Full title: Dealing with the consequences of exchange rate misalignments for macroeconomic adjustments in the EMU.

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Abstract. The euro crisis sheds light on the nature of alternative adjustment mechanisms in the EMU. This paper examines the exchange rate misalignments within the euro zone, using a FEER approach. To explore the consequences of these misalignments, we use an open economy SFC model with endogenous interest rates and Eurobonds. Facing a competitiveness loss in southern countries due to misalignments, three sets of alternative economic policy are investigated: a policy-mix based on tax rebates to improve competitiveness; an increase in intra-European financing by banks of northern countries; and an issuance of Eurobonds to pool European sovereign debt.

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1. Introduction

"The second implication of the absence of fiscal transfers is that countries need to invest more in other mechanisms to share the cost of shocks. Even with more flexible economies, internal adjustment will always be slower than it would be if countries had their own exchange rate. Risk-sharing is thus essential to prevent recessions from leaving permanent scars and reinforcing economic divergence."
Mario Draghi (2015).

The euro crisis sheds light on the nature of alternative adjustment mechanisms in a heterogeneous monetary union. Adjustment mechanisms are defined in a broad sense as mechanisms that ensure a return to the initial situation or, possibly, to recover towards full employment after a slowdown. Very few efficient alternative mechanisms remain in the absence of exchange rate flexibility as underlined by the quotation of Mario Draghi. Budgetary policy could play a major role. In the United States, budgetary policy stabilizes 20 percent of shocks on the GDP (Italianer and Pisani-Ferry, 1992). Nevertheless, there is no equivalent in the European case.

Well-integrated capital markets, with portfolio diversification and intra-zone credit, have been proposed as a powerful adjustment mechanism by the "international risk sharing" approach. Intra-zone credit and capital income from international portfolio could almost absorb 40 to 60 percent of the shocks (Asdrubali and Kim, 2004). Proponents of liberal economic policies in the EU have used these results during the 2000s to promote a deeper financial integration instead of having to develop a federal budget (European Commission, 2007)[2].

This approach is still present in the last Action Plan of the European Commission (2015) on the Capital Market Union with the goal of creating one single market for shares, bonds and securitized bank loans. However, the theoretical basis, the empirical methodology and the results seem to be highly questionable (Clévenot and Duwicquet, 2011).

Consequently, relative wage and price flexibility are proposed in order to take the place, at least partially, of exchange rate adjustments. Actually, these mechanisms allow only a very slow and partial return to equilibrium with an important cost in terms of growth and employment and with large differences between countries, due to sizeable structural specificities. They are more inefficient when implemented simultaneously in interdependent countries, as it is the case in the EMU, especially in the Southern European countries. They are more efficient in a largely opened economy like Ireland than in rather closed ones like Greece or even Portugal (Mazier and Saglio, 2008).

At the level of the whole EMU, until the beginning of the 2010s, the current account was close to equilibrium and the fiscal deficit was smaller than in many other OECD countries. The euro was close to its equilibrium parity but intra-European imbalances were sizeable.

The euro experienced a strong overvaluation for Southern European countries, including France, and was largely undervalued for Northern European countries, especially for Germany (Jeong *et al.*, 2010). These overvaluations slow growth and induce fiscal and current deficits in the South while undervaluations boost growth in the North via exports, especially towards the rest of the EMU, and they reduce deficits. This situation is equivalent to implicit positive transfers in favor of the North and negative transfers at the detriment of the South[3].

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[2] Mario Draghi (2015) acknowledges the crucial role of budgetary policies and that this approach "the less public risk-sharing we want, the more private risk-sharing we need" could be insufficient in case of financial storms in the future. However, he concludes that Member States should achieve structural reforms to have sound public finances in order to be able to deal with periods of financial and economic turmoil.

[3] We can note that, quite interestingly, policy-making discussions largely ignore these issues.

In order to investigate these issues, Duwicquet et al. (2013) have used a two-country Stock-Flow Consistent (hereafter, SFC) model of a monetary union along the lines of Godley and Lavoie (2006, 2007a, 2007b), Lavoie (2003) and Duwicquet and Mazier (2010, 2011). The model described the real sector, assets, and liabilities of economic agents in order to analyze financial integration in a consistent manner. A federal budget has been introduced with federal expenditures and social transfers financed by federal taxes and Eurobonds issuance. The stabilizing role of such a federal budget has been confirmed facing asymmetric shocks or, equivalently, exchange rate misalignments within the monetary union. Similarly, we illustrate the stabilizing role of Eurobonds, used to finance European investment projects. Nevertheless, the model was limited to exogenous interest rates, which was only a preliminary step, as we have witnessed large movements of interest rates in Southern European countries since the onset of the euro crisis.

We organize the remainder of the paper in the following manner. In the first part, we discuss the structural heterogeneity of the EMU, and we give a new evaluation of these exchange rate misalignments within the EMU, using a Fundamental Equilibrium Exchange Rate (hereafter, FEER) approach. In the second part, we introduce an SFC model of a monetary union with endogenous interest rates. With this model, we examine to what extent these asymmetric evolutions due to intra-European misalignments can be adjusted. Interest rates on public bonds are now endogenous. Fiscal policy is partially endogenous and reacts to financial markets evolution with the implementation of budget cuts. An increase in intra-zone financing allows containing upward pressure on interest rates. We introduce Eurobonds and we use them in two ways, on the one hand, in order to mutualize a part of the European public debts and, on the other hand, to finance European investments in growing sectors. We also investigate a combination of tax rebates and budget cuts.

