

A team of the Working Group on Econometric Modelling of the European System of Central Banks

**Research Report**

## Competitiveness and external imbalances within the euro area

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EUROPEAN CENTRAL BANK

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**OCCASIONAL PAPER SERIES**

**NO 139 / DECEMBER 2012**

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EXTERNAL IMBALANCES  
WITHIN THE EURO AREA**

A Team of the  
Working Group on  
Econometric Modelling  
of the European System  
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## **A TEAM OF THE WORKING GROUP ON ECONOMETRIC MODELLING OF THE EUROPEAN SYSTEM OF CENTRAL BANKS**

This paper was prepared by a team of the Working Group on Econometric Modelling of the European System of Central Banks.

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**ABSTRACT**

The onset of the financial crisis in 2008 has highlighted the problems of diverging external imbalances within Economic and Monetary Union (EMU) and the role of persistent losses in competitiveness. This paper starts by investigating some of the competitiveness factors which contributed to external imbalances in euro area countries. The evidence suggests significant heterogeneity across countries in both price/cost and non-price competitiveness in the euro area and that there is no one factor, but rather a range of potential factors explaining diverging external imbalances. In particular, while non-price competitiveness effects contributed largely to the trade surplus in some countries, for some southern European countries the trade balance was also driven by price factors.

The second part of the paper studies the implications of competitiveness adjustment by means of quantitative tools. Using four different multi-country macro models, improvements in both price/cost aspects (namely wage reduction, productivity improvements or fiscal devaluation) and non-price competitiveness factors (quality improvements) were shown – under certain conditions – to improve external imbalances. The analysis suggests differences in countries' composition of trade could lead to heterogeneity in the potential gains from improvements in competitiveness.

**JEL codes:** F10, F41, F43, F47, O52.

**Keywords:** Competitiveness, trade, open economy, euro area, macro models, simulations.

## NON-TECHNICAL SUMMARY

The onset of the financial crisis in 2008 has highlighted the problems of diverging external imbalances within Economic and Monetary Union (EMU) and the role of persistent losses in competitiveness. Some deficit countries are currently undergoing a process of adjustment in external imbalances, although the adjustment in certain countries appears slow and may be driven by temporary and cyclical factors rather than due to structural factors.

For this paper, a team from the Working Group on Econometric Modelling (WGEM) of the European System of Central Banks investigated the link between competitiveness and external imbalances in euro area countries and studied the implications of competitiveness adjustment by means of quantitative tools.

The main findings of this paper can be organised around two themes:

### (i) Competitiveness factors contributing to external imbalances: Key findings

- Unit labour costs (ULCs) as one key competitiveness indicator suggest cross-country differences come mainly from higher increases in labour costs in deficit countries relative to surplus countries. Slow productivity growth also contributed negatively to competitiveness in a few countries which seemed to be related to sectoral reallocations, from traded to non-traded sectors. Part of the difference in labour costs can be attributed to heterogeneity across countries of their tax wedge (direct taxes and social security contributions).
- Non-price competitiveness effects are also important. Some indicators of non-price competitiveness such as technological innovation (R&D), labour force characteristics (e.g. skills), product market regulations and business environment factors (e.g. procedures for enforcing contracts) show large heterogeneity across

countries. These indicators suggest some correlation with current account positions and thereby point to some scope for possible improvements.

- Using highly disaggregated trade data, this paper quantifies the price versus non-price effects. Over the last decade, non-price competitiveness effects contributed largely to the trade surplus in some countries. However, for some southern European countries the trade balance was driven by both price and non-price factors. The decomposition of the trade balance into components driven by price and non-price factors is important because policies aimed at reducing nominal rigidities and in general improving the business climate may be more effective than cost-side measures in countries where the deficit is dominated by structural, non-cost factors.
- The pre-crisis period 1999-2007 saw weak cross-country correlation between export growth rates adjusted for geographical and sector-specific effects and changes in the current account or deviations in ULCs. This suggests that the negative correlation between the two latter variables was partly driven by common shocks. This in turn suggests that current account imbalances are not simply the result of heterogeneous cost competitiveness.
- Using alternative methodologies proposed by the literature, estimates of trade elasticities at aggregate and sectoral levels for all EU countries are presented. The significant heterogeneity across countries suggests a large role for sectoral composition in determining the speed of adjustment of trade to changes in international prices.

Given these findings, *a suite of models* (both structural and empirical) was used to quantify the likely adjustment in the external balance following a range of changes in competitiveness for a large euro area country with a current account deficit.

**(ii) Model simulations: Key findings**

- One example of so-called internal devaluation is a fiscal reform designed to switch expenditure from foreign to domestic output, comparable to the effects of nominal exchange rate depreciations. Our simulations show that in the most benign case, a 1% improvement in the current account requires a 2.2% of GDP reduction in employers' social security contributions compensated for ex ante by an increase in VAT.
- The impact of productivity improvements on the current account is model dependent. In the best case, a 1% reduction in the current account balance over three years requires productivity gains of around 4%. Productivity-enhancing measures in the tradable sector are more likely to have a positive effect in terms of reducing external imbalances than similar gains in the non-tradable sector.
- By contrast, permanent productivity improvements may lead to an increase in domestic demand, which depends not only on current income but also on the expectation of higher future income. This anticipation can trigger sizeable foreign capital inflows and high consumption and investment raising imports and thereby a worsening of the current account. However, in countries where agents face credit constraints, the demand effects will be more muted. False expectations about the future path of the economy could be a large part of the source of external imbalances.
- Model simulations also suggest that non-price factors such as quality improvements (proxied by an increased preference for a country's goods) are effective in addressing external imbalances, although a more detailed analysis is needed. These gains are not necessarily independent as improvements in cost competitiveness that are only partially transmitted to prices in order to increase profits could potentially be reinvested in non-price competitiveness factors (through R&D).

- Improving wage competitiveness in a number of deficit countries simultaneously could rebalance trade within the euro area. The small cross-country spillovers could be due to the limited role of the financial sector in the macro models used. Our findings are generally robust to different modelling choices. However, results are sensitive to the structure of the economy, e.g. the sectoral and geographical composition of trade.

This paper has focused on the role of competitiveness. However, the existing literature suggests that external imbalances also resulted from other factors. Notably, the elimination of exchange rate risk, diverging inflation rates and a common monetary policy resulted in low real interest rates in some euro area countries, which led to increased demand pressures (e.g. purchases of real estate) which were fuelled by capital inflows from abroad and resulted in current account deficits. More recently, a higher cost of external financing has led to a reduction in demand and an improvement in current account deficits.

The focus of this paper is primarily on a transitory medium-run (five-year) horizon. Indeed, while the measures analysed can potentially help to correct existing external imbalances, they may not remove them permanently. Further research is therefore needed on identifying possible permanent changes to euro area economies. However, it is likely to take time for any structural changes to lead to improvements in external balances. To conclude, there is heterogeneity in both price/cost and non-price competitiveness in the euro area and there is no one factor, but rather a range of potential factors that explain the diverging external imbalances prior to 2008. Using four different macro models, improvements in both price and non-price competitiveness were shown under certain conditions to improve external imbalances. The analysis suggests differences across countries in potential areas for adjustment and also heterogeneity in potential gains from improvements in competitiveness.

## I INTRODUCTION

Since the introduction of the euro, there has been a persistent and steady divergence in competitiveness among the euro area countries. Whereas some countries saw persistent gains in price and cost competitiveness, e.g. consumer price inflation or unit labour cost-based measures, other countries registered substantial losses. At the same time, countries experienced a steady widening in current account balances, with some countries accumulating very large deficits, which resulted in a sharp deterioration of their net foreign asset positions. As highlighted by Trichet (2011) and Draghi (2012), this is a cause for concern, as persistent losses in competitiveness and mounting external imbalances not only increase the economic and financial vulnerability of individual countries, but given the strong financial and trade interconnectedness of the euro area countries may also hinder the functioning of the euro area as a whole.

Real convergence of economies, as shown by Blanchard and Katz (1992) for the United States and Decressin and Fatas (1995) for Europe, does not necessarily happen and indeed differences in competitiveness and current account positions in a monetary union are not necessarily a cause for concern. The current account balance of a country generally corresponds to the difference between aggregate savings and aggregate net investment; therefore, countries that invest more than they save at home need to borrow money from abroad. Transition countries characterised by relatively strong growth and high investment requirements face an inflow of foreign capital and a corresponding current account deficit could be a natural consequence of the catching-up process. Furthermore, in these countries, fast productivity growth combined with changes in product composition and quality lead to relatively fast growth in wages and prices without worsening their competitiveness if expected productivity increases materialise and surplus countries are saving more. Nevertheless, the divergence observed among euro area countries since the start of EMU could reflect

a less benign build-up of a range of domestic imbalances. As part of the strengthened framework for economic governance in the EU, a new surveillance procedure has been in force since December 2011 for the prevention and correction of harmful macroeconomic imbalances. In some countries, wage increases unwarranted by productivity developments eroded competitiveness (see European Commission 2012). In several countries, the source of current account imbalances was not necessarily a lack of competitiveness in the traded goods sector, as wage increases were the result of capital inflows which pushed up prices and wages in the non-traded sector (e.g. construction), with possible wage contagion effects to other sectors in the economy. This suggests that dysfunctional labour markets could also have played a role in some countries, suggesting scope for reforms.

Most countries that experienced persistent current account deficits went through a period of unsustainable aggregate demand growth, fuelled by expanding credit in the private sector, housing bubbles and construction booms. In some countries, these imbalances were aggravated by inappropriate fiscal policy. By contrast, large external surpluses in other countries sometimes reflected persistent weaknesses in domestic demand and market rigidities.

With the onset of the financial crisis in 2008, the problems posed by imbalances were aggravated and attention focused on persistent weaknesses. Indeed, the crisis prompted a reversal in external imbalances, with some deficit countries significantly improving their current account position through relatively larger drops in domestic demand and smaller falls in exports. Balance sheet adjustments by households and firms reduced consumption and investment and increased savings, thereby leading to lower net financing requirements. From a financial perspective, the crisis accelerated the trend towards more short-term financing of current account deficits (mainly through interbank loans), which suggests weaker sustainability in the future. The surplus countries have also

seen a substantial reduction in their external imbalances. Although resilient private sector domestic demand kept imports close to pre-crisis levels, the surplus countries experienced a disproportionately high reduction in exports, due to their specific product specialisation and greater trade openness.

The recent reduction of external imbalances has partly been driven by temporary and cyclical factors, so the pre-crisis divergence may resume once the economic environment normalises. In order to prevent this, several countries require more structural adjustment, e.g. competitiveness could be improved by redirecting production towards the tradable sectors. In some cases, the crisis has already prompted a correction in domestic asset and real estate prices, reduced the construction sector and improved private sector balance sheets. However, new imbalances such as high unemployment have emerged and further restructuring will be needed. Therefore, it is important that economic policies also address labour and product market rigidities. This paper considers necessary a correction of persistent external imbalances over the medium term.

While the existence of external imbalances within the euro area is taken as a given, it is worth reflecting briefly on one of the possible causes of the imbalances. The existing literature suggests diverging nominal and real interest rates as one primary cause for the emergence of imbalances in the euro area.<sup>2</sup> In the process of creating Monetary Union, nominal yield differences between euro area members declined substantially. Regarding short-term interest rates, this process was a natural consequence of implementing a single monetary policy. At longer maturities, yields converged because of the elimination of exchange rate risk and (possibly irrational) convergence in perceptions of country default risk. At the same time, inflation rates diverged from the start of Monetary Union with relatively poor, peripheral countries registering persistently higher rates of price increases. As a result, real interest rates (and in particular their distance from equilibrium) diverged, leading to increasing

demand pressures in peripheral countries. These countries faced increasing current account deficits matched by capital inflows from abroad that financed private consumption, purchases of real estate or government deficits.

The aim of this paper is twofold: (i) to analyse past behaviour of the variables that contribute to external imbalances, in particular related to competitiveness; and (ii) to derive policy implications from simulation results using four alternative macro-econometric models.

Section 2 starts by presenting stylised facts about ULCs and other relevant variables in an attempt to analyse the growth of external imbalances within the euro area, and in particular the causes of competitiveness losses – as measured by the appreciation of the ULC-based real exchange rate in the decade before the financial crisis.

First, the paper shows that labour cost developments were disconnected from productivity changes in a number of countries. This raises the question of wage determination mechanisms and some interesting sectoral aspects are highlighted. Given the importance of taxes in labour costs, the possible effects of fiscal devaluation – the shift from direct taxes and social security contributions to indirect taxation – on competitiveness and trade are also considered.

The paper then investigates how gains in productivity could be used to improve competitiveness and, hence, to encourage a successful export performance and discourage imports. Two aspects are considered: the first is improvements in productivity that lead to cost and price competitiveness improvements (process efficiency, labour force skills or business environment factors); the second is the non-price aspects of competitiveness – e.g. product quality or after-sales services. Some relevant variables from the literature are presented (technology, business environment,

<sup>2</sup> See e.g. ECB (2003), Fagan and Gaspar (2007), Bundesbank (2010) and Brzoza-Brzezina et al. (2010).

human capital, etc.) and their potential role in correcting external imbalances is discussed. In order to understand the respective contributions of price and non-price competitiveness, highly disaggregated trade data of European countries over the last decade are used.

There are various structural differences across countries that may affect the potential gains from improvements in price competitiveness. In Section 2.5, the trade performance of euro area economies is analysed, while excluding effects stemming from the geographical and sector specialisation of their exports. Trade elasticities of substitution also differ across countries depending on a number of features, e.g. composition of exports, price elasticity of demand and import content of exports. Sectoral estimates of trade elasticities are also studied to see what insights they can provide to explain heterogeneity across countries and serve as benchmarks for macro models. Finally, the reduction of external imbalances through improved competitiveness (either price or non-price competitiveness) also depends on the import content of exports. If the share of imported products used to produce exports is high, gains in competitiveness do not lead to sizeable reductions in external imbalances.

Section 3 presents the simulation results of four policy change scenarios which aim to improve competitiveness, and consequently the current account and GDP of a large-deficit economy. The structure of Section 2 is followed by considering four main shocks: (1) a reduction in the wage mark-up; (2) a fiscal devaluation shock (a cut in social security contributions, accompanied by an increase in indirect taxes); (3) a higher productivity shock; and (4) a non-price competitiveness (preference) shock.

Four different multi-country macro models are used for the simulations: the Global VAR (GVAR) model, the National Institute Global Econometric Model (NiGEM), the New Multi-Country Model (NMCM) and the Euro Area and Global Economy (EAGLE) model. These models range from empirical to structural

models and enable an evaluation of whether the effects of the policy change are model dependent or robust to different specifications. The current account generally improves in the medium term as a result of the simulated shocks; however, sensitivity analysis with respect to crucial parameter values in the EAGLE model shows to what extent the results are robust to different features of the economy such as increased price sensitivity, higher/lower trade elasticities or permanent versus temporary productivity shocks.

Finally, the implications of a number of deficit countries simultaneously undertaking reforms are examined and in particular the size of the spillovers to the rest of the euro area. The scenario considered corresponds to a simultaneous cut in wages for all countries with current account deficits in 2010. Even though there are differences in the results across the models, overall they suggest that spillovers are limited within the euro area, especially for current account balances, although generally there are positive effects on euro area GDP in the short term.

2 FACTORS AFFECTING EXTERNAL IMBALANCES

This section starts by reviewing the links between price and cost competitiveness, particularly as embodied by unit labour costs and external imbalances within the euro area. It is well known that whole economy ULCs diverged significantly across euro area countries in the decade prior to the financial crisis and this was associated with current account imbalances. In Chart 1, the change in the real effective ULC-based exchange rate from the start of the euro in 1999 until 2007, i.e. before the crisis began, is plotted against the change in the current account (CA) balance over that period or against the actual current account balance in 2007. In both cases, there seems to be a negative correlation – i.e. an increase in ULCs is associated with a worsening of the current account.<sup>3</sup>

ULCs capture cost competitiveness, and under the assumption that labour costs comprise a major part of companies’ cost structure, it is a plausible indicator. However, it is nonetheless important to note that ULCs are only one of a number of real effective exchange rate (REER) indicators of price competitiveness. Other REER indicators might show a different picture in the short term.

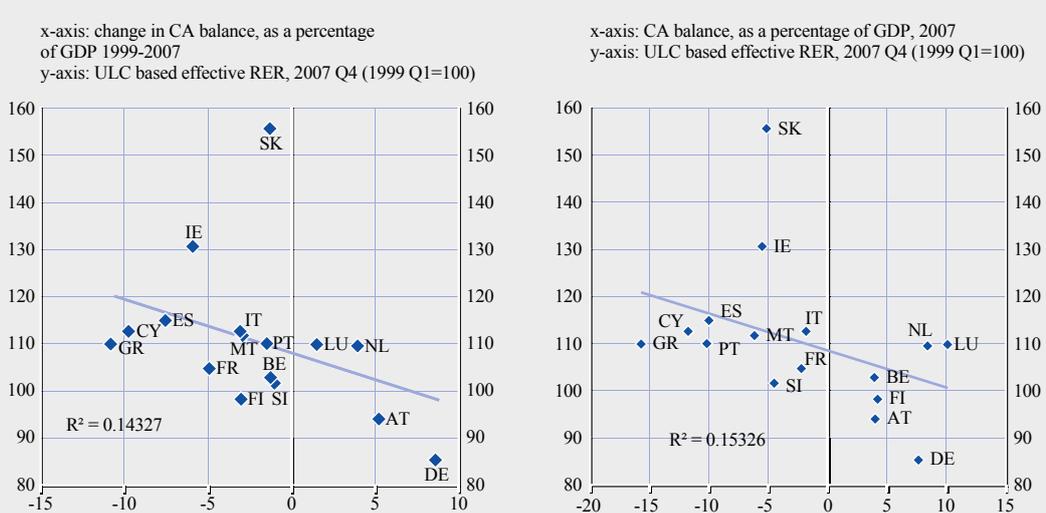
In the pre-crisis period, one can observe a strong co-movement between the REER indicator based on GDP deflators and the one based on total economy ULCs, while correlation with the REER indicator based on consumer price inflation (CPI) is less pronounced (see Chart 2). This could be due to many causes, including incomplete pass-through, i.e. a change in margins.

It is also worth recalling at this stage that export or import performance and current account changes are weakly correlated across countries, consistent with an analysis of the balance of payments starting from the financial account. Current account performance is also affected by factors that are not directly related to competitiveness, such as net income payments or oil price changes.

If the real appreciation against the euro area 16<sup>4</sup> prior to 2007 in terms of the ULC components is analysed, then high-deficit countries were mainly

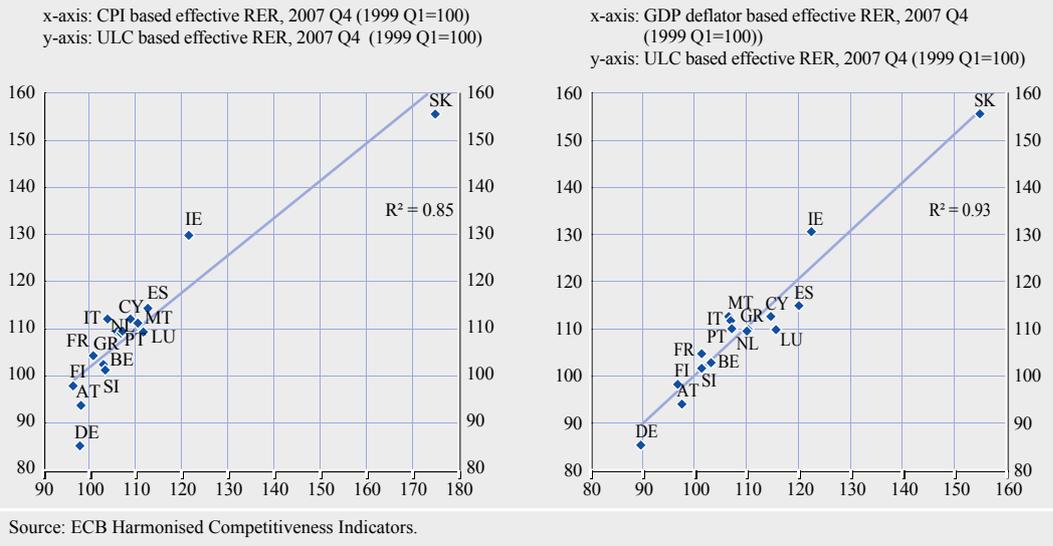
- 3 For euro area countries, the figures show the harmonised competitiveness indicators calculated vis-à-vis the same 20 trading partners plus the other euro area countries (see De Clercq et al., 2012).
- 4 The euro area 16 comprises Belgium (BE), Germany (DE), Ireland (IE), Greece (GR), Spain (ES), France (FR), Italy (IT), Cyprus (CY), Luxembourg (LU), Malta (MT), the Netherlands (NL), Austria (AT), Portugal (PT), Slovenia (SI), Slovakia (SK) and Finland (FI).

Chart 1 Real effective ULC-based exchange rate and current account



Source: Ameco and ECB Harmonised Competitiveness Indicators.

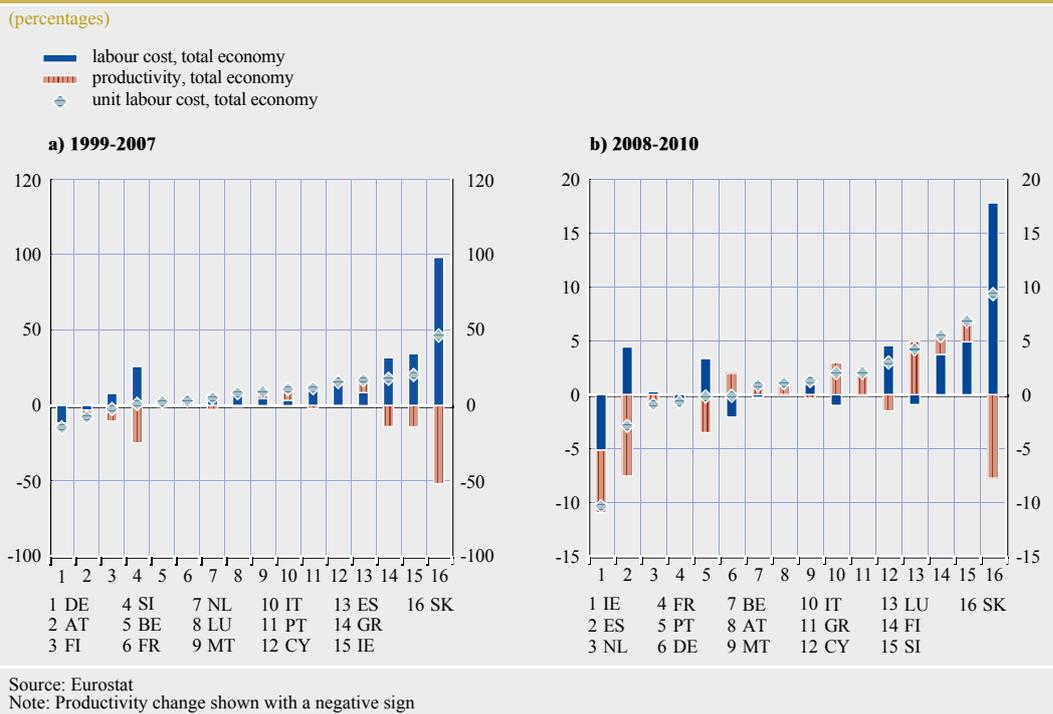
**Chart 2 Different REER indicators**



associated with a faster increase in labour costs (wages) (see Chart 3). In catching-up economies, a faster growth of both labour costs and productivity is to be expected. However, for some

countries with strong wage growth, productivity growth was below the euro area average, which suggests a mismatch between real wage developments and productivity across the

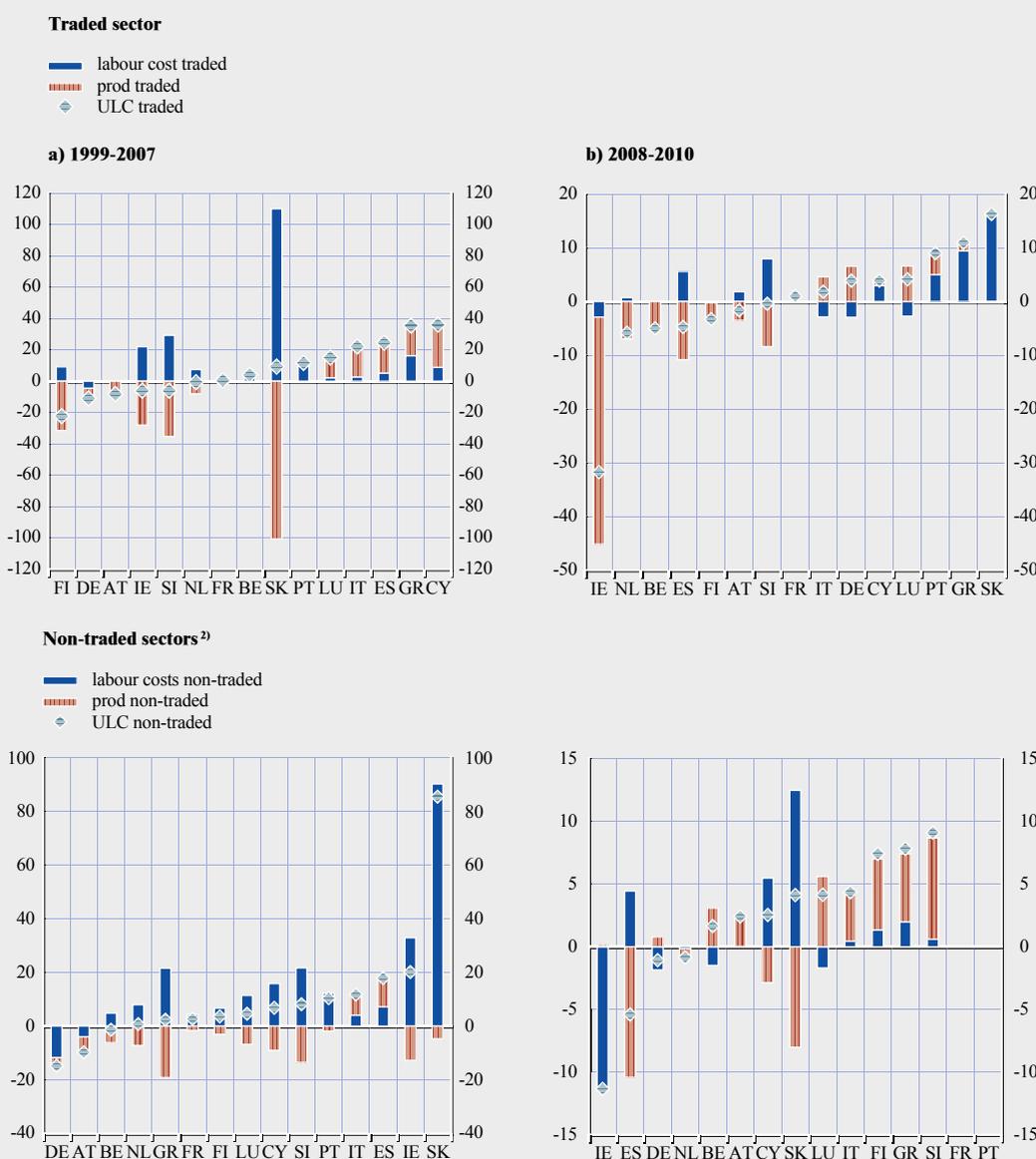
**Chart 3 Decomposition of change in ULCs compared with the euro area 16**



countries. Since the end of 2007, there has been a significant correction in current account imbalances, but – with a few exceptions, such as Ireland and Spain – only a modest adjustment in price and cost competitiveness. This casts doubt on the durability of convergence in external balances and suggests that rebalancing could be partly explained by cyclical factors, such as the

Chart 4 Sectoral decomposition of change in ULCs compared with the euro area 16<sup>1)</sup>

(percentages)



Sources: Eurostat. Labour costs: compensation of employees/employment (persons); productivity: value added volumes (at basic prices, reference year 2000)/employment (persons). Traded sector: manufacturing, and for 2008-2010: industry. Non-traded sector: construction, wholesale and retail trade, hotels, restaurants, transport, financial intermediation and real estate. For Portugal and France, traded ULCs for 2009 and 2010 (ESCB Statistical Data Warehouse, last update: 8 November 2011). Malta, France and Portugal (non-traded 2008-2010) excluded due to data limitations. For Greece: 2000-2007.

