Waysand *et al.* (2010) and authors' calculations.

Figure 8. During the same period, France and Germany accumulated net foreign assets within the eurozone almost exclusively vis-à-vis the five debtor countries. While Germany had a growing positive net asset position vis-à-vis the rest of the world, France had a growing net liability position vis-à-vis the rest of the world. A closer look at the data shows that investors from the rest of the world held debt securities in 'core' eurozone countries, in particular France and Germany, but accumulated very few claims vis-à-vis the eurozone debtor countries. Figure 9 also shows that France and Germany's claims on the debtor countries were mostly in the form of debt securities.

In sum, this evidence shows that the financing of debtor countries' trade deficits vis-à-vis the rest of the world was mostly indirect and intermediated by the large countries of the eurozone. The fact that most capital inflows in the eurozone debtor countries originated from other eurozone countries suggests that the substitutability between financial instruments issued by different eurozone countries was higher within the eurozone than for outside investors. While it is straightforward to explain why

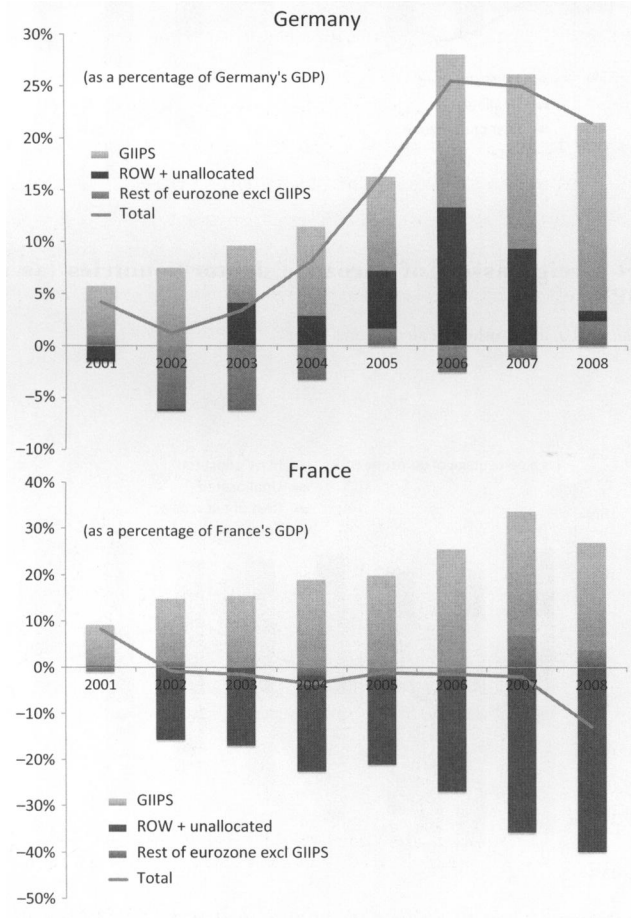

Figure 8. Bilateral net foreign assets of Germany and France

Source: Waysand *et al.* (2010) and authors' calculations.

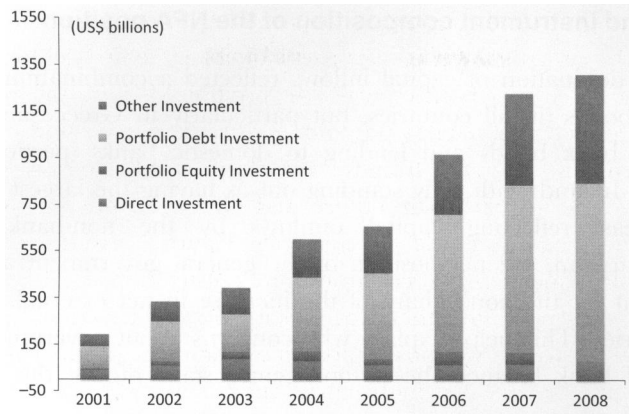

Figure 9. Bilateral net foreign assets of Germany and France vis-à-vis eurozone debtor countries (by instrument)

Source: Waysand *et al.* (2010) and authors' calculations.

monetary union and financial harmonization increased the substitutability of bonds issued by different eurozone countries for a local investor, it is more difficult to explain why investors outside the eurozone would perceive bonds from the eurozone periphery as less substitutable with those from the eurozone core. One possibility is that core eurozone investors perceived deficit countries' bonds as less risky because of bail-out expectations (that would somehow favour eurozone holders); another is that these bonds had the same collateral value at the European Central Bank for eurozone financial institutions accessing ECB financing, but no such benefit for outside investors.