2. Structural divergence within the EMU

2.1. Structural heterogeneities

The euro resulted from a political compromise between France and Germany which paid little attention to economic realities. France wanted to avoid simply being integrated into an expanded mark zone. Germany agreed to the elimination of the mark in return for the acceptance of its reunification but imposed its own rules. The initial compromise of 1992 presupposed a limited EMU because it was thought that the restrictive Maastricht criteria for inflation and public finances would prevent the two main southern countries – Italy and Spain – from participating. But the adjustment efforts made by these countries in the first half of the 1990s so as not to be left outside allowed them to enter in the EMU although the criteria were far from being strictly satisfied, especially as regards the level of public debt in Italy.

In fact, a convergence of inflation rates and interest rates did take place. At the beginning of the 2000s the debt securities of Greece, Spain or Portugal appeared to be equivalent to German debt securities. This led to an investment boom, with capital flowing in from northern Europe, including massive speculation in Spanish and Irish real estate. Growth was slower in Germany, held back by wage adjustments under the Schröder reforms of the early 2000s. This apparent convergence disguised important imbalances. There was a wide divergence in unit wage costs with, in relative terms, big increases in Spain, Portugal, Ireland, Greece and Italy and falls in Austria, Finland and, above all, Germany (see figure 1). Current account imbalances widened enormously, with deficits in the South in contrast to surpluses in the North. But these current account imbalances were regarded as a secondary matter in the monetary union where the overall current account was close to balance. Rather, the key issue for governance in the EMU was seen as public finance. Here things seemed to be going well: European countries had reduced their public sector deficits; Germany returned to balance in 2007 while Spain, Portugal

and Ireland were regarded as models of budgetary rigor in complete conformity to the Maastricht norms.

On the eve of the financial crisis, these large imbalances due to heterogeneity appeared to be hidden. They were characterized by an undervalued euro for countries in the German bloc and an overvalued euro for the countries of southern Europe (including France) while for the EMU as a whole the euro was close to its equilibrium value, as it can be estimated with a FEER approach (see table 1)[4]. These misalignments of real exchange rates reflected the structural heterogeneity between northern and southern Europe. In several respects, we can mention that France is an intermediate position. The North of Europe is more specialized in manufacturing while the South of Europe is increasingly specialized in non-tradable goods. The size of industrial firms is clearly smaller in Greece, Portugal, Spain and Italy than in the rest of Europe. In general, small firms have lower productivity. Innovation efforts are significantly weaker in the South than in the North and the active population is clearly less qualified (OECD, 2010).

[Insert figure 1 about here]
[Insert table 1 about here]

The financial crisis of 2008 worked to reveal these disequilibria. Economic activity declined and the banks were shaken, especially in countries where a real estate bubble was bursting, such as Spain and Ireland. Current account deficits were reduced because of the fall in imports brought about by the recession. Public sector deficits widened in order to support economic activity and rescue the banks. The European Central Bank (hereafter, ECB) switched to an active monetary policy with a sharp decrease in the interest rate and huge interventions in the secondary market. Since exchange rate adjustments are no longer available within the EMU, the markets realized that the debts of peripheral countries were not equivalent to those of Germany. Interest rates exploded in the periphery, first in Ireland and Greece, then in the other peripheral countries, while they remained very low in Germany, but also in France, leading to financial turmoil (see figure 2). The measures adopted in a series of steps since 2010 in the face of this crisis have been partial responses to the threat of immediate breakdown. They have gained some time without providing a solution for the structural imbalances of the EMU.

[Insert figure 2 about here]

Real devaluations and austerity policies were the first set of measures. The value of price elasticities for intra-euro area trade is a highly debated question. The non-price competitiveness factors, related to the quality of the international specialization, and volume effects are important, as it has been shown in many papers (see, for example, Storm and Naastepad (2012); Storm (2017)). But the effects of the price competitiveness remain important. They must not be underestimated, although they are less important in Germany than in southern European countries[5]. Bayoumi *et al.* (2011) provide recent estimations of these intra-European trade elasticities. To some extent, macroeconomic adjustments based on relative prices can produce positive effects. Nevertheless, these gains can be preserved provided that countries managed to improve their non-price competitiveness, their trade structures and their international

[4] The FEER methodology is discussed in more details below.

[5] In the German case, it seems quite reasonable to think that larger undervaluations *and/or* depreciations could constitute an undeniable advantage for the export sector. Indeed, the impact of trade prices on trade balances could be stronger in the case of larger undervaluations *and/or* depreciations. However, we need to conduct additional empirical investigations to detect these nonlinearities in the relationship between trade balances and external trade prices. We leave this for future research.

specializations in the long run (Saadaoui, 2017). Besides, these types of adjustment are not equally effective across different countries. They are more effective in small countries with a big sector exposed to international competition, such as Ireland or the Baltic Republics. They are less effective in countries with a smaller share of foreign trade, even when they are small, as in Greece and Portugal (Cenedese and Stolper, 2012). Their effectiveness is even more limited when the same policy is implemented generally across a large number of interdependent countries, as it was the case in the EMU. Budgetary cuts made in an indiscriminate way amplified the decline in economic activity. This policy was imposed throughout the EU and especially in the countries of southern Europe. The results were not surprising: a decline in production and a rise in unemployment while the reduction in budgetary imbalances and deficits could only be partial, or indeed non-existent because of the collapse of production and tax receipts.