1) Productivity changes shown with a negative sign.

2) Including construction, wholesale and retail trade, hotels, restaurants, financial services and real estate.

contribution of imports. Nevertheless, in some deficit countries, the observed adjustment in domestic asset and real estate prices and the deleveraging process started in the private sector suggest that part of the correction has a more permanent nature. In addition, EU/IMF programme countries and other affected countries are undertaking structural reforms.

It could also be that competitiveness indicators measured for the total economy reflect demand shocks originating in the non-traded sector (e.g. construction) due to capital inflows pushing up prices and wages in those sectors (with possible spillovers to wages in other sectors). So the deterioration is not necessarily primarily the consequence of a lack of competitiveness in the traded goods sector. Indeed, sectoral ULC decompositions reveal some differences between the traded and non-traded sectors. In the non-traded sector – which accounts for more than 50% of gross value added in the euro area countries – the cross-country ULC differences show a similar picture to the total economy ULCs, i.e. differences are mainly rooted in divergent developments in compensation per employee. On the other hand, cross-country ULC differences in the traded sector, which are usually considered to be more important for export and import competitiveness, are mainly attributable to divergences in labour productivity. Moreover, cross-country differences seem to be much larger for productivity growth than for labour costs.

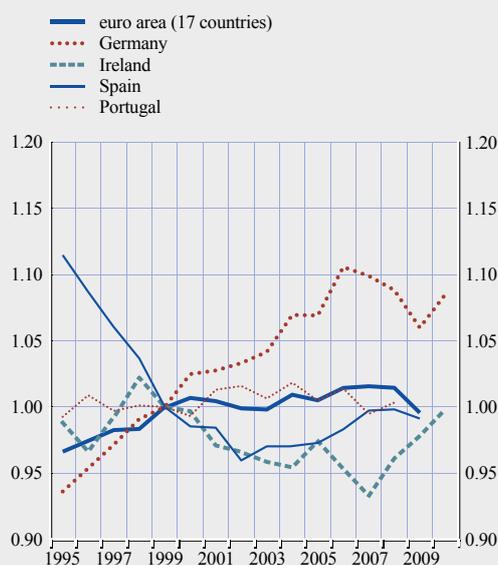
## 2.1 WAGE COMPETITIVENESS

The previous section indicated that in a number of countries labour cost developments were disconnected from productivity changes. This raises the question of wage determination mechanisms. There has been some recent analysis on wages, so here the focus is limited to some sectoral aspects. Theories of wage determination usually assume wage equalisation between sectors through high labour mobility or rigid collective bargaining, which hampers proper wage responses to cyclical conditions and productivity growth. Another frequent assumption is that wages are driven by

productivity developments in the traded sector (the so-called Scandinavian model of wage determination; see Aukrust, 1970).

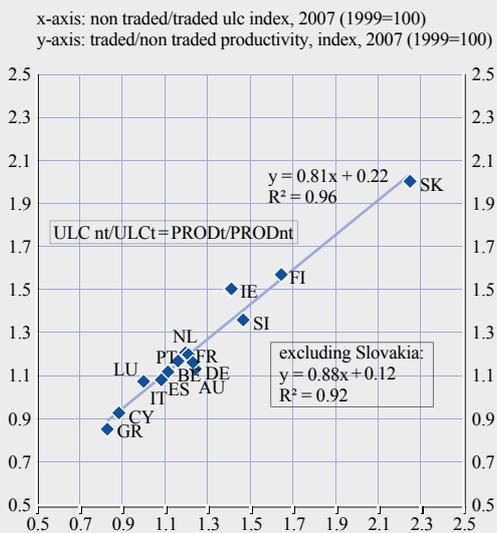
Compensation per employee in the traded and non-traded sectors shows similar patterns in euro area countries. Systematic sectoral wage divergence does not appear between surplus and high-deficit countries (see Chart 5). This might indicate high inter-sectoral labour mobility, or some form of coordinated wage increases across sectors. Regarding public wages, Holm-Hadulla et al. (2010) find a strong positive correlation between public and private wages in the short-to-medium term, with private wages often following public wages. Strong wage co-movement in traded and non-traded sectors also suggests that sectoral ULC differences are mainly attributable to productivity differentials between traded and non-traded sectors (see Chart 6 and 7). To sum up, wage spillovers from non-traded or public sectors might generate a persistent increase in traded sector ULCs. It seems that this phenomenon contributed to

**Chart 5 Compensation per employee in the traded sector compared with the non-traded sector (1999=1)**



Source: Eurostat.  
Note: Compensation per employee in the traded sector corresponds to manufacturing.

**Chart 6 Sectoral ULC and productivity differences for euro area countries**



Source: Eurostat, see above.

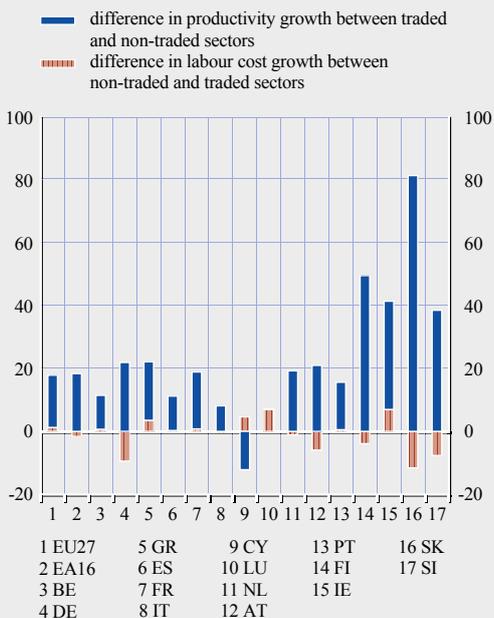
competitiveness losses in a number of countries, providing some insight into possibilities for future adjustment.

## 2.2 FISCAL DEVALUATION

While wage costs are a key part of a firm's labour costs, another aspect worth considering is employment taxes such as direct taxes and social security contributions. This section describes reforms shifting the tax structure from social security contributions towards indirect taxes that could be used to improve competitiveness; in other words, a shift from taxation based on origin (where the goods are produced) towards taxation based on destination (where the goods are consumed). Such "fiscal devaluation" represents a change in the fiscal structure aimed at improving external competitiveness. This argument relies largely on the idea that in an open economy context there seems to be scope

**Chart 7 Decomposition of difference between non-traded and traded ULC growth (1999-2007)**

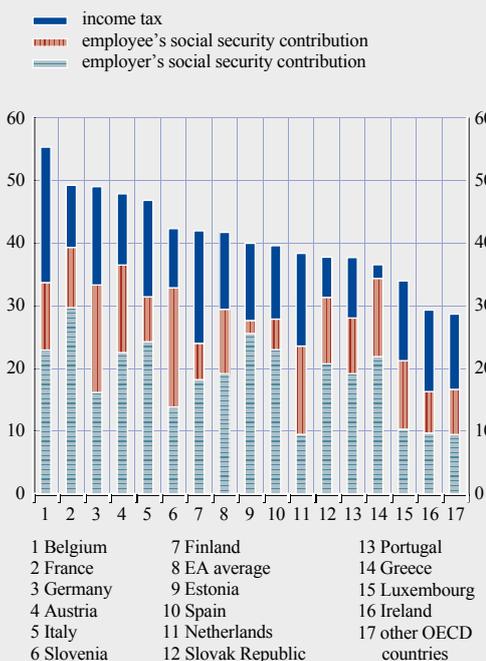
(percentages)



Source: Eurostat.

**Chart 8 Income tax plus employee and employer social security contributions**

(percentage of labour costs, 2010)



Source: OECD.

Note: Based on a single individual without children at the income level of the average worker.

for balanced-budget tax reforms, which shift the tax incidence from direct taxation towards immobile consumers, thereby making tradable production more competitive.<sup>5</sup>

Fiscal devaluation may carry particular appeal for members of a monetary union since nominal exchange rate adjustments cannot be used to affect their intra-area competitiveness. As shown in Chart 8, the labour tax burden in the euro area is relatively high by international comparison, since the average tax wedge far exceeds that of other OECD countries. Furthermore, European countries are relatively heterogeneous.

A more striking observation is that the total tax burden on labour is usually lower in deficit countries than in surplus countries. Social security contributions from employers are however higher in deficit countries as a percentage of labour costs.

Therefore, a budget-neutral temporary tax swap could help to accelerate external adjustments and improve competitiveness temporarily. One example is the 2007 increase in the German VAT rate by 3 percentage points, which was partly offset by reduced contributions to the unemployment insurance scheme. In the theoretical literature, the result of a fiscal devaluation is controversial. In particular, competitive equilibrium analysis of a small price-taking economy suggests that an across-the-board increase in consumption taxes, accompanied by a balanced-budget cut in labour taxes, may well be neutral with respect to trade. This was discussed extensively by Feldstein and Krugman (1990) in their classical paper on the effects of VAT on competitiveness. They found that the substitution of VAT for income taxation is likely to have an uncertain short-run effect on a country's net exports, but is likely to reduce net exports in the longer term.

To sum up, the shift from direct taxes and social security contributions towards indirect taxes may be a way for euro area countries which cannot rely on nominal exchange rate adjustments to improve their intra-area competitiveness.

## 2.3 PRODUCTIVITY

This section analyses how productivity gains could improve competitiveness. This raises two aspects. The first is improvements in productivity that lead to cost and price competitiveness improvements (process efficiency, labour force skills or business environment factors). The second is non-price aspects of competitiveness – e.g. product quality or after-sales services. In some sense, it is artificial to treat productivity and quality improvements as separate issues, as factors that generate gains in productivity are also often those that enhance quality. For example, capital (technological) and labour skill endowments not only affect costs, but also quality. However, in the model simulations later in the paper, the main transmission channel of improved competitiveness is via prices so, first, possible linkages on the cost side are considered. Non-price aspects are considered in the following section.

With the cost aspects, supply considerations are clearly crucial. There is an extensive literature on the role of technological performance as a trade determinant. Technological competitiveness could be broadly defined as the capacity to innovate, as well as to increase efficiency and reduce costs.<sup>6</sup> Therefore, technological advantage could translate into better products, but also into new products (product innovation) as well as into more efficient ways of producing products (process innovation). Since it is difficult to measure the ability to innovate, and whether it leads to process or product innovation, several proxies have been used in the literature, for example, *R&D* expenditure<sup>7</sup> and the number of

5 See ECB (2011).

6 Technology can lead to a process or product innovation. A process innovation results in a product being manufactured more efficiently, lowering costs of production, while a product innovation results in a new commodity or a higher quality product.

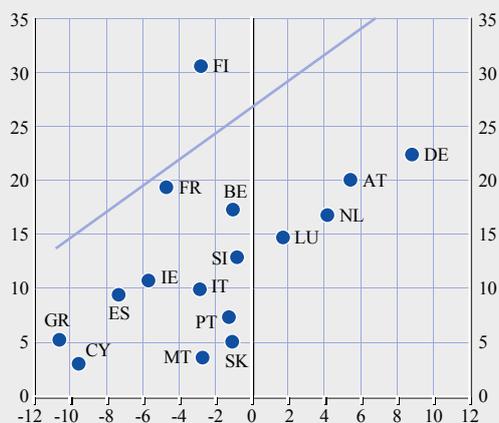
7 *R&D* intensity does not capture all possible innovation efforts; for example, producers may accumulate a knowledge base which is useful for production without engaging in formal innovation. Hence, the positive link between technological competitiveness and trade has to be interpreted with caution because this correlation is expected to vary across sectors.

**Chart 9 Current account balance and R&D expenditure, 1999-2007**

x-axis: change in Current Account (pp of GDP)<sup>1)</sup>  
y-axis: R&D (percentage on GDP)<sup>2)</sup>

$$y = 14,477 + 0.7892 x$$

$$R^2 = 0.2861$$



Sources: ECB and Eurostat.

1) Differences in percentage points between 1999-2007. A positive (negative) sign denotes an improvement (worsening).  
2) Accumulated from 1999 to 2007 (including both years) is represented.

**Chart 10 Current account balance and upper education employment, change in 1999-2007**

x-axis: change in Current Account (pp of GDP)<sup>1)</sup>  
y-axis: change in Upper Education (percentage total)<sup>2)</sup>

$$y = 0.088 + 0.003 x$$

$$R^2 = 0.0607$$



Sources: ECB and EU Labour Service.

1) Differences in percentage points between 1999-2007. A positive (negative) sign denotes an improvement (worsening).  
2) Differences in percentage points in the ratio of employees with upper education to the total.

patents.<sup>8, 9</sup> The empirical evidence seems to indicate that technological progress supports export performance, reduces import penetration and, therefore, contributes to improving current account balances. This positive link between innovation intensity and current account balances in the euro area countries is shown by Chart 9. An increase in the accumulated R&D expenditure between 1999 and 2007 seems to have a positive effect on current account performance. Nevertheless, it is difficult to find a strong correlation between these two variables because some current account components, such as the net income payments, are not directly correlated with competitiveness performance. A similar conclusion is reached using changes in the number of patents.

According to the theoretical literature, human capital plays a key role in determining a country's competitiveness, but empirical evidence is mixed. The skill level of the workforce is the most commonly used indicator to assess the role of human capital in trade performance. Its

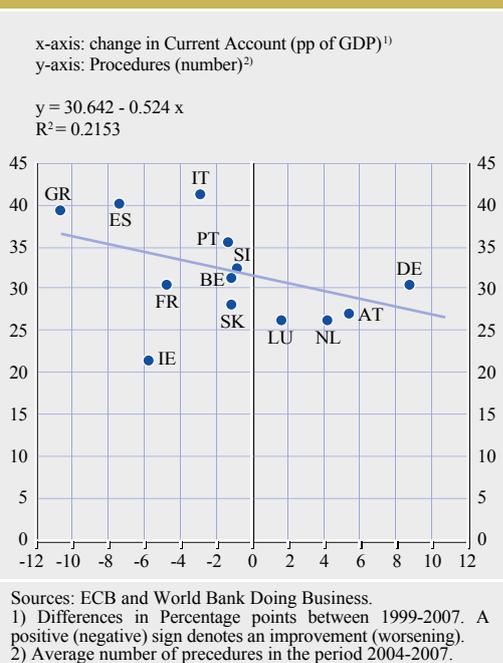
relationship with the current account is not as well understood. Chart 10 relates changes in the percentage of employees with upper education to changes in the current account balance over the period 1999-2007. The graphical analysis suggests a weak positive correlation between these two variables since the beginning of EMU. As in the case of R&D expenditure, the low correlation could highlight other factors affecting the current account composition across countries.

As regards the business environment, the existence of structural rigidities could have a negative effect on a firm's productivity and on its external trade. The number of procedures

8 The patent indicator is an output innovation indicator reflecting successful innovation efforts. See Van Hove (2010).

9 In Lomantzs (2011) innovation is an important determinant of export growth in euro area countries, in particular the change in R&D expenditure and in patent applications. Other indicators of technological progress, such as productivity growth in industry and the share of high-technology sectors in value added, are positively correlated with exports. Knowledge diffusion through international outsourcing of intermediate inputs, as well as the higher quality or the lower costs of intermediate inputs, also contribute to export growth.

**Chart 11 Current account balance and procedures enforcing contracts, 1999-2007**



and costs associated with enforcing a contract in a country are usually used as indicators of the business environment. According to the available empirical evidence, these two variables seem to have a negative effect on trade performance (and on current account balances). Chart 11 compares the number of procedures required for enforcing contracts in euro area countries and the changes observed in the current account balance between 1999 and 2007. These two variables seem to display a negative correlation over this period.

To sum up, measures aimed at increasing innovation, improving the business environment or fostering human capital should be expected to increase firm efficiency and productivity and raise the number of firms that can compete better in domestic and foreign markets. Indeed, such measures should help the necessary price adjustment in countries having experienced significant price competitiveness losses.

#### EXPANSION OF THE NON-TRADED SECTOR

In theory, eliminating exchange rate risk and relaxing financing constraints should result in

higher investment, widening current account deficits and higher productivity growth in the converging euro area countries (e.g. Blanchard-Giavazzi, 2002). However, most deficit countries face lower productivity growth in manufacturing compared with surplus countries, despite higher investment ratios and rapid productivity growth prior to the launch of the euro.

A number of papers confirmed that real convergence cannot account for observed inflation differentials among member countries, which manifest themselves as divergent real exchange rates in the euro area (e.g. Andersson et al., 2009; Ortega, 2003; Égert, 2007). Sectoral ULC developments also suggest that in most current account deficit countries – except Ireland – persistent ULC increases cannot be justified by catching-up or the Balassa-Samuelson effect. In theory, if the Balassa-Samuelson effect holds, the real exchange rate based on ULCs in the non-traded sector would appreciate more than in the traded sector.<sup>10</sup> Slovakia and Slovenia confirm this idea at least in part (they appear above the red line in Chart 12). However, in most high current account deficit euro area countries, the real exchange rate based on manufacturing ULCs usually appreciated against the euro area average even more than the one based on ULCs in the non-traded sector (under the red line in Chart 12). In some high-deficit countries, there is evidence of labour market segmentation, which might explain this disconnect. Analysing the factors behind low productivity growth in the traded sector is beyond the scope of this paper. However, according to BIS (2011), sectoral imbalances themselves have contributed to weak productivity growth in some member countries.

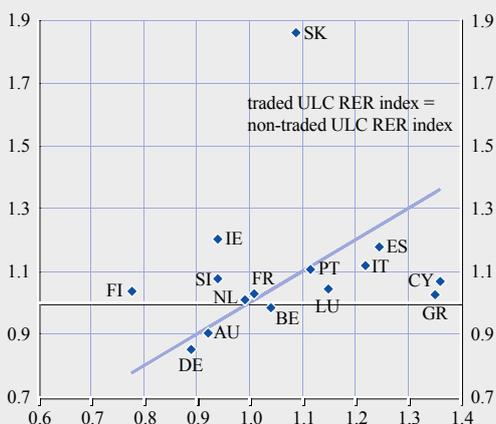
As a result, current account imbalances were mostly accompanied by a high share of the non-traded sector in employment (see Chart 13). BIS (2011) presents some evidence that in some current account deficit countries, low

<sup>10</sup> According to the Balassa-Samuelson theory, the differential between traded and non-traded productivity is higher in a catching-up country. As wages are assumed to equalise across sectors due to high inter-sectoral labour mobility, the result is higher inflation and increasing unit labour costs in the non-traded sector.

**Chart 12 Traded and non-traded ULC REER in 2007 against the euro area 16**

(1999=100)

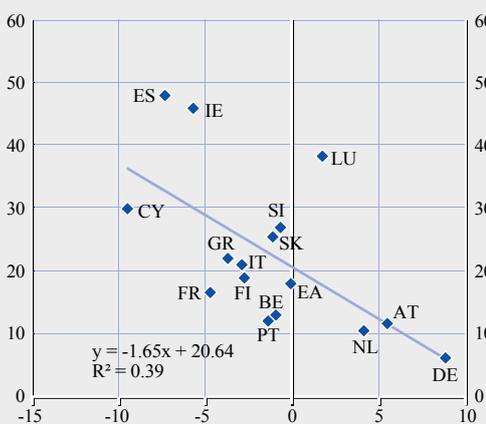
x-axis: traded ULC vis-à-vis EA16, 2007, 1999 = 100  
y-axis: non-traded ULC vis-à-vis EA16, 2007, 1999 = 100



Source: Eurostat. National accounts, last update: 11 January 2012.

**Chart 13 Change in the current account balance and non-traded employment, 1999-2007**

x-axis: change in current account as a percentage of GDP, 1999-2007  
y-axis: change in non-traded employment, per cent, 1999-2007



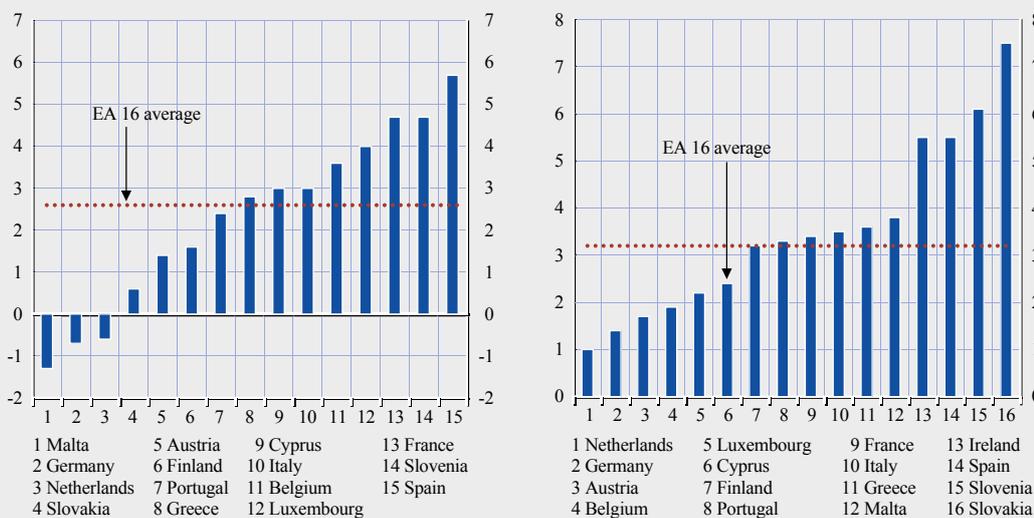
Sources: Ameco and Eurostat.

productivity growth in the manufacturing sector might even reflect expansion of the non-traded sector, especially construction and financial intermediation. Booms in the non-traded sector

led to a resource reallocation from traded sectors, drawing away skilled labour and capital and lowering total factor productivity growth in the manufacturing sector. Although this explanation

**Chart 14 Change in the ratio of non-traded sectors in gross value added (left panel) and employment (right panel), 1999-2007**

(percentages)



Source: Eurostat.

Note: Non-traded sectors: construction, wholesale and retail trade; hotels and restaurants; transport and financial intermediation; real estate. For Malta and Greece: 2000-2007.

is only tentative, the shift of production towards the non-traded sector seems to be more pronounced in countries with higher external imbalances (see Chart 13 and 14).

#### 2.4 NON-PRICE COMPETITIVENESS <sup>11</sup>

Price and cost competitiveness and demand (both internal and external) are only some of the key determinants of trade performance. However, the available empirical evidence suggests that these factors cannot account for differences in EU countries' trade performance since the mid-1990s.<sup>12</sup> Indeed, the evidence supports the existence of non-price competitiveness factors.<sup>13</sup> These encompass a wide range of factors, including product quality, technological advantage, industry specialisation, the efficiency of sales networks, the business environment, after-sales services and export firm characteristics. According to the so-called new new trade theory, exporters (and importers) are bigger, more productive, innovate more and pay higher wages (see Melitz, 2003). Of course, directly or indirectly all these variables are related to productivity, but are treated separately.

The empirical literature uses different variables to measure non-price competitiveness (see ECB, 2006).

Concerning quality, the main challenge faced by the empirical literature is that the variable is unobserved.<sup>14</sup> Research on international trade has attempted to deal with this problem by using indirect indicators of quality. One stream of that research emphasises that consumers are willing to pay higher prices for greater product quality. This approach, while convenient, requires strong assumptions, since higher export prices (proxied by unit value ratios, usually at a very detailed level of disaggregation by product) could reflect not just quality, but also variations in production costs, for example. Nevertheless, it is generally accepted that increasing export market shares combined with higher prices is a good indicator of better quality, because higher prices capture consumer preferences for product quality (see Baldwin and Ito, 2008). Empirical

evidence suggests that richer countries pay higher prices to import more from countries that produce high-quality goods.<sup>15</sup> These findings are consistent with a positive link between increasing export prices and product quality.