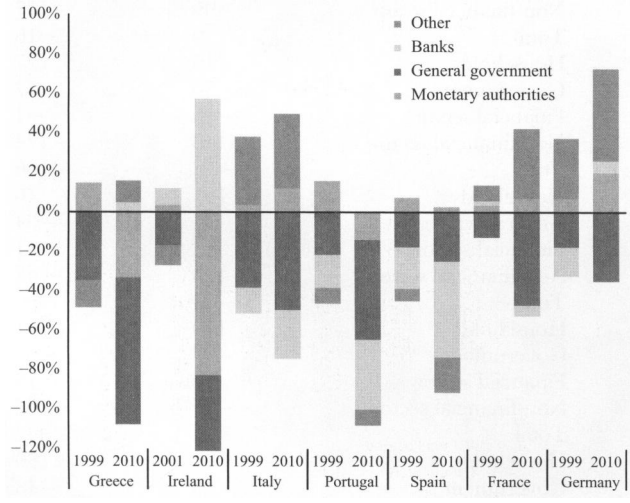

Figure 10. Sectoral NFA positions (as a percentage of GDP)

Note: Data available only from 2001 for Ireland.

Sources: IFS data.

4.2. Sectoral and instrument composition of the NFA position

The sectoral destination of capital inflows reflected a combination of purchases of government bonds (in all countries, but particularly in Greece and Portugal) and purchases of bank bonds and lending to domestic banks (particularly in Spain, Portugal and Ireland) with Italy standing out as having the largest accumulation of assets overseas, reflecting capital outflows by the non-bank private sector (Figure 10). In sum, the net position of the general government and the financial sector account for the lion's share of the increase in net external liabilities for the debtor countries. This helps explain why concerns about government finances and the health of bank balance sheets took centre stage during the crisis starting in early 2010.

Table 9. Net financial assets by sector (as a percentage of GDP, 2001–2008)

	Sector	2001	2009	Change
Greece	Households	131	59	−71
	Government	−93	−87	6
	Financial sector	−9	−6	4
	Non-financial sector	−71	−69	2
	Total	−42	−102	−60
Ireland	Households	103	65	−38
	Government	−13	−28	−15
	Financial sector	−2	1	3
	Non-financial sector	−103	−105	−2
	Total	−15	−67	−52
Italy	Households	202	186	−16
	Government	−96	−103	−7
	Financial sector	2	19	17
	Non-financial sector	−99	−117	−18
	Total	9	−16	−25
Portugal	Households	140	127	−13
	Government	−30	−57	−27
	Financial sector	−10	−1	9
	Non-financial sector	−148	−174	−26
	Total	−48	−106	−58
Spain	Households	107	76	−31
	Government	−42	−34	7
	Financial sector	3	11	7
	Non-financial sector	−103	−143	−40
	Total	−34	−90	−56
France	Households	118	131	14
	Government	−37	−51	−14
	Financial sector	11	19	8
	Non-financial sector	−77	−102	−25
	Total	15	−2	−17
Germany	Households	98	130	32
	Government	−36	−48	−12
	Financial sector	0	7	7
	Non-financial sector	−58	−59	−1
	Total	4	30	26

Source: Eurostat statistics, OECD statistics.

However, a parallel analysis of domestic financial balance sheets reveals a more complex picture: the worsening external position of debtor countries is to a significant extent associated with a worsening in the financial balance sheet of the private sector – specifically, households (Table 9). In turn, this worsening of the financial balance sheet of households is mostly explained by an increase in purchases of non-financial assets (primarily housing). The net position of the general government (as of end 2008) was still stronger than early in the decade (the exception being Portugal) but the domestic private sector reduced substantially its holdings of domestic government debt and increased its indebtedness vis-à-vis the domestic financial system, which in turn increased its reliance on external funding. What changed therefore was the pattern of ownership of domestic public debt, rather than its overall size – worsening private sector balance sheets were the driving force behind increased external imbalances.

