# DEFINING THE RIGHT INTERNAL EXCHANGE RATE

European economies need to adjust to a sustainable growth path. That implies adjusting internal exchange rates. Since the start of the Great Recession, euro area crisis countries (and more specifically Greece, Portugal, Spain, Italy, Ireland) have engaged in austerity policies in order to slash public deficits, but also in attempt to regain lost competitiveness. These policies, by weighing on internal demand and growth, have successively pushed euro area countries into competitive disinflation policies. This non-cooperative game, whose goal is to win market shares against euro area partners by improving the country's price-competitiveness, has already had sharp disinflationary effects and runs the risk of pushing the euro area economy into deflation, a threat already identified in last year's iAGS report.

Wage deflation is producing adjustment but at a high social cost, and there is a serious risk of overshooting. Defining the appropriate target is thus critical. In this chapter, we attempt to define adjustment targets for euro area countries. To do so, we compute the variation of the general price level of each country compatible with a stable and sustainable international investment position, that is the balance between a country's foreign assets and liabilities. We take into account the fact that economies have not yet recovered from the crisis as this influences long-run trade balances. The simulations also include the simultaneous determination of import and export prices, which determines the final real effective exchange rate of each country endogenously. They rely on recent econometric estimates of trade elasticities (see Ducoudré and Heyer, 2014).

This chapter is a first attempt at calibrating a cooperative and coordinated price/wage policy in the euro area in a unified framework. Even though a substantial readjustment has been achieved since 2011, much still remains to be done. A rebalancing strategy should rely on maintaining inflation differentials within the euro area over an extended period, with higher inflation in Germany and lower inflation in crisis countries; deflation is not required in the latter countries if the readjustment is implemented gradually. A nominal depreciation of the Euro would facilitate the rebalancing by making it compatible with a higher inflation rate. Deleveraging in some countries would also ease the adjustment.

The chapter is organised as follows. The first part studies the external imbalances of the euro area countries, by looking at structural trade balances. It emphasises the role of wage deflation in the effective exchange rate adjustments that occurred since 2008 as a way to correct external imbalances. The second part briefly presents the model, and discusses the simulation results.

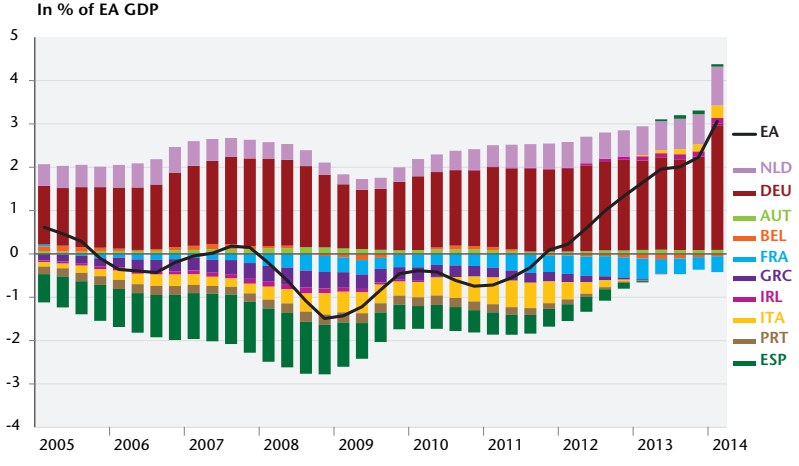
## 1. External imbalances adjustments since 2008

To assess the need for adjusting to internal exchange rates, we start the analysis by looking at current trade balances in euro area (EA thereafter) countries. Next we point to the adjustments already achieved in EA countries. To do so, we carefully look at labour costs, relative prices and trade flow variations since 2008.

## External disequilibrium in euro area countries

Since the start of the 2008 crisis, the current account of the euro area has strongly increased, starting from a current account deficit of -1% of GDP in 2008, to a surplus of +3% of GDP in 2013 (Figure 1). This apparent improvement mainly comes from the harsh reduction of current account deficits in southern countries: Spain, Italy, Greece and Portugal. A tentative analysis would stop here and conclude that external imbalances have been corrected, France being the last country needing to correct this. However, high unemployment and depressed internal demand account for an important part of the adjustment. Austerity policies weigh on internal demand and imports, explaining a substantial part of the improving trade balances. On the other side, the shrinkage of exports due to trade partners' internal demand collapse worsens the trade balance. Moreover, these current account surpluses, once business cycle effects are taken into account, may not be compatible with sustainable trajectories of international investment positions.

**Figure 1. Current accounts developments in the euro area since 2000**




*Source:* Eurostat.

Starting from these remarks, we try to assess current external disequilibria in EA countries taking into account the fact that these countries and the world economy have not yet recovered from the crisis. The external disequilibrium of a country can be assessed by computing the gap between the structural trade balance (the trade balance obtained when output gaps are closed—STB thereafter, see Box 1 for computation details) and the trade balance that stabilizes the net international investment position (NIIP thereafter) at a desired level expressed as a % of GDP[1]. The structural trade balance of a country depends on the output gap of the economy: a negative output gap signals a weak internal demand that diminishes

1. Clearly, given that a negative NIIP (normally) implies an outflow of interest, dividend and other payments, which burden the current account, a persistent rise in the NIIP is not sustainable. Although the constraints are not as binding in the case of surpluses, it is usually inadvisable to pile up increasing net foreign assets as this creates imbalances that can lead to capital losses.

imports. Closing the output gap would then worsen the trade balance of that country. The structural trade balance also depends on the output gaps of trade partners: if they face a negative output gap, they import less from the country. Closing their output gap would then improve the trade balance of the country.

In Table 1 we report the STB for eleven EA countries. STB are generally lower than current trade balances, since almost all EA countries face a more negative output gap than that of their partners. Greece, the most extreme case, has an actual trade balance near to 0 in 2013 (-0.2% of GDP), but its STB amounts to -11.4% of GDP due to its strongly negative output gap (-13.3% of GDP). On the contrary, Germany has a STB (8.3% of GDP) higher than its trade balance (6.2% of GDP) in 2013, since its output gap is nearly closed while the one of its main trading partners is on average larger.

We also report the STB target, *i.e.* the STB compatible with a stable NIIP. It is computed as the current NIIP adjusted by the gap between the potential growth rate and the long run real interest rate, and corrected for the gap between the current account and the trade balance. Defining the target of the external adjustment of EA countries is a critical task. It is clear that an ever increasing or decreasing external position is not sustainable in the long run. Stabilizing the NIIP is therefore a necessary condition, but the level at which that position becomes unsustainable is not clearly quantified in the literature. In this part, for sake of simplicity we stabilise the NIIP in the long run at its *current* level. In the second part of the chapter, we define different constraints on long run NIIPs.

**Table 1. Trade balance gap for 11 euro area countries in 2013**

**% of GDP**

| | Net international investment position | Current account | Trade balance | Output gap (%) | Potential growth (%) | Weighted output gap of trade partners (%) | Structural trade balance | Structural trade balance target* |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) = (3) – (6) + (4) | (8) = [(5) – r] x (1) – [(2) – (3)] |
| **AUT** | 1 | 2.7 | 3.7 | -2.9 | 1.5 | -2.0 | 2.8 | 1.0 |
| **BEL** | 46 | -1.9 | -0.1 | -1.9 | 2.0 | -2.7 | 0.7 | 2.2 |
| **FIN** | 16 | -1.1 | 0.3 | -3.1 | 2.0 | -2.0 | -0.8 | 1.5 |
| **FRA** | -17 | -1.3 | -1.3 | -2.9 | 1.7 | -2.5 | -1.7 | 0.0 |
| **DEU** | 48 | 7.5 | 6.2 | -0.6 | 1.1 | -2.6 | 8.3 | -1.2 |
| **GRC** | -121 | 0.7 | -0.2 | -13.3 | 1.5 | -2.1 | -11.4 | -1.5 |
| **IRL** | -105 | 6.6 | 23.3 | -8.7 | 2.0 | -2.4 | 17.0 | 15.6 |
| **ITA** | -30 | 1.0 | 2.6 | -5.6 | 0.9 | -2.2 | -0.8 | 1.6 |
| **NLD** | 46 | 10.9 | 10.6 | -4.3 | 1.8 | -2.2 | 8.5 | 0.1 |
| **PRT** | -119 | 0.5 | 1.7 | -7.2 | 1.6 | -3.0 | -2.6 | 0.5 |
| **ESP** | -98 | 0.8 | 2.9 | -5.3 | 1.7 | -2.8 | 0.3 | 1.3 |

* The structural trade balance target is the structural trade balance that is compatible with NIIP stability at its 2013 level. We assume that the gap between the current account and the trade balance (revenues and current transfers) is constant. We assume r = 1%.