Spending more on innovation-enhancing activities enables firms to improve their quality and move up the quality ladder. The link between export performance and innovation intensity is confirmed by including this variable in standard trade demand models in addition to foreign demand and relative prices. Existing reduced-form results confirm that innovative euro area countries export more and that the long-term effect of R&D on exports is important.<sup>16</sup>

11 Annex 1 summarises the main indicators used in the empirical literature to approximate non-price competitiveness and reports these indicators in euro area countries and compares them with those used in some other countries. The general picture is heterogeneous across countries, which could indicate that some countries are more sensitive to non-standard variables than others.

12 Standard export demand equations highlight price competitiveness (usually measured by the real effective exchange rate) and external demand in explaining export performance, but a simple panel regression for euro area countries, using data over 1998-2008, finds that external demand and the real effective exchange rate explain around 55% of the variance of exports (see European Commission, 2010). However, it is important to mention that studies using disaggregated data (e.g. firm-level or sector-level data) find a higher response of export volumes to relative price changes than those estimated using aggregated data. For a detailed description of geographical specialisation and product composition of euro area exports, see European Commission (2010) and Baumann and Di Mauro (2007).

13 Apart from non-price competitiveness, other variables are included in the export demand equation, such as indicators of domestic demand growth, relative profitability of the domestic uses vis-à-vis export ones, the share of several sectors in value added or the sectoral composition of exports (Lommantzsche, 2011).

14 Product quality encompasses the physical attributes of a product (e.g. size, a set of available functions, durability, etc.) as well as intangible attributes (e.g. product image, brand name, etc.). According to Hallack and Schott (2011), product quality refers to all the features, tangible or intangible, influencing consumers' economic valuation.

15 Hallack (2006) finds wide variation in export unit values across countries, even when measured for very disaggregated product categories. Quality differentiation is considered one of the explanations. Using a cross-section of bilateral trade flows between 60 countries, the paper finds that product quality plays an important role as a determinant of the direction of trade.

16 A 1% increase in R&D intensity increased exports by nearly 0.2% (see European Commission, 2010, box II.3.1). This result should be interpreted with caution as R&D expenditure is expected to be more important in some sectors than in others. The positive link between R&D expenditure and export performance across the euro area, the United Kingdom, the United States and Japan is also found in ECB (2005).

Indicators of international technological spillovers, such as inward and outward foreign direct investment (FDI), have also been considered to explain innovation and quality. The relationship between trade and FDI is complex, due to its heterogeneous nature.<sup>17</sup> The empirical evidence finds higher productivity in multinationals than in other firms (whether non-exporting or exporting). Multinationals are more competitive and can cover the fixed cost of accessing foreign markets more easily.<sup>18</sup> Regarding inward FDI, although it has grown in all euro area countries, it has increased less in the largest countries (with the exception of the Netherlands). Outward FDI has been dominated by the largest euro area countries. Since the beginning of the financial crisis, FDI flows have moderated, reflecting increased uncertainty around the world and the sovereign debt crisis in Europe.

Structural indicators of competitiveness may also help to explain export performance (see ECB, 2005). These include, among others, human capital, infrastructure, product market regulations, legal and institutional frameworks and taxation.<sup>19</sup>

In recent years, services have become more interconnected with manufacturing sectors. This reflects increased outsourcing of non-core activities, the role of services as intermediate inputs in manufacturing and the growing use of services to differentiate products (e.g. after-sales service, maintenance and training). Despite the increasing importance of this sector, few studies have considered these activities as a potential determinant of exports. Most studies usually focus on some specific sectors, in particular finance, transport and communication and business services. Empirical results suggest that both financial sector development and communication technology have a positive effect on export growth.<sup>20</sup>

This section reviewed some policies that could improve non-price competitiveness and encourage exports. This is important not only because exports could help support economic

growth, but also because export growth is necessary to correct external imbalances in euro area countries. Economic measures designed to promote innovation and raise product quality would allow developed countries to improve their world export market shares. Results suggest that by promoting entrepreneurship and innovation, policy-makers can help European companies face increasing competition and benefit from rapid growth in emerging countries.

### NON-PRICE VERSUS PRICE COMPETITIVENESS

As just discussed, there are many non-price dimensions of competitiveness, such as reputation, quality, availability and reliability of supplementary services, preferences, etc. These are combined together under the label “non-price” competitiveness factors.

Since quality is not directly observable, the approach in Aiginger (1998) is adopted, by categorising export industries into those where the export/import unit values predominantly signal a cost or quality advantage/disadvantage. A more comprehensive study by Hallack and Schott (2011) is based on the same ideas.

First, the unit values of exports/imports ( $UVX/ UVM$ ) are calculated by dividing nominal exports/imports (measured in EUR) by quantities (measured in kilograms or special

17 In Lommantzs (2011) inward and outward FDI are only rarely significant in a panel of euro area countries between 2000 and 2010. However, there is some evidence of positive effects of inward FDI on export growth in new EU Member States (see ECB, 2006).

18 See European Commission (2008) and Mayer and Ottaviano (2007) for European multinationals.

19 In di Mauro et al. (2010) a broad measure of competitiveness, called the overall competitiveness indicator, is calculated. According to this measure, the most competitive countries are the ones combining technological superiority with easy market access, that is, institutional advantage. Nevertheless, these indicators suffer from important data limitations, since firm-level data are not sufficiently detailed and homogeneous across European countries.

20 Francois and Woerz (2008) showed that imported services were important inputs stimulating exports of manufactured goods in skill and technology-intensive industries. Wolfmayr (2008) examined the effects of services inputs on manufacturing competitiveness for 16 OECD countries and 17 industries from 1995 to 2000, and found a positive correlation between international services mainly related to high-skilled, technology-driven industries and increases in market shares.

units). Second, the relative export unit values are derived as the log-ratio of UVX to UVM. Finally, the trade balance (*TB*) for each sector is calculated by taking the log of the ratio between the quantities of exports and imports. Depending on the size of relative export unit values and the sign of relative quantities sold, the export sectors of an economy are allocated into four possible “competitiveness regimes”.

- *Price domination conditions:* The cost side would dominate in sectors where a low relative unit value of exports is associated with a trade balance surplus ( $UVX < UVM \Rightarrow TB > 0$  and vice versa).
- *Non-price domination conditions:* It is assumed that demand is dominated by non-price factors in sectors where a high relative unit value of exports is associated with a trade balance surplus ( $UVX > UVM \Rightarrow TB > 0$  and vice versa).

Each quadrant in Table 1 represents a sector driven by either price or non-price advantage/disadvantage.

According to economic theory, the price of a given good can be higher if the market is vertically differentiated and one firm concentrates on the higher-quality segment. Therefore, sectors located in the *Non-price +* quadrant are assumed to consist of high-quality products. In these sectors, firms are likely to target the most sophisticated market segments. By contrast, sectors in the *Non-price -* quadrant could suffer from some structural problem because low relative unit values of exports coexist with a trade deficit. Potential reasons for this deficit could be inadequate product

quality or variety, absence of integration in international supply chains, labour and product market rigidities, an unfavourable business environment, insufficient scale economies, etc. The decomposition of the trade balance into price and non-price factors is important because policies aimed at reducing rigidities and in general improving the business climate may be more effective than cost-side measures in countries where the deficit is dominated by structural, non-cost factors.

As for price-driven competitiveness, the quadrant *Price +* contains sectors showing successful price competition (lower costs or maybe smaller profit margins), while the quadrant *Price -* includes sectors with a price competitiveness deficit.

Using data from the UN COMTRADE database, our analysis covers all EU27 countries over the period 1999-2010 across HS 6-digit sectors (on average over 5,000 sectors). These disaggregated data enable us to tackle major shortcomings of previous studies, which overlooked the impact of the value chain (i.e. the use of intermediate goods) and aggregation bias in quantity measures. For instance, in the “motor cars” sector, products are allocated into different categories according to the cylinder capacity of the engine and into categories “cars with spark-ignition or compression ignition (diesel or semi-diesel)”. As a result, one kg of Fiat exports and one kg of Ferrari exports would end up in different car categories that would not be compared. However, our analysis is still not product-level, so even with a very detailed sectoral disaggregation, products within a category may not be completely homogeneous.

**Table 1 Competitiveness regimes**

	Higher Relative Export Unit Values ( $UVX > UVM$ )	Lower Relative Export Unit Values ( $UVX < UVM$ )
Trade Surplus ( $TB > 0$ )	Non-price-driven competitiveness <i>Non-price +</i>	Price-driven competitiveness <i>Price +</i>
Trade Deficit ( $TB < 0$ )	Price competitiveness deficit <i>Price -</i>	Structural deficit <i>Non-price -</i>

To normalise our measures and make them comparable across time and countries, the trade balance contribution of the sectors belonging to each quadrant (as a share of GDP) is calculated. Note that the total will not match the actual ratio of the trade balance to GDP, as only those sectors where a country is both an exporter and an importer can be used. While the allocation to a quadrant is based on price-quantity pairs, the sum is over euro values. The allocation of products to each category should be based on value and not on quantity because if export prices are high enough, the total value of exports could still be higher than that of imports, although the quantity (items, kg) sold is less. Such a case should be allocated to “negative price competition” rather than to “positive non-price competition”.

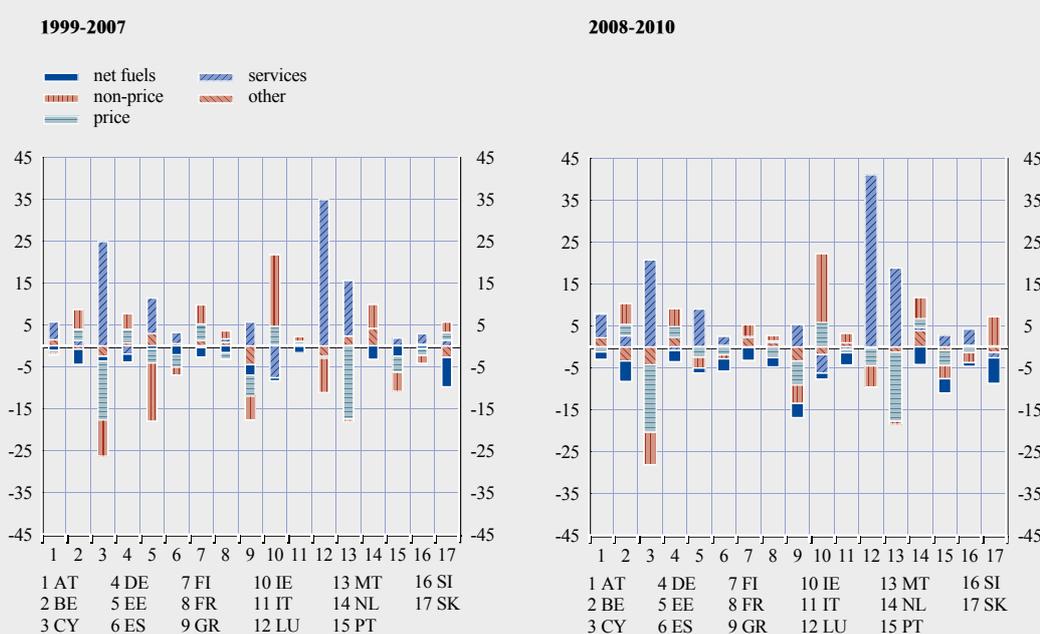
For the sake of simplicity, for each competitiveness category (i.e. Price or Non-price), *net trade balance contributions* are obtained by summing up the *Price (Non-price) + contributions* with the *Price (Non-price) – contributions*.

Chart 15 displays the average net price and non-price contributions of each sector to the trade balance in the 27 EU countries for the periods 1999-2007 and 2008-2010. Oil and natural gas trade is excluded from the classification and shown in the chart as “net fuels”. Every sector for which it is not possible to compare import and export unit values, either because the country only imports it or only exports it, or because no quantity is reported (a quite regular occurrence), is classified as “Other”. The chart also shows the net trade in services and the overall goods and services balance (red diamonds). Over the last decade, Germany’s trade surplus appears to have been driven by both price and non-price competitiveness of its exports. Ireland, Finland, the Netherlands and Belgium also display large non-price trade surpluses. In the Netherlands, this may be an outcome of transit trade, which is not recorded as such in COMTRADE for these countries (unlike e.g. for Hong Kong).

Finland is another country with a large non-price trade surplus, but unlike Germany, it also

Chart 15 Decomposition of the trade balance into price and non-price competitiveness

(percentage of GDP)



Source: UN COMTRADE database and ECB calculations.

has a rather large price surplus, meaning that both non-price and price competitiveness factors favour Finland's trade performance.

For Ireland, the high share of *medicinal and pharmaceutical products* and *chemicals* sectors in Irish exports could explain the non-price dominance.

France and Italy also show a positive non-price contribution to the trade balance, which however has declined in the past few years and was broadly counterbalanced by a negative price contribution. Spain exhibited overall small deficits, with negative goods trade contributions (both from price and non-price factors) counterbalanced by net services exports. The large contribution of positive net services exports is also very clear in very small euro area countries, such as Cyprus, Estonia, Luxembourg and Malta. Services trade also partly counterbalances the large goods deficits of Greece and Portugal, which appear to be supported by both price and non-price factors.

In Greece, Portugal and Spain, the trade deficit has been driven by both price and non-price factors over the period 1999-2010.

## 2.5 OTHER FACTORS AFFECTING TRADE

There are many factors that determine how improvements in price competitiveness affect external imbalances. The role of geographical linkages and sectoral composition/specialisation of trade is now considered. First, export growth is decomposed into the geographical and sectoral contributions. Then, the potential insights that sectoral estimates of trade elasticities could give in terms of heterogeneity across countries are considered and the implications are used as benchmarks for macro models. Finally, the reduction of external imbalances through improved price or non-price competitiveness also depends on the import content of exports, i.e. if the share of imported products used to produce exports is high, gains in competitiveness do not lead to sizeable reductions in external

imbalances. This factor, along with the other ones, are now explored in more detail.

## THE HETEROGENEITY OF EXPORT PERFORMANCE IN THE EURO AREA

Since the late 1990s most advanced economies have experienced a significant fall in their export market share, reflecting the emergence of new competitors, most notably China. These losses have been more limited for some countries. Many factors could help explain these differences. The most commonly mentioned are: (i) the degree of product specialisation, which increases pricing power; (ii) the extent to which geographical structure is oriented towards fast-growing destinations; and (iii) competitiveness patterns.<sup>21</sup>

The Banque de France, in cooperation with the World Bank, is currently developing a tool to decompose export growth in these dimensions.<sup>22</sup> A statistical procedure determines export growth of each country as if all exporters had the same geographical and sectoral specialisation. This is important for export data, as export growth is affected by structural effects: exporters benefit from strong positions in the most dynamic destination markets or specialisation in high-growth sectors. With this methodology, export performance can be assessed separately from geographical and sectoral effects. Below “pure export performance” and “adjusted export market share growth” are compared. The decomposition is further extended to separate quantity from price effects using unit values (see the methodological annex for more details).

For this paper, two datasets are used. For the pre-crisis period, starting from the launch of the euro (1999-2007), CEPII's dataset BACI, which provides harmonised (reconciling exporter and importer trade reports) annual

21 For developing countries, a low initial export market share and a catch-up process seem to play an important role in explaining export growth.

22 Daria Taglioni (World Bank) and Soledad Zignago (Banque de France) are also involved in the project.

bilateral trade flows at the HS6 product level of disaggregation, is used. Raw trade reports are from the UN COMTRADE database. For the crisis period (Q1 2008-Q4 2010), quarterly four-digit bilateral goods export data from the dataset Trademap of the International Trade Center (Geneva) are used. The tables and figures below show the results for 11 euro area countries and four large exporters (China, Japan, the United Kingdom and the United States).

From 1999 to 2007 almost all euro area countries lost world market shares (during that period world trade grew at 11.6% per year in US dollars) – see Table 2 and Chart 16. This probably reflected the rising share of emerging economies in world markets and the expansion of trade within that group. Only Austria managed to gain market shares, but at a relatively slow pace (annual growth of +1.3%). Belgium, Greece and Germany nearly maintained their world market shares (very high for Germany and very low for Greece, given that exports of *goods* are close to 40% of German GDP but less than 10% of Greek GDP). Ireland, Italy and particularly France lost ground. Our decomposition shows that the changes in export shares were mainly driven by “pure” performance and not by composition effects for countries like Germany or France (respectively good and worst performances), although composition effects played a major role for many countries. Portugal, Italy, Greece and Spain suffered from poor sectoral specialisation (weak in equipment, pharmacy and other sectors with dynamic demand, specialised in clothing, etc.), while Ireland and Finland benefited from their comparative specialisation in pharmacy or electronics. Ireland and Spain’s structure of export destinations was detrimental (low share of emerging markets), while Finland and Greece benefited from relatively strong demand in countries and regions like the Baltics, Russia, Eastern European countries or Turkey. Finally, our analysis reveals that Spain, Portugal and to a lesser extent Italy performed relatively well

once weak growth in the markets where they are best positioned is taken into account.

From the start of the euro until the crisis, export growth adjusted for geographical and sector-specific effects was only weakly correlated with changes in the current account or deviations in ULCs. This suggests that the negative correlation between the two latter variables was partly driven by common shocks rather than current account imbalances resulting from heterogeneous cost competitiveness. The data are consistent with demand shocks in peripheral euro area countries moving resources from the traded sector to the non-traded sector, with price and wage increases concentrated in the non-traded sector.

Unit values provide more details on the source of cross-country heterogeneity after adjusting for market share growth and sectoral effects (the decomposition of geographical effects is not reported, since this was much more homogeneous). It appears that the largest part of heterogeneity is due to “volumes”, with very little differences in price developments between “core” countries (Germany, France, Belgium, Austria and the Netherlands). However, stronger growth in unit values in countries like Italy and Spain could reflect quality upgrading rather than deteriorating price competitiveness (which would be consistent with better-adjusted performance in value terms, for Spain in particular). For most countries, sectoral specialisation was more favourable in terms of “volumes” than in terms of “prices”: this is not surprising given increases in energy and raw materials prices before the 2008 crisis and the small export share of those commodities in most European countries (the Netherlands and Greece are exceptions due to their exports of agricultural goods and energy).

In volume terms, euro area countries outperformed the major developed countries outside the euro area (for the euro area aggregate and other countries in Table 2,

**Table 2 Decomposition of export market share growth between 1999 and 2007**

(percentages)									
	World market share growth (1999Q1-2007Q4, current USD, annual growth rate)	Decomposition of market share growth				Prices (unit-value)/Volumes decomposition of "Adjusted market share growth"		Prices (unit-value)/Volumes decomposition of "Sectoral effect"	
		Adjusted market share growth (1999Q1-2007Q4)	Geographical effect	Sectoral effect	Prices (UV)	Volumes (Values/UV)	Prices (UV)	Volumes (Values/UV)	
Austria	1.3	1.5	0.0	-0.2	-0.6	2.1	-1.3	1.1	
Belgium	-0.3	-0.5	-0.2	0.4	-0.5	-0.1	-0.3	0.7	
Finland	-0.8	-3.0	1.4	0.8	0.1	-3.1	-0.6	1.4	
France	-3.6	-3.6	0.2	-0.1	-0.6	-3.1	-1.2	1.1	
Germany	-0.2	-0.6	0.4	0.0	-0.5	-0.1	-1.4	1.4	
Greece	-0.2	-0.8	1.4	-0.8	0.1	-0.9	0.3	-1.1	
Ireland	-2.2	-1.5	-1.3	0.6	-2.4	0.8	-1.1	1.7	
Italy	-1.7	-0.8	0.5	-1.3	0.5	-1.4	-1.3	0.0	
Netherlands	-1.0	-1.0	-0.3	0.4	-0.8	-0.3	0.5	-0.1	
Portugal	-2.4	-0.2	0.0	-2.2	0.2	-0.4	-1.4	-0.9	
Spain	-0.8	0.2	-0.6	-0.4	0.3	-0.1	-1.0	0.6	
Euro area <sup>1)</sup>	-1.1	-1.1	0.1	-0.1	-0.1	-0.9	-1.3	1.1	
China <sup>1)</sup>	10.6	17.1	-1.2	-5.3	1.2	15.9	-2.1	-3.2	
Japan <sup>1)</sup>	-4.3	-4.2	0.2	-0.3	-0.9	-3.3	-1.7	1.5	
United Kingdom <sup>1)</sup>	-5.0	-5.6	0.1	0.5	-0.2	-5.4	-0.1	0.6	
United States <sup>1)</sup>	-5.3	-5.3	0.3	-0.2	-0.5	-4.9	-1.2	1.0	

Sources: World Bank-Banque de France project decomposing world trade; data from BACI dataset of CEPII (Paris).

1) Excluding intra EA trade

intra-euro area trade flows are dropped before export growth is decomposed). As expected, euro area countries were largely outperformed by China, which could at least partly be attributed to sector specialisation in areas in which its export performance would benefit from low wages.

During the 2008-2010 crisis<sup>23</sup>, adjusted performances explain much of the export growth heterogeneity within the euro area (see Table 3 and Chart 17). The best performers were the Netherlands, Austria, Portugal and Spain. But for Portugal and Spain, export growth was significantly reduced by trade flows directed to low-growth markets (the rest of the euro area) and products (e.g. clothing for Portugal). Finland, France and Ireland had the weakest performance. Finland was able to overcome a (small) part of its poor export performance thanks to a (relatively) good geographical

specialisation; France benefited from a good sectoral specialisation (pharmaceutical products, wine, etc.); and in Greece export growth and "adjusted" performance were above the euro area average.<sup>24</sup>

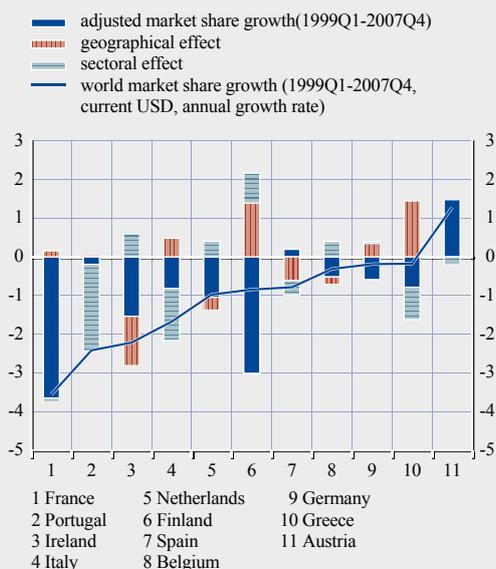
The aggregate euro area performance relative to other developed countries deteriorated during the crisis compared with the former period (1999-2007) – see Chart 18. Performance deteriorated significantly for most countries, in particular for Germany. The Netherlands is the only country that improved its performance. Spain, Portugal, Greece and France did not change their performance much.

<sup>23</sup> From Q1 2008 to Q4 2010, the growth rate of world trade was 2.2% per annum according to our calculations (11.6% in the preceding period). Given that an index of unit values grew at 1.8% per annum, world trade in volume terms was nearly flat.

<sup>24</sup> Weighted averages of euro area countries (therefore including intra-euro area trade flows) are -3.6% per annum for market share and -2.3% for "adjusted" market share growth rates.

**Chart 16 Decomposition of export market share growth between 1999 and 2007**

(percentages)

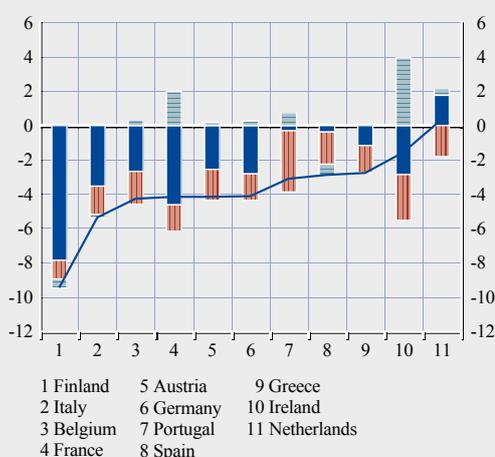


Sources: World Bank-Banque de France project; data from Trademap dataset, International Trade Center (Geneva).

**Chart 17 Decomposition of export market share growth between Q1 2008 and Q4 2010**

Legend:

- adjusted market share growth (2008Q1-2010Q4)
- geographical effect
- sectoral effect
- world market share growth (2008Q1-2010Q4, current USD, annual growth rate)



Sources: World Bank-Banque de France project decomposing world trade; data from Trademap dataset, International Trade Center (Geneva).

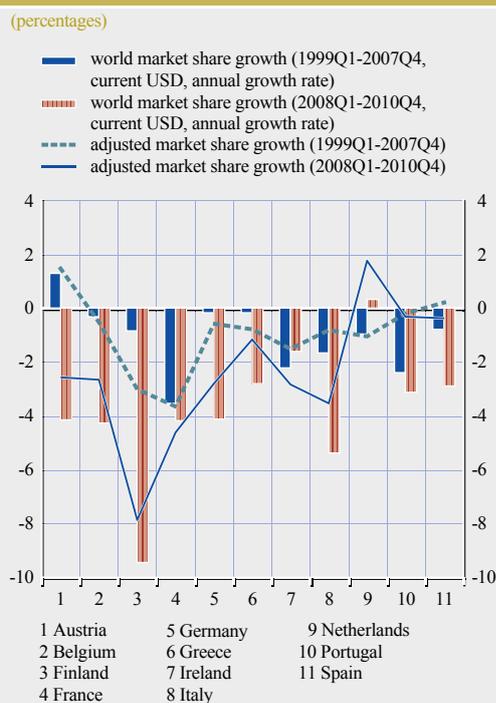
**Table 3 Decomposition of export market share growth between Q1 2008 and Q4 2010**

(percentages)

	World market share growth (2008Q1-2010Q4, current USD, annual growth rate)	Decomposition of market share growth			Prices (unit-value)/Volumes decomposition of "Adjusted market share growth"		Prices (unit-value)/Volumes decomposition of "Sectoral effect"	
		Adjusted market share growth (2008Q1-2010Q4)	Geographical effect	Sectoral effect	Prices (UV)	Volumes (Values/UV)	Prices (UV)	Volumes (Values/UV)
Austria	-4.2	-2.6	-1.8	0.2	-2.6	0.1	0.2	0.0
Belgium	-4.3	-2.7	-1.9	0.3	-1.4	-1.3	0.5	-0.2
Finland	-9.5	-7.9	-1.1	-0.5	-4.1	-3.7	0.7	-1.2
France	-4.2	-4.6	-1.5	2.0	-1.4	-3.3	0.2	1.7
Germany	-4.1	-2.8	-1.6	0.2	-2.1	-0.7	0.3	0.0
Greece	-2.8	-1.2	-1.6	-0.1	-1.4	0.3	-0.2	0.2
Ireland	-1.6	-2.9	-2.7	3.9	4.7	-7.5	-0.8	4.7
Italy	-5.4	-3.5	-1.7	-0.2	-1.9	-1.6	0.4	-0.6
Netherlands	0.3	1.7	-1.8	0.4	-1.2	3.0	-0.6	0.9
Portugal	-3.1	-0.3	-3.6	0.7	-2.4	2.0	0.4	0.3
Spain	-2.9	-0.4	-1.9	-0.6	-1.5	1.1	-0.6	-0.1
China	4.0	6.6	0.1	-2.6	1.7	4.9	-1.0	-1.7
Japan	-1.6	-3.1	2.3	-0.8	4.6	-7.7	0.7	-1.5
United Kingdom	-3.6	-2.8	-1.7	0.9	-1.0	-1.8	0.4	0.4
United States	-1.0	-3.5	2.0	0.5	-0.7	-2.8	-0.3	0.8

Sources: World Bank-Banque de France project decomposing world trade; data from Trademap dataset, International Trade Center (Geneva).