5. CONCLUDING REMARKS

In this paper we have documented the evolution of external imbalances among eurozone countries, and explored the role of various factors in rising net foreign liabilities. The asymmetric impact of trade developments with countries outside the eurozone are important but often overlooked factors contributing to the growing external imbalances. The rise of China, the integration of Central and Eastern European countries with the rest of Europe, and rising oil prices contributed to the divergence of external balances in the eurozone. In particular, exports of several southern European countries were negatively affected by Chinese competition, while Chinese import demand provided little benefits to the trade balance of these countries. At the same time, the very sharp nominal appreciation of the euro compounded the well-documented losses in competitiveness of deficit countries within the eurozone due to domestic prices and costs.

We also show that the current account deficits of eurozone countries were mostly financed by eurozone surplus countries, despite significant trade imbalances vis-à-vis the rest of the world. That is, in deficit countries trade imbalances vis-à-visital the rest of the world were financed by net lending from the core eurozone. In turn, investors from outside the eurozone increased their claims on countries such as Germany and France. This suggests a special role for intra-eurozone financial integration in allowing for persistent current account imbalances. Why investors from the rest of the world displayed different portfolio preferences for eurozone investment is an important subject for future research.

While external imbalances in debtor countries reflected to an important extent an increase in claims by non-residents on the public sector (as well as financial institutions) these increased claims reflected sales of public debt by the domestic private sector. Indeed, between 2000 and 2008 the entire deterioration in the net financial position of deficit countries vis-à-vis non-residents reflects a worsening of private

sector financial balance sheets, with the effect on household balance sheets masked by asset price booms.

These results suggest that the build-up in external liabilities in several eurozone countries reflected a variety of factors, including external shocks, with the ease of external financing coming from core eurozone countries playing an important role in allowing these imbalances to persist. Given the persistence of the external shocks we discussed – the rise of China, the integration of Central and Eastern Europe with the eurozone, high commodity prices – and especially the dramatic change in the willingness of non-residents to finance large current account deficits – the need for external adjustment in debtor countries is particularly pressing. Domestic demand-side policies (such as fiscal consolidation and internal devaluation) and supply-side policies boosting productivity and competitiveness (such as product and labour market reforms) are likely to be important elements of rebalancing in a monetary union. But our evidence of asymmetric shocks calls for mechanisms to develop centralized risk sharing and transfers across eurozone countries to ease adjustment to country-specific shocks. Having fiscal transfers in place, conditional on strong governance, would be particularly important given limited mobility of labour and existing labour market rigidities in the eurozone.[11] The adjustment would be greatly facilitated by an easing of external factors. These include stronger external demand, less onerous financing conditions as well as a depreciation of the euro.

Discussion

Gianluca Benigno

London School of Economics

This is a must read paper for understanding the dynamic of the external imbalances in the eurozone in the past ten years or so. It is timely both in terms of the analysis and the policy implications that follows from its reading.

In my written comments I will briefly summarize what I believe is the main contribution of the paper and then discuss why it is important to care about external imbalances and conclude by providing some suggestions beyond the ones that have been already incorporated in the current final version of the paper.

Brief summary

One way to read this paper is to think about it as a paper that challenges the conventional perspective on the origins of external imbalances in the eurozone. The popular view is that the net debtors in the eurozone (Greece, Ireland, Italy, Portugal and

[11] See for instance, Bordo *et al.* (2011) for a related discussion.