*Sources*: *OECD Economic Outlook 95*, *IMF WEO* October 2014, *Oxford Economics, IMF International Financial Statistics, Eurostat*, iAGS calculations

STB targets are generally positive. This is due to three points. First a positive and stable NIIP needs a positive STB insofar as the gap between the potential growth rate and the real interest rate is positive. Second, a higher real interest rate than the potential growth rate implies NIIP and STB with reverse signs, which is the case for Italy here. Third, the gap between the current account and the trade balance (revenues and current transfers in % of GDP) is assumed to be constant in the long run and has then to be compensated by a higher or lower STB. This last point is for instance very important for Ireland.

We now analyse more carefully the gap between the STB and its target in Table 2. Results show that situations differ from one country to another. Some countries need to strongly increase their STB to achieve the target. This is the case when the last column of Table 2 reports a positive TB gap. It concerns first and foremost Greece: a strong improvement in Greek competitiveness is needed to improve its trade balance in the long run and stabilise the NIIP. Finland, France, Belgium, Italy, Portugal and Spain are concerned to a lesser extent. Conversely, Germany and the Netherlands, which already have the highest NIIP, should reduce their STB, since the current ones imply ever increasing NIIP.

**Table 2. Structural trade balance adjustment since 2008**

% of GDP

| | Structural trade balance | | Structural trade balance target | Variation 2008-2013 | Trade balance gap |
|---|---|---|---|---|---|
| | 2008 | 2013 | | | |
| | (9) | (7) | (8) | (10) = (7) – (9) | (11) = (8) – (7) |
| AUT | 6.1 | 2.8 | 1.0 | -3.3 | -1.8 |
| BEL | -1.6 | 0.7 | 2.2 | 2.3 | 1.6 |
| FIN | 5.8 | -0.8 | 1.5 | -6.6 | 2.3 |
| FRA | -4.3 | -1.7 | 0.0 | 2.6 | 1.6 |
| DEU | 7.0 | 8.3 | -1.2 | 1.3 | -9.5 |
| GRC | -2.6 | -11.4 | -1.5 | -8.8 | 9.8 |
| IRL | -7.3 | 17.0 | 15.6 | 24.3 | -1.4 |
| ITA | 10.5 | -0.8 | 1.6 | -11.3 | 2.4 |
| NLD | -1.3 | 8.5 | 0.1 | 9.8 | -8.5 |
| PRT | 10.1 | -2.6 | 0.5 | -12.7 | 3.1 |
| ESP | -11.6 | 0.3 | 1.3 | 11.9 | 1.0 |

*Sources*: *OECD Economic Outlook 95*, *IMF WEO* October 2014, *Oxford Economics*, *IMF International Financial Statistics*, *Eurostat*, iAGS calculations.

To a certain extent, these results come from the countries' responses to the crisis. Column 10 in Table 2 shows the evolution of STB between 2008 and 2013. This provides a way to gauge the effort made by EA countries to reduce external disequilibria since the start of the crisis. Four country groups emerge. The first one consists of Spain, France, Belgium and Austria who have made a part of the adjustment. These countries have completed about 60% of the required adjustment (90% for Spain). The second one refers to countries (Portugal, Finland and Italy) that were in excess STB before the crisis and the hit from the crisis has resulted in a decreasing NIIP, i.e. a too low STB. The crisis has brought these countries in the red zone. The third group includes Ireland and the Netherlands, who have increased

their STB too much and have overshot the target. Finally, during the crisis Germany and Greece increased imbalances, but in opposite fashions. These two countries are symmetrical in a sense: rapidly increasing NIIP for Germany and rapidly decreasing NIIP for Greece, in structural terms.

These results emphasize that the massive external trade surplus in Germany is a concern for the EA, since without a German adjustment other countries cannot adjust as well. First, a large NIIP for Germany can imply large negative NIIP for the rest of the EA if the euro exchange rate is in a way sensitive to EA wide NIIP. Second, increasing NIIP dynamics, even larger when STB is higher than current TB, thus indicates a strong increase in NIIP is to be expected unless price adjustment is done.

The strong compression of internal demand in Greece has had no significant effect on the competitiveness of the country until now. More generally, overshooting and increasing imbalances of seven countries out of eleven stresses that macroeconomic policies conducted during the crisis have not been well-designed to correct external imbalances among EA countries in the sense that they do not favour stabilising NIIPs.

### Box 1. Computing structural trade balances

Structural trade balances can be computed by correcting trade balances from the differentiated effects of business cycle among countries. The intuition is to estimate trade balances with closed output gaps, while neglecting the effect of relative prices adjustments, that is to say that we assume constant market shares in the long run (this assumption is relaxed in the second part of the chapter).

Assume that the volume of exports $x_i$ of country $i$ depends on the total foreign demand $d_i^{EX}$:

$$x_i = d_i^{EX}$$

Similarly, the volume of imports $m_i$ of country $i$ depends on the domestic output $y_i$:

$$m_i = y_i$$

The long run volume of imports is equal to the potential domestic output $\overline{m_i} = \overline{y_i}$. It follows that $\overline{m_i} = m_i - (y_i - \overline{y_i})$.

As bilateral trade imposes $m_{ij} = x_{ji}$ we deduce:

$$d_i^{EX} = \sum_j wx_i^j m_j = \sum_j wx_i^j y_j \quad \text{and} \quad \overline{d_i^{EX}} = \sum_j wx_i^j \overline{y_j}$$

where $wx_i^j$ is the share of country $j$ in the exports of country $i$.

The structural trade balance is then $STB = \overline{x_i} - \overline{m_i} = x_i - m_i +$

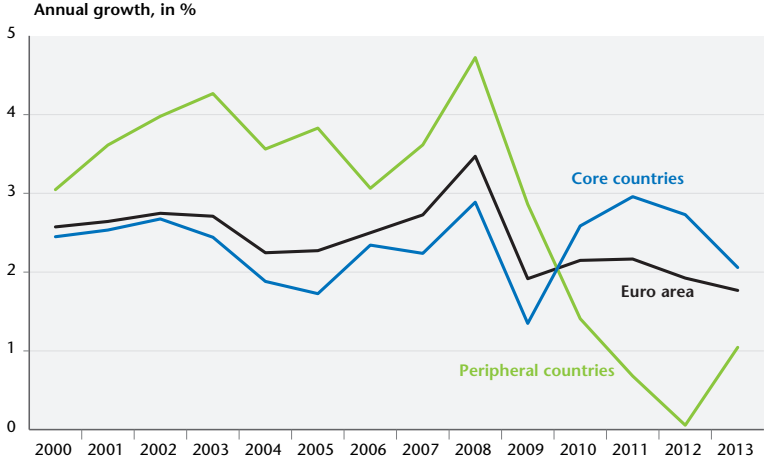
$$\underbrace{(y_i - \overline{y_i})}_{\text{output gap of country } i} - \underbrace{\sum_j wx_i^j (y_j - \overline{y_j})}_{\substack{\text{weighted output gap} \\ \text{of trade partners}}}$$

## Correcting external imbalances since 2008

As shown in Table 2, some countries with a high STB in 2008, like Austria and Finland, have decreased their surplus since the beginning of the crisis and countries with high deficits have reduced them (Ireland and Spain). Intra-EMU trade figures also attest for decreasing imbalances (see Box 2). This tendency to the rebalancing of current account imbalances has been supported by labour cost developments, and for some authors, among them Buti and Turrini (2012)[2], wage adjustments have been one of the main drivers of the correction of external imbalances.

Before the inception of the crisis (2000-2007), nominal compensation per employee grew faster in peripheral countries of the Eurozone (+3.6% annual mean growth, Figure 2) than in core countries (+2.3%), generating a divergence of competitiveness among Member States. This tendency has been reversed since 2010. Between 2010 and 2013, nominal compensation per employee has slowed down very significantly in peripheral countries (+0.8%) while it has accelerated, modestly, in core countries (+2.6%).

**Figure 2. Evolution of nominal compensation per employee (total economy)**




*Note:* peripheral countries group includes Spain, Italy, Portugal, Ireland and Greece. Core countries group includes France, Germany, Belgium, Netherlands, Austria and Finland. Within a group, national evolutions are weighted according to their respective nominal GDP.
*Sources:* Ameco, iAGS calculations.