**Chart 18 Comparison between the two periods**



Sources: World Bank-Banque de France project decomposing world trade; data from BACI dataset, CEPII (Paris), and Trademap dataset, International Trade Center (Geneva).

### MEASURING TRADE RESPONSES TO CHANGES IN INTERNATIONAL PRICES

This section provides a survey of the main results on estimates of trade responses to international price changes and offers new estimates based on Corbo and Osbat (2012), both at an aggregate and at a sectoral level, for most euro area countries.<sup>25</sup>

The usefulness of these estimates is twofold: (1) the aggregate measures can be used as a benchmark for calibration of macro models; and (2) the disaggregated estimates provide some insight into the effect of sectoral specialisation on heterogeneity of trade elasticities across countries.

The first is an issue at the core of policy analysis in discussions about the adjustment of external imbalances, both at the global level and within the euro area. Such discussions can be framed as policy simulations conducted on the basis of

structural macroeconomic models, or in a more empirical context as reduced-form estimation of the reaction of aggregate trade to changes in the relative price of tradable goods.

The second aspect motivates the first: given the rather clear evidence of heterogeneity, it becomes particularly important to assess the robustness of standard macro models to changes in the assumptions on the elasticity of substitution.

Despite the very large body of empirical trade literature since the 1950s, little consensus has been reached on the magnitude of the response of trade volumes to price changes. Evidence for most European countries is especially scarce.<sup>26</sup> In fact, there is much variation in estimates across countries and even greater variation across studies in applying the different methodologies.<sup>27</sup> Table A3 in Annex 3 summarises the estimated trade price elasticities from a selection of the available studies suggesting a range between -0.1 and -1.7.

When comparing trade elasticity estimates across studies, the elasticity of substitution of traded goods must be distinguished from the response of imports to a change in import prices; this is explained well by Imbs and Méjean (2011), who also provide a mapping between the two, namely that the price elasticity of imports in sector  $k$  in country  $j$ ,  $\eta_{kj}$ , is given by:

$$\eta_{kj} = (1 - \sigma_k)(1 - \lambda_j^k)$$

where  $\sigma_k$  is the elasticity of substitution in sector  $k$  and  $\lambda_j^k$  is the share of imports in total consumption in sector  $k$  and country  $j$ . For example, an estimate

25 Data for Belgium and Luxembourg separately are not available for the whole sample, hence the trade elasticities for Belgium and Luxembourg are estimated together.

26 Existing studies mostly cover one or a few member countries at a time, making comparisons between countries difficult due to differences in methodology and sample choice.

27 Some confusion regarding what elasticity measures are relevant in what context arises from different definitions of these parameters. The elasticity of substitution between domestically produced and imported goods is the relevant measure for structural models, such as the EAGLE model used for policy analysis at the ECB and in the next section of this paper. The term “trade elasticity”, on the other hand, usually refers to estimates of the reaction of aggregate trade volumes to changes in relative prices.

of the elasticity of substitution equal to 3, in a country where imports are 40% of consumption expenditure, would yield a response of imports to price changes of -1.2.

More recent estimates of the elasticity of substitution between traded goods are now considered. Table 4 reports estimates from three studies that adopt the Feenstra approach<sup>28</sup>: Corbo and Osbat (2012), Imbs and Méjean (2011) and Broda and Weinstein (2006). Estimates reported from Broda and Weinstein (2006) are the simple median of sectoral estimates, while for Corbo and Osbat (2012) and Imbs and Méjean (2011) estimates are the weighted average of the sectoral modes from each country. Thus, only the latter two studies take the sectoral structure into account.

These results suggest wide heterogeneity in elasticities across countries. This in turn can be linked to heterogeneity across sectors in the reaction of trade to prices as well as heterogeneity in the sectoral composition of countries' production and trade. Applying the Feenstra (1994) approach, estimates of elasticity of substitution were obtained for individual sectors that range from close to 1 (the lower bound of theoretically consistent values for the elasticity of substitution<sup>29</sup>) to rather high numbers.

These heterogeneous sectoral estimates were aggregated using weights based on production and trade data, resulting in a range between 3 and 5.3 for the aggregate elasticity that is used for the sensitivity analysis in calibration exercises (see Table 4). The magnitudes vary by country and are also largely affected by the weighting scheme applied, but tend to be higher than the trade price elasticities reported in Table A3 in Annex 3.

The discussion in Corbo and Osbat (2012) stresses that the Feenstra method tends to yield very high estimates of the elasticity of substitution, due to the treatment of non-linearity. A modification to the method, based on the bootstrap, lowers the estimated elasticity relative to the traditional Feenstra estimator (e.g. for the elasticity estimated on exports, the average across countries drops from 8.4 to 3.9).

28 The Feenstra (1994) approach is based on a CES import demand system where each good has many varieties (each corresponding to an exporting country) and the identification is based on the Armington assumption that the elasticity of substitution between foreign varieties is the same as that between the foreign and domestic varieties.

29 On this theoretical constraint, see Feenstra (1994), footnote 2: "For  $\sigma < 1$  all goods are essential to achieve positive production or utility, which is why a new or disappearing variety has an infinite effect on unit costs. For this reason,  $\sigma < 1$  is excluded from the analysis."

Table 4 Estimates of the aggregate elasticity of substitution between traded goods

	Broda et al. 2006	Imbs & Mejean (2011)	Osbat & Corbo (2012)
		Unconstrained	Mode
Austria	4.0	7.8	5.0
BelgiumLux	n.a.	n.a.	3.6
Finland	3.1	10.0	3.9
France	3.7	6.4	4.8
Germany	3.9	7.3	5.3
Greece	2.6	n.a.	3.2
Ireland	3.8	n.a.	3.0
Italy	3.7	7.1	3.9
Netherlands	3.3	n.a.	4.0
Portugal	3.4	9.7	4.4
Slovakia	4.0	8.1	5.0
Slovenia	3.7	n.a.	4.3
Spain	2.8	7.3	3.7
United Kingdom	2.3	8.2	4.3
United States of America	n.a.	6.5	n.a.

Sources: Broda et al (2006), Imbs and Mejean (2011), Osbat and Corbo (2012).

Note: Calculated using exports estimation and weighting scheme from 1995 to 2009 and from early 2000s for new Member States.

While the estimation method employed here appears to be reducing the variation across countries compared with the estimates in Imbs and Méjean (2011), it does yield quite high variation across sectors. Similarly, at the disaggregated sectoral levels, elasticities vary a lot across countries.

The cross-country variation of sectoral estimates does not produce a consistent pattern for those countries that performed better in the past decade (see Chart 19). The only pattern that appears relatively clearly is that new Member States tend to exhibit higher and more dispersed estimates.

What matters for trade adjustment is also the relative weight of low- or high-elasticity sectors. Once the elasticity estimates are weighted together to produce aggregate estimates, the cross-country differences are shown in Table 4. These results suggest a large role for sectoral composition in determining the speed of adjustment of trade to changes in international prices. However, to test hypotheses linking the speed of adjustment and non-price

competitiveness factors, it appears that data with much finer granularity are required.

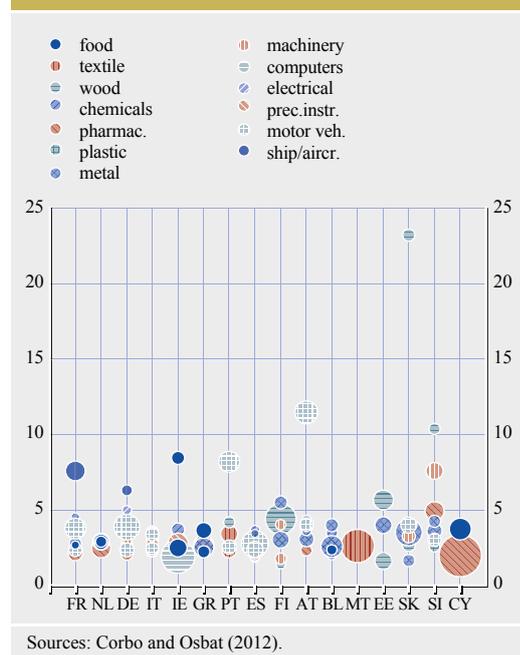
The disaggregation, though rich, is still too broad to offer insights on this link. For example, in the “motor” sector, this classification does not separate: (i) sectors that are more closely identifiable with “goods” of a given quality, e.g. “luxury cars” versus “all cars, motorcycles and parts thereof”; and (ii) intermediate from final goods, which may respond differently to price changes even in the absence of differences in “quality”: outsourcing the production of some parts of a final good to a foreign country via FDI will require large and sustained changes in prices to offset the initial fixed cost. The higher relevance of quality differences at a more disaggregated level, and the effect of integration in global value chains, both require trade data at a much finer disaggregation if the objective is to study non-price factors.

#### IMPORT CONTENT OF EXPORTS

Apart from improvements in competitiveness, the potential reduction in external imbalances also depends on the import intensity of exports. When the share of imports in the production of exports is large, it is more difficult to reduce the trade deficit by improving exports. The vertical fragmentation of production chains across borders, aimed at lowering costs and raising productivity, has been accompanied by a surge in international trade in intermediate goods and services. This process takes place either by corporations outsourcing stages of intermediate production and buying the necessary inputs from foreign suppliers or by establishing plants abroad to produce the intermediate goods and services.

The literature on international supply chains indicates that this global phenomenon has been increasing over time. Using data for US manufacturing, Feenstra and Hanson (1996) calculated that the share of intermediate imports in materials purchased increased from 5.3% in 1972 to 11.6% in 1990. A similar finding is documented in Chen et al. (2005) for a group of OECD countries. An ECB study (ECB, 2005) reports an increase in the import content of

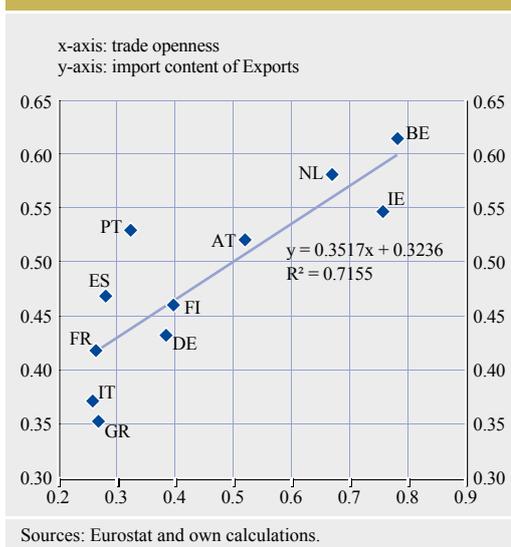
Chart 19 Weighted elasticity comparison across countries: Exports



exports for five euro area countries (Germany, Italy, the Netherlands, Austria and Finland) between 1995 and 2000. Over this five-year period, this study calculates that the import content of exports for the euro area as a whole (intra plus extra exports) increased from 37.6% to 44.2%. Similar findings for a set of euro area countries are reported in Breda et al. (2008), even when accounting for energy products to avoid the influence of price volatility.

The process of vertical specialisation partly explains the doubling of the average share of exports and imports in euro area GDP over the past four decades, from around 20% in 1970 to 40% in 2010.<sup>30</sup> It has also contributed to the high co-movements of exports and imports. Based on Eurostat's external trade statistics, the contemporaneous correlation coefficient for quarter-on-quarter growth rates of extra-euro area exports and imports of goods increased from around 0.2 in the seven-year

Chart 20 Trade openness and import content of exports



30 Data for 1970 from the Area-Wide Model database (see Fagan et al., 2001).

Table 5 Import content of exports

Based on 2005 Input-Output tables	Austria	Belgium	Germany	Finland	France	Greece	Ireland	Italy	Netherlands	Portugal	Spain
Total imports/GDP	0.50	0.76	0.36	0.38	0.27	0.31	0.70	0.26	0.61	0.37	0.31
Intra EU	0.37	0.57	0.21	0.23	0.16	0.17	0.40	0.15	0.34	0.29	0.19
Extra EU	0.13	0.20	0.15	0.15	0.11	0.14	0.30	0.11	0.27	0.09	0.12
Total exports/GDP	0.54	0.80	0.41	0.42	0.26	0.22	0.82	0.26	0.70	0.28	0.26
Intra EU	0.38	0.61	0.25	0.23	0.16	0.10	0.56	0.16	0.50	0.22	0.18
Extra EU	0.16	0.20	0.16	0.19	0.10	0.12	0.26	0.10	0.20	0.06	0.07
Import content of exports – total	0.52	0.61	0.43	0.46	0.42	0.35	0.55	0.37	0.56 <sup>1)</sup>	0.53	0.47
Intra imports in total exports	0.39	0.46	0.26		0.26	0.16	0.28			0.42	0.30
Extra imports in total exports	0.13	0.16	0.17		0.16	0.19	0.26			0.11	0.17
Total imports in intra exports	0.52	0.60	0.44	0.46	0.44	0.36			0.35 <sup>1)</sup>	0.53	0.47
Intra imports in intra exports	0.39	0.46	0.27		0.28	0.17				0.43	0.31
Extra imports in intra exports	0.13	0.14	0.18		0.16	0.20				0.10	0.16
Total imports in extra exports	0.52	0.65	0.42	0.46	0.42	0.38			0.59 <sup>1)</sup>	0.52	0.47
Intra imports in extra exports	0.39	0.44	0.25		0.24	0.19				0.39	0.28
Extra imports in extra exports	0.13	0.21	0.17		0.17	0.20				0.13	0.19

Sources: Eurostat and own calculations.

Notes: Current prices. National sources may differ depending on calculations, e.g. Portugal INE data suggest a number of 0.407.

1) Import content of total/intra/extra exports for the Netherlands is calculated using 2000 IO tables.

period preceding the start of EMU to 0.6 in the subsequent seven years.

Euro area countries are considerably heterogeneous in terms of openness and geographical composition of their trade. Table 5 summarises their international trade. First, the degree of openness is considered as it may play an important role when a country faces external imbalances. Furthermore, the table provides details on the import content of exports split into intra- and extra-area trade.

The degree of openness, defined as the ratio of nominal imports and exports to GDP, varies from less than 30% in France, Greece, Italy and Spain to above 75% in Ireland and Belgium. Production of export goods is quite import intensive in all countries. In general, more open countries have more import-intensive exports (see Chart 20). Import content of exports among the least open economies fluctuates around 40%. By contrast, for the more open economies, the import content of exports varies between 50% and 60%.

The table also reveals another policy-relevant issue. Almost all countries depend more on trade (both exports and imports) with European Union countries than on trade with other countries, which means that negative spillovers from deteriorating trade following competitiveness losses remain in European economies. Consistent with this finding, exports depend more on intra-EU imports (except for Greece and Ireland where intra- and extra-EU imports are used roughly equally in producing exports). Higher intra-EU concentration in imports is usually associated with higher intra-EU import content of exports. Furthermore, the distinction between intra-EU and extra-EU exports does not matter. These are roughly equal in terms of import content of total exports.

Smaller countries such as Austria, Belgium, Ireland and the Netherlands are among the most dependent on trade and yet have the highest import content of exports. This suggests that

they may be more vulnerable to external shocks and therefore lower domestic costs are an essential way to gain competitiveness.

### 3 CORRECTION OF EXTERNAL IMBALANCES: MODEL EVIDENCE

In this section, a suite of models featuring alternative modelling approaches are simulated to study the adjustment of external imbalances to some standardised economic shocks that stem from the analysis in the previous section. This exercise serves to demonstrate the importance of different modelling frameworks and the associated uncertainty in evaluating the sensitivity of external imbalances to policy shocks.

The simulations are calibrated for a generic large-deficit country of the euro area rather than for any individual country so that the findings are broadly relevant to a number of countries. The simulations are based on four models – EAGLE, the NMCM, NiGEM and a GVAR – therefore ranging from dynamic general equilibrium models to more empirically oriented ones. A short summary of the main characteristics of those models is provided in Annex 4.

The focus is on the implications of policy changes over a medium-run (five-year) horizon, which could take the form of a publicly announced formal policy commitment agreed between government and social partners to address the competitiveness problem. One example of this could be a reduction in wages relative to competitors as a result of negotiations with unions or a reduction in government wages. Another example could be a (temporary) increase in R&D spending, leading to technological advances. In both of these cases, the measures are transitory and are likely to unwind (in a booming economy, unions or employees will subsequently demand higher wages, and technological gains are typically only temporary as patents expire or other countries catch up). However, there could be a sequence of policy changes, or changes of a more structural nature (increased human capital). To the extent that agents are forward looking, the expected duration of the

changes matters, therefore a permanent shock to productivity is compared with a temporary change in productivity, whilst abstracting from any adjustment to a new steady state.

A detailed model comparison goes beyond the scope of this paper, which instead highlights possible ranges of the impulse responses and points to the substantial uncertainty of the respective impact estimates. In order to ensure comparability of the simulations across the models, the simulations where possible are designed in terms of observable variables. Following the descriptive analysis in the previous section, four main scenarios are considered:

- *Price competitiveness*: a shock such that the level of whole economy wages are, on average, 1% lower over five years.
- *Fiscal devaluation*: an ex ante revenue-neutral 1% of GDP cut in employers' social security contributions offset with a rise in value added taxes over five years.
- *Productivity gains*: a positive shock to productivity such that it is on average 1% higher over five years. In addition, (i) permanent productivity shocks and (ii) the effects of productivity shocks in the tradable vs. the non-tradable sector are simulated.
- *Non-price competitiveness*: a temporary shock to non-price competitiveness (e.g. higher-quality products) which is proxied by an increased preference by foreign firms and households for goods produced in the country under consideration.
- Additionally, the consequences of *coordination of reforms* are considered, namely: a temporary wage mark-up reduction such that nominal wages are, on average, 1% lower over five years with a gradual return to base in all countries with a current account deficit.

The results of the model simulations reveal that although most of the scenarios have a positive impact on GDP, the short-to-medium term impact on the current account position, both in terms of size and timing, are model dependent. The findings suggest that both price and non-price competitiveness are effective in reducing the external imbalance, though the impact of the latter tends to be more pronounced. Internal devaluation policies, such as the fiscal devaluation scenario, are also found to be an effective tool to reduce external imbalances. No clear conclusion can be drawn from the productivity scenario since the results are model dependent and, in general, the impact on the current account depends on whether productivity gains are temporary or permanent in nature. However, productivity gains in the tradable sector are found to be more effective in closing the current account deficit than those concentrated in the non-traded sector. Finally, the model simulations suggest that spillovers from adjusting countries to the rest of the euro area countries are limited.

Lastly, the size and costs of the reduction in external imbalances depend on a number of parameters governing the transmission mechanism, the most important of which are the degree of nominal rigidities and import and export elasticity of substitution. A more detailed analysis of the sensitivity of the current account adjustment with respect to specific model parameters and the shock scenario design is presented below.

### 3.1 WAGE COMPETITIVENESS SCENARIO

The wage competitiveness scenario is simulated via a temporary reduction in the wage mark-up. This shock is akin to a positive supply-side shock that leads to higher competition in the labour market, thereby lowering the cost of production for firms.<sup>31</sup> In the simulation, wage mark-ups are reduced such that nominal wages are on average 1% lower over five years.

In structural models, the transmission mechanism operates via the following channels. Lower wage

mark-ups are expected to bring down firms' marginal costs and hence prices. The speed at which lower marginal costs are passed through to lower domestic and export prices depends on the prevailing level of competition in the goods market and the degree of nominal price and wage rigidities. Lower producer prices enhance the competitiveness of the domestically produced goods, thereby improving the external balance (the *competitiveness channel*). The latter response depends on the price sensitivity of export demand and elasticity of substitution between domestic tradable goods and imports. Lower export prices also imply a decline in the terms of trade that worsens the nominal trade balance (the *terms-of-trade channel*). On the other hand, the implied surge in market efficiency raises expectations of higher income in the future, thus boosting domestic demand and, hence, real imports today (the *income channel*). The pass-through of future income to contemporaneous demand depends on a number of factors, including the share of rule-of-thumb consumers or the share of consumers that are credit or liquidity constrained. Furthermore, in response to higher output growth and lower inflation, the monetary authority is expected to accommodate the supply-side shock by lowering the nominal interest rate. Assuming the uncovered interest rate condition holds, the latter would bring nominal depreciation of the domestic currency in the short run and the expected currency appreciation over the medium run, thereby limiting the price competitiveness gains released by the shock (the *exchange rate channel*).

### WAGE COMPETITIVENESS: BENCHMARK SIMULATION

The impact of a negative wage mark-up shock on selected macro variables in the four models is displayed in Chart 21. In all models, the shock has a positive impact on GDP (except for the GVAR in the short run<sup>32</sup>) and a negative impact

31 As an alternative price competitiveness scenario, one could consider rising competition on the goods market captured by a reduction in the price mark-up (see Annex 5).

32 The shocks in the GVAR have been identified through a Cholesky decomposition. However, given the relatively small size of the VAR, the shock to wages could possibly reflect a labour demand shock.

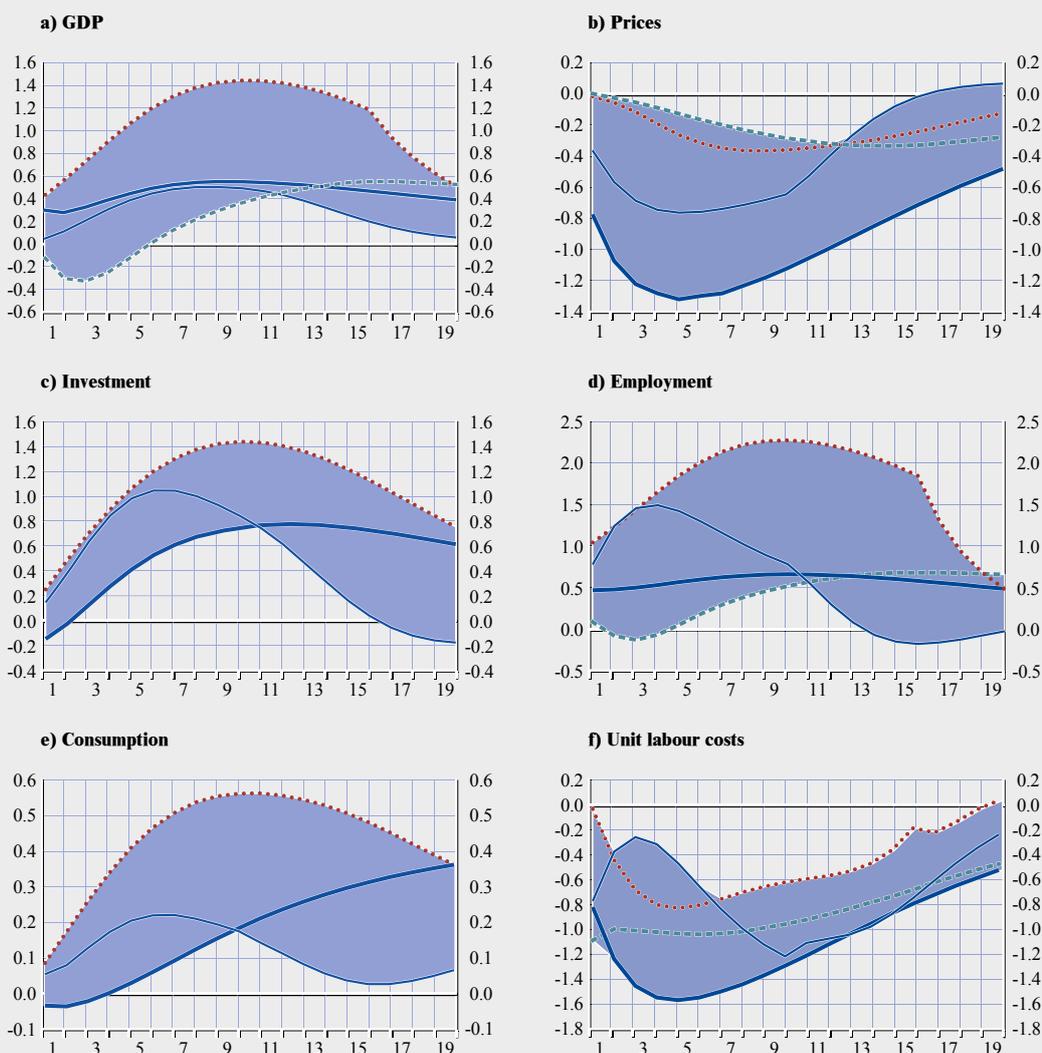
on prices. While the shock facilitates an increase in price competitiveness through lower prices, the adjustments in the current account balance display substantial heterogeneity across the models. Both NiGEM and EAGLE feature a small deterioration of the current account in the

short run; by contrast, the external balance improves in the GVAR and NMCM. These differences can be partly attributed to relatively low responsiveness of prices in NiGEM and EAGLE, which may be associated with a higher degree of price rigidities in these models. As a

Chart 21 Responses to a temporary wage mark-up reduction across the models

(percentages)

— NMCM  
- - - EAGLE  
- - - GVAR  
— NiGEM



Source: Own calculations.