The surveillance of budgetary policies was reinforced in the framework of the reform of European governance with the *six-pack* in 2011, the Treaty on Stability, Coordination and Governance (hereafter, TSCG) in 2012 including the *fiscal compact* which imposes a path of rapid convergence and return to balanced budgets and reduced public debt in deficit countries, together with a program of so-called structural reforms. This is certainly the real motive behind the TSCG. Its economic justification is weak but, as has been shown in practice, it is an effective instrument to pressurize European governments to implement liberal policies and an excessive liberalization of labor, output and capital markets.

In France, the successive governments have been reluctant to implement cost adjustments and the euro remained overvalued for France. After the assessment of the competitiveness constraints faced by the French manufacturing sector, the policy followed since 2013 has been a tax rebate given to firms without any counterpart and any target (as it was given to all firms, exposed or not to international competition)[6]. The amount was initially already high (20 billion euros, around 1% of GDP) and has been doubled later on. The wage deflation has been avoided but the cost for the public finance was considerable and limited any action in the other fields. While trying to improve competitiveness and to preserve the employment at the same time, this policy has been a failure since improvements in competiveness are limited and unemployment remains high in spite of a prohibitive cost. *Ex ante* estimations (Plane, 2012) gave 150 000 jobs created in five years and an increase of 0.1% of GDP in 2018. According to *ex post* estimations (France Stratégie, 2016), around 50 000 to 100 000 jobs have been created or preserved in 2013-2014 with limited effects on export and investment dynamics.

At the monetary level, tensions increased in 2011 with the speculative attacks on Spanish and Italian government bonds and on the banks with large holdings of those bonds. The ECB did not initially find an appropriate answer and even increased its key interest rate in 2011 by fear of inflation. At the end of 2011, the ECB adopted measures to gain some time with the Very Long Term Refinancing Operation (VLTRO), the purchase of significant quantities of Spanish and Italian bonds and the decrease in the key interest rate, down to 0.75% in 2012 and 0% in 2016. A reversal only took place after the announcement of the ECB in September 2012 to intervene without restriction on public bonds secondary markets in case of necessity[7]. A final step was taken in January 2015 with the launch of the quantitative easing (QE). In spite of its ambition, the QE has had limited effects, mainly through the boom of the financial markets and the euro depreciation, with a reduced increase of credit.

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[6] We can notice that targeted subventions *and/or* tax rebates towards the tradable goods sector could be *de facto* forbidden by competition rules in the E.U.

[7] During the Global Investment Conference in London in July 2012, Mario Draghi pledged to do "whatever it takes" to save the euro and make it irreversible (Draghi, 2012).

Overall, results have been uneven amongst Member States. Real devaluation has been inefficient in Greece and, largely, in Portugal and the social costs have been important. Combined with restrictive fiscal policies, it has led to a deep recession that has limited the improvement of public finances. The public debt ratio has increased massively. In Ireland and, to a less extent, in Spain the real devaluation has been more operational thanks to the role played by the export sector. Germany has preserved its advantages built during the 2000s. In France, the wage deflation has been avoided but the competitiveness problem remained.

2.2. The FEER concept

John Williamson defines the FEER as the level of exchange rate consistent with indefinitely sustainable capital flows assuming that public intervention pursues internal balance (Williamson, 2006). Williamson coined this term as the antonym of the "fundamental disequilibrium" of the Bretton Woods era. During this period, a "fundamental disequilibrium" (for example, an excessive current account deficit *and/or* a massive unemployment) implied a change in the exchange rate parities (which were fixed at that time). Moreover, in the context of an international monetary cooperation, governments and central banks can use this concept to establish target zones for exchange rates as it was the case for the Plaza Accord and the Louvre Accord during the 1980s.

Driver and Westaway (2005) define the FEER methodology as a method of calculation aimed at computing the level of exchange rate consistent with sustainable capital flows (i.e. the external balance) and an internal demand that would ensure non-inflationary potential. In order to give a brief description of the FEER methodology, we can use a simple current account model as in Clark and MacDonald (1998):

$$CA = -KA \qquad [2.1]$$

$$CA = ntb + nfar \qquad [2.2]$$

$$ntb = b_0 + b_1 q^{reer} + b_2 ydpot + b_3 yfpot \qquad [2.3]$$

$$nfar = f\left(q^{reer}\right) \qquad [2.4]$$

Where *CA* is the current account; *KA* is the capital account; *ntb* is the net trade balance; *nfar* represents returns of net foreign assets; q^{reer} is the real effective exchange rate (when q^{reer} increases, we have a real effective depreciation); *ydpot* is the domestic full employment and *yfpot* stands for full employment output of foreign economies. A real effective depreciation and an increase of full employment output of foreign economies improve the trade balance ($b_1 > 0$; $b_3 > 0$), an increase of domestic full employment output deteriorates the net trade balance ($b_2 < 0$). Combining equations [2.1] to [2.4] gives:

$$CA^* = f\left(q^{reer}, ydpot, yfpot\right) = -KA^* \qquad [2.5]$$

Where CA^* is the sustainable current account in the medium run. In order to determine the FEER, we solve the following equation:

$$q^{feer} = f\left(CA^*, ydpot, yfpot\right) \qquad [2.6]$$

Where q^{feer} is the Fundamental Equilibrium Exchange Rate. In addition, interested readers can find a complete description of the model and the methodology used in Saadaoui (2015, 2017)[8].