As can be seen from Figure 3 and Table 3, the evolution of nominal wages is heterogeneous among countries. The magnitude of wage moderation has been closely linked with the extent of the slack in the labour market, as measured by the increase in the unemployment rate. For example, in Greece, where the adjustment of employment was extreme, nominal wages have decreased at an annual

2. See Buti and Turrini (2012).

rate of 3.5% since 2010. Wage moderation was also pronounced in Ireland, Spain and Italy. Since the crisis, nominal wages have stagnated in Ireland, contrasting with their pre-crisis dynamism (+6.0% per year between 2000 and 2007), and a similar pattern is observable in Spain (+0.7% average yearly growth since 2010, contrasting with +3.7% before 2008). Wage growth has also moderated, but to a lesser extent, in countries preserved from sovereign crisis, as can be seen in France, Belgium, Austria and Finland. In a context of rising employment and falling unemployment, the acceleration of German wages (+2.5% of average yearly growth since 2010, compared to +1.0% between 2000 and 2007) constitutes a noteworthy exception among euro area states.

However, macroeconomic data may underestimate the magnitude of the process. The effects of the crisis were more severe among young and unskilled workers, whose wages tend to be lower than the average. According to several studies that use micro-data, composition effects have had a positive contribution to average wages since the start of the crisis[3], which is hidden in macro-data. This is true in both core countries and peripheral ones.

**Table 3. Nominal compensation per employee (total economy)**

In %

| | 2000-2007 | 2008-2009 | 2010-2013 |
|---|---|---|---|
| **Core countries** | **2.3** | **2.1** | **2.6** |
| **FRA** | 2.8 | 2.2 | 2.4 |
| **DEU** | 1.0 | 1.2 | 2.5 |
| **NLD** | 3.5 | 3.2 | 1.9 |
| **BEL** | 2.8 | 2.4 | 2.6 |
| **AUT** | 2.5 | 2.8 | 2.0 |
| **FIN** | 3.1 | 3.1 | 2.7 |
| **Peripheral countries** | **3.6** | **3.8** | **0.8** |
| **ESP** | 3.7 | 5.6 | 0.7 |
| **ITA** | 3.0 | 2.9 | 1.5 |
| **IRL** | 6.0 | 2.1 | 0.0 |
| **PRT** | 3.8 | 2.5 | 0.4 |
| **GRC** | 5.9 | 3.3 | -3.5 |
| **EA** | 2.6 | 2.7 | 2.0 |

*Sources*: Ameco, iAGS calculations.

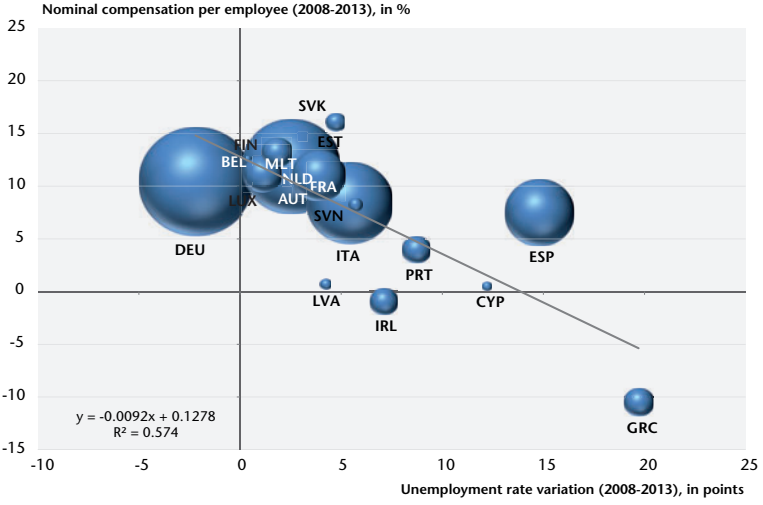
Focusing exclusively on nominal wages might be incomplete in order to assess the magnitude of the adjustment. In the presence of downward wage rigidities, firms may adjust their wage bill by cutting jobs. According to the "Wage Dynamics Network" survey made by ECB[4], this was precisely the main strategy

3. See for example, ECB (2012) which focuses on the start of the crisis. For the Spanish case see Puente et Galan (2014) and Verdugo (2013) for the French case.

4. For a summary of the results, see Lamo (2013). Firms that answered the survey come from 9 EU countries: Belgium, Czech Republic, Estonia, Spain, France, Italy, Netherlands, Austria and Poland.

used by firms. Two thirds of firms reacted to the demand shock associated with the start of the crisis by cutting costs[5] and among those firms, 66% did it by reducing labour costs despite the inability to cut wages[6]. Hence, 24% of firms reduced the number of temporary employees, 17% permanent employees and 14% decreased the number of hours worked.

**Figure 3. Evolution of unemployment rate and nominal compensation per employee**




*Sources:* iAGS calculations on Ameco data.

Unit labour costs (ULC) measure the labour cost per unit of added value, which is a better indicator of labour cost adjustment as it takes into account simultaneously the dynamics of nominal compensation per employee and the one of employment through its accounting impact on productivity.

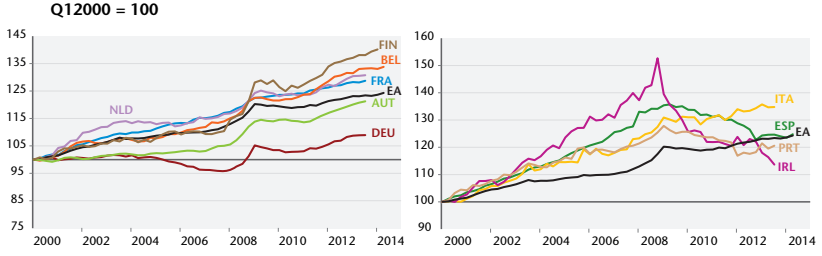
Between 2000 and 2007, important divergences contributed to the emergence of external imbalances. Euro area ULC increased by 12 points during this period—rather less than the increase in consumer prices—but this figure masks heterogeneity across Member States. Before the crisis, ULC increased significantly in peripheral countries as Ireland (+40 points), Spain (+28), Italy (+23) or Portugal (+20). The evolution was close to the euro area mean in France (+17), Belgium (+14) and the Netherlands (+17). Finally, ULC growth was moderate in surplus countries like Austria (+5) and even decreased in Germany (-4).

As discussed in the 2014 iAGS Report, since the start of the crisis ULCs have adjusted but very asymmetrically. The trends identified in last year's report continue. The crisis countries (except Italy) have all by now (Figure 4 includes the

5. This share reached 78% if the shock was judged to be strong and to 94% if it was coupled with credit constraints.
6. Only 1% of firms declare a decrease of base wages and 10% of firms a cut on flexible wages.

first two quarters of 2014 for most countries) adjusted so as to return to the trajectory of average ULC growth in the currency union (+24 points between 2000 and Q2 2014). Nevertheless, a positive gap persists in Italy (+34 over the same period), Belgium (+33) and France (+29). Although German ULC started to increase after the crisis, it has only increased by 9% since Q1 2000, which remains 15 points below the average of the Eurozone. In interpreting these figures it is important to recognise that the EA average ULC increase has lagged behind the benchmark given by the target inflation rate of the ECB.[7] A ULC increase in line with this target (1.9% a year) would amount to over 30% between 2000 and 2014.

**Figure 4. Unit labour costs (total economy)**



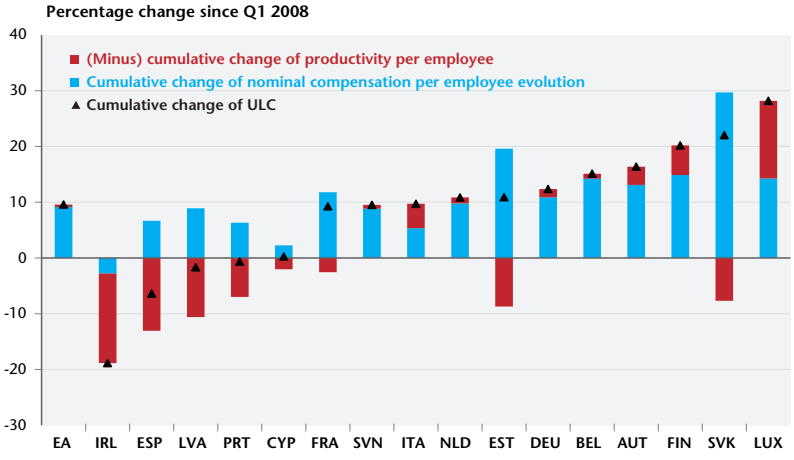

*Sources:* iAGS calculations on Eurostat data.

As it can be seen in Figure 5, all of the crisis countries except Italy actually achieved negative ULC growth between 2008 and 2012. For some countries the cut in ULC is very significant as in Ireland (-19%) or Spain (-6%). While the period following the crisis is characterized by nominal compensation moderation, most of the decrease of ULC in deficit countries can be explained by the surge of labour productivity (Figure 5): employment adjustment was higher than the output drop which translates into an observed rise of productivity that, for given labour costs, results in the increase of firms' profitability.