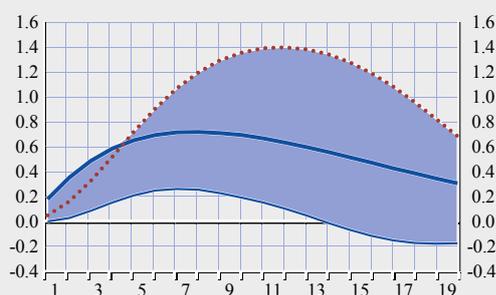
Notes: x-axis: quarters; y-axis: percentage of deviations, except for the current account which is deviations in percentage of GDP (for EAGLE, the trade balance as a percentage of GDP). Terms of trade are defined as import price over export price.

Chart 21 Responses to a temporary wage mark-up reduction across the models (cont'd)

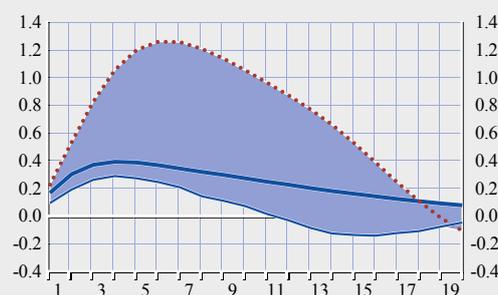
(percentages)

— NMCM  
 ..... EAGLE  
 - - - - GVAR  
 — NIGEM

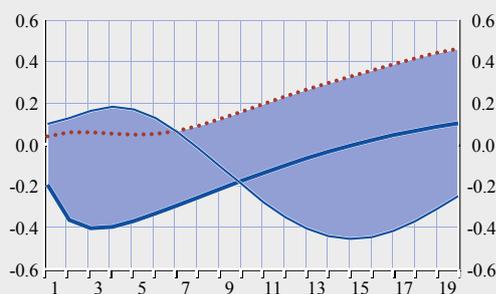
g) Exports



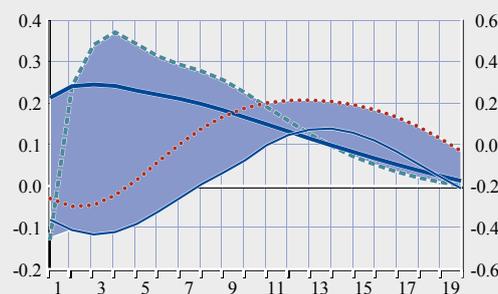
h) Terms of trade



i) Imports



j) Current account



Source: Own calculations.

Notes: x-axis: quarters; y-axis: percentage of deviations, except for the current account which is deviations in percentage of GDP (for GVAR and EAGLE, the trade balance as a percentage of GDP). Terms of trade are defined as import price over export price.

result of lower real wages, employment increases immediately, boosting domestic demand strongly in the short run. By contrast, in the NMCM, imports initially decline, reflecting the lower boost to employment from the reduction in wages possibly due to greater sensitivity of domestic demand to contemporaneous income.

Over the medium term, however, all models predict a slight improvement in the current account balance of around 0.1% to 0.2% of GDP. The range implied by the models suggests that an improvement in the current account balance of 1% of GDP requires a temporary reduction in wages (relative to competitors) of around 5% to 10%.

#### WAGE COMPETITIVENESS: SENSITIVITY ANALYSIS

The results so far have been presented for a representative large-deficit economy and the differences across the model results are due to a range of different factors, both theoretical and related to calibration/estimation. As a way to explore in more detail some of the key channels governing the transmission mechanism, the EAGLE model is used to assess in more detail the implications of some specific alternative parameterisations. The goal is to analyse the robustness of the improvement in the trade balance-to-GDP ratio that is obtained in the benchmark scenario. This is done by changing four key parameters in EAGLE: the degree of nominal

price stickiness, export and import elasticities of substitution and the Frisch elasticity (the labour supply elasticity with respect to wages).

Table 6 reports the values of the main variables in correspondence to the alternative values of these key parameters. For each new parameterisation, a shock of exactly the same size as in the benchmark simulations has been applied (decreasing the wage mark-up from 1.30 to 1.20 for five years). This implies that the wage mark-up shock induces an impact on wages which might be different than the

benchmark case (a reduction of wages of 1% a year on average).

The sensitivity analysis shows that the trade balance-to-GDP ratio always improves after three years, but the magnitude varies across the different parameterisations. In the benchmark scenario, a 1% reduction in the wage mark-up shock in EAGLE leads to an improvement in the trade balance-to-GDP ratio of around 0.2% after three years. Depending on the different parameterisations, the sensitivity analysis shows that the improvement in the trade balance after three years ranges from almost nil to 0.3% of GDP.

Table 6 Temporary wage shock sensitivity analysis using EAGLE

	Real GDP	Consumption	Investment	Exports	Imports	Trade balance over GDP	Nominal Wages	HICP
<b>YEAR 1</b>								
Benchmark	0.7	0.2	0.6	0.3	0.1	-0.04	-1.2	-0.1
Calvo=0.5	0.8	0.3	0.7	0.3	0.1	-0.04	-1.1	-0.2
Trade Elasticity of Substitution=1.5	0.6	0.2	0.5	0.3	0.0	-0.06	-1.4	-0.1
Trade Elasticity of Substitution=6	0.7	0.2	0.6	0.2	0.0	-0.02	-1.1	-0.1
Import substitution=0.5	0.6	0.2	0.5	0.3	0.2	-0.09	-1.3	-0.1
Frisch Elasticity = 0.75	0.9	0.3	0.8	0.3	0.1	-0.05	-1.6	-0.1
Frisch Elasticity = 0.25	0.4	0.1	0.3	0.2	0.0	-0.02	-0.7	-0.1
<b>YEAR 2</b>								
Benchmark	1.2	0.5	1.2	1.0	0.1	0.08	-1.6	-0.3
Calvo=0.5	1.4	0.6	1.3	1.0	0.1	0.08	-1.5	-0.5
Trade Elasticity of Substitution=1.5	1.2	0.5	1.1	1.1	0.1	-0.03	-2.0	-0.5
Trade Elasticity of Substitution=6	1.3	0.5	1.2	0.9	-0.1	0.14	-1.5	-0.3
Import substitution=0.5	1.1	0.5	1.2	1.2	0.6	-0.05	-1.7	-0.3
Frisch Elasticity = 0.75	1.6	0.6	1.6	1.3	0.1	0.09	-2.1	-0.4
Frisch Elasticity = 0.25	0.7	0.2	0.6	0.6	0.0	0.06	-1.0	-0.2
<b>YEAR 3</b>								
Benchmark	1.4	0.6	1.4	1.4	0.2	0.19	-1.4	-0.4
Calvo=0.5	1.4	0.7	1.5	1.2	0.3	0.14	-1.3	-0.5
Trade Elasticity of Substitution=1.5	1.4	0.6	1.5	1.5	0.3	0.01	-1.9	-0.6
Trade Elasticity of Substitution=6	1.4	0.5	1.2	1.3	0.0	0.29	-1.3	-0.3
Import substitution=0.5	1.5	0.6	1.7	1.8	0.8	0.07	-1.6	-0.4
Frisch Elasticity = 0.75	1.9	0.8	1.9	1.8	0.3	0.23	-1.9	-0.5
Frisch Elasticity = 0.25	0.8	0.3	0.6	0.8	0.0	0.13	-0.8	-0.2

Source: Own calculations.

Note: Benchmark parameters: Calvo = 0.75; trade elasticity of substitution = 3.3; import substitution = 3.3; Frisch = 0.5.

In order to see the importance of some of the key underlying parameters, each channel is now considered in more detail:

- *The degree of nominal price stickiness (Calvo parameter).* The speed at which lower marginal costs are passed through to lower domestic and export prices depends on the degree of price rigidity in the economy, more specifically on how often prices are adjusted. In the benchmark simulation, EAGLE has a Calvo parameter of 0.9 on domestic prices (prices are reset every ten quarters) and 0.75 on traded prices (prices are reset every four quarters). In Table 6, a sensitivity simulation with a lower Calvo parameter of 0.5 in both traded and non-traded sectors is shown, which corresponds to an economy where prices are reset on average every two quarters. In EAGLE, prices that adjust more quickly do not greatly affect the main picture. The only noticeable effect is that the reduction in consumer prices is more frontloaded (in particular, prices decrease more in the second year). The robustness of the results to changes in this parameter is not surprising, as exports increase mainly in the medium run when prices have already adjusted even when the nominal price rigidities are set to relatively high values.
- *Competitiveness effect (export substitution elasticity).* The extent to which domestic price competitiveness leads to increased demand by trading partners depends on the elasticity of substitution between domestic tradables and imports by the rest of the world from the home country. As mentioned in Section 2.5.2, there is large uncertainty surrounding this estimate, with some heterogeneity across countries. In the benchmark calibration of EAGLE, the elasticity was set at 3.3. In a country where imports are 40% of consumption expenditure, this would yield a response of imports to price changes of -1.4. Two alternative elasticities of substitution are considered – either 1.5 or 6 which again, assuming imports are 40% of consumption, corresponds to a price elasticity of -0.3 and -3 respectively, i.e. a low elasticity implies that the goods are highly complementary, whereas a high elasticity implies that goods are more substitutable. Improvement in the trade balance is large when the elasticity of substitution between tradable goods is relatively high, as worldwide demand easily shifts towards relatively cheap home-produced goods for a given reduction in domestic relative prices. Conversely, a low elasticity of substitution implies no improvement in the trade balance even after three years. This means countries where goods are complementary or not price sensitive should focus on aspects other than price competitiveness to reduce their external imbalances, e.g. the composition of exports.
- *Asymmetric import demand effect (import substitution elasticity).* Lower domestic prices imply a shift in demand towards cheaper domestic traded products and away from imported goods. The key elasticity governing this process is that of substitution between domestic tradable goods and imports for the home economy. One possibility is that imports are highly complementary (e.g. high dependency on energy imports or a high import content of exports). In the baseline, trade elasticities are equal to 3.3 for all countries. In the sensitivity analysis, the elasticity for the home economy is set to 0.5, but the corresponding parameter for the foreign economies is left unchanged at 3.3. In this case, imports increase substantially more than in the benchmark scenario. This has a dampening effect on the trade balance (which initially worsens), but by the third year the boost to exports more than compensates leading to an improving trade balance, albeit to a lesser extent than in the benchmark case.

- *Labour supply (Frisch elasticity)*. Lower wages imply that employment is cheaper and so firms hire more, leading to increased income in the economy as a whole. In the baseline calibration, the Frisch elasticity is set at 0.5. Two alternative parameter values of 0.25 and 0.75 were simulated, with the higher Frisch elasticity implying a more responsive supply of labour to changes in wages. In this case, the improvement in the trade balance is larger than in the benchmark scenario as the more elastic labour supply favours a relatively large increase in the supply of home goods combined with a relatively large decrease in wages. The excess in supply is absorbed not only by domestic aggregate demand (which increases relatively more) but also by higher exports, driven by the decrease in the relative prices (the decrease in consumer prices is now relatively large). The opposite effects are observed with a lower Frisch elasticity, with the improvement in the trade balance being lower this time compared with the benchmark case.

The main conclusion that can be derived from this analysis is that the results are particularly sensitive to the trade elasticity of substitution. As already mentioned in Section 2, this is one parameter where there is a lot of uncertainty in the literature and which could be one source of heterogeneity across euro area countries.

### 3.2 FISCAL DEVALUATION SCENARIO

An alternative way countries in a monetary union can regain competitiveness is through a process of fiscal devaluation, consisting of a revenue-neutral shift from taxes on labour to taxes on consumption. Such a revenue-neutral tax reform reduces the level of distortion in the economy, thereby exerting a positive impact on GDP and employment. The reduction in firms' social security contributions lowers unit labour costs and output prices, thus increasing the competitiveness of firms producing tradables. Domestically, higher consumption taxes push consumer prices upwards, including those on

imported goods. As a result, higher exports and depressed imports are expected to contribute to an improvement of the external balances.

Many recent papers using open economy models with a detailed fiscal sector investigate the channels through which fiscal devaluation can improve competitiveness. Most of these papers use New Keynesian models with endogenous terms of trade or wage rigidities, which affect the transmission of fiscal policy and its effect on trade.

Lipinska and Von Thadden (2009) study the fiscal devaluation hypothesis in a two-country DSGE model of a monetary union with endogenously derived terms of trade and price rigidities but competitive labour markets with flexible wages. The authors consider a broad range of factors influencing the impact of a country in a monetary union unilaterally shifting its tax structure from direct towards indirect taxes, namely the size and the degree of openness of the two countries, the speed at which the increase in indirect taxes leads to a compensating decline in direct taxes, the choice of the inflation index stabilised by monetary policy, and the anticipation effects of pre-announced fiscal reforms, both in the long run and the short run. The main finding of this paper is that the effect of fiscal devaluation on GDP is positive. But all the above features matter for the strength and shape of the dynamic adjustment pattern.

Franco (2011) studies the short-run effects of a swap between a consumption tax and a labour tax within a monetary union in the presence of nominal wage rigidities and performs an empirical analysis using Portuguese data. The flexible nominal wage assumption proves critical as it neutralises the demand-side effects of the fiscal devaluation, leading to purely neoclassical results. On the other hand, when workers face nominal wage rigidities (Calvo-type constraints) a proportional tax swap affects competitiveness.

Farhi, Gopinath and Itskhoki (2011) provide an analysis of fiscal devaluations in a New

Keynesian open economy DSGE model, with varying degrees of price rigidity, alternative asset market assumptions and both expected and unexpected devaluations. Despite the differences in allocations that accompany these various specifications, there exists a small set of fiscal instruments that can robustly replicate the effects of nominal exchange rate devaluations across all specifications.

Fiscal devaluation has also been extensively discussed in policy circles. An IMF (2011) paper explores both the theoretical and the empirical findings on fiscal devaluation. As discussed, the effectiveness of this strategy requires rigidity in both the exchange rate and the nominal wage. Furthermore, although the effects of a fiscal devaluation may be largely temporary, this does not mean that it is irrelevant. This is particularly true when downward rigidities in nominal wages mean that the economy is initially in a disequilibrium position, with an overvalued real exchange rate and involuntary unemployment. In these conditions, a fiscal devaluation can speed up adjustment in the labour market, which may otherwise take a long time. Empirical evidence in de Mooij and Keen (2012) using an unbalanced panel of annual observations for 30 OECD countries between 1965 and 2009 suggests that a revenue shift of one point of GDP from social security contributions to VAT leads to an increase in net exports of 0.4 point of GDP.

The potential effect of fiscal devaluation has also been analysed based on simulations using the three-region version of the European Commission's QUEST model (detailed in Ratto et al., 2009), which consists of a small euro area country, the rest of the euro area and the rest of the world. The results show that the effects of exchange rate devaluation can be mimicked by internal devaluations, with similar expenditure switching from foreign to domestic output. Internal devaluation can increase trade competitiveness by reducing domestic production costs and hence improve external balances over the short term. However, the long-lasting competitiveness gain from a

permanent internal devaluation measure does not result in a permanent improvement in the trade balance, which increases in the short run by 0.1%.

More recently, the Banco de Portugal used PESSOA, a general equilibrium model detailed in Almeida et al. (2010), to simulate a shift from social security contributions to VAT equivalent to 1% of GDP. The results in Banco de Portugal (2011) show that in the first year, this boosts total exports by 0.5% and improves the trade balance by 0.6% of GDP. After three years, the effect on the trade balance disappears.

The fiscal devaluation scenario, considered in this section, consists of a 1% of GDP cut in employers' social security contributions and a concurrent 1% of GDP rise in value added taxes for a period of five years so that the reform is ex ante revenue neutral. The results are shown in Chart 22. Overall, the effects of the fiscal devaluation scenario are similar to those of exchange rate depreciation and yield an improvement in the current account balance. This result is robust across the three models considered in this simulation, with the current account improving by around 0.1% to 0.4% of GDP after three years.<sup>33</sup> In the most benign case (EAGLE), this implies that a 1% improvement in the current account balance would require a 2.2% of GDP reduction in employers' social security contributions compensated for by an ex ante increase in VAT.

In all the considered models, supported by enhanced international price competitiveness, export volumes increase. At the same time, imports tend to decline, though the magnitude varies across the models, among other factors, reflecting cross-model differences in import intensity of domestic demand. Other visible differences in terms of timing and size of the model responses can be partly related to the

<sup>33</sup> The shock simulation results for the GVAR are not available, as social security contributions and VAT are not included in the model.

firms' ability to pass through the indirect tax increase to consumer prices. In this regard, the relatively weak performance of exports in NiGEM could be attributed to the domestic firms' failure to exploit the external price competitiveness gains in the face of higher

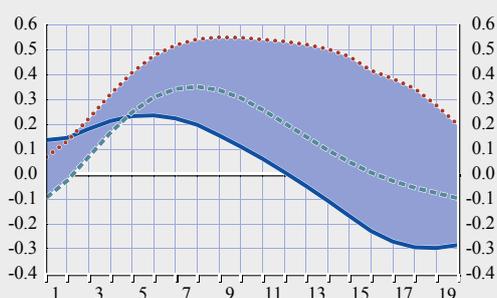
domestic inflation supported by the booming economy. Finally, it should be noted that while the reforms were revenue neutral ex ante, they are not necessarily revenue neutral ex post, although the fiscal policy effects are generally small.

Chart 22 Responses to a temporary revenue-neutral fiscal devaluation across the models

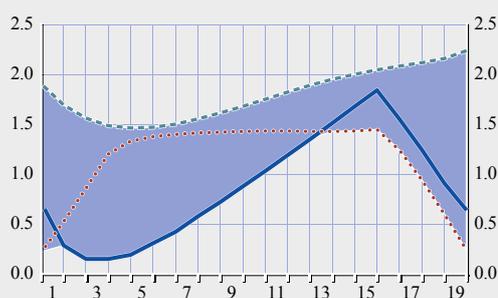
(percentages)

— NCMC  
- - - EAGLE  
- - - NiGEM

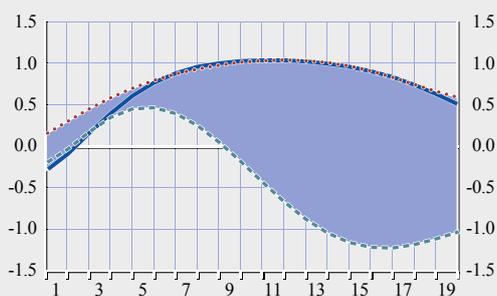
a) GDP



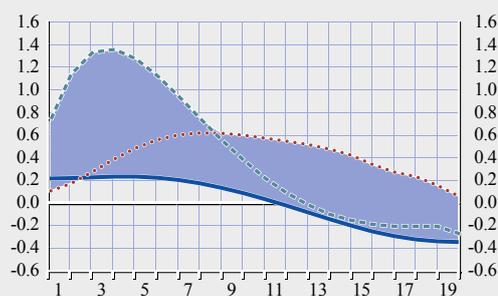
b) Prices



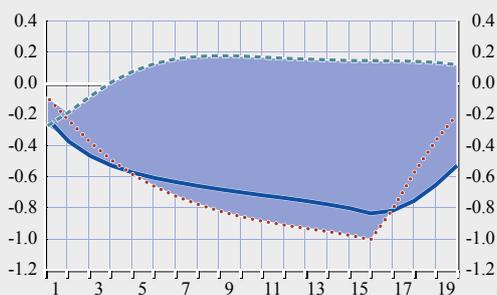
c) Investment



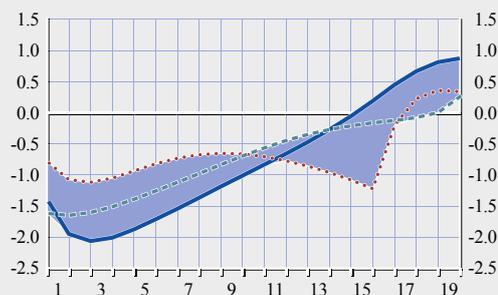
d) Employment



e) Consumption



f) Unit Labour Costs



Source: Eurostat.

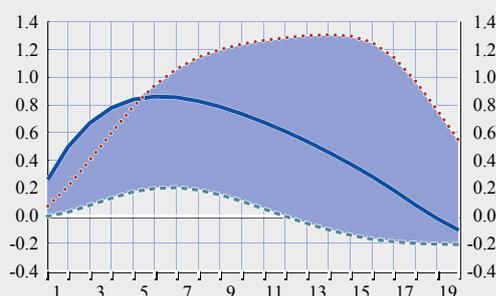
Notes: x-axis: quarters; y-axis: percentage of deviations, except for the current account which is deviations in percentage of GDP (for EAGLE, the trade balance as a percentage of GDP). Terms of trade are defined as import price over export price.

**Chart 22 Responses to a temporary revenue-neutral fiscal devaluation across the models (cont'd)**

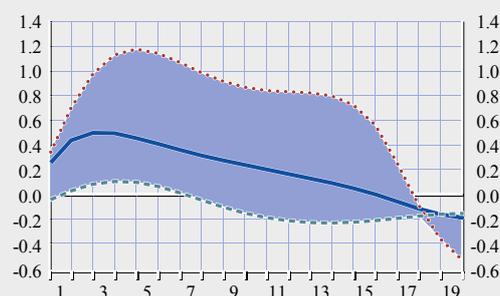
(percentages)

— NMCM  
 ..... EAGLE  
 - - - NIGEM

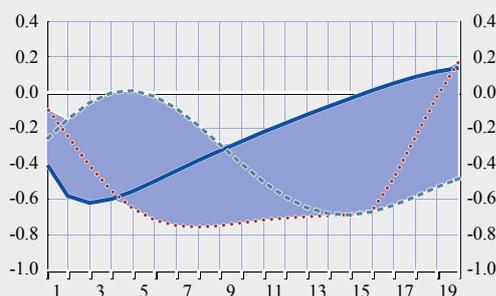
**g) Exports**



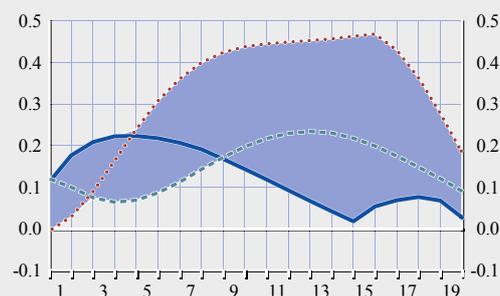
**h) Terms of Trade**



**i) Imports**



**j) Current Account**



Source: Eurostat.

Notes: x-axis: quarters; y-axis: percentage of deviations, except for the current account which is deviations in percentage of GDP (for EAGLE, the trade balance as a percentage of GDP). Terms of trade are defined as import price over export price.

### 3.3 PRODUCTIVITY SCENARIO

A productivity shock scales down the marginal costs of production by increasing the effectiveness of workers and capital, thereby allowing firms to produce more output with a given level of capital and labour. As a result, monopolistically competitive firms are able to reduce their prices while leaving their price mark-up unchanged. Higher price competitiveness, which traditionally is one of the main determinants of trade performance, contributes to higher exports and lower imports. At the same time, rising current and expected future income boost domestic demand, hence imports. The literature suggests that the impact of productivity shocks on the current account balance is ambiguous. Its timing, size and sign

may depend on the nature of the shocks affecting the economy. In particular, it depends on whether the shocks are temporary or permanent. Also, it may depend on whether the productivity shocks originate from the tradable or non-tradable sector. These aspects are investigated in greater detail below.

As with wages, a temporary productivity simulation consisting of a five-year economy-wide productivity shock with a gradual return to base is considered, such that productivity is on average 1% higher over five years. The results are illustrated in Chart 23. As expected, the shock has a positive impact on domestic demand and exports and a negative impact on prices and unit labour costs. However, the model responses of the current account balance display substantial

heterogeneity. In the NMCM, the initial impact on the current account is positive and considerable, whereas in other models the impact is rather muted. This difference can be partially attributed to the relatively flexible pricing in the NMCM, which considerably strengthens the competitiveness channel, in particular the speed of adjustment to the shock.<sup>34</sup> In EAGLE, the

current account balance starts to improve after around one year, while the other two models

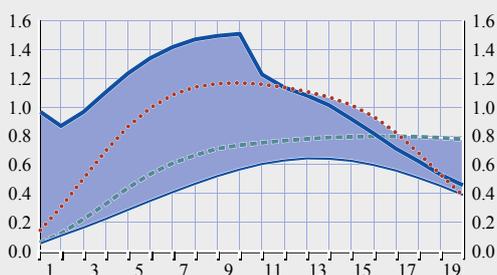
<sup>34</sup> In this report, the NMCM is simulated under rational expectations, so agents know the duration of the productivity shock and thus react immediately. When the NMCM is simulated under learning, where agents do not know the duration of the shock, then prices adjust much slower, leading to a muted initial response of the current account.