Spain), or most of them, have accumulated external liabilities as a by-product of a relative increase in their unit labour costs (loss of competitiveness hypothesis due to domestic forces).[12] In this article, the evolution and the sources of eurozone current account imbalances are analysed under a different angle, which in my opinion has quite different and critical policy implications. The thesis that is put forward, through a descriptive and an empirical analysis, is that external factors are important in understanding the dynamics of the eurozone periphery's current account. There are two dimensions along which external factors are relevant: first, the fact that there has been, among European economies, an asymmetric trade interaction with emerging Europe, fast-growing China and oil exporters. Germany's growth has been due to its ability to redirect its exports towards fast-growing markets. The second factor is given by the role of the nominal exchange rate. In fact in the period going from 2000 to 2009, the authors show that real exchange rate appreciation in eurozone periphery economies has been mainly driven by the nominal exchange rate (see Figure 2 of the paper that decomposes the real effective exchange rates based on unit labour costs and consumer price index).

Why do we care?

Why do we care about external imbalances in general and specifically of the eurozone? In fact, according to the convergence hypothesis, countries that are catching up would borrow if their expected growth rate is higher than the average growth rate of the eurozone. In this way, current account deficit would be interpreted as the by-product of the convergence process. In an interesting paper Giavazzi and Spaventa challenge this view and show how the behaviour of labour productivity in the euro-periphery countries is not compatible with the convergence hypothesis. Giavazzi and Spaventa (2010) point out that foreign borrowing that is directed towards unproductive sectors might affect the sustainability of the external position. In particular, they show that the lower is the expected relative price of tradable versus non-tradable goods (usually denoted as P^T/P^N) the more investment is allocated towards the less productive non-tradable sector. Importantly, they also note that in a currency union this effect could be more relevant since there is no internal adjustment in terms of nominal exchange rate: a nominal depreciation would mitigate this force. Here I add that if we consider the eurozone as an economy integrated with the rest of the world, a nominal exchange rate appreciation vis-à-vis the rest of the world would amplify this effect creating further reallocation towards non-tradable.

While so far we have focused on the trade side of the external imbalances, Chen, Milesi-Ferretti and Tressel also point out the financing side of this imbalance as particularly interesting. In fact they show that current account deficits by euro-debtor countries were financed by capital inflows coming from France and Germany rather than

[12] For example, this increase of labour costs could be the outcome of over-optimistic expectations of convergence (see Giavazzi and Spaventa, 2010).

from outside the eurozone. Another asymmetry for which there is economic rationale at least in the context of the period examined to the best of my knowledge.

Policy implications

In my view there are at least two key policy implications that emerge from this analysis. First, in terms of growth strategy and secondly, in terms of monetary policy.

In terms of growth strategy, the analysis suggests that one important feature of Germany's growth in the past 10 years has been the ability to diversify its export market towards economies that are growing faster or for which there are growth prospects. The development of an appropriate growth strategy is beyond the scope of the article or my comments since it requires a more articulated analysis of which are the sectors in which each country has a comparative advantage and at the same time what are the products that are in demand in fast-growing economies (conditional, of course, on their stage of development).

For example, it would be interesting to conduct a similar analysis to the one that is done here in terms of the real effective exchange rate by looking at the industry-specific real exchange rate. The sectoral real exchange rate could also be used: construction of industry specific real effective exchange rates (I-REER).[13] An industry-specific exchange rate could ideally be constructed by using industry data on producer price index and on industry specific unit costs.

They would allow for a more accurate picture of which are the forces that might affect sectoral competitiveness and eventually imply sectoral specific policy tools for growth strategy purposes rather than more general macro policies.

Indeed the I-REER is a better gauge of international price competitiveness of exporters. For example in the analysis of Japanese export volume suggests that demand factor and pricing strategy are more relevant than nominal effective exchange rates in explaining the sectoral export pattern of the Japanese economy. I guess that there might be something similar here if we had the opportunity to examine with the same lens the German experience.

The second policy implication that this article could emphasize more, is on the importance of the role of the nominal exchange rate. Indeed, the decomposition of the different factors that determine the real effective exchange rate show that the nominal appreciation of the euro is the main factor in the loss of competitiveness of the eurozone periphery. In terms of monetary policy this would imply that a more accommodative policy stance would be needed in order to engineer at least indirectly a correction in the nominal exchange rate of the eurozone. This policy could be effective insofar as the nominal exchange rate plays a similar important role in determining the sector specific real exchange rate as it does in explaining the aggregate real exchange rate as in Figure 2.

[13] Sato *et al.* (2012) do this for the Japanese case.