On the other hand, Germany has experienced a ULC growth since the crisis (+12%), that contrasts with the decrease observed before. Since 2008, its ULC growth rates have been broadly in line with the EMU average (+10%): in other words, while it is no longer opening up a competitiveness gap vis-à-vis the other EMU countries, neither is it closing the accumulated gap that had built up in previous years. Nominal compensation accelerated in Germany in 2012, but this momentum was not maintained, the rate weakening in 2013 and improving only slightly in 2014 (Herzog-Stein and *al.*, 2014). Meanwhile labour productivity still grows faster than the euro area average. Austria, by contrast, has been steadily closing the gap with the EMU average from below, offering an example of successful symmetrical adjustment.

7. See e.g. Watt (2007).

**Figure 5. Determinants of Unit labour costs evolution (total economy)**




*Sources:* iAGS calculations on Eurostat data.

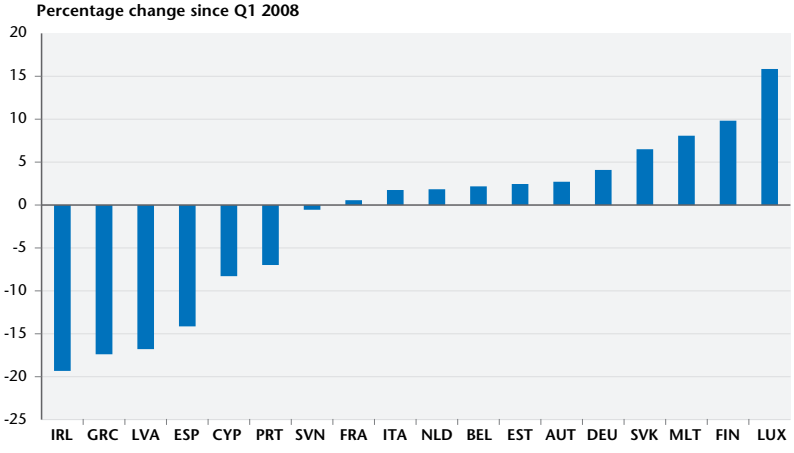
If the evolution of ULC seems to support the rebalancing of current accounts in the euro area (with the notable exceptions of Italy and Germany), the analysis of cost-competitiveness needs to compare the relative labour cost adjustment with respect to the evolution of the labour cost of competitors. The simultaneity of the adjustment reduces the amplitude of relative cost adjustments in many countries. Even in Ireland (which reduced ULC by -31%), the relative ULC (Figure 6) gains with respect to competitors based in the rest of the euro area are lower, although they remain significant (-20%). A similar effect is observable in some countries of Eastern Europe (like Slovenia) where labour costs reductions offset each other.

Among big countries only Spain has improved its cost-competiveness significantly. This is explained not only by the decrease of domestic ULC (by 6 points since 2008), but also because its principal partners, most of them in core countries, have increased, even if moderately, their own labour costs (Figure 7). At the end the Spanish relative ULC decreased by 14 points. On the other side, French and Italian competitiveness have not deteriorated significantly since 2008 in spite of the fact that their nominal ULC have remained relatively dynamic, thanks to the persistence of wage dynamics in other core countries, like Germany after 2009.

While recent labour market developments seem to support the correction of imbalances, their impact should not be overstated. EA countries have made a lot of efforts to compress ULC since 2008. But these efforts do not spread automatically into export prices as firms may restore margins instead of decreasing prices, particularly in a context where firms have restricted access to bank loans and suffer from damaged balance sheet after the hit of the crisis. Significant divergences can arise between relative export prices and labour costs. Since 2008, in spite of an impressive reduction in relative labour costs, export prices of goods and services have risen in Ireland (+3.9%) and Greece (+6.3%) and remained unchanged in Spain (Figure 8). Otherwise, the relative export price has decreased

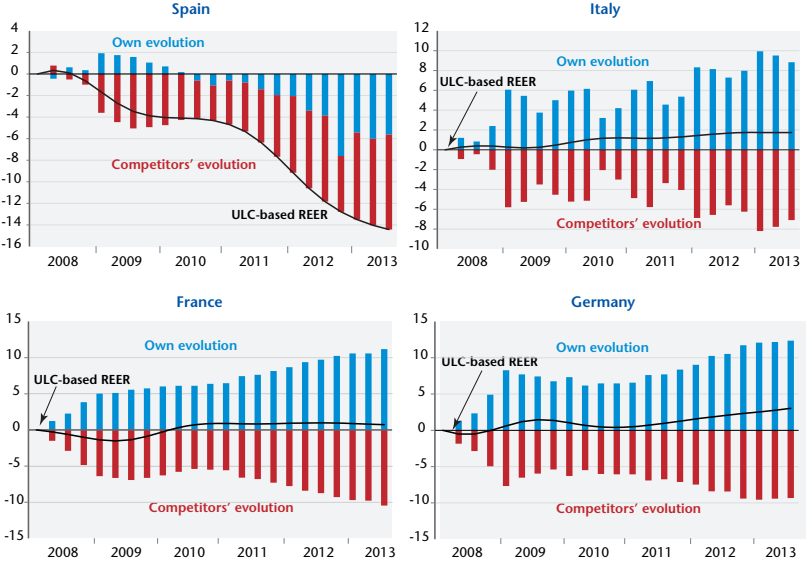
in Finland (-4.9%) while it was the country with the highest relative ULC growth (Herzog-Stein and *al.*, 2014).

**Figure 6. Relative ULC (country ULC / competitors average ULC) within EMU**




*Note:* the competitors average ULC corresponds to the geometric mean of the reference competitors (here Eurozone countries) weighted by a double weighting scheme that takes into account the bilateral intensity of competition in each market.
*Sources:* iAGS calculations on DG Ecfin data.

**Figure 7. Evolution of relative ULC**




*Sources:* iAGS calculations on Eurostat and European Commission data.

Once one restricts the comparison to the export price of goods and the competitor group is extended to euro area countries, the relative export price decreases in most euro area countries, pointing to the role of exchange rates in the assessment of price-competitiveness. Only Belgium (-5.1%) and Greece (-6.0%) have lost price-competitiveness with respect to this broader group.

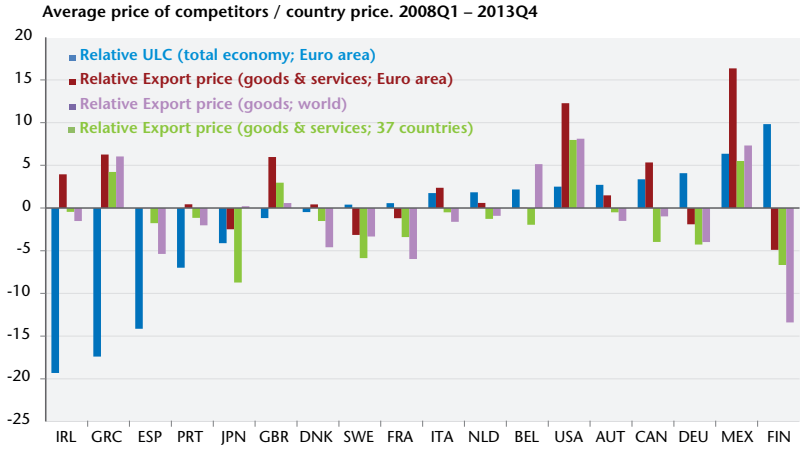
It is important to signal that the gap between labour cost developments and export prices may reflect some statistical bias: while ULC are computed for all firms in the economy, which have adjusted severely in many countries, export prices are, by definition, set by the group of exporters. It is now well known that the bulk of foreign sales are concentrated among relatively few exporters. Those firms, which have been called "the happy few"[8], tend to be more productive, produce higher quality products, are more profitable and have a better financial situation. The crisis hit particularly small firms of which many had to close, while the "happy few" have better resisted to the shock. This selection mechanism favours big firms with advantages in terms of quality and reputation that are able to set higher prices. On the other hand, small firms shut down and stop exporting. Hence, the average export price may rise while the firm-level export price may decrease in line with costs developments.

The gap between ULC and export prices may also suggest that firms are "pricing to market": irrespective of changes in their labour costs of production they sell goods on foreign markets in line with price trends on those precise markets. The adjustment variable is the firm margin and profitability, suggesting that exporters may be restoring margins that had been squeezed in the pre-crisis period. Even so, the gap between ULC and export price developments suggest that export growth could have been stronger if price rises had been restrained.