Chart 23 Responses to a temporary productivity increase across the models

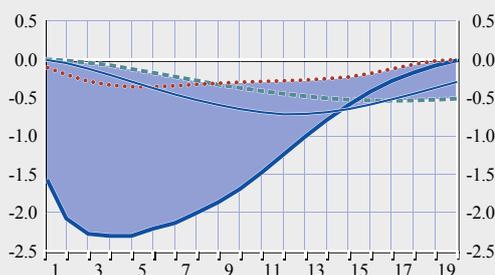
(percentages)

— NMCM  
- - - EAGLE  
- - - GVAR  
— NIGEM

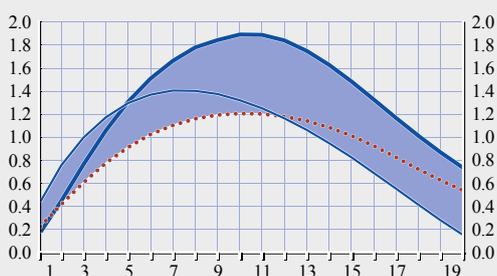
a) GDP



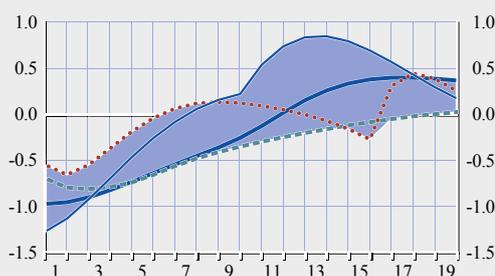
b) Prices



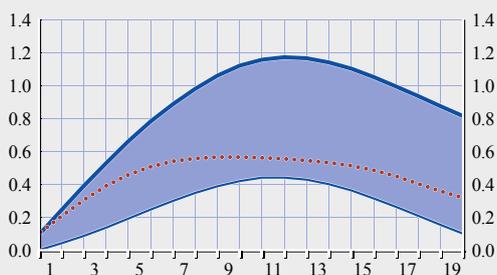
c) Investment



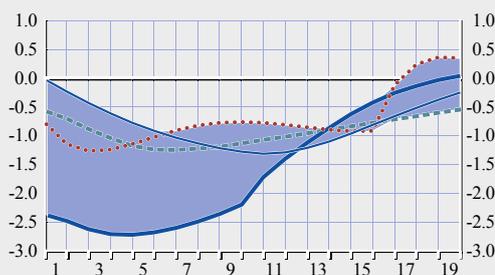
d) Employment



e) Consumption



f) Unit labour cost



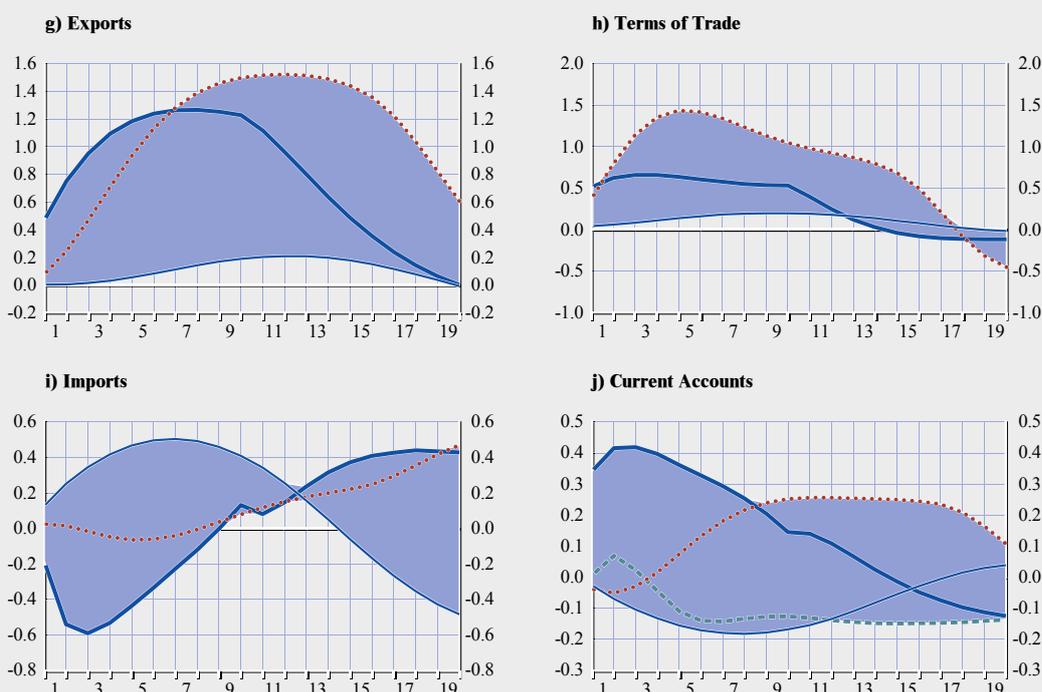
Source: Own calculations.

Notes: x-axis: quarters; y-axis: percentage deviations, except for the current account which is deviations in percentage of GDP (for EAGLE, trade balance as a percentage of GDP). Terms of trade are defined as import price over export price.

Chart 23 Responses to a temporary productivity increase across the models (Cont'd)

(percentages)

— NMCM  
 ..... EAGLE  
 - - - GVAR  
 — NIGEM



Source: Own calculations.

Notes: x-axis: quarters; y-axis: percentage deviations, except for the current account which is deviations in percentage of GDP (for GVAR and EAGLE, trade balance as a percentage of GDP). Terms of trade are defined as import price over export price.

suggest a deteriorating external balance over the simulation horizon.

Given that the impact of a productivity shock hinges on whether the shocks are temporary or permanent, the impact of a permanent economy-wide technology shock on the current account balance using EAGLE is simulated.

#### PERMANENT PRODUCTIVITY SCENARIO

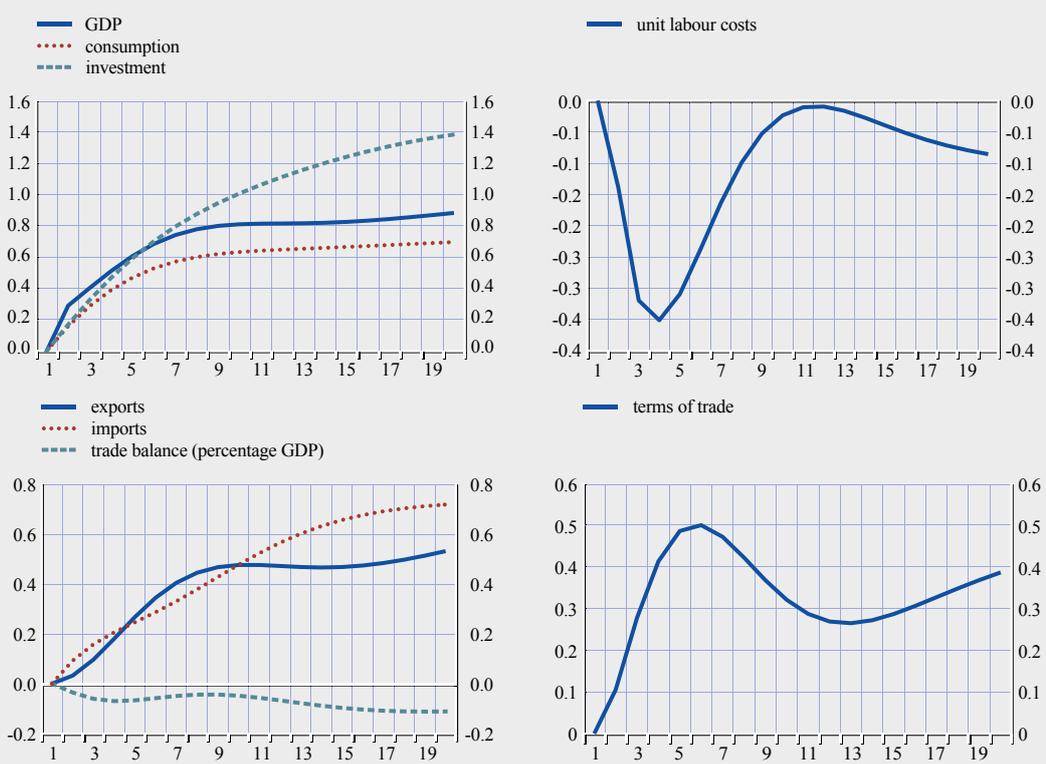
Simulating permanent productivity shocks allows us to better understand the role of forward-looking expectations in explaining the current account reaction to the shock. Permanent improvements in productivity lead to an increase in domestic demand, which depends not only on current income but also on the expectation of higher future income. This anticipation can

trigger sizeable foreign capital inflows and high consumption and investment raising imports and thereby a worsening of the current account. However, in countries where a significant number of agents face credit constraints, the demand effects will be more muted.

The permanent productivity shock has been designed to get broadly the same impact on GDP in the medium run as in the case of the temporary shock. The results are shown in Chart 24. A permanent productivity shock leads to a slight deterioration of the trade balance-to-GDP ratio of around 0.1% in the medium term.<sup>35</sup> Export volumes increase as a decline in costs

<sup>35</sup> EAGLE does not incorporate a current account, so the focus is on the trade balance.

Chart 24 Permanent productivity shock: EAGLE



Source: Own calculations.

brings down prices and in turn leads to an improvement in international price competitiveness. However, imports increase much more than in the case of transitory shocks due to the larger increase in aggregate demand associated with the gains in permanent income.<sup>36</sup> The corollary is that an unwinding of unfulfilled expectations of permanent productivity gains could possibly lead to a large drop in aggregate demand and imports and potentially lead to a quick improvement in the trade balance (Brzoza-Brzezina et al., 2010).

#### TRADED VERSUS NON-TRADED PRODUCTIVITY SCENARIO

Using EAGLE, the impact of sector-specific (tradable vs. non-tradable) temporary productivity shocks on the current account balance are now considered. The results are illustrated in Chart 25. This simulation is designed such that each sector-specific positive

shock to productivity is broadly similar to the whole economy shock (i.e. given the shares of the sectors, it roughly corresponds to a 0.4% shock compared with a 0.2% productivity shock to the whole economy).

Following a sluggish reaction in the first year, transitory productivity shocks in both the tradable and non-tradable sectors lead to an improvement in the trade balance. The improvement is driven by higher exports, which are only partially counterbalanced by higher imports. The former are driven by the increase in price competitiveness, favoured by a decline in unit labour costs, while the latter stem from lower import penetration and higher domestic

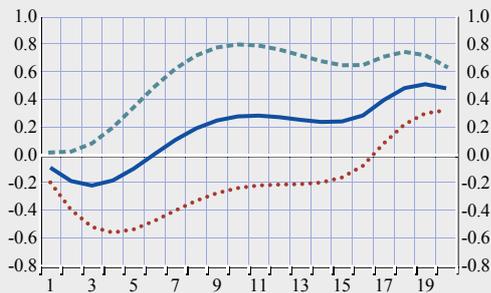
36 EAGLE does not have an endogenous mechanism to adjust the long-run net foreign assets, so only the medium-run effects are considered. Indeed, there are many challenges in simulating structural changes that imply a permanent change in the steady state.

Chart 25 Traded versus non-traded productivity shock EAGLE

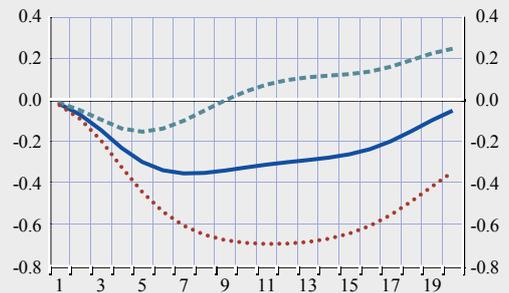
(percentages)

— benchmark  
 ..... non-traded  
 - - - - - traded

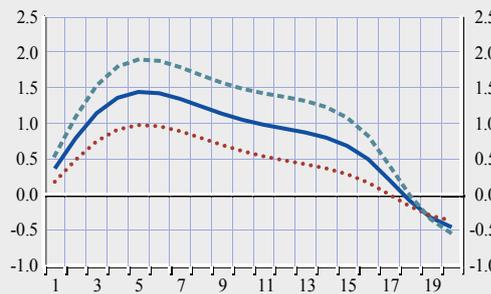
a) Nominal Wages



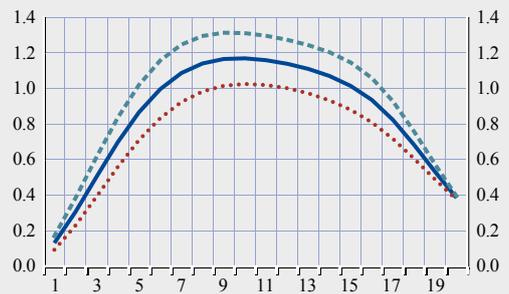
b) Prices



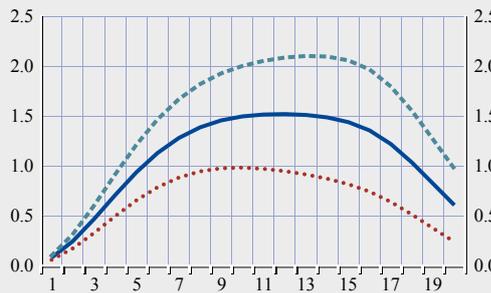
c) Terms of Trade



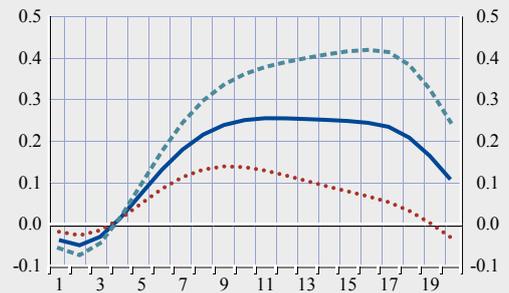
d) GDP



e) Exports



f) Trade Balance (percentage GDP)



Source: Own calculations.

Notes: x-axis: quarters; y-axis: % deviations, except for trade balance as a percentage of GDP. Terms of trade are defined as import price over export price.

aggregate demand. However, the improvement in the trade balance is larger following an increase in tradable sector productivity than in the case of a corresponding increase in the non-tradable sector. The productivity shock in the tradable sector leads to a higher increase in export volumes and reduced imports, driven by

enhanced price competitiveness. The gains in the international price competitiveness following a positive supply shock in the non-tradable sector are less pronounced. In this case, while the real exchange rate depreciates because of the lower prices of non-tradable goods, the terms of trade deteriorate to a lower extent, given the

complementarity between non-tradable and tradable goods and the fact that aggregate demand is biased towards domestic tradables.<sup>37</sup> As such, domestic demand for domestic tradable goods increases, partially limiting the gain in price competitiveness and, consequently, the increase in exports.

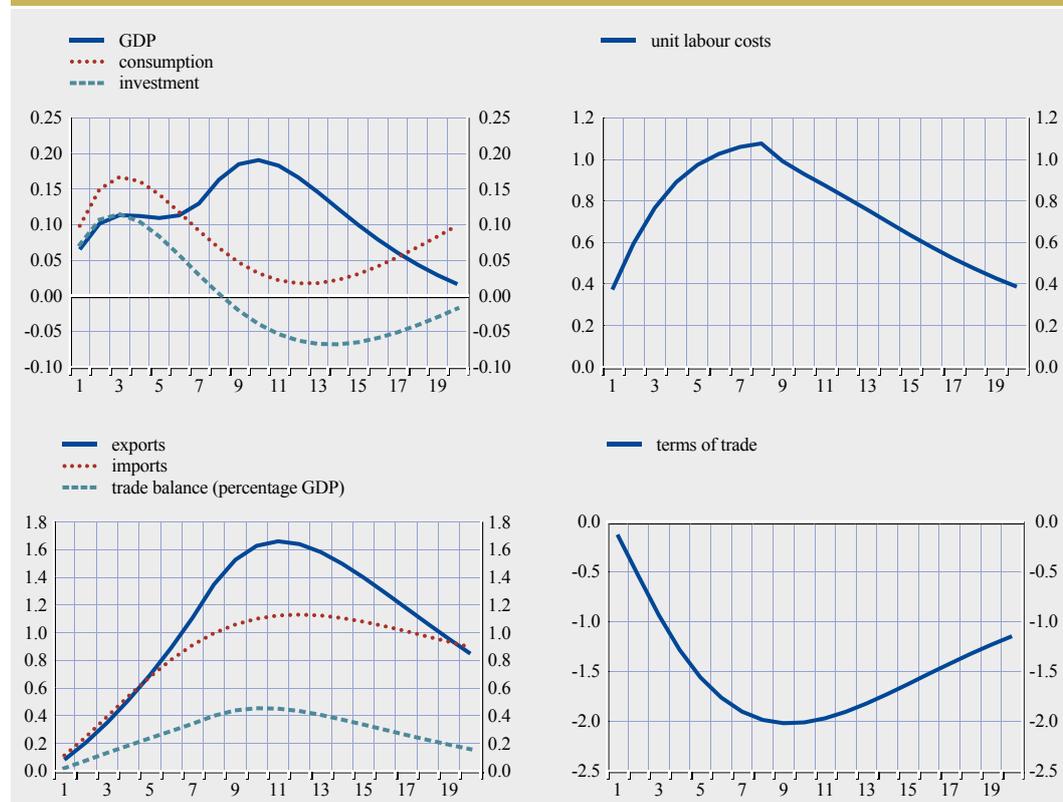
### 3.4 NON-PRICE COMPETITIVENESS SCENARIO

Despite the importance assigned to price competitiveness, Section 2.4 showed that there are other factors influencing export performance and that more insights are needed to understand the role of non-price competitiveness. There is no unique definition of what constitutes “non-price competitiveness”, but as mentioned in Section 2.4 it can be defined as the sum of all factors other than foreign income and relative

prices that have an impact on a country’s export performance and typically includes a broad range of factors, such as product quality, technological advances, industry specialisation, export orientation of medium-sized enterprises, etc. It is not straightforward to simulate a “non-price competitiveness” shock with the available suite of models since the main adjustment channel in these models typically works through changes in relative prices. Therefore, the scenario is simulated in EAGLE by assuming a transitory shock in the preferences of the rest of the world towards the tradables produced by the large-deficit country. The shock has been designed such that all other countries increase their demand for the tradables produced by the

37 Home bias is 70% in the case of consumption goods and 50% in the case of investment goods.

Chart 26 Non-price competitiveness shock: EAGLE



Source: Own calculations.  
Notes: x-axis: quarters; y-axis: percentage deviations, except for trade balance as a percentage of GDP. Terms of trade are defined as import price over export price.

domestic economy by more or less the same amount. The size of the shock has been calibrated so that the increase in export volumes in the non-price competitiveness scenario is broadly similar to that in the price competitiveness scenario. The results are shown in Chart 26.

The impulse responses show that while the impact on export volumes has been calibrated to be broadly similar between the price and non-price competitiveness scenarios, there are noticeable differences in the transmission mechanism to real economic activity and the impact on the trade balance. First, the impact on GDP and the domestic components of aggregate demand is substantially lower. The main reason is that, in this simulation, the impact on the labour market is fundamentally different in comparison to the price competitiveness scenario simulation where a favorable supply-side shock brought a reduction in wages and a rise in employment. In the current scenario, a positive demand shock leads to upward pressure on wages, hence, rising costs of production and higher domestic prices. As the rise in domestic disposable income is constrained by limited employment gains and higher inflation, the response of domestic demand is weaker.<sup>38</sup> Second, in the current scenario, relatively weak domestic demand implies lower real import demand. Combined with an increase in the terms of trade, the nominal trade balance-to-GDP ratio improves by around 0.45% after three years. These estimates are almost double those predicted by the same model (EAGLE) in the price competitiveness scenario and confirm that improvements in non-price competitiveness leading to higher foreign demand should be an important complement to price competitiveness measures in correcting the external imbalances.

A word of caution is warranted in interpreting this result. Since the term “non-price competitiveness” is a complex concept that cannot be easily measured (it encompasses all the different factors other than prices and costs that have an impact on trade performance), it is generally very difficult to quantify the impact of

these different factors in correcting the external imbalances. The design of the scenario assumes that other countries are more willing to buy domestically produced goods for some reason other than prices, but it is unable to identify what these factors are.

### 3.5 THE ROLE OF COORDINATION

So far, the implications of the adjustment mechanism in a single euro area country have been explored. In that case, spillover effects to other countries were small, in part because of the limited reaction of monetary policy, which does not respond to a single country but rather to the whole euro area. That raises the question of what happens if a number of countries adjust simultaneously, i.e. there is some synchronisation of reforms among a number of euro area countries.

This scenario is illustrated via a reduction in the wage mark-up in all euro area countries which had current account deficits in 2010, namely Greece, Ireland, Italy, Spain, Portugal, France, Cyprus and Malta. This group constituted roughly half of the euro area. Using NiGEM, the GVAR and the NMCM, the shock is calibrated such that wages for each country are ex ante 1% lower after five years (i.e. the same approach as that used in Section 2.1).<sup>39</sup> The results are illustrated in Chart 27 for two groups of countries: those undertaking the adjustment and the rest of the euro area countries (labelled “spillovers”).

The main conclusions from this simulation can be summarised as follows:

- Domestic prices fall more in the adjustment countries than in the rest of the euro area.

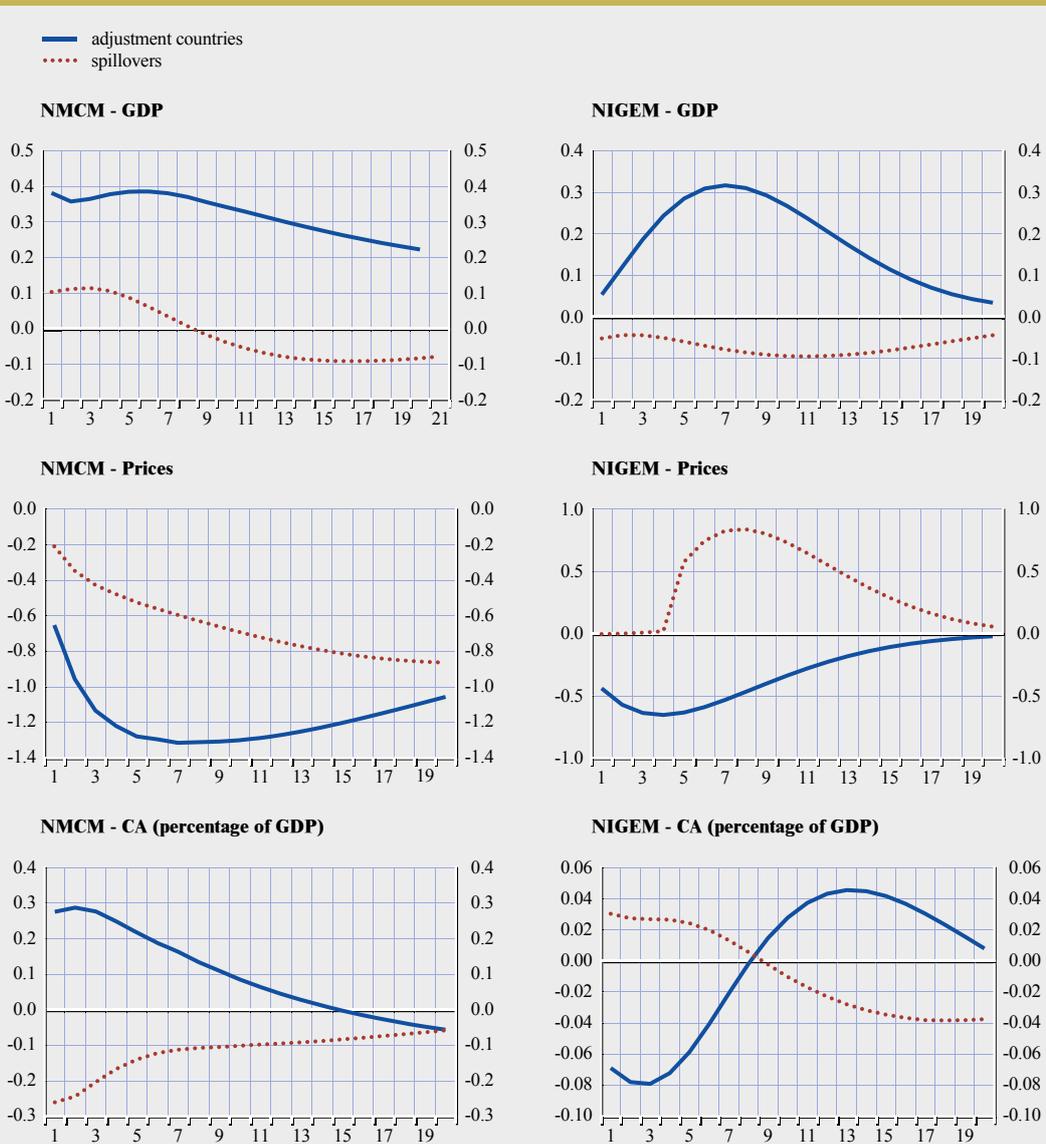
<sup>38</sup> For ease of exposition, the shocks have been separated out, but one could consider a non-price competitiveness gain that also induces partial wage increases leading to stronger domestic demand. As with the other shocks, monetary policy is endogenous.

<sup>39</sup> In the GVAR, the common shock is calibrated so that wages are temporarily down by 1% in the group of countries. In this sense, it can be labelled as an ex post shock. As the shock is to multiple countries, EAGLE is not used for this simulation.

This conclusion is robust across the three models. Higher price competitiveness has a positive impact on adjusting countries' exports and their current account balances (improvements in NiGEM are only visible in the medium run), though the medium-term impact is relatively small (less than 0.1% in all models). However, the evidence on the current account adjustment in the rest of the

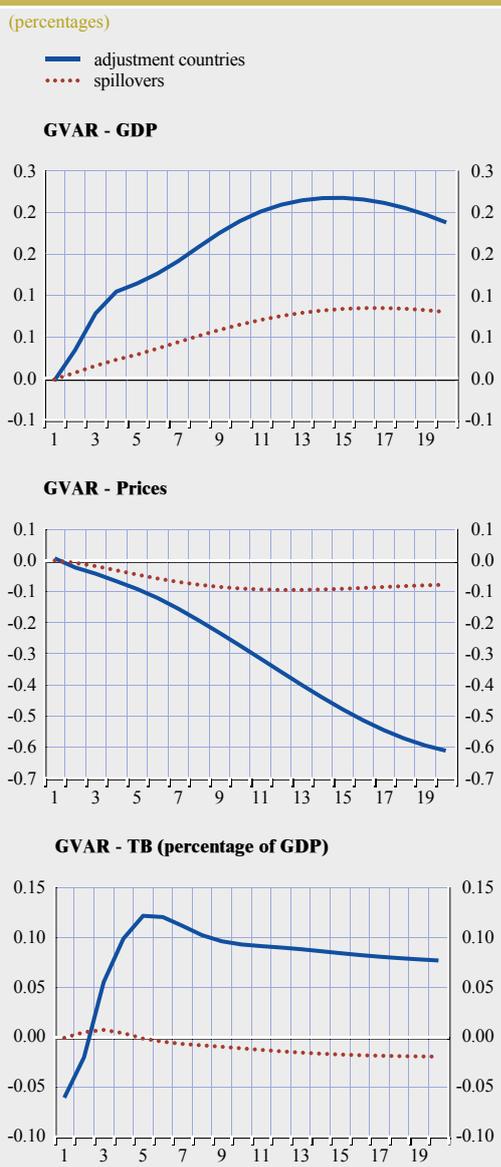
euro area countries is more mixed, though, in general, a slight deterioration in the medium term is observed. An improvement in price competitiveness has a positive impact on GDP in the adjustment countries of around 0.2% to 0.3% after three years. The impact on the rest of the euro area varies significantly across the models. The NMCM and GVAR show an improvement in GDP in

Chart 27 Adjustment and spillovers



Source: Own calculations.  
Notes: x-axis: quarters; y-axis: percentage deviations, except for trade balance as a percentage of GDP. Terms of trade are defined as import price over export price.