As pointed out by Officer (2012), the Purchasing Parity Power (PPP) approach is indeed a monetarist approach as changes in relative prices (a nominal variable) affect the nominal exchange rate but not the real exchange rate. In the long run, nominal variables do not affect real variables in this approach. Thus, we have a dichotomy between the real sphere and the monetary sphere. We can classify the different approaches of equilibrium exchange rates thanks to the criterion of Officer (2012). Approaches in which real variables are not affected by nominal variables can be labelled as monetarist and approaches in which nominal variables affect real variables can be regarded as non-monetarist.

In the case of the FEER approach, the current account expressed in nominal terms persistently affects the real effective exchange rate. An increasing current account deficit will induce downward pressures on the real effective exchange rate. Thus the FEER approach can be regarded as a non-monetarist approach. Furthermore, Cline and Williamson indicate that the FEER approach may be characterized as "path dependent". An increasing depreciation will produce an undervalued currency only in the case where the fundamental rate does not observe a stronger depreciation. Path dependency can be defined in this way: the initial situation will affect the evolution of exchange rate misalignments in the following periods (Cline and Williamson, 2012).

In the light of the Post Keynesian tradition, the FEER approach has two important features. The FEER approach is non-monetarist (absence of dichotomy between the real sphere and the monetary sphere) and admits hysteresis (any assumption on the stationarity of misalignments, the exchange rate can or cannot revert to its fundamental value (Duwicquet et al., 2013)). Davidson (2004) argues that the only analytical difference between Williamson's FEER and market fundamentalists' view is the speed of adjustment of the real exchange rate towards its fundamental value. According to Davidson, market forces are not able to reach this equilibrium rate. Our empirical results are in line with the point of Davidson. They indicate a huge divergence in the EMU. Some countries are increasingly undervalued and other countries are increasingly overvalued. The case of the EMU is very interesting as it illustrates the failure of market forces to reach the FEER in a very striking way.

As market forces are unable to reach FEERs, we need a new economic and financial architecture in the euro area in order to help overvalued countries affected by mass unemployment and sluggish growth to achieve their external adjustments without putting a huge strain on aggregate demand in the euro area.

2.3. Divergence of misalignments

In other approaches of equilibrium exchange rate like the Behavioral Equilibrium Exchange Rate approach (BEER), the misalignments are necessarily stationary during the studied period (Coudert *et al.*, 2013). They correspond to residuals of a long run relationship between the real effective exchange rates and its long-run determinants. Thus, the misalignment is stationary, by definition. In the case of European countries during the last decades, the hypothesis of exchange rates on average in equilibrium during the studied period (i.e. the misalignment is stationary) seems to be unrealistic since these countries have experienced diverging paths concerning their competitiveness, as evidenced by the evolution of current account imbalances.

[8] In appendix A, we detail the correction proposed by Bayoumi and Faruqee (1998) in order to consider the reduction of business cycles synchronization observed in the euro area since the onset of the crisis.

At the world level, the fundamental rates and the actual rates are integrated and co-integrated. In other words, exchange rate misalignments are stationary for a large panel of industrialized and emerging countries over the period spanning from 1982 to 2010 (Saadaoui, 2015). Nevertheless, for several EMU countries over the period spanning from 1982 to 2011, it seems highly doubtful that the misalignments have been stationary.

In table 2, we implement unit root tests proposed by Carrion-i-Silvestre *et al.* (2005) on the series of misalignments of eight EMU countries over the period 1982 to 2011. These unit root tests take into account structural breaks. The tests give clear-cut results. We reject the null of stationarity at the 1% level. The intra-European misalignments are not stationary over the studied period. In order to impose any value on the co-integrating vector, we also implement panel co-integration tests proposed by Westerlund (2008). These tests allow for cross-sectional dependence and eventually stationary regressors. In table 3, we can see that we cannot reject the null of non-co-integration at the 1% level in all tests. The fundamental rates and the actual rates are not co-integrated. These results are in line with those of Duwicquet et al. (2013) and reflect unsustainable evolutions of competitiveness in the EMU over the studied period.

As a final point, we underline that current account imbalances can persist during a peculiar period of time and/or in a specific geographic area. However, this situation is only transitory since the current account balances are stationary in the medium run at the global level (Lee et al., 2003). Indeed, Saadaoui (2015) provides empirical evidences that fundamental and actual rates are cointegrated in an error-correction model with heterogeneous slopes. These evidences tend to show that large current account imbalances cannot persist in the long run at the global level. In other words, actual rates return to fundamental rates (and vice-versa)[9] in order to correct large current account imbalances in the long run. Williamson (2004) argues that the return to the equilibrium could be grueling and costly in terms of growth potential.