While labour market dynamics might contribute to the correction of imbalances in euro area, the social and economic costs of this strategy seem too high. The ULC decrease in crisis countries is explained mostly by the rise of productivity which is linked to a massive surge of the unemployment rate (See chapter 1). By September 2014, unemployment had increased by more than 7 million people since the start of the crisis. Unemployment has decreased at a moderate pace lately, but the scars of the "Great Recession" will last. First, the impact of the unemployment gap on wage negotiations will last, as a Phillips curve analysis suggests. Second, this kind of adjustment transfers revenues from workers—and, among them, the most vulnerable with higher propensity to consume—to firms. In a context of low investment, this transfer will weigh on aggregate demand. Third, the ULC reductions have not been sufficiently offset by higher ULC and price inflation in Germany. Together, these developments increase deflation risks, notably in peripheral countries, in a period where private and public actors are seeking to repair their balance sheets. The wage deflationary pressures will then continue and may even strengthen if expectations re-anchor to a deflationary equilibrium.

8. See Mayer and Ottaviano (2007).

### Figure 8. Variation of the relative export price of merchandises




*Note:* Relative ULC (export-price) is computed as the ratio between ULC (export-price) in the country over the average ULC (export-price) of its competitors (weighted by a double weighting that measures the intensity of competition in world markets).
*Sources*: iAGS calculations based on DG Ecfin data.

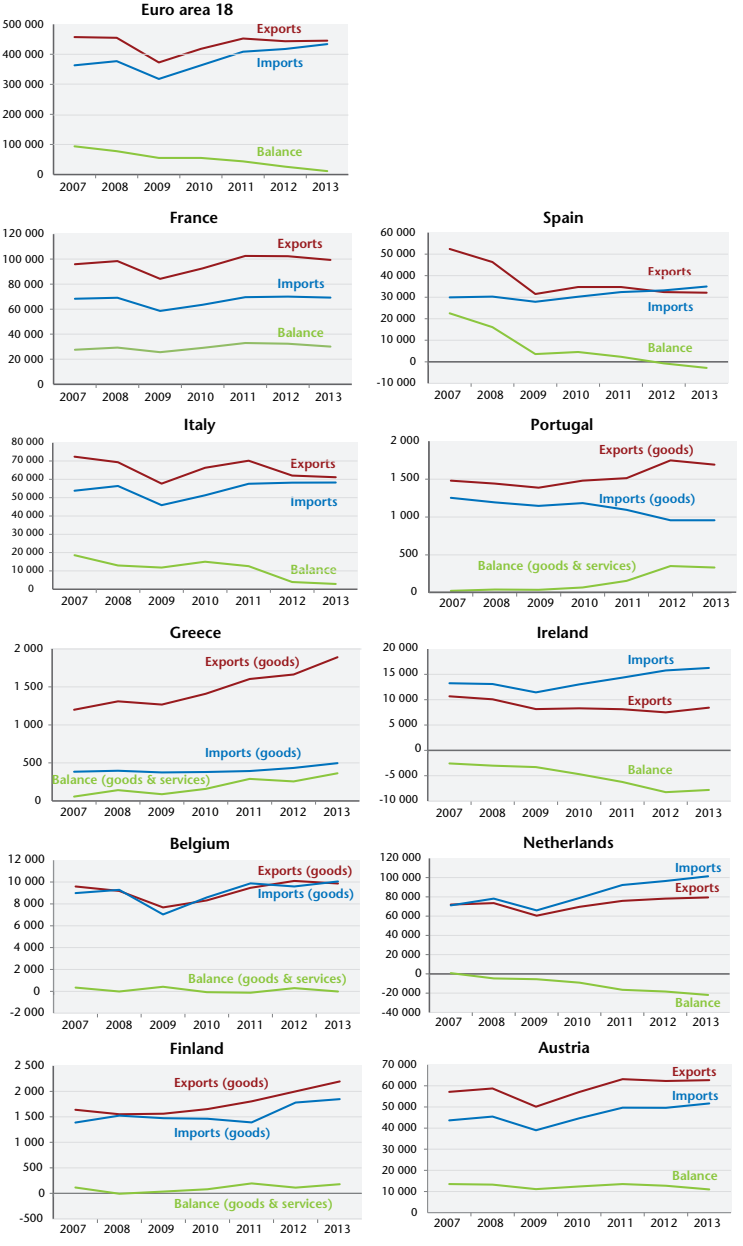
### Box 2. Adjustments of euro area countries regarding Germany

Another way to assess the correction of imbalances is to look at bilateral trade between EA countries (Figure 9). So we consider Bundesbank data for the bilateral trade and payments relations between Germany–the largest economy and by far the most important surplus country in the currency area–and ten other EA countries including the biggest ones (France, Italy, Spain) and crisis countries (Ireland, Greece, Portugal). The figures are reported from the German position, so that the line representing "Exports" to, for instance, Spain represents Spanish imports of goods and services from Germany. Overall, the German trade surplus vis-à-vis other EA countries vanished in 2013. Germany has maintained a current account surplus throughout the period since the crisis with all the other countries except Ireland and Netherlands. But the current account surpluses have fallen substantially, and Germany is now in deficit with Spain in 2013.

If we consider the developments of exports and imports separately, a similar pattern emerges as evidenced for post-crisis trade relations more generally. Initially the trade deficits were closed primarily by import compression. More recently, though, exports from the crisis countries to Germany have picked up somewhat. As a combined result of these two trends, the German trade surpluses are now very limited in most cases (except for France). The fact that the current account deficit remains considerably wider is due to the other components of the current account (factor income and transfers) which have tended to remain rather stable in the years since the crisis broke. This means that, despite the improvement in bilateral trade balances with Germany, the crisis countries still have to fund current account deficits, which implies further increasing their net foreign liabilities vis-a-vis Germany.

## Figure 9. Bilateral trade (Goods and services) of EA countries with Germany

Millions of euros




*Sources:* Bundesbank, iAGS calculations.

Greater import absorption by Germany on the back of expansionary policies and measures to increase wage and price growth would have reduced the costs of adjustment and the crisis countries would already certainly be running trade surpluses and probably also current account surpluses against Germany, enabling them to pay down foreign debt. It is not too late to rectify this costly error. A corollary of shrinking bilateral current account surpluses with the EMU crisis countries is that the continued German current account surpluses of between 6 and 7% of GDP are due to growing net exports in trade with non-EMU countries, for instance the US and the BRICS.

## 2. Correcting external imbalances in the euro area

In order to perform a more systematic and globally consistent analysis of imbalances in the EA, we construct a small trade model that computes the required price adjustment of every EA country. Those price adjustments are by construction compatible with both an internal rebalancing–closing the output gap–and an external rebalancing–stabilizing the net international investment position (NIIP) at a sustainable level.

The core of the model consists of equations linking import and export volumes to output variations and to competitors' prices.[9] Imports react positively to domestic activity and to domestic prices, and negatively to competitors' prices. Exports react positively to foreign activity levels and to competitors' prices, and negatively to domestic export prices. The model also incorporates equations for export and import prices in order to reflect the pricing strategies (in the space between local currency pricing on one extreme and producer currency pricing on the other extreme). A detailed description of the model and its calibration are given in the technical appendix.

The main contribution of this modeling exercise relative to previous studies is that a global equilibrium is computed at the EA level. Instead of computing partial equilibrium price adjustments, *i.e.* those needed in one country without taking into account the effect of domestic price changes on the equilibrium of other countries, our methodology computes price adjustments that are compatible with internal and external adjustment of all EA countries *simultaneously*. Said otherwise, we compute the equilibrium that should be reached if all EA countries were acting cooperatively. The rest of the world is assumed to adjust its demand for imports according to its activity level and to the EA export prices, but to keep its own prices unchanged.

Defining the target of the external adjustment of EA countries is the critical task.[10] Even though it is clear that an ever increasing external position is unsustainable over the long run, and that stabilizing the NIIP is therefore a necessary condition, the level at which that position becomes unsustainable is not clearly quantified in the literature and may depend on a wide range of parameters. In our baseline scenario, we somewhat arbitrarily assume that NIIPs are sustainable over

9. See the technical appendix for more details.
10. On the other hand, the target of the internal adjustment is naturally defined as closing the output gap.

the long run provided they are within the ±50% range of GDP (the sensitivity to that parameter is studied in alternative scenarios further below). Therefore, for those countries whose NIIP is already within ±50%, the target of their external adjustment is simply to stabilize their NIIP at its current level. For those countries whose NIIP is below -50% (resp. above +50%), their target is to stabilize their NIIP at -50% (resp. +50%) at a 20-year horizon.