Chart 27 Adjustment and spillovers (cont'd)



Source: Own calculations.  
 Notes: x-axis: quarters; y-axis: percentage deviations, except for trade balance as a percentage of GDP). Terms of trade are defined as import price over export price.

the rest of the euro area countries (although in the NMCM the increase is only short lived), whereas GDP declines in NiGEM. In both models that show positive spillovers, however, the increase in GDP in the rest of the euro area countries is much smaller than that registered in the adjustment countries. The higher spillover effects obtained with

the GVAR are in line with previous experiments, which show that the GVAR tends to capture relatively more international linkages owing to its larger geographical coverage.<sup>40</sup> The story behind NiGEM is more about the beggar-thy-neighbour effect, with a positive impact on GDP and domestic demand in the adjustment countries and negative spillovers to the rest.

These results are related to the existing literature on the coordination of reforms. Everaert and Schule (2006, 2008) quantify the effects of reforms in product and labour markets for France and Belgium using the IMF's Global Economy Model (GEM). A similar study is conducted by Gomes et al. (2011) using EAGLE for both a large and a small euro area country (calibrated for Germany and Portugal, respectively). Forni et al. (2010) use a two-region currency union model to study the effects of reforms in Italy's service industry. In these studies, the impact of reforms is assessed by permanently lowering mark-ups in the respective markets, which are inversely related to the degree of substitutability between product and labour varieties and, therefore, to the degree of competition in the respective sectors. The main conclusions from this literature are:

1. Reforms are associated with sizeable benefits in the long term and an increase in welfare.
2. If implemented in isolation, labour and product market reforms have transitional costs: labour market reforms lead to a decline in real wages, while product market reforms induce a temporary decline in consumption, as forward-looking consumers anticipate lower future prices.
3. Synchronising reforms could mitigate to a large extent the transitional costs.
4. International spillovers of reforms are limited.

40 For example, in the NMCM the extra-euro area is exogenous, so any second-round effects are excluded.

Vogel (2011) uses the European Commission's QUEST model to assess the impact of reforms on external positions. He investigates how synchronised reforms in the euro area affect the impact of structural reforms on member countries' trade and current account balances. The simulations show that euro area implementation of reforms dampens the positive short-to-medium term impact on external balances compared with a unilateral reform implementation. The study concludes that reforms at the pace of other EMU members may increase net trade positions vis-à-vis the rest of the world (conditional on monetary policy accommodation of structural reforms that leads to temporary depreciation of the euro exchange rate) but do not reduce disparities inside the euro area. However, it is important to emphasise that Vogel (2011) simulates euro area-wide synchronised reforms, while our simulations imply only reforms in the countries with current account deficits.

In summary, higher price competitiveness is associated with an increase in GDP in the countries undertaking the adjustment, but there is no clear evidence from modelling results of the size of the impact of the reform coordination on GDP. Spillovers to the rest of the euro area countries are model dependent and in general small – positive in the short run for the NMCM, negative for NiGEM and positive throughout in the GVAR. In all models, the current account improves for adjusting countries, but the evidence on the rest of the countries is more mixed, though, in general, a slight decline in the medium term is observed. In NiGEM, the current account balance of the rest of the euro

area countries actually improves in the short run and only starts to decrease over the medium term, which can partly be explained by the fact that the effects of increasing international price competitiveness need more time to be effective.

Overall, the simulation results suggest that spillovers from improved competitiveness are limited within the euro area, especially for current account balances. This conclusion is broadly in line with the literature on the impact of structural reforms, which also points towards limited international spillovers of reforms. Particularly important for the purpose of this paper, it seems that raising price competitiveness in all deficit countries would only have a small effect on trade rebalancing within the euro area and that these effects would only be visible in the medium term.

### 3.6 SUMMARISING MODEL EVIDENCE

A suite of models ranging from structural to empirically oriented ones have been simulated in order to quantify the magnitude of the required adjustment in external imbalances in euro area countries. Table 7 rescales the results linearly to show the required adjustments of the different channels to achieve an improvement in the current account balances by 1% of GDP. Since the model results display substantial heterogeneity over the short term, the implied adjustment is shown for an improvement after three years. The model simulations suggest that an improvement in the current account balance of 1% of GDP in the medium term requires a temporary reduction in wages relative to competitors of around 5% to 10%.

Table 7 Adjustments to improve current account balances by 1% of GDP (after three years)

Competitiveness adjustment	Magnitude of adjustment
Wages	Wage reduction of 5% to 10%
Fiscal devaluation	Greater than 2.2% of GDP reduction in employers' social security contributions compensated for by higher indirect taxes
Productivity	Gains in productivity of at least 4%
Non-price competitiveness	Proxied by a 3% increase in the preference for a country's goods exports

Source: Own calculations.

The results confirm that improvements in non-price competitiveness should be an important complement to price competitiveness measures in correcting the external imbalances. Model simulations suggest that an increase in export volumes comparable to the price competitiveness scenario improves the trade balance-to-GDP ratio by around 0.5% in the medium term. These estimates are almost double those predicted by the same model in the price competitiveness scenario. The term “non-price competitiveness” is, however, a complex concept that is not easily measured – it includes factors such as product quality, technological advances, industry specialisation and the business environment, or in other words, the sum of those factors other than prices and costs that have an impact on export performance. Our analysis suggests that these factors could be much more important than price competitiveness in addressing the external imbalances, though a detailed investigation of the quantitative impact of the individual measures is beyond the scope of this paper.

Fiscal devaluation represents one example of so-called internal devaluation policies that are designed to switch expenditure from foreign to domestic output, thereby replicating the effects of nominal exchange rate depreciations, which are not possible in a monetary union. Model simulations suggest that a 1% of GDP shift from employers’ social security contributions to value added tax would improve the current account balance by around 0.1% to 0.4% in the medium term. In the most benign case, a 1% improvement in the current account balance would require a 2.2% of GDP reduction in employers’ social security contributions compensated for ex ante by an increase in VAT.

The impact of productivity improvements on the current account is generally ambiguous and model dependent. In EAGLE, for example, a 1% reduction in the current account balance over the medium term requires (temporary) productivity gains of around 4%; predictions from the other models are less benign. Model

simulations suggest that productivity-enhancing measures in the tradable sector are more likely to reduce the external imbalances than similar gains in the non-tradable sector.

The current account balance depends not only on current economic conditions, but also on expectations of future developments because, in anticipation of a higher stream of future income, forward-looking agents will bring forward consumption and investment decisions, thereby leading to current account deficits. Simulation results indeed show that permanent productivity improvements are associated with a slight deterioration in the current account balance, both in the short and medium term. In this case, foreign borrowing may still be sustainable given the permanently higher future income, in particular if it is used to finance productive investment. Two important caveats are that the results are dependent on the extent that agents are credit constrained and it is very difficult for economic agents and policy-makers to determine whether observed productivity improvements are of a temporary or permanent nature. If temporary gains are misperceived as being permanent or if foreign borrowing is channelled into non-productive activities, external deficits may well turn out to be unsustainable.

The speed and costs of the adjustment process depend in particular on the degree of price flexibility in the economy and the elasticity of substitution between domestic tradables and imports. More price flexibility leads to sizeable current account improvements even in the short run, while a low elasticity of substitution leads to very limited adjustment in the trade balance, suggesting that such countries should focus on aspects other than price competitiveness to reduce their external imbalances. Reducing the accumulated external imbalances consists not only in cuts in domestic prices and unit labour costs, but requires also an adjustment in the structure of the economies concerned, in particular a reallocation of demand from the non-traded to the export sector and relative price changes between these sectors.

Finally, model simulations show that spillovers from improved competitiveness within the euro area are limited. More importantly, the results show that improving price competitiveness in deficit countries may lead in the medium term to trade rebalancing within the euro area.

## CONCLUSIONS

This paper used cross-country analysis to shed some light on competitiveness and external imbalances within the euro area. Labour costs in a number of euro area countries increased substantially in the decade prior to the financial crisis that began in 2008 compared with some other euro area countries such as Germany, Austria and Finland. The cross-country differences were mainly due to excess increases in labour costs relative to labour productivity. As well as wages, payroll taxes also played a significant role in the rise in labour costs. Slow productivity growth, possibly due to sectoral reallocation from traded to non-traded sectors, also contributed to reduced competitiveness in many countries. Another finding of this paper is that current account developments were not necessarily related to price competitiveness effects. The paper also presented some non-price indicators such as technology, labour force characteristics, product and labour market regulations, and business environment factors, which showed significant heterogeneity across countries.

There are many factors that determine whether improvements in competitiveness lead to improvements in exports, in particular geographical and sector specialisation of exports. Taking these into account, all the analysed euro area economies except Austria lost world market shares in the period 1999-2007, suggesting some common negative shock. The sectoral composition of trade also suggests that potential export growth from price competitiveness gains may vary across countries. Finally, the import content of exports tends to increase over time in the euro area.

Given these findings, a suite of multi-country models (both structural and more empirically oriented) quantified the required adjustment in external imbalances in euro area countries. Five main scenarios are considered: (i) price competitiveness; (ii) a fiscal devaluation consisting of a budget-neutral shift from labour to consumption taxes; (iii) productivity-enhancing measures; (iv) non-price competitiveness

(quality/preference); and (v) coordination of reforms in current account deficit countries. This paper focuses primarily on the medium-term adjustment in external imbalances, which was defined as the third year after the start of the reforms, since short-term adjustments are typically model dependent.

Model simulations suggest that multiple factors could lead to an improvement in external imbalances. A temporary reduction in wages (relative to competitors) of around 5% to 10% would improve the current account balance by 1% of GDP in the medium term. In the most benign case, and assuming a linear relationship, a similar improvement in the current account balance would require a 2.2% of GDP reduction in employers' social security contributions compensated for ex ante by an increase in VAT or at least (temporary) productivity gains of around 4%. The analysis in this paper also suggests that non-price factors can be potentially more important than price competitiveness in addressing the external imbalances, though a more detailed analysis is needed. Finally, model simulations show that improving price competitiveness could lead to a rebalancing of trade within the euro area.

Since the model results are generic for a large current account deficit country, the findings are broadly applicable to a number of countries, but sensitive to the structure of the economy, particularly the sectoral composition. Indeed, the cross-country indicators shown in this paper combined with model sensitivity analysis suggest significant heterogeneity across countries both in potential areas for adjustment and in potential gains from reforms. Further research is needed to assess which reforms would be most beneficial to each individual euro area economy.

## ANNEXES

## I NON-PRICE COMPETITIVENESS ASPECTS

Table AI Non-price competitiveness indicators

	Code or web page	Definition	Source, coverage
Export Market Share of goods and services (Real terms)		Exports of goods and services in world imports. (Costant prices; base year 2000)	IMF, EUROSTAT
Relative export prices		Price competitiveness is represented by relative export prices (Country's export prices divided by competitors' export prices).	ECB
<b>Technology indicators</b>			
R&D	rd_e_gerdtot	R&D expenditure/GDP	EUROSTAT
Patents	pat_ep_nnac	Patent applications to the EPO by priority year at the national (Manufacturing).	EUROSTAT
FDI (INWARD)	<a href="http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx">http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx</a>	FDI (INWARD_Stock)/GDP.	UNCTAD
FDI (OUTWARD)	<a href="http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx">http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx</a>	FDI (OUTWARD_Stock)/GDP.	UNCTAD
<b>Structural competitiveness: services</b>			
TFPva_I (Code I)	VAConTPF (Code I)	Contribution of TFP to value added growth (percentage points)_transport and storage and communication.	EUKLEMS
TFPva_I (Code J)	VAConTPF (Code J)	Contribution of TFP to value added growth (percentage points)_financial intermediation	EUKLEMS
TFPva_I (Code K)	VAConTPF (Code K)	Contribution of TFP to value added growth (percentage points)_real estate, renting and business activities.	EUKLEMS
<b>Structural competitiveness: framework conditions</b>			
Upper education	educ5o+educ6o	Percentage of employees with upper secondary education.	EUROSTAT (EU Labour Force Survey Database)
Low education	educ1o+educ2o	Percentage of employees with low secondary education.	EUROSTAT (EU Labour Force Survey Database)
Enforcing contracts: #procedures	<a href="http://www.doingbusiness.org/custom-query">http://www.doingbusiness.org/custom-query</a>	Enforcing contracts, (number of procedures) A procedure is defined as any interaction, required by law or commonly used in practice, between the parties or between them and the judge or court officer.	World Bank Doing Business
Enforcing contracts: time	<a href="http://www.doingbusiness.org/custom-query">http://www.doingbusiness.org/custom-query</a>	Time for enforcing contracts (days).	World Bank Doing Business
Enforcing contracts: cost	<a href="http://www.doingbusiness.org/custom-query">http://www.doingbusiness.org/custom-query</a>	Cost for enforcing contracts (% of claim).	World Bank Doing Business
Strictness of employment protection – overall	<a href="http://stats.oecd.org/Index.aspx?DataSetCode=EPL_OV">http://stats.oecd.org/Index.aspx?DataSetCode=EPL_OV</a>	The OECD indicators of employment protection measure the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers on fixed-term or temporary work agency contracts.	OECD: Employment data base
Restrictiveness of economy-wide product market regulation	<a href="http://stats.oecd.org/OECDStat_Metadata/ShowMetadata.ashx?DataSet=GROWTH&amp;ShowOnWeb=true&amp;Lang=en">http://stats.oecd.org/OECDStat_Metadata/ShowMetadata.ashx?DataSet=GROWTH&amp;ShowOnWeb=true&amp;Lang=en</a>	The OECD Indicators of Product Market Regulation (PMR) are a comprehensive and internationally-comparable set of indicators that measure the degree to which policies promote or inhibit competition in areas of the product market where competition is viable.	OECD: Going for Growth 2010

**Table A2 EU countries: Non-price competitiveness indicators**

	Export market share of goods and services (Real terms) (percentage)	Technology indicators			FDI/GDP (percentage)		Structural competitiveness: Services TFP contribution to value added growth (pp) (percentage)	
		Relative export prices	R&D/GDP	Patents (Manufacturing) (Numbers)	Outward	Inward	Transport, storage and communication	Financial intermediation
European Union (27 countries)	35.84 (-2.63)		16.63 (0.02)	54,906 (7,213)	51.5 (25.4)	44.3 (24.1)		
Euro area (16 countries)	26.67 (-2.30)		16.68 (0.06)	45,488 (6,572)	51.3 (28.8)	42.9 (24.5)		
Belgium	1.93 (-0.38)	0.84	17.25 (-0.04)	1,497 (180)	141.4 (81.7)	176.8 (106.0)	0.32 (-2.87)	3.0 (3.17)
Bulgaria	0.10 (-0.00)	3.17	4.34 (-0.1)	12 (4)	1.9 (1.4)	90.1 (73.6)		
Czech Republic	0.65 (0.21)	4.57	11.75 (0.4)	11 (112)	4.9 (3.8)	64.5 (35.4)	-1.37 (-5.29)	-1.5 (9.32)
Denmark	0.82 (-0.12)	1.16	21.9 (0.4)	1,207 (368)	59.1 (29.6)	52.3 (24.9)	2.60 (-1.59)	3.189 (5.90)
Germany	8.65 (0.71)	-0.41	22.36 (0.13)	23,145 (2,570)	40.0 (20.7)	20.9 (9.9)	2.50 (4.25)	-2.40 (0.65)
Estonia	0.06 (0.01)	2.06	7.48 (0.42)	27 (19)	28.4 (23.5)	77.5 (34.3)		
Ireland	1.15 (0.03)	-1.00	10.69 (0.11)	289 (73)	57.9 (31.7)	78.6 (2.9)	-0.43 (2.76)	5.82 (-5.55)
Greece	0.33 (-0.06)	3.39	5.21 (-0.02)	99 (47)	10.3 (7.5)	17.2 (5.9)		
Spain	1.87 (-0.30)	1.31	9.37 (0.41)	1,333 (621)	40.7 (25.0)	40.6 (20.4)	-2.10 (-0.80)	5.45 (-0.15)
France	3.78 (-1.05)	-0.54	19.33 (-0.09)	8,183 (1,194)	69.0 (46.2)	48.47 (31.1)	2.14 (5.62)	0.52 (-0.26)
Italy	2.83 (-0.93)	1.59	9.9 (0.16)	4,733 (1,032)	19.7 (4.6)	17.8 (8.7)	1.17 (0.98)	1.47 (0.32)
Cyprus	0.05 (-0.01)	1.11	3.01 (0.21)	8 (3)	42.4 (38.4)	83.36 (62.8)		
Latvia	0.05 (0.01)	2.30	4.28 (0.23)	15 (14)	3.2 (-0.1)	37.68 (13.0)		
Lithuania	0.09 (0.03)	6.04	6.19 (0.31)	9 (6)	4.0 (3.8)	38.52 (19.7)		
Luxembourg	0.41 (0.03)	1.27	14.68 (-0.06)	70 (7)	150.6 (70.3)	158.7 (3.8)	3.18 (-0.34)	1.0 (-2.26)
Hungary	0.60 (0.19)	-0.12	8.1 (0.3)	175 (63)	12.6 (10.7)	69.2 (21.8)	3.00 (9.54)	7.22 (0.67)
Malta	0.03 (-0.01)	-2.05	3.58 (0.32)	6 (1)	15.9 (11.2)	111.0 (63.1)		
Netherlands	3.05 (-0.33)	0.56	16.74 (-0.15)	3,116 (209)	120.3 (56.9)	97.9 (51.2)	3.05 (3.60)	1.23 (-0.84)
Austria	1.14 (0.03)	0.08	20 (0.62)	1,626 (561)	39.9 (30.9)	43.6 (32.5)	0.28 (2.09)	-1.55 (-1.29)
Poland	0.73 (0.19)	4.29	5.31 (-0.12)	196 (161)	4.9 (4.4)	42.0 (26.4)		

Sources: ECB, EU Labour Force Survey, EU KLEMS, Eurostat, IMF, UNCTAD, World Bank and OECD.

Notes: Export Market Share, Patents, FDI/GDP, Employees Skills and Enforcing Contracts data is referred to year 2007. Relative export prices data is the average growth of the 1999-2007 period. TFP corresponds to the 1999-2005 average (last available data). Employment protection and wide product market regulation is referred to 1999-2007 average. R&D/GDP is referred to the 1999-2007 accumulated. In brackets the change from 1999 to 2007 is shown (pp in the case of Export Market Share, R&D/GDP, FDI/GDP and Employees, numbers in the case of Patents), except for Enforcing Contracts (change from 2004). In the case of TFP the average 1996-1998 is shown in brackets.

Structural competitiveness: Services TFP contribution to value added growth (pp) Real estate, renting and business activities  (percentage)	Structural competitiveness: framework conditions						
	Employees Skills (percentage of Total)		Enforcing contracts			Market Flexibility	
	Upper education	Low education	Number of procedures  (Numbers)	Time for enforcing contracts  (Days)	Cost  (percentage of claim)	Strictness of employment protection (0 to 6 scale, 0 low-6 high)	Restrictiveness of economy-wide product market regulation (0 to 6 scale, 0 low-6 high)
-1.43 (-1.46)	37.9 (5.7)	22.8 (-9.0)	28 (0) 40 (0)	505 (0) 564 (0)	16.6 (0) 23.8 (0)	2.2	1.7
0.0 (-7.65)			27 (-1)	653 (-10)	33.0 (-0.5)	1.9	2.2
-0.96 (-3.46)			35 (1)	380 (0)	23.3 (-1.3)	1.5	1.3
-1.32 (-2.11)	25.6 (25.6)	15.3 (15.3)	30 (0)	394 (-9)	14.4 (0)	2.2	1.7
	34.5 (0.02)	9.8 (-1.8)	36 (-2)	425 (0)	18.9 (0)		
-0.71 (8.96)	35.2 (20.3)	25.3 (-33.6)	20 (-2)	515 (0)	26.9 (0)	1.0	1.3
	25.5 (6.0)	32.2 (-12.1)	39 (0)	819 (0)	14.4 (0)	3.1	2.6
-0.81 (-2.26)	32.9 (6.4)	43.2 (-11.9)	40 (0)	515 (0)	17.2 (0)	3.0	1.8
-0.06 (0.28)	30.1 (5.6)	25.2 (-6.0)	30 (0)	331 (0)	17.4 (0)	3.0	1.9
-0.54 (-0.96)	16.0 (4.0)	38.2 (-9.4)	41 (0)	1,210 (-180)	29.9 (0)	2.0	1.9
	35.7 (9.1)	23.4 (-9.1)					
			27 (-3) 30 (0)	279 (-3) 210 (0)	16 (-0.7) 23.6 (0)		
-1.36 (-2.38)	29.5 (8.0)	23.4 (-7.6)					1.5
0.001 (1.51)			35 (0)	335 (0)	15 (0)	1.4	1.8
-1.21 (-0.43)	30.7 (6.8)	25.4 (-5.4)	26 (0)	514 (0)	24.4 (0)	2.1	1.3
-1.52 (-3.83)	0.0 (3.0)	17.5 (-3.6)	26 (-1) 38 (0)	397 (0) 980 (-20)	12.7 (0) 12 (0)	2.1	1.8
						1.6	3.1

**Table A2 EU countries: Non-price competitiveness indicators**

	Export market share of goods and services (Real terms) (percentage)	Technology indicators (percentage)			FDI/GDP (percentage)		Structural competitiveness: Services TFP contribution to value added growth (pp) (percentage)	
		Relative export prices	R&D/GDP	Patents (Manufacturing) (Numbers)	Outward	Inward	Transport, storage and communication	Financial intermediation
Portugal	0.38 (-0.06)	1.18	7.32 (0.48)	120 (85)	29.3 (20.2)	49.9 (28.6)	0.07 (-1.54)	4.75 (7.37)
Romania	0.21 (0.07)		3.7 (0.12)	31 (23)	0.7 (0.3)	36.9 (21.1)		
Slovenia	0.16 (0.03)	-1.94	12.85 (0.08)	116 (84)	15.3 (12.5)	30.4 (18.3)	-0.61 (-1.55)	0.17 (-4.78)
Slovakia	0.25 (0.06)	8.45	5.05 (-0.2)	34 (18)	2.5 (0.8)	56.8 (41.08)		
Finland	0.63 (-0.00)	-0.97	30.53 (0.3)	1,105 (-121)	47.4 (21.4)	37.2 (23.21)	2.69 (4.45)	-3.07 (8.19)
Sweden	1.38 (-0.08)	-1.26	33.55 (-0.18)	2,506 (399)	71.8 (30.8)	63.4 (35.1)	0.62 (0.07)	1.29 (0.43)
United Kingdom	4.40 (-0.91)	-1.28	15.9 (-0.04)	5,063 (-531)	65.3 (19.6)	44.2 (18.6)	1.65 (5.12)	1.98 (2.51)

Sources: ECB, EU Labour Force Survey, EU KLEMS, Eurostat, IMF, UNCTAD, World Bank and OECD.

Notes: Export Market Share, Patents, FDI/GDP, EmployeesSkills and Enforcing Contracts data is referred to year 2007. Relative export prices data is the average growth of the 1999-2007 period. TFP corresponds to the 1999 -2005 average (last available data). Employment protection and wide product market regulation is referred to 1999-2007 average. R&D/GDP is referred to the 1999-2007 accumulated. In brackets the change from 1999 to 2007 is shown (pp in the case of Export Market Share, R&D/GDP, FDI/GDP and Employees, numbers in the case of Patents), except for Enforcing Contracts (change from 2004). In the case of TFP the average 1996-1998 is shown in brackets.