In this context, it is worthwhile, using an SFC model of a monetary union, to assess various alternative economic policies that try to tackle this problem of intra-European misalignments.

[Insert table 2 about here]
[Insert table 3 about here]

3. SFC modeling of adjustment mechanisms in a monetary union

3.1. The structure of the model

An SFC model allows obtaining a consistent description of assets and liabilities of all associated real and financial flows in a monetary union. This monetary union is composed of two countries (*n* and *s*) with an asymmetry of size. The country *n* is five times larger than the country *s*. This configuration eases the exploration of the adjustment mechanisms of the country *s* facing the rest of the monetary union.

In this model, we introduce the possibility of public federal expenditures and Eurobonds. This will open the road to investigate stabilizing effects of Eurobonds[10]. Firms can accumulate both real and financial capital. They can finance their investments by non-distributed profits, bank loans or equities. Commercial banks are able to supply credit and to ration credit. The single central bank (i.e. the ECB) refinances the commercial banks.

[9] After a public intervention enshrined in an international monetary cooperation or the burst of a financial crisis.
[10] In a recent contribution, Ioannou (2018) investigates the complex interactions between the credit rating agencies and fiscal policy in the Eurozone. Thanks to an open economy SFC model, he shows that credit rating agencies could hinder the conduct of counter-cyclical policies by inducing upward pressures on interest rates. However, he does not explore the possible stabilizing role of Eurobonds.

Households hold banking deposits, bonds and equities. The two national governments issue bonds and Treasury bills.

In table 4, we describe the balance sheet in terms of assets (written with a positive sign) and liabilities (written with a negative sign) of each sector: households, firms, government, commercial banks, the single central bank and a federal budget.

[Insert table 4 about here]

Beyond physical capital (*k*), eight kinds of monetary or financial assets are distinguished[11]:

- Bank deposits (*bd*) held by households, bonds issued by governments (*pb.b*) and held by households of both countries;
- Loans (*l*) supplied by each commercial bank to firms of the two countries;
- Equities issued by firms (*pe.e*) and held by households and firms of both countries;
- Treasury bills issued by each State (*bt*) and held by commercial banks of both countries;
- High-powered money (*h*) held by households (*hh*) as well as by commercial banks; (mandatory reserves);
- Advances supplied by the central bank to commercial banks (*rf*) and finally Eurobonds (*bte*) issued by a federal authority and held by banks.

Our model includes several crucial features in order to examine current developments in the EMU crisis:

- Interest rates on Treasury bills supplied by the State are endogenous. The demand of Treasury bills by private banks is an increasing function of interest rate. Thus, in case of an insufficient demand, this mechanism induces upward pressures on interest rates.
- Budgetary policy is partially endogenous and linked to financial markets. When interest rates on sovereign debt increase, the national government can reduce public expenditures in reaction.
- We introduce the possibility to increase intra-zone financing in order to reduce the pressure on interest rates. We include three ways to increase intra-zone financing: (i) through foreign banks purchases of public bonds or Treasury bills, (ii) through the European Stability Mechanism (hereafter, ESM), (iii) or even through direct intervention of the central bank on the public bond markets.
- We investigate the role of Eurobonds in two ways. On the one hand, to pool a part of sovereign debt in the EMU. On the other hand, to finance European investment projects in several sectors namely education, health and innovation.
- Last, we discuss the rather traditional policy-mix combining tax rebates and expenditure cuts (roughly the French government strategy).

For the sake of brevity, we present the main equations in the following. The interested reader can find the whole set of equations in Duwicquet *et al.* (2016). Lastly, we calibrate the model to represent the economic and financial structure of the EMU.

The demand side

The model dynamics rely essentially on the investment function. As we can see below, investment reacts positively to the rate of profit and to variation of aggregate demand. It responds negatively to the debt structure and to credit costs.

[11] When there are two symbols (*n* and *s*), the subscript denotes the country where the asset is held, the superscript the country where the asset is issued. For example, bt^s_n represents the amount of bills held by country *n* and issued by the country *s*.

$$g_n = k_{0n} + k_{1n}\frac{up_n(-1)}{k_n(-2)} + k_{2n}\frac{\Delta y_n}{y_n(-1)} - k_{3n}\frac{l_n(-1)}{k_n(-1)} - k_{4nn}rl_n - k_{4sn}rl_s \quad [3.1]$$

Where *g* stands for the rate of accumulation of physical capital; *up* represents the amount of undistributed profits; *l* is the firms' level of indebtedness; *rl* is the credit cost and *y* is the gross domestic product.

At the macroeconomic level, an increase in investment spending will generate more profits. These profits will be, on the one hand, distributed in part to shareholders (here, households and other firms) and, on the other hand, undistributed.

The household consumption function includes a positive wealth effect. This wealth effect describes the behavior of households, which target a constant ratio between wealth and disposable income.

$$c_n = a_{0n} + a_{1n}yh_n + a_{2n}vh_n(-1) \quad [3.2]$$

Where *vh* stands for the households' wealth and *yh* for the disposable income with capital gains.