Table 4 summarizes the baseline scenario. The first column presents the NIIP targets. Greece, Ireland, Portugal and Spain are expected to improve their NIIP and reach the -50% level, while other countries are simply expected to stabilize their NIIP at its current level. The last two columns present the results in terms of real effective exchange rate (REER) adjustments and in terms of value added (VA) price adjustments. Note that VA price adjustments and REER adjustments differ precisely because all the countries are supposed to change their VA prices simultaneously: the REER incorporates changes in domestic prices but also changes in prices of multiple trade partners. All the adjustments are computed using the data available at the end of 2013, and therefore represent what remains to be done as of the beginning of 2014. In the baseline, export prices of countries outside the EA are supposed to remain constant in Euro terms. The computed adjustments are such that, if implemented immediately, all the countries would reach their NIIP targets in 20 years from now. The prescribed adjustments cannot be achieved instantly but will be gradually implemented, so our results in terms of VA prices should rather be understood as cumulative inflation differentials.[11] For example, according to Table 4, Germany should increase its prices by 26.1% while Greece should decrease them by 6.9%, corresponding to a cumulative inflation differential of 33%, so the adjustment could be achieved in 20 years with an annual inflation differential of 1.65% between Germany and Greece.[12]

We now discuss the results in terms of REER adjustments. Unsurprisingly, Germany and the Netherlands need a substantial real appreciation. Greece, on the other hand, still needs to depreciate by almost 14% despite having already reached a balanced current account because its recent current account improvement has a strong cyclical component, related to the compression of its internal demand. The other crisis countries (Ireland, Italy, Spain, Portugal) have already mostly completed their adjustment. Looking at the results in terms of VA prices, the model predicts moderate negative price adjustments for only three countries: Belgium, Finland and Greece, and substantial positive price adjustments in Austria, Germany and the Netherlands. Given that these figures should be understood as deviations relatively to a global inflation trend, our results indicate that deflation is no more needed–even in crisis countries–in order to

11. More precisely, price adjustments should be understood as cumulative inflation differentials relatively to the average inflation rate in the EA. When we say in Table 4 that Germany should increase its prices by 26.1%, we mean that the adjustment will be over when the cumulative inflation differential between Germany and the EA average reaches 26.1%. In the baseline, we also suppose that prices of countries outside the EA (expressed in Euro terms) increase at the same rate as the average EA inflation (*i.e.* we suppose that the relative purchasing power parity holds). This assumption will be relaxed when we examine changes in the Euro exchange rate.

12. If price adjustments are not done immediately but are gradually implemented over time, then the NIIP will not reach its target in 20 years, but later. How much later depends on the speed and profile of the adjustment. We abstract from these short term dynamics and maintain the focus on long term equilibria.

achieve the adjustment; only inflation lower than the EA average is required. Most of the adjustment should now go through inflation rates above the average in surplus countries.

**Table 4. Baseline scenario**

In %

| | NIIP target (% GDP) | REER adjustment | VA price adjustment |
|---|---|---|---|
| **AUT** | 0.5 | +14.9 | +26.6 |
| **BEL** | 45.8 | -16.1 | -6.0 |
| **FIN** | 15.8 | -14.3 | -8.6 |
| **FRA** | -17.0 | -4.5 | +2.7 |
| **DEU** | 48.4 | +21.8 | +26.1 |
| **GRC** | -50.0 | -13.7 | -6.9 |
| **IRL** | -50.0 | +5.6 | +9.6 |
| **ITA** | -29.5 | +5.8 | +12.3 |
| **NLD** | 46.3 | +19.5 | +25.0 |
| **PRT** | -50.0 | -3.2 | +5.4 |
| **ESP** | -50.0 | +2.9 | +9.7 |

If Greece is to reach a NIIP of -50% of GDP in 20 years from now, it must achieve a real depreciation of 13.7%. This can be obtained by decreasing its VA prices by 6.9% (assuming that the other EA countries also adjust their VA prices by the prescribed amounts and that prices outside the EA are unchanged).

*Source*: iAGS calculations.

Since the model predicts price increases in most EA countries and since our baseline scenario assumes unchanged price levels outside the EA, the model predicts a loss of competitiveness of the EA as a whole and therefore a deterioration of its trade balance (of 2.8% of GDP, down to 0.8%). This result stems from the chosen NIIP country targets which sum up to an almost zero aggregate NIIP for the whole EA. As a consequence the model targets an almost balanced current account at the EA level, and therefore predicts a deterioration of the aggregate trade balance. Alternative scenarios with respect to the exterior position of the EA are analyzed further below.

We explored the sensitivity of our results to various hypotheses: the degree of internal rebalancing, the nominal depreciation of the Euro, the real interest rate, the adjustment horizon and the NIIP target range. The main conclusion is that the general picture given by the baseline results is robust, while other interesting features emerge.

First, if price adjustments are computed without assuming that output gaps are closed, then the results are broadly similar except for Greece, for the reasons mentioned above: instead of a real depreciation of 13.7%, the country would need an appreciation of 11.9% in the absence of internal rebalancing; the same applies to a lesser extent to Ireland, which would need an appreciation of 19.8% instead of 5.6% (because of its large output gap of -8.7%).

We also performed simulations in which the nominal effective exchange rate of the Euro is allowed to change (but export prices of countries outside the EA are still kept unchanged in foreign currency terms). The result is that REER adjustments are insensitive to changes in the nominal effective exchange rate of the

Euro. The intuition for this result is that long term equilibria in real variables are invariant to nominal variables (and we do not incorporate short term adjustment dynamics). However, adjustments expressed in terms of VA prices are affected by the nominal exchange rate, on a one-to-one basis. For example, under the hypothesis of nominal depreciation of the Euro of 10%, all internal prices must increase by 10% more than in the baseline scenario. In particular, this means that in the 10% depreciation scenario, no negative price adjustment is needed (even relative to the common inflation trend).

The results are not very sensitive to the value assumed for the real interest rate on foreign assets, which is 1% in the baseline.[13] Again, Greece is the exception with a required REER adjustment ranging from -22.3% (in case of a negative real interest rate of -1.5%) to -7.7% (for a real interest rate of 3%).

We also tested the sensitivity of our results to the horizon at which the NIIP is assumed to reach its target position. In the baseline, this horizon is set at 20 years, which means that the target NIIP will be reached in 20 years if the countries adjust immediately to the new internal prices and maintain that price level over the next 20 years. Shortening or extending the adjustment horizon significantly changes the adjustment required from those countries which are not already within the required NIIP range (±50%), *i.e.* Greece, Ireland, Spain and Portugal. The impact on other countries in terms of REER adjustment is small, but not zero, because of general equilibrium effects. Results for this exercise are reported in Table 5. The main point to be stressed is that, if we leave them 50 years or even more to adjust, then Greece and Portugal no longer need a real depreciation in order to reach equilibrium (as was already the case of Italy, Spain and Ireland in the 20 years baseline).

**Table 5. REER adjustments as a function of the adjustment horizon**

In %

| Horizon | 10 years | 20 years | 50 years | Infinite |
|---|---|---|---|---|
| **AUT** | +14.2 | +14.9 | +15.3 | +15.5 |
| **BEL** | -16.9 | -16.1 | -15.6 | -15.3 |
| **FIN** | -15.5 | -14.3 | -13.7 | -13.3 |
| **FRA** | -4.3 | -4.5 | -4.7 | -4.7 |
| **DEU** | +21.8 | +21.8 | +21.8 | +21.8 |
| **GRC** | -43.7 | -13.7 | +4.3 | +14.8 |
| **IRL** | -0.8 | +5.6 | +9.4 | +11.4 |
| **ITA** | +5.7 | +5.8 | +5.8 | +5.9 |
| **NLD** | +19.1 | +19.5 | +19.7 | +19.8 |
| **PRT** | -17.4 | -3.2 | +5.3 | +10.1 |
| **ESP** | -5.4 | +2.9 | +7.9 | +10.6 |

*Source*: iAGS calculations.

13. In our simulations it is necessary to make an assumption for the real interest rate on foreign assets in order to make the transition from trade balances to current accounts (and the latter is then used for computing the NIIP). See the technical appendix for more details.

Finally, we examine the influence of the target range for NIIP, which is ±50% in the benchmark. Table 6 shows the results. On one end if we impose a return to a zero NIIP for all countries, then the crisis countries–which currently have highly negative NIIP–must depreciate much more than in the baseline, while the adjustment required for other countries is mostly unchanged.[14] On the other end, if the upper limit on the absolute NIIP is lifted–and therefore if the only constraint is to stabilize the NIIP at its current level–then no crisis country needs to depreciate.[15] Simulations with the range ±25% give result close to those obtained with a lower bound of -35% as it is set in the six pack scoreboard.