Panel discussion

Following up on Fernando Broner's discussion, Thorsten Beck asked to what extent were the net foreign asset positions in both Spain and Ireland affected by the housing booms during the sample period. Second, he enquired if the authors could further elaborate on the specific policy implications of the paper (e.g. exchange rate policy, redistribution within the eurozone). Refet Gürkaynak wondered if the ECB's collateral policy could explain why the core eurozone countries/banks attributed greater value to peripheral eurozone debt than other non-eurozone countries. Philip Lane noted that the terms of trade data might not provide a clear account of what happened on the price side due to changes in the composition of trade etc. Moreover, he stressed that empirically the terms of trade are dominated by oil prices which is only one part of the overall picture in the paper. Richard Portes completely agreed with Gianluca Benigno's analysis and reiterated that there is no straightforward mapping between the terms of trade and relative price of non-traded goods. The message he gleaned from the paper was that the capital account drove the current account and, furthermore, surmised that funds primarily flowed directly into the non-traded sector, in particular the housing and construction industry. Portes suggested that the authors provide a decomposition of capital inflows in order to determine the extent to which they were used to directly purchase government bonds.

On the role of the nominal exchange rate, Thierry Tressel acknowledged that its effects may have been different across sectors. Moreover, he agreed with Georges de Ménil that a devaluation of the euro could help to alleviate the pressure on Greece, Portugal and Italy. He also mentioned that Target 2 imbalances are only a symptom of the underlying problems in the eurozone. Tressel noted that Spain is a country that did not suffer as much from the asymmetric trade shocks. Their current account deficit was driven by capital flows fuelling the housing boom. Tressel suggested that the ECB's collateral policy is indeed one possible explanation for the low spreads that were observed up until the crisis, in addition to capital requirements and low risk premia (the expectation that no country in the eurozone will default).

APPENDIX

The bilateral export data are from the IMF's Direction of Trade Statistics. For export regressions we collect annual bilateral exports of 11 euro countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain) to their top 50 trading partners.[14] For displacement effect regressions, we focus

[14] We rank trading partners based on bilateral trade values (exports + imports) in 2009.

on countries that choose to import from either the eurozone or China. From the first dataset, we select countries that are in the top 20 export trading partners for at least 6 euro countries (US, UK, Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden, Switzerland, Japan, Spain, Turkey, Russia, Czech Republic and Poland). We collect bilateral nominal exports and imports for those 17 countries with their top 50 trading partners. Because bilateral price deflators are not available, nominal bilateral exports (imports) are converted into real values using the reporter country's export (import) price deflators.

The bilateral sectoral export and import data are from the UN Commodity Trade Statistics database (UN COMTRADE). We aggregate different product types into four categories according to technology intensity using the ISIC Rev. 3 breakdown of activity: high, medium-high, medium-low, and low technology. All other non-manufacturing products are grouped as 'not classified'. Table A3 describes the technology classification.

We construct two datasets using sectoral trade data for export regressions and displacement effect regressions respectively. The lists of reporter countries and their top 50 trading partners are the same as those in the bilateral trade datasets for export and displacement effect regressions. To convert the sectoral trade data from values to volumes, we use the reporter country's export (import) prices as export (import) price deflators. To address the bias on sectors, we include sectoral time trends in our regressions.

The bilateral real exchange rate is the bilateral nominal exchange rate divided by the relative CPI, with higher values denoting real depreciation of the reporter country's currency. Export and import price deflators, exchange rates, CPI, and total domestic demand are from the IMF's *International Financial Statistics and World Economic Outlook* (April 2010).Our datasets cover the period from 1990 to 2009.