The disposable income of households is the sum of after-tax labor incomes (wages) and after-tax capital incomes (interest rates and dividends). Households consume a part of disposable income augmented with capital gains whereas the residual saving corresponds to bank deposits, money holdings and to financial assets (bonds supplied by the State and equities supplied by private firms). The financial wealth covers a large array of financial assets (bank deposits, cash money, equities and bonds).

The government receives taxes from households and banks, spends and pays interests. The issuance of bonds and Treasury bills finance the public deficit. Supply of Treasury bills balances the gap between public deficit and bonds issuance thus:

$$\Delta bt_n = gn_n + r_n bt_n(-1) + b_n(-1) - t_n - tb_n - teb_n - pb_n\Delta b_n + ps_n - cl_n - tf_n \quad [3.3]$$

Where *bt* is the amount of T-bills; *gn* stands for the national public expenditures; *r* is the interest rate on T-bills; *b* represents the amount of bonds issued.

Where *t* are the taxes paid by the households; *tb* are the taxes paid by commercial banks; *teb* are the transfers by the ECB of its profit to the State; *tf* are the taxes paid by firms; *ps* stands for social benefits and *cl* for social contributions of firms.

The banking sector

The central bank supplies money and provides an unlimited amount of refinancing to private banks at the key interest rate (*ib*) thus acting as the lender of last resort. The interest rate on bank deposit (*id*) is simply determined with a margin on the key interest rate of the central bank.

$$\Delta rf_n = \Delta h_n + \Delta l_n^n + \Delta l_n^s + \Delta bt_n^n + \Delta bt_n^s - bp_n - \Delta bd_n \quad [3.4]$$

$$id = ib - m_{2b} \quad [3.5]$$

The central bank does not make any profit as in Godley and Lavoie (2007). Thus, interests paid to the central bank are transferred to the State. This is in line with the practice of most modern central banks in the world economy. Besides, commercial banks supply the entire amount of demanded credit:

$$\Delta l_n = inv_n - up_n - pe_n \Delta e_n + pe_n \Delta ee_n^n + pe_s \Delta ee_n^s \quad [3.6]$$

The credit market is open to foreign banks. We suppose that banks of the smaller country (country *s*) do not lend to firms of the larger country *n* ($l^n_s = 0$). We allocate bank loans between domestic and foreign firms relatively to their respective trade openness. The interest rate on bank loans is endogenous and depends on the lagged value of Treasury bills' rate of each country and on their own lagged value.

$$rl_n = (1-a) rl_n(-1) + a.r_n(-1) \quad [3.7]$$

$$rl_s = (1-a) rl_s(-1) + a.r_s(-1) \quad [3.8]$$

Treasury bills play a key role in the model resolution. Banks purchase a limited amount of Treasury bills with a demand that depend positively on the rate of interest. Thus, interest rates become endogenous, as they adjust the supply of Treasury bills determined by the public deficit and the private demand of Treasury bills in each country.

Bills issued by the southern country and domestically held in the private sector (bt^s_s) as well as bills held in the rest of the union (bt^s_n) depends on the interest rates differential between the two countries:

$$\frac{bt_s^s}{y^s} = a_{1ss} r_s - a_{2ss} r_n \; ; \; \frac{bt_n^s}{y^n} = a_{1ns} r_s - a_{2ns} r_n$$

By summing demands of these two countries, we obtain the global demand for Treasury bills issued by the southern country:

$$bt_s = \left(a_{1ss} r_s - a_{2ss} r_n\right) y_s + \left(a_{1ns} r_s - a_{2ns} r_n\right) y_n$$

The interest rate on Treasury bills issued by the southern country becomes endogenous and we can write:

$$r_s = \frac{bt_s + \left[a_{2ss} r_n y_s\right] + \left[a_{2ns} r_n y_n\right]}{\left[a_{1ss} y_s\right] + \left[a_{1ns} y_n\right]} \quad [3.9]$$

Regarding the rest of the union (the northern country), we assume that the southern country does not hold bills issued by the northern country that finances its public deficit only domestically:

$$bt_s^n = 0 \; ; \; bt^n = bt_n^n$$

The global demand for Treasury bills issued by the northern country depends on the level of interest rate (r_n) and the national income (y_n):

$$bt_n^n = \frac{\left(r_n - a_{1nn}\right) y_n}{b_{2nn}}$$

Consequently, we have the following interest rate determination for the northern country:

$$r_n = a_{1nn} + \frac{b_{2nn} bt_n}{y_n} \quad [3.10]$$

After an increase of public deficit, the public deficit remains financed by commercial banks. However, the level of interest rates is higher. We diffuse this tightening of financial conditions to rates on bank loans granted to firms and to interest rates on public bonds that are supposed to be equal to interest rates on Treasury bills.