**Table 6. REER adjustments as a function of the NIIP target range**

In %

| NIIP target range | 0% | ±25% | ±50% | ±100% | No range limit |
|---|---|---|---|---|---|
| **AUT** | +14.8 | +14.8 | +14.9 | +15.5 | +15.6 |
| **BEL** | -3.9 | -10.1 | -16.1 | -15.3 | -15.2 |
| **FIN** | -7.3 | -14.1 | -14.3 | -13.2 | -13.1 |
| **FRA** | -9.9 | -4.9 | -4.5 | -4.7 | -4.8 |
| **DEU** | +28.9 | +25.2 | +21.8 | +21.8 | +21.8 |
| **GRC** | -34.9 | -24.5 | -13.7 | +8.6 | +17.8 |
| **IRL** | -0.0 | +3.1 | +5.6 | +12.0 | +12.6 |
| **ITA** | -4.0 | +4.1 | +5.8 | +5.9 | +5.9 |
| **NLD** | +23.7 | +21.6 | +19.5 | +19.8 | +19.8 |
| **PRT** | -13.8 | -8.6 | -3.2 | +7.4 | +11.8 |
| **ESP** | -6.4 | -2.0 | +2.9 | +12.0 | +11.9 |

*Source*: iAGS calculations.

The last two sensitivity exercises have shown that, for the countries with a very negative NIIP (Greece, Ireland, Portugal, Spain), the adjustment could be made easier or even avoided if the constraints were relaxed (either in terms of adjustment horizon or of NIIP target). Another way of relaxing the constraints would be to introduce some external debt relief, which could be achieved through a public debt relief. Though we did not quantify this possibility, it is clear that it would translate into a smaller relative price adjustment for these countries.

So far we have presented the adjustments needed as of early 2014. But it is possible to apply the same methodology to past data and therefore to reconstruct the evolution over time of the internal disequilibria of the EA. We performed this exercise for all years between 1995 and 2013 (implicitly considering the Ecu as the single currency before 1999). Some clear historical patterns emerge from this exercise. Germany starts from an overvaluation of about 10% in 1995 and then

14. The depreciation required for Belgium and Finland is smaller in that case than in the baseline, because those countries currently have a positive NIIP and a trade balance deficit. Sustaining a zero NIIP requires less effort than sustaining a positive NIIP.

15. The results for this case are similar to the results with a very large time horizon to adjust. Having a lot of time to adjust means letting the NIIP drift very slowly, which in the medium term is almost the same as stabilizing the NIIP.

sharply reverses its position in the early 2000s to arrive at an undervaluation of 21% in 2007, which has mostly remained constant since. The Netherlands exhibit a fairly stable pattern of undervaluation oscillating between 10% and 20% during the whole sample. France starts from an equilibrium position in 1995, quickly becomes undervalued by 20% by 1999, then gradually loses its competitive advantage to arrive at a small overvaluation today. Portugal and Greece were overvalued during the whole sample, with a worsening of their situation during the financial crisis, followed by a marked improvement between 2011 and 2013. Spain qualitatively follows a similar pattern, but with a quantitatively smaller overvaluation.

In all the exercises above, the target of the adjustment has been defined in terms of stabilizing the NIIP at its current level, or as an effort to bring back the NIIP into a sustainable range if needed. But considering the adjustment under this angle has some drawbacks. For example, some countries (Belgium and Finland) today have current account deficits but a positive NIIP. Stabilizing their NIIP at its current level means turning their current account deficit into a surplus. But one could argue that shrinking the deficit down to a level compatible with a negative —but sustainable—NIIP would constitute an acceptable adjustment, which actually happens to be more sensible because less painful. This observation led us to consider another type of global EA readjustment in which the price adjustments are minimized, under the constraint that all NIIPs are stabilized in a sustainable range over a given horizon. More precisely, we computed the vector of price adjustments that minimizes the quadratic sum of price deviations weighted by country GDPs, under the constraint that all NIIPs converge in the range of ±50% of GDP within 20 years. Table 7 shows the results. The optimal NIIP targets are different from those of the baseline; in particular, only Greece will reach the lower bound of -50%, while three countries—Austria, Germany and the Netherlands—will reach the upper bound of +50%.

Turning to REER adjustments and VA price adjustments, one can see that the magnitude of bilateral readjustments is globally the same as in the baseline, but with a lower average price level (*i.e.* this scenario requires a lower average

**Table 7. Alternative scenario: Minimization of price deviations**

In %

| | Long-term NIIP(% GDP) | REER adjustment | VA price adjustment |
|---|---|---|---|
| **AUT** | 50.0 | +2.1 | +5.8 |
| **BEL** | 37.4 | -14.8 | -9.2 |
| **FIN** | -5.5 | -6.8 | -3.7 |
| **FRA** | -5.4 | -7.2 | -4.6 |
| **DEU** | 50.0 | +22.2 | +22.2 |
| **GRC** | -50.0 | -13.6 | -11.1 |
| **IRL** | 50.0 | -7.5 | -5.6 |
| **ITA** | 8.0 | -6.1 | -3.2 |
| **NLD** | 50.0 | +17.9 | +20.1 |
| **PRT** | -32.8 | -5.6 | -4.1 |
| **ESP** | 6.9 | -7.3 | -5.2 |

*Source*: iAGS calculations.

inflation in the EA). The baseline was biased towards inflation because it was based on a shrinking of the current account surplus of the EA, itself needed because the aggregate NIIP target of the EA was close to zero; in this alternative scenario where price deviations are minimized, the average price deviation is close to zero, and therefore the aggregate trade balance shrinks by less (it shrinks by 1.8% of GDP, down to 1.7%).

The last scenario that we examined is also based on a minimization of the price deviations, but under the additional constraint that the REER of the whole EA should remain unchanged. The results are reported in Table 8. The general picture is that this scenario calls for even less inflation on average, especially for France and Italy which are additionally asked a much larger devaluation relatively to Germany. The consequence is that the aggregate trade balance is shrunk by only 1.3% of GDP, down to 2.2%. Note that this scenario still predicts a degradation of the trade balance–even though the real exchange rate of the EA is kept constant–because the EA has a larger output gap than the rest of the world at the end of 2013 and will therefore import relatively more when output gaps are closed.

**Table 8. Alternative scenario: Minimization of price deviations, under stable aggregate REER**

In %

| | Long-term NIIP (% GDP) | REER adjustment | VA price adjustment |
|---|---|---|---|
| **AUT** | 50.0 | -2.8 | +3.0 |
| **BEL** | 3.6 | -7.2 | -4.7 |
| **FIN** | -15.5 | -3.4 | -1.5 |
| **FRA** | 34.9 | -18.9 | -17.3 |
| **DEU** | 50.0 | +21.9 | +20.1 |
| **GRC** | -50.0 | -13.5 | -13.1 |
| **IRL** | -10.2 | -1.8 | -0.9 |
| **ITA** | 25.8 | -12.1 | -11.2 |
| **NLD** | 50.0 | +16.6 | +17.8 |
| **PRT** | -50.0 | -1.3 | -2.8 |
| **ESP** | 10.6 | -7.3 | -8.5 |

*Source*: iAGS calculations.

Of course this exercise has its limitations. It is based on a crude model of the trade behaviours of EA countries, and it abstracts from many important issues: short and medium term dynamics, non-price competitiveness, sectoral disaggregation, valuation effects on the NIIP, feedback effects on the rest of the world. In particular, a Euro depreciation should further reduce the adjustment because of the expected positive valuation effects on the NIIP.[16] Further effort is therefore needed to obtain more precise estimates of the disequilibria within the EA. We nevertheless believe that our estimates provide a good starting point and are useful enough to draw some policy conclusions.

16. See for example Pupetto L. and Sode A. (2012).

The main conclusions can be summarized as follows. First, even though a substantial readjustment has been achieved since 2011, much still remains to be done. The price disequilibria between overvalued and undervalued countries within the EA could be as much as 35% under reasonable assumptions. Secondly, a rebalancing strategy should rely on maintaining inflation differentials within the EA over an extended period, with higher inflation in Germany and lower inflation in crisis countries; deflation is not required in the latter countries if the readjustment is implemented gradually. A coordinated wage policy, with substantial wage increases in Germany, would definitely be needed in order to achieve the rebalancing while limiting adjustment costs. Third, a nominal depreciation of the Euro would facilitate the rebalancing by making it compatible with a higher inflation rate even in crisis countries. Fourth, public debt relief in some countries–at least in the smaller crisis countries like Portugal, Greece and Ireland–would also ease the adjustment.

This year's iAGS report does not contain a detailed analysis of wage policy. We refer readers to last year's report, in which a coordinated setting of minimum wage increases in accordance with macroeconomic considerations in each country was shown to have a significant potential in achieving balanced adjustment of competitiveness within the euro area without imposing the high costs associated with deflationary policies.