Table A1. Sectoral export regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			P = CEE	P = CEE	P = China	P = China	P = Oil	P = Oil
Nominal exchange rate	0.526***		0.447***	0.444***	0.532***	0.533***	0.501***	0.500***
Relative CPI	−0.605***		−0.519***	−0.516***	−0.613***	−0.615***	−0.585***	−0.584***
Real exchange rate		0.564***						
ReporterDemand	0.392***	0.368***	0.370***	0.383***	0.391***	0.388***	0.403***	0.406***
PartnerDemand	1.302***	1.318***	1.243***	1.253***	1.182***	1.181***	1.401***	1.402***
PartnerDemand × P			0.435***	0.439***	0.350***	0.350***	−0.492***	−0.493***
× Low			0.0416***	0.0415***	−0.0877***	−0.0877***	0.0751***	0.0753***
× Medium-Low			0.0290**	0.0290**	−0.0404*	−0.0404*	0.0494***	0.0495***
× Medium-High			0.0407***	0.0406***	0.0411*	0.0411*	0.0989***	0.0990***
× High			0.114***	0.114***	0.0523**	0.0523**	0.132***	0.132***
PartnerDemand × R(R = Deu) × P			0.139	0.145	−0.0540	−0.0546	0.458***	0.458***
× Low			−0.0108	−0.0109	0.00651	0.00651	−0.0635***	−0.0635***
× Medium-Low			0.0483***	0.0483***	0.174***	0.174***	0.0864***	0.0864***
× Medium-High			0.0606***	0.0605***	0.169***	0.169***	0.0731***	0.0731***
× High			−0.0745***	−0.0745***	0.0906*	0.0906*	0.0126	0.0126
PartnerDemand × R(R = GIPS) × P			0.704***		0.364*		0.297**	
× Low			−0.156***		−0.154***		−0.0607***	
× Medium-Low			−0.133***		−0.0947**		0.0216	
× Medium-High			−0.196***		−0.160***		−0.116***	
× High			−0.374***		−0.287***		−0.246***	
PartnerDemand × R(R = Grc) × P				−0.376*		0.952**		−0.170
× Low				−0.442***		−0.380***		−0.165***
× Medium-Low				−0.407***		−0.122*		−0.0601*
× Medium-High				−0.618***		−0.277***		−0.268***
× High				−0.760***		−0.597***		−0.360***
PartnerDemand × R(R = Ita) × P				0.0643		−0.251		0.385**

Table A1. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			P = CEE	P = CEE	P = China	P = China	P = Oil	P = Oil
× Low				−0.0775***		0.0731*		−0.0763***
× Medium-Low				−0.0387**		0.0785*		0.0400**
× Medium-High				−0.0761***		0.110***		−0.0122
× High				−0.296***		−0.0207		−0.171***
PartnerDemand × R(R = Prt) × P				2.635***		1.013***		0.224
× Low				0.407***		−0.185***		0.0826**
× Medium-Low				0.345***		−0.310***		0.0787**
× Medium-High				0.365***		−0.370***		−0.0625*
× High				0.176***		−0.398***		−0.201***
PartnerDemand × R(R = Esp) × P				1.842***		−0.316		0.644***
× Low				−0.388***		−0.138***		−0.0958***
× Medium-Low				−0.316***		−0.0398		0.0273
× Medium-High				−0.309***		−0.116**		−0.125***
× High				−0.474***		−0.146**		−0.251***
Observations	47396	47396	47396	47396	47396	47396	47396	47396
R-squared	0.837	0.837	0.840	0.846	0.839	0.839	0.842	0.843

Notes: The dependent variable is annual bilateral sectoral export volume of 11 euro countries with their top 50 trading partners from 1990 to 2009. The 11 euro countries are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain. The independent variables include the nominal exchange rate, relative CPI (reporter CPI/Partner CPI), real exchange rate, reporter demand (reporter's domestic demand), partner demand (trading partner's domestic demand), and interactions of trading partner's domestic demand with various country pair dummies and sectoral dummies. R is the dummy for reporter country, and P is the dummy for partner country (definition for P is listed in the column header). For example, the coefficient of −0.442 for 'PartnerDemand × R(R = Grc) × P × Low' in column (4) indicates the marginal difference in demand elasticity for exports of low technology goods from Greece to CEE countries.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. All regressions include a full set of country fixed effects and sectoral time trends.