Baseline scenario

Our model represents a monetary union characterized by a sluggish growth in the baseline scenario (around 1 percent per year). We provide the value of the most relevant parameters and conduct several robustness checks on them (see appendix B). They indicate a rather good robustness of the results. From this baseline scenario, we simulate an asymmetric loss of competitiveness in the southern country due to an exchange rate misalignment. As underlined by Blanchard and Milesi-Ferretti (2012), overvaluations induce distortions in prices of internationally traded goods. Thus, cumulative effects of overvaluations amount to negative competitiveness shock. To illustrate this loss of competitiveness, the term *ti* is equal to 10 between periods 10 and 45 in the import equations:

$$\log(im_n) = \mu_{0n} + \mu_{1n} \log(y_n) + \mu_2 \log\left(\frac{w_n - ti}{y_n}\right) - \mu_2 \log\left(\frac{w_s + ti}{y_s}\right) \quad [3.11]$$

$$\log(im_s) = \mu_{0s} + \mu_{1s} \log(y_s) + \mu_2 \log\left(\frac{w_s + ti}{y_s}\right) - \mu_2 \log\left(\frac{w_n - ti}{y_n}\right) \quad [3.12]$$

This shock deteriorates the current account of the southern country and improves external trade of the northern country. Consequently, we observe a decline of national income in the South and an increase of national income in the North. In order to investigate the current developments of the EMU crisis, we compare the effect of this shock in different versions of the model. In addition to this baseline scenario, we successively examine five versions of the model.

3.2. Alternative scenarios of economic policies

Scenario 1: Budget cuts

In this first scenario, public expenditures become endogenous and react to rising interest rates on Treasury bills:

$$gn_n = a_{gg1} gn_n(-1) - a_{gg2} r_n bt_n(-1) \quad [3.13]$$

In line with the objectives of the TSCG as well as aims of the *fiscal compact*, we assume that the government targets to reach a debt-to-GDP ratio of 70 percent in period 45. To achieve this challenge, the government progressively reduces its public expenditures. The evolution of interest rates governs the speed of public expenditures reduction. The year of the shock, public expenditures decrease by 0.2 percent of GDP relatively to the baseline scenario. In the baseline scenario, public expenditures amount to 19.5 percent of GDP in period 45. In this first scenario, they drop to 12 percent of GDP in period 45, which means a decline of 0.17% of GDP at each period and an average GDP growth of -1.1%. This is a huge cut, but rather consistent with the measures implemented in the peripheral countries during the 2010s.

Scenario 2: Intra zone financing

We investigate, here, implications of financial support granted by the northern country to the southern country. In the wake of a loss of competitiveness in the southern country, the issuance of public securities will rise to finance an increasing deficit. We assume that private banks of the northern country will sustain this supplementary demand to bring down interest rates. This scenario illustrates the ESM where northern countries grant loans with low rates of interest to southern countries. We could expect similar effects if the ECB purchases directly Treasury bills of southern countries. In each case, the southern country receives financial aid to reduce substantially the debt burden.

Scenario 3: Issuance of Eurobonds

In this scenario, we issue Eurobonds in order to partially pool the sovereign debt of southern countries. We assume that there is threshold (a debt-to-GDP ratio of 60 percent) from which Eurobonds are issued to finance public debt in the EMU as a substitute to national debt. Nevertheless, national governments have to pay interest on issued Eurobonds. Southern countries must be committed to stabilize their public debt.

$$If \quad \frac{d_n}{y_n} < 60\% \quad then$$

$$\Delta bt_n = \left(g_n^n + r_n bt_n(-1) + b_n(-1) - t_n - tb_n - teb_n - pb_n \Delta b_n + ps_n - cl_n - tf_n \right) \qquad [3.14]$$
$$+ reuro.bte_n(-1)$$

$$If \quad \frac{d_s}{y_s} < 60\% \quad then$$

$$\Delta bt_s = \left(g_s^s + r_s bt_s(-1) + b_s(-1) - t_s - tb_s - teb_s - pb_s \Delta b_s + ps_s - cl_s - tf_s \right) \qquad [3.15]$$
$$+ reuro.bte_s(-1)$$

Each government may appeal the issuance of Eurobonds (bte_n for the northern government and bte_s for the southern government).

$$If \quad \frac{d_n}{y_n} > 60\% \quad then \qquad [3.16]$$

$$\Delta bte_n = \left(g_n^n + r_n bt_n(-1) + b_n(-1) - t_n - tb_n - teb_n - pb_n \Delta b_n + ps_n - cl_n - tf_n \right) + ge_n$$

$$If \quad \frac{d_s}{y_s} > 60\% \quad then \qquad [3.17]$$

$$\Delta bte_s = \left(g_s^s + r_s bt_s(-1) + b_s(-1) - t_s - tb_s - teb_s - pb_s \Delta b_s + ps_s - cl_s - tf_s \right) + ge_s$$

We obtain the aggregate supply of Eurobonds by the summing of the supply in the two countries.

$$bte = bte_n + bte_s \qquad [3.18]$$

Demand for Eurobonds simply depends on the interest rate (*reuro*) and the level of GDP of the entire EMU ($y_e = y_s + y_n$). Consequently, we use the following determination of interest rates:

$$reuro = a_{0e} + a_{1e}\left(\frac{bte}{y_e}\right) \quad [3.19]$$

Scenario 4: Issuance of Eurobonds and European projects
To complete the previous scenario, we use Eurobonds as an instrument to finance European projects in innovative sectors. Southern countries as well as northern countries can use Eurobonds in order to stimulate their economic growth.