More generally, the Macroeconomic Imbalances Procedure offers, in principle, an opportunity to reach a "grand bargain" centred around a golden wage rule.[17] This would increase the capacity of social partners and governments to deliver balanced wage outcomes that respect the need for growth and competitiveness while avoiding a dangerous race to the bottom. This requires, rather than the destruction of collective bargaining institutions, on the contrary, joint national and European initiatives to develop the institutional capacity for wage setting that takes macroeconomic outcomes as a firm basis for outcomes.

17. See Watt, A. (2012).

# Technical appendix

## The model

The first step is, for given NIIP targets, to compute the corresponding trade balance targets. Let $i$ denote the country index, $TB_i$ the trade balance to GDP ratio of country $i$, $CA_i$ the current account to GDP ratio, $NIIP_i$ the NIIP to GDP ratio, $r$ the real interest rate, $\pi$ the inflation rate. We compute the part of the current account $R_i$ (expressed as a ratio of GDP) that is not explained by trade or by interest payments on the external position:

$$R_i = CA_i - TB_i - (r + \pi)NIIP_i$$

That residual is non zero either because of transfers (remittances, debt cancellation…), errors and omissions, or because the assumed interest rate $r$ does not correspond to the effective average interest rate on the net external position.

Then, given potential growth $g_i$, the adjustment horizon $h$ and the NIIP target $\overline{NIIP_t}$, the target trade balance is defined by:

$$\overline{TB_t} = \frac{\overline{NIIP_t} - NIIP_i\left(\frac{1+r+\pi}{1+g_i+\pi}\right)^h}{\sum_{t=0}^{h-1}\left(\frac{1+r+\pi}{1+g_i+\pi}\right)^t} - \mathrm{R}_i$$

This target trade balance is such that, if the country were adjusting to this new value today, then the NIIP would reach the target NIIP in $h$ years, provided the hypotheses on growth, real interest rate and inflation are realized.

It is important to note that this calculation incorporates several other assumptions. First, the residual $R_i$ is assumed constant over time; as a side effect, if the value that we assumed for $r$ is wrong, then our interest payment computations are wrong only on the difference between the initial NIIP and its target. Second, we assume that changes in the NIIP are only due to current account surpluses or deficits and not to valuation effects: this seems like a reasonable approximation since there is no time pattern or trend in those valuation effects over time (see Pupetto and Sode, 2012, p. 30 for more details).

We now describe the trade model that is at the core of the computation. All the endogenous variables denoted by lower letters are log-deviations from a reference level (defined as the actual values at the end of 2013).

The volume of exports $x_i$ of country $i$ depends on the foreign demand $d_i^{EX}$ and on the difference between $p_i^{EX}$, the index of competitors' prices on export markets of country $i$, and $p_i^X$, the export prices of country $i$:

$$x_i = d_i^{EX} + \varepsilon_i^X(p_i^{EX} - p_i^X)$$

where $\varepsilon_i^X$ is the price-elasticity of exports. Note that the elasticity of exports with respect to the foreign demand is equal to one, which means that this is a specification in terms of market shares.

Similarly, the volume of imports $m_i$ of country $i$ depends on the domestic output $y_i$ and on the difference between domestic VA prices $p_i^{VA}$ and import prices $p_i^M$:

$$m_i = y_i + \varepsilon_i^M(p_i^{VA} - p_i^M)$$

where $\varepsilon_i^M$ is the price-elasticity of imports. Again, the elasticity with respect to demand is equal to one, which is necessary to ensure homogeneity.

The foreign demand $d_i^{EX}$ faced by country $i$ is a function of import volumes of trade partners and of the output of the rest of the world $y_{RoW}$ (the latter being a proxy for the imports of the rest of the world):

$$d_i^{EX} = \sum_j wx_i^j \, m_j + wx_i^{RoW} y_{RoW}$$

where $wx_i^j$ is the share of country $j$ in the exports of country $i$.

The price $p_i^X$ of exports of country $i$ depends on domestic VA prices and on competitors' prices on export markets:

$$p_i^X = (1 - \varepsilon_i^{PX}) p_i^{VA} + \varepsilon_i^{PX} \, p_i^{EX}$$

where $\varepsilon_i^{PX}$ is the price-elasticity to competitors' prices. On one extreme if $\varepsilon_i^{PX} = 1$ then the producers of country $i$ entirely adjust to competitor's prices, potentially at the expense of their margins. On the other extreme if $\varepsilon_i^{PX} = 0$ then the producers focus exclusively on their margins, potentially at the expense of their competitiveness.

Similarly the price $p_i^M$ of imports of country $i$ depends on domestic VA prices and on a price index $p_i^{EM}$ of exporters to country $i$:

$$p_i^M = (1 - \varepsilon_i^{PM}) p_i^{VA} + \varepsilon_i^{PM} \, p_i^{EM}$$

where $\varepsilon_i^{PM}$ is the price-elasticity to export prices. On one extreme if $\varepsilon_i^{PM} = 0$ then the exporters to country $i$ entirely adjust to domestic prices, potentially at the expense of their margins. On the other extreme if $\varepsilon_i^{PM} = 0$ then the exporters focus exclusively on their margins, potentially at the expense of their competitiveness.

The index of competitors' prices on export markets of country $i$ is defined by:

$$p_i^{EX} = \sum_j wc_i^j p_j^X + wc_i^{RoW} e$$

where $e$ is the nominal effective exchange rate of the Euro, and the weights $wc_i^j$ are computed by double weighting. Note that we make here the assumption that export prices (in foreign currency) of countries outside the Eurozone do not change, so $e$ can be understood as non-euro competitors' price expressed in euros.

The price index of exporters to country $i$ is defined by:

$$p_i^{EM} = \sum_j wm_i^j p_j^X + wm_i^{RoW} e$$

where $wm_i^j$ is the share of country $j$ in the imports of country $i$.

Given the changes in exports, imports, prices and output, one can infer the percentage point variation in the trade balance ratio, which is given by:

$$\Delta TB_i = X_i\left(p_i^X + x_i\right) - M_i\left(p_i^M + m_i\right) - TB_i\left(p_i^{VA} + y_i\right)$$

The solution of the model is defined as a set of vectors $x,m,p^{VA},p^X,p^M,p^{EX},p^{EM},d^{EX}$ satisfying the equations of the model, under the constraint that the trade balances reach their target (*i.e.* $\Delta TB_i = (\overline{TB}_i) - TB_i$ for all countries) and given the assumptions for the output changes and the exchange rate (in the baseline, the output gaps are supposed to close, so the output

changes $y$ are set to the opposite of the 2013 output gaps, and the exchange rate of the Euro is supposed to remain unchanged, so $e = 0$).

Finally, for a given solution of the model, one can compute the REER changes for every country:

$$reer_i = p_i^{VA} - \left( \sum_j \left( \frac{wm_i^j + wx_i^j}{2} \right) p_j^{VA} + \left( \frac{wm_i^{RoW} + wx_i^{RoW}}{2} \right) e \right)$$

Note that again this calculation assumes that prices of countries outside the euro area (expressed in foreign currencies) remain unchanged.

## Calibration

The data for the 2013 NIIP, TB and CA come from Eurostat. The 2013 output gaps come from the OECD database. The potential growth rates are the same as those used for the iAGS model. The bilateral import and export shares come from CEPII's CHELEM database.

The inflation rate $\pi$ is set at the ECB target of 2%. In the baseline, the real interest rate $r$ is 1% and the horizon $h$ is 20 years.

Finally, Table 9 shows the values assumed for the price-elasticities of export and import volumes and prices.I

**Table 9. Price-elasticities of export and import volumes and prices**

| Elasticities | $\varepsilon^X$ | $\varepsilon^M$ | $\varepsilon^{PX}$ | $\varepsilon^{PM}$ |
|---|---|---|---|---|
| **AUT** | 0.60 | 0.16 | 0.18 | 0.51 |
| **BEL** | 0.47 | 0.28 | 0.57 | 0.79 |
| **FIN** | 0.60 | 0.31 | 0.57 | 0.79 |
| **FRA** | 0.58 | 0.74 | 0.52 | 0.72 |
| **DEU** | 0.42 | 0.79 | 0.53 | 0.77 |
| **GRC** | 0.47 | 0.37 | 0.41 | 0.40 |
| **IRL** | 0.60 | 0.33 | 0.28 | 0.51 |
| **ITA** | 0.43 | 0.57 | 0.44 | 0.43 |
| **NLD** | 0.60 | 0.28 | 0.41 | 0.36 |
| **PRT** | 0.47 | 0.56 | 0.77 | 0.79 |
| **ESP** | 0.85 | 0.81 | 0.44 | 0.76 |

*Sources*: Ducoudré and Heyer (2014) for France, Germany, Italy and Spain. OECD (2005) for the other countries.