Table A2. Sectoral displacement effect regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
						only euro	only euro
Nominal exchange rate	0.144*		0.153**	0.154**	0.149*	0.391*	0.438**
Relative CPI	−0.285***		−0.290***	−0.291***	−0.291***	−0.211	−0.255
Real exchange rate		0.208***					
ReporterDemand	0.933***	0.963***	0.880***	0.876***	0.914***	0.450**	0.317*
PartnerDemand	1.114***	1.099***	0.795***	0.806***	0.791***	0.933***	1.003***
Import from China			0.335***	0.332***	0.332***	0.0862*	0.0762**
Import from China × P(P = Euro)			−0.179***	−0.179***			
× Low			0.111***	0.111***			
× Medium-Low			0.0941***	0.0941***			
× Medium-High			0.134***	0.134***			
× High			0.194***	0.194***			
Import from China × P(P = GIPS)			0.134***			0.155***	
× Low			−0.0988***			−0.100***	
× Medium-Low			−0.117***			−0.118***	
× Medium-High			−0.174***			−0.176***	
× High			−0.218***			−0.219***	
Import from China × P(P = Grc)				0.199***	0.0476		0.265***
× Low				−0.193***	−0.0990***		−0.195***
× Medium-Low				−0.191***	−0.111***		−0.191***
× Medium-High				−0.389***	−0.275***		−0.391***
× High				−0.374***	−0.209***		−0.375***
Import from China × P(P = Ita)				0.0276	−0.119***		0.00150
× Low				−0.0502***	0.0442***		−0.0515***
× Medium-Low				−0.0218**	0.0581***		−0.0221***
× Medium-High				−0.0506***	0.0634***		−0.0517***
× High				−0.119***	0.0461***		−0.119***
				0.0377	−0.111***		0.0377

Table A2. (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
						only euro	only euro
Import from China × P(P = Prt) × Low				0.0985***	0.193***		0.0973***
× Medium-Low				−0.0223	0.0577***		−0.0229
× Medium-High				−0.00616	0.108***		−0.00791
× High				−0.0624***	0.103***		−0.0641***
Import from China × P(P = Esp)				0.278***	0.126***		0.326***
× Low				−0.266***	−0.171***		−0.267***
× Medium-Low				−0.235***	−0.155***		−0.236***
× Medium-High				−0.241***	−0.127***		−0.242***
× High				−0.314***	−0.149***		−0.315***
Observations	29605	29605	29605	29605	29605	6495	6495
R-squared	0.747	0.746	0.755	0.759	0.753	0.873	0.900

Notes The dependent variable is the annual bilateral sectoral import volume of 17 countries with their top 50 trading partners from 1990 to 2009. The 17 countries are United States, United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Sweden, Switzerland, Japan, Spain, Turkey, Russian Federation, Czech Republic, and Poland, which are the major countries importing from the eurozone. The independent variable 'Import from China' is the reporter country's import from China. Other specifications are consistent with Table 6. For example, 0.111 for 'Import from China × P(P = Euro) × Low' in column (3) means the marginal effect of imports of low technology goods from China on the reporter country's imports from euro countries. Column (7) and (8) use the sub-sample where trading partners are only euro countries.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. All regressions include a full set of country fixed effects and sectoral time trends.

Table A3. Classification industries based on technology

Technology classification	ISIC Rev.3
High-technology industries	
Aircraft and spacecraft	353
Pharmaceuticals	2423
Office, accounting and computing machinery	30
Radio, TV and communications equipment	32
Medical, precision and optical instruments	33
Medium-high-technology industries	
Electrical machinery and apparatus, n.e.c.	31
Motor vehicles, trailers and semi-trailers	34
Chemicals excluding pharmaceuticals	24 excl. 2423
Railroad equipment and transport equipment, n.e.c.	352 + 359
Machinery and equipment, n.e.c.	29
Medium-low-technology industries	
Building and repairing of ships and boats	351
Rubber and plastics products	25
Coke, refined petroleum products and nuclear fuel	23
Other non-metallic mineral products	26
Basic metals and fabricated metal products	27–28
Low-technology industries	
Manufacturing, n.e.c.; Recycling	36–37
Wood, pulp, paper, paper products, printing and publishing	20–22
Food products, beverages and tobacco	15–16
Textiles, textile products, leather and footwear	17–19

Source: OECD (2005).

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