Scenario 5: Tax rebates and public expenditures cuts
This scenario roughly describes the French "Crédit d'impôt pour la compétitivité et l'emploi (CICE)". The government reduces the social contributions paid by the firms to partly compensate the competitiveness loss due to the overvaluation (*trs* equals to 1.5 when *ti* is equal to 10 in period 10 in scenario 5). To avoid an increase of the public debt, public expenditures are cut in the same proportion ($gs_s = a_{gg1}gs_s$ (-1) - *trs* in period 10 in scenario 6).

However, these measures are not sufficiently devoted to the tradable sector and the total effect on employment, which is the other main target, is very uncertain (Plane, 2012; France Stratégie, 2016). That is why the government toolkit includes also industrial policy measures such as innovation and technology policy or relocation policy. These measures are complex to design and to manage and they are only efficient in the long-term. As an illustration and in an optimistic way, we assumed that after period 30 the non-price competitiveness of country *s* is improved (the import income elasticity of country *s*, μ_{1s} declines from 1 to 0.98 while the import income elasticity of the country *n*, μ_{1n} increases from 1 to 1.02 in scenario 7).

3.3. Adjustments in the monetary union and economic policies

In figure 3, we can observe the evolution of interest rates and public debt in the southern country in the baseline scenario (competitiveness loss in the southern country) and in the first four versions of the model.

In the baseline scenario, we assume that policy-makers implement any adjustment mechanism to face the competitiveness loss. Thus, this competitiveness loss widens the external deficit and the need of external financing increases at the same time. In addition, the negative impact of trade deficit on the GDP implies a diminution of taxes collected by the government and thus an increase of the public deficit. On the Treasury bills market, interest rates increase alongside the debt increase and the slowdown of GDP. This "snowball" effect implies a tremendous increase in debt levels (140 percent of GDP in period 45) and of interest rates (4.5 percent in period 45). For the sake of clarity, figures 3 to 7 (in the main text) and tables C5 to C10 (in appendix C) provide a synthetic view of the main results.

[Insert figure 3 about here]

In order to eschew another "Greek drama", European authorities can react by implementing various alternative economic policies in order to achieve more sustainable adjustments.

In the first scenario, the government tries to reduce its public expenditures in order to prevent an increase of interest rates. The long run purpose of this policy is to reach a debt-to-GDP ratio limited to 70 percent. However, due to the Keynesian multiplier effect, public expenditures reduction puts a sizeable pressure on economic activity as we can see in figure 4. We can note that the average reduction of the GDP growth rate for each period of time amounts to about 0.5% during the entire time span of the simulations. Interest rates dropped in comparison with the baseline scenario but still rise in the medium run and reach 2.8 percent in period 45 due to a weaker demand of Treasury bills induced by the decline of the activity.

In the second scenario, we assume that intra-zone financing is important thanks to an eased demand from private banks of the Northern countries or to the implementation of the ESM. This allows keeping interest rates at low level (2.4 percent in period 45) in spite of a sizeable increase of public debt-to-GDP ratio (130 percent in period 45). This scenario partly stabilizes economic growth but does not solve the competitiveness problem (see figure 4). We can recall that the TSCG ratified in March 2012, which gives an institutional background to the ESM, stipulates that Member States must reach a debt-to-GDP ratio of 60 percent in the medium run. The results of the second scenario would greatly change in terms of growth stabilization if we respect the goal targeted by the ESM. In such a case, the result in terms of relative growth rates would be largely similar to those of the first scenario.

[Insert figure 4 about here]
[Insert figure 5 about here]

The third and the fourth scenario analyze the impact of an issuance of Eurobonds in the EMU. We can observe that interest rates increase less rapidly in the fourth scenario than the third scenario. In the fourth scenario, Eurobonds finance investments in innovative sectors therefore economic growth is stronger and upward pressures on interest rates are weaker.

We observe these growth gaps in the figure 4. We use the following formula to compute adjustments on GDP:

$$Relative\,GDP = \frac{GDP_{scenario\ with\ competitiveness\ loss} - GDP_{scenario\ without\ competitiveness\ loss}}{GDP_{scenario\ without\ competitiveness\ loss}} \qquad [3.20]$$

[Insert figure 6 about here]

Initially, the GDP drops after the negative competitiveness shock. The implementation of European projects financed by Eurobonds (scenario 4) absorbs almost completely the competitiveness loss in the long-term as GDP returns to its value before the shock in period 45. Eurobonds issuance to pool sovereign debt (scenario 3) induces a partial adjustment. We can observe that intra-zone financing (scenario 2) appears to be more efficient than Eurobonds issuance alone (scenario 3). The implementation of the ESM, aimed at providing low interest rates to governments and firms, stimulates investment. Eurobonds are more efficient when aimed at financing investment programs which ensure stronger economic stimulus (scenario 4). In terms of relative growth, the worst case is the first scenario where governments implement drastic budget cuts in order to achieve a debt-to-GDP ratio of 70 percent in the long-term. The GDP drops by 30 percent in relative terms in period 45. The slowdown of economic activity induces a decrease of imports and then a massive adjustment of the current account balance. Without any