Structural competitiveness: Services TFP contribution to value added growth (pp) Real estate, renting and bussines activities  (percentage)	Employees Skills (percentage of Total)		Structural competitiveness: framework conditions				
	Upper education	Low education	Enforcing contracts			Market Flexibility	
			Number of procedures (Numbers)	Time for enforcing contracts (Days)	Cost (percentage of claim)	Strictness of employment protection (0 to 6 scale. 0 low-6 high).	Restrictiveness of economy-wide product market regulation (0 to 6 scale. 0 low-6 high)
-5.03 (-3.20)	14.2 (4.9)	70.8 (-8.3)	35 (-1)	577 (0)	14.2 (0)	3.6	1.8
			32 (0)	537 (0)	19.9 (0)		
-3.40 (-3.86)	23.5 (6.4)	15.6 (-5.1)	32 (0)	1350 (-90)	18.6 (-1.1)		
	16.4 (4.5)	4.5 (-3.4)				1.5	1.7
-1.35 (0.79)			32 (0)	235 (-42)	13.3 (0)	2.0	1.5
-0.58 (-1.64)			30 (0)	508 (0)	31.3 (0)	2.2	1.6
-0.64 (0.28)			30 (0)	404 (0)	23.4 (1.5)	0.7	0.9

## 2 ANALYSING EXPORT COMPETITIVENESS

*Computation of the measures of “export competitiveness”, sectoral specialisation and geographical specialisation.*

The method envisages a decomposition of export growth based on a weighted variance analysis (ANOVA) of bilateral export data, disaggregated by product. The methodology is based on Jayet (1993), which initially adapted the ANOVA methodology to give a statistical basis to geographical structural analysis, and Cheptea et al. (2005), Cheptea et al. (2010) and Bricongne et al. (2011), which proposed different versions of the method for application to international trade. The model identifies the export growth of each exporting country as if all exporters had the same geographical and sectoral specialisation. This is important for export data, as export growth rates are affected by structural effects: exporters with strong positions in the most dynamic destination markets or specialised in high-growth sectors benefit, *ceteris paribus*, from stronger growth. With this methodology, “pure” exporter performance can be assessed separately from geographical and sectoral effects.<sup>41</sup> The computation of the method consists of four main steps:

### STEP 1: COMPUTE MID-POINT GROWTH RATES

For a country  $i$  exporting a value  $x$  to a country  $c$  of product  $k$  at time  $t$ , the mid-point growth rate is defined as follows:

*Equation 1*

$$g_{ickt} = \frac{x_{ickt} - x_{ick(t-1)}}{\frac{1}{2}(x_{ickt} + x_{ick(t-1)})}$$

Similarly, the weight attributed to each flow  $g_{ickt}$  is given by the relative share of the flow in total exports, where total refers to the exports of the whole sample of countries:

*Equation 2*

$$s_{ickt} = \frac{x_{ickt} + x_{ick(t-1)}}{(\sum_c \sum_i \sum_k x_{ickt} + x \sum_c \sum_i \sum_k x_{ick(t-1)})}$$

The year-on-year growth rate of the total value of world exports is given by summing each individual flow  $g_{ickt}$  weighted by  $s_{ickt}$ :

*Equation 3*

$$G_{i,t} = \sum_{i,c,k} G_{ick}^t = \sum_{i,c,k} g_{ick}^t * s_{ick}^t \approx \ln \left( \frac{\sum_{i,c,k} x_{ick}^t}{\sum_{i,c,k} x_{ick}^{t-1}} \right)$$

The G measure is monotonically related to the conventional growth rate measure, and it represents a very good approximation of the latter except for extremely high growth rates.<sup>42</sup> For a given exporter:

*Equation 4*

$$G_{i,t} = \sum_{i,c,k} G_{ick}^t = \sum_{i,c,k} g_{ick}^t * s_{ick}^t \approx \ln \left( \frac{\sum_{i,c,k} x_{ick}^t}{\sum_{i,c,k} x_{ick}^{t-1}} \right)$$

The advantage of the mid-point growth rate over standard growth rate measures is that it allows factoring in entries and exits of countries into/from new markets and new products, which would otherwise disappear if log specifications were used. Moreover, it preserves the additivity property as in delta log specifications.

41 Seeking the “good” products and destinations is also part of “performance”. Our methodology does not, within the sectoral effects, disentangle what is due to the ability of countries to adapt their specialisation and what is exogenous. However, continuous change in specialisations is taken into account by estimating the model at each date (by computing some kind of chained indices).

42 In the first quarter of 2009 Trinidad and Tobago reported aggregate exports 90% higher than in the previous quarter. The corresponding aggregate mid-point growth rate (weighted average of mid-point growth rate over all export flows reported) is 86% ( $\exp(0.62)$ ) since the mid-point growth rate approximates the change in logarithm). In the same quarter Iceland reported a 38.5% drop in exports, which is pretty well approximated by the mid-point growth rate at -38%. For countries reporting more than 10,000 elementary export flows (starting with Pakistan), the average absolute difference between the conventional and the (weighted) mid-point growth rate was 0.05% (for an average growth rate of exports of -10%).

## STEP 2: FIXED-EFFECT REGRESSION

Starting from a dataset disaggregated by destination and sector (or product), the ANOVA methodology is used to decompose export growth into a sectoral effect, a geographical effect and a pure export competitiveness effect. Specifically, the mid-point growth rate is regressed on three sets of fixed effects, i.e. exporter, importer and sector/product fixed effects, here denoted with the letter  $f$  by means of a weighted OLS estimation. A separate regression is carried out for each year in the data. Hence, if  $\alpha$  is the intercept,  $\phi$  is the regression coefficient for exporter fixed effects,  $\beta$  the one for importer fixed effects,  $\gamma$  the one for product/sector fixed effects, and  $\varepsilon$  the error term, this can be written as:

Equation 5

$$g_{ickt} = \alpha + \sum_i \phi_i f_i + \sum_c \beta_c f_c + \sum_k \gamma_k f_k + \varepsilon$$

The terms  $f_i$ ,  $f_c$  and  $f_k$  are the exporter country, importer country and sector-specific fixed effects, respectively. In the regression, one exporter  $i$ , one importer  $c$  and one sector  $k$  is omitted to avoid perfect multicollinearity with the constant term  $\alpha$ . The constant term  $\alpha$  corresponds to the export growth of the reference country and the coefficients have to be interpreted as deviations from the performance of this country. In order to minimise computational problems with standard errors, a large exporter/importer was chosen as the omitted country, i.e. one that exports to a high number of destinations and that exports numerous products. Hence, the estimated coefficients in the above equation are to be read as deviations from the value for the omitted term. For example, if the US is omitted as a destination country, all coefficients for importer fixed effects are to be interpreted as deviations from the coefficient for exports to this country.

In Step 3, however, the effects are normalised so as to quantify them as deviations from the average growth rate of exports for the overall

sample in the dataset (i.e. in our case this roughly corresponds to world export growth).

## STEP 3: COMPUTATION OF THE INDICES FROM THE ESTIMATED COEFFICIENTS

From the estimated coefficients, growth is decomposed for each exporter (i.e. aggregating destination and product dimensions). First, however, the coefficients need to be normalised.

In Equation 6,  $\hat{\phi}_i^t$  indicates the performance for exporter  $i$  relative to the omitted destination and sector. By contrast,  $\hat{\phi}_i^t$  is the marginal average for  $i$ 's performance independent of the choice of omitted variable. It gives the export growth that country  $i$  would have if its geographical and sectoral specialisation would be equal to the average for the full sample. This is our measure of export performance (competitiveness). Specifically, to obtain such a term, a least-squares is needed which means computation. In other words, for each exporter  $i$ , a normalised coefficient is needed for the fixed effects, by summing them up to a constant term equal for all  $i$ 's and to the weighted mean of the partner and product effects (weights are selected and computed as in Equation 2). This method generates identical results regardless of the choice of the omitted term in the estimation procedure, thereby facilitating interpretation.

Equation 6

$$\hat{\phi}_i^t = \hat{\alpha}^t + \hat{\phi}_i^t + \sum_c s_c^t \hat{\beta}_c^t + \sum_k s_k^t \hat{\gamma}_k^t$$

This allows writing down the identity in Equation 7, telling us that standard growth (log difference of exports) is well approximated by the weighted mid-point growth rate. The equality exploits the fact that the weights of all flows involving exporter  $i$  sum to the weight of its exports in world trade, i.e.

$$s_i^t = \sum_{ck} s_{c,k}^t \text{ and that the sample weighted average error in Equation 5 is zero.}$$

Equation 7

$$\ln \left( \frac{\sum_{c,k} x_{ick}^t}{\sum_{c,k} x_{ick}^{t-1}} \right) \approx \sum_{c,k} G_{ick}^t = \sum_{c,k} g_{ick}^t * s_{ick}^t$$

$$= \hat{\phi}_i^t + \sum_c s_{ic}^t \hat{\beta}_c^t + \sum_k s_{ik}^t \hat{\gamma}_k^t$$

Equations 8 and 9, instead, are weighted averages for the effect of geographical and sectoral specialisation, which are also quantified.

Equation 8

$$\hat{\beta}_c^t = \hat{\beta}_c^t - \sum_c s_c^t \hat{\beta}_c^t$$

Equation 9

$$\hat{\gamma}_k^t = \hat{\gamma}_k^t - \sum_k s_k^t \hat{\gamma}_k^t$$

#### STEP 4: EXTENSION TO PRICE AND QUANTITY EFFECTS

The decomposition is further extended to separate quantity from price effects. The procedure used in Bricongne et al. (2011) is followed, which uses a Tornqvist index to carry out the decomposition. In the fixed-effect regression described above, the mid-point growth rate is simply replaced with the log change of unit value. Results are expressed in “volume” terms by taking the difference between change in value and change in unit value. The caveat of this methodology is that only the intensive margin can be taken into consideration when disentangling price from quantity effects. Alternative methods will be explored in the course of the project with the aim to overcome the above shortcoming.



### 3 TRADE PRICE ELASTICITIES

**Table A3 Summary of estimation results for trade price elasticities for the euro area countries and the US<sup>1)</sup>**

Country	Study	Hervé (2001): short run, imports, volumes	Hervé (2001): long run, imports, volumes	Hervé (2001): short run, exports, volumes	NMCM (2010): imports, values	NMCM (2010): exports, values
Austria		<b>-0.41</b>	0.01	<b>0.37</b>	-	-
Belgium		-0.16	1.73	<b>0.46</b>	-	-
Cyprus		-	-	-	-	-
Finland		0.06	<b>0.60</b>	<b>0.37</b>	-	-
France		0.06	0.24	0.15	<b>-0.711</b>	<b>1.056</b>
Germany		<b>-0.42</b>	<b>-0.11</b>	<b>0.42</b>	<b>-0.782</b>	<b>1.021</b>
Greece		0.04	<b>0.34</b>	<b>0.92</b>	-	-
Ireland		<b>0.17</b>	<b>0.51</b>	0.27	-	-
Italy		<b>1.24</b>	3.11	-0.005	<b>-1.001</b>	<b>1.22</b>
Luxembourg		-	-	-	-	-
Malta		-	-	-	-	-
Netherlands		-0.07	<b>0.18</b>	<b>0.13</b>	<b>-0.576</b>	<b>1.314</b>
Portugal		-0.10	<b>0.76</b>	0.09	-	-
Slovakia		-	-	-	-	-
Slovenia		-	-	-	-	-
Spain		0.08	<b>0.51</b>	<b>0.65</b>	<b>-0.979</b>	<b>1.345</b>
US		0.05	<b>0.40</b>	<b>0.48</b>	-	-

Notes: 1) Numbers in bold indicate that the estimate is statistically significant, while numbers in italics indicate that the significance level was not reported.

2) The estimates reported for Belgium and Luxembourg correspond to the joint Belgium-Luxembourg estimate in the paper; the ones for Germany correspond to the West Germany estimate.

3) It is unclear whether these reported estimates are significant or not, since no standard errors or t-values are reported by Hervé (2001).

4) The reported values correspond to the OLS estimates of multilateral price elasticities in Marquez (1990). None of the other euro area countries are treated separately; available are instead estimates for the rest of the OECD (ROECD), excluding Canada, Germany, Japan, the UK and the US. The ROECD (US) price elasticity of imports is -0.49 (-0.92) and the corresponding price elasticity of exports is -0.83 (-0.99). The estimation is done with volumes as the left-hand-side variable.

5) This is the median price elasticity of import volumes at the industry level from Anderton (1999). The average for the twelve industry estimates equals 0.64 for Germany. Values for the UK are however higher; the median and average elasticities are now 1.03 and 1.06, respectively. All reported price elasticities, for Germany as well as the UK, are significant at the 5% level.

6) The reported estimates are long-run export elasticities from the European Commission's Quarterly Report on the Euro Area 2010-1. They are obtained using aggregate quarterly data covering Q1 1980-Q3 2008 for all countries but France, for which the data only cover the time period Q1 1980-Q1 2000. All estimates are significant at the 5% level.

Houthakker and Magee (1969): imports, values <sup>2)</sup>	Houthakker and Magee (1969): exports, values <sup>2)</sup>	NiGEM imports, volumes (Hervé, 2001) <sup>3)</sup>	NiGEM exports, volumes (Hervé, 2001) <sup>3)</sup>	Other studies: imports	Other studies: exports
-	-1.30	0.31	1.25	-	-0.82 <sup>6)</sup>
-1.02	0.42	0.39	0.40	-	-
-	-	-	-	-	-
-	-	0.36	1.20	-	-
0.17	-2.27	0.59	0.63	-	-1.18 <sup>6)</sup>
-0.24	1.70	0.28	0.55	-0.60 <sup>4)</sup>	-0.66 <sup>4)</sup>
-	-	-	-	-0.73 <sup>5)</sup>	-0.73 <sup>6)</sup>
-	-	1.49	0.88	-	-
-	-	0.12	4.28	-	-
-0.13	-0.03	0.73	0.49	-	-1.72 <sup>6)</sup>
-1.02	0.42	-	-	-	-
-	-	-	-	-	-
0.23	-0.82	0.37	0.40	-	-
-0.53	-0.07	0.25	2.43	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-0.65	0.82	0.31	-	-1.31 <sup>6)</sup>
-0.54	-1.51	0.61	0.52	-	-

## 4 DIFFERENT MODEL STRUCTURES

### EAGLE

The EAGLE (Euro Area and Global Economy)<sup>43</sup> model is a global DSGE model in the same vein as GEM or SIGMA. Based on the NOE paradigm, it is a multi-country/multi-sector extension of the NAWM. As such, the model features the usual real and nominal rigidities. The model has been calibrated to represent: a LDC, the rest of the euro area, the US and the rest of the world. Accordingly, the steady state produces useful ratios and a GDP breakdown. Structural parameters have been chosen using information in the existing literature. Households: they have infinite lives, consume final goods and supply labour to all firms in a monopolistic manner. Two types of agents are distinguished according to their access to the financial market. Those who are allowed to own domestic firms and rent the physical capital to them, and those who can buy or sell bonds: a government bond or a bond denominated in dollars. The internationally traded bond is subject to transaction costs, meaning that households are paying a premium to financial intermediaries. Firms: there are two types of firms. First, firms producing non-tradable final goods for consumption or investment purposes. They use a CES assembling domestic intermediate goods and imports and act under perfect competition. Second, firms producing intermediate goods operate under monopolistic competition. Intermediate goods can either be internationally traded (tradable sector) or not (non-tradable sector). Both sectors use a Cobb-Douglas production function combining domestic capital and domestic labour and set nominal prices. Exporting firms set prices in the currency of the market destination. The government: purchases the public good and finances its expenditure by issuing bonds and levying taxes. A fiscal rule stabilises the debt. The monetary authorities fix the short-term nominal interest rate following a Taylor rule.

### NMCM

The NMCM (New Multi-Country Model)<sup>44</sup> is a large-scale estimated model covering the five largest euro area countries. The behavioural

equations and the production function are estimated on the basis of quarterly national historical data from 1980 onwards. The theoretical core of the model consists of one exportable domestic good and one imported good and the production function is the normalised CES, allowing for non-unitary elasticity of substitution, non-constant augmenting technical progress and heterogeneous sectors with differentiated price and income elasticities of demand across sectors. There are three optimising private sector decision-making units, i.e. utility-maximising households, profit-maximising firms and trade unions, which minimise the quadratic loss function under the staggered wage adjustment assumption. Monopolistically competing firms set prices, inventories and factor demands under the assumptions of indivisible labour. Output is in the short run demand-determined. Monopoly unions set wages and overlapping generation households make consumption/saving decisions. The reaction functions of the government sector and the central bank close the model. Expectation formation is treated explicitly so that the model can be simulated under rational model consistent expectations or under learning expectations. Under learning expectations, agents optimise their learning based on unknown driving stochastic processes but without uncertainty of the deep parameters – i.e. there is uncertainty concerning the process driving future developments. In this paper, the shocks are anticipated and therefore use the rational expectations version (which the learning version converges towards). The linked version of the model is used where the cross-country linkages occur through four channels: trade volumes; trade prices; common monetary policy; and a common exchange rate.

### NIGEM

NiGEM (National Institute Global Econometric Model) is a simulation program developed by the National Institute of Economic and Social Research (NIESR).<sup>45</sup> The model covers

<sup>43</sup> See Gomes et al. (2010) for more details.

<sup>44</sup> See Dieppe et al. (2011) for more details.

<sup>45</sup> A comprehensive overview of the model and the database can be found on the NiGEM website: <http://nimodel.niesr.ac.uk>.

over 40 individual countries and 13 regions. All of the OECD countries (except Turkey, Iceland, Luxembourg and Chile) are modelled separately using between 60 and 130 single equations and the parameters for each country are estimated individually.<sup>46</sup> Linkages between countries take place through trade and competitiveness, financial markets and the international distribution of asset stocks. The simulations, which were conducted using NiGEM Version 2.11, assume rational expectations with regard to wages, interest rates, exchange rates, share prices and inflation. They presuppose myopic consumers and a (modelled) two-pillar monetary strategy of the Eurosystem.

#### **GVAR**

The GVAR (see Dees et al, 2009) used is a new GVAR model estimated for this exercise which includes seven variables (real GDP, consumer prices, nominal wages, productivity, trade balance, real exchange rate and short-term interest rates).<sup>47</sup> The model includes 36 countries, of which 11 are part of the euro area (Germany, France, Italy, Spain, the Netherlands, Belgium, Finland, Austria, Greece, Portugal and Ireland). The model has been estimated over Q1 1986-Q4 2009. As in the original GVAR model (see Dees et al., 2007), the country-specific models are estimated as VECMs and include country-specific foreign variables that account for international linkages. In this new GVAR model, the country-specific foreign variables include foreign real GDP, foreign prices and foreign interest rates. These are constructed as trade-weighted averages of the corresponding variables for other countries. Once estimated, the various country models are stacked together and the resulting GVAR model is solved and used for impulse response analysis. The solution of the present model is stable, as supported by the analysis of the eigenvalues of the system, which are either equal to one or below.

<sup>46</sup> For this reason, it should be noted that in principle it is not possible to run simulations for a “representative big deficit country”. The results yielded for a specific country cannot be automatically applied to other countries. Moreover, differences in baseline situations, e.g. with respect to public debt, employment figures or interest rates, can affect the impact of policy measures. Consequently, results obtained in this study should be interpreted carefully.

<sup>47</sup> The GVAR model used in this exercise has been developed using the GVAR Toolbox. For more details, see Smith and Galesi (2011).

## 5 A REDUCTION IN THE PRICE MARK-UP

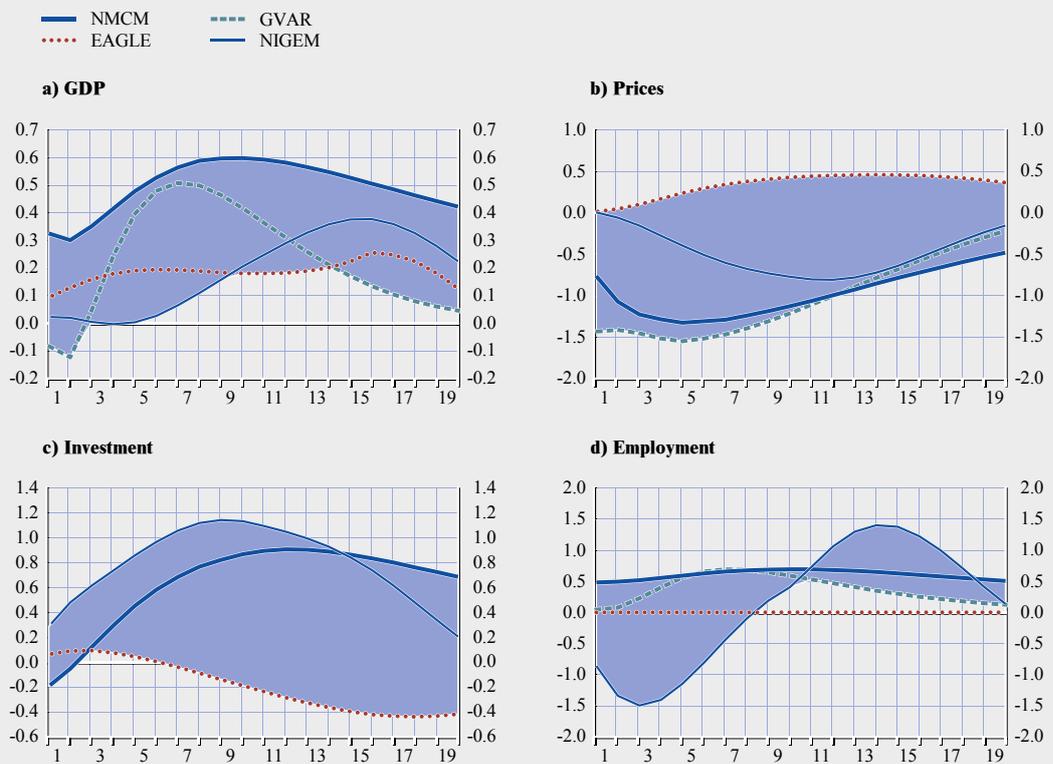
An unexpected autonomous decline in the price mark-up can be associated with product market reforms, such as an increase in the level of competition on the goods market which limits the pricing power of monopolistically competitive firms. For given marginal costs, the output price is expected to decline and, similar to the negative wage mark-up shock discussed above, improve price competitiveness of the domestically produced goods, thus boosting exports. Domestic demand may rise due to higher current and expected income, leading to higher import demand, limiting the improvement in the external position of the country implied by the shock.

Chart A1 shows the macroeconomic response to the price mark-up shock in the considered models. Except for the NMCM, in all models

the current account deteriorates initially and improves gradually over the medium term. In NiGEM and EAGLE<sup>48</sup> model prices react only gradually, whereas in the GVAR and the NMCM they drop on impact, allowing for quicker price competitiveness gains. In addition, in the GVAR and the NMCM the nominal wages decline more than the consumer prices, bringing the disposable income down. As a result, in the short run imports are significantly reduced. Overall, in the NMCM both the price competitiveness and the income channels are contributing to improving the current account position.

48 In contrast to the other considered models, in the EAGLE model prices rise as this shock is specific to the exporter sector. Overall prices rise due to a Balassa-Samuelson effect, where the positive boost to the whole economy due to this sector-specific shock implies an increase in GDP, labour demand and wages that is spread to the whole economy including non-tradable and domestic tradable sectors (which do not face the shock).

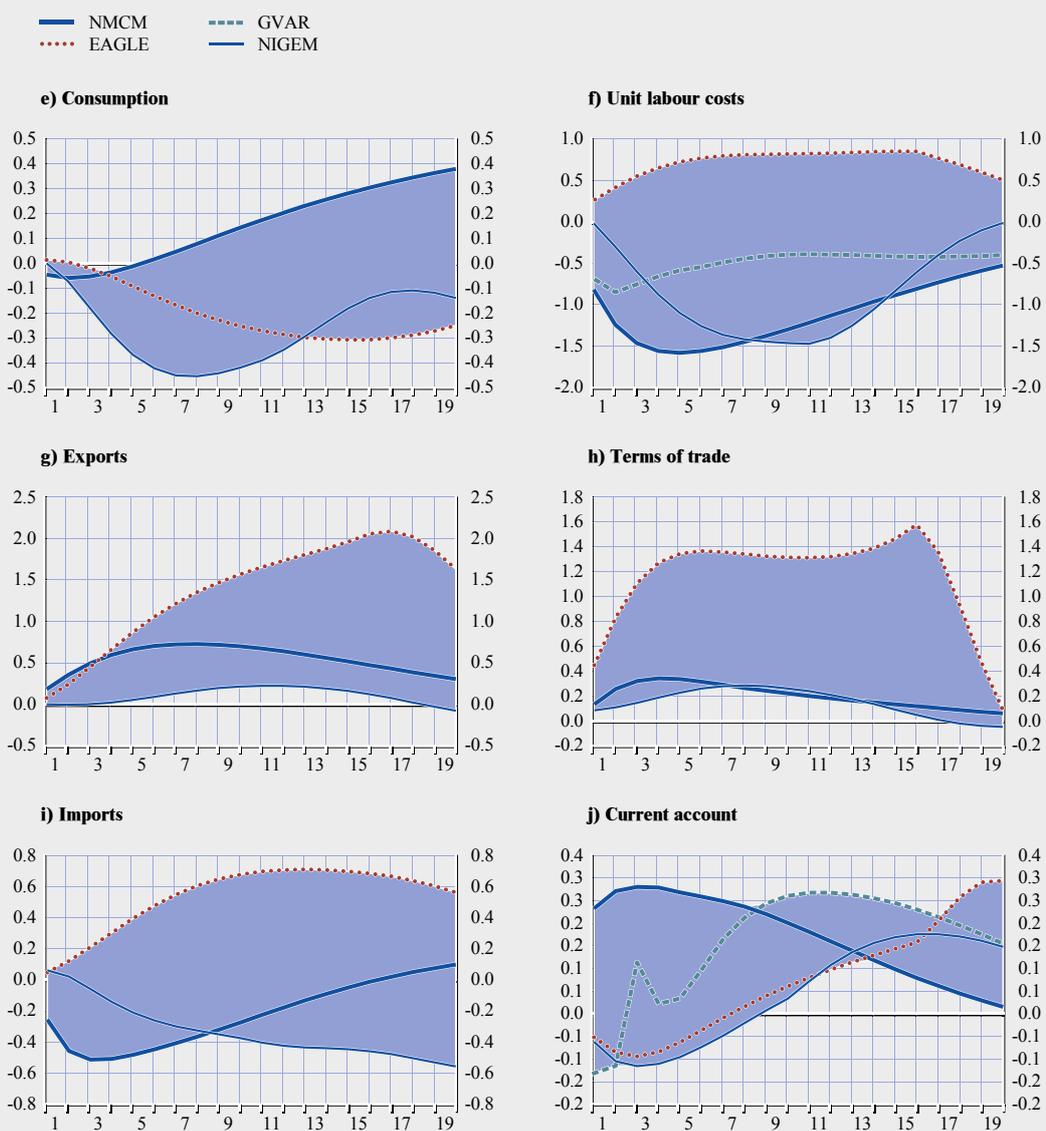
Chart A1 Responses to a temporary price mark-up shock across the models



Source: Own calculations

Notes: x-axis: quarters; y-axis: percentage deviations, except for the current account which is deviations in percentage of GDP (for GVAR and EAGLE, the trade balance as a percentage of GDP). Terms of trade are defined as import price over export price.

Chart A1 Responses to a temporary price mark-up shock across the models (cont'd)



Source: Own calculations

Notes: x-axis: quarters; y-axis: percentage deviations, except for the current account which is deviations in percentage of GDP (for GVAR and EAGLE, the trade balance as a percentage of GDP). Terms of trade are defined as import price over export price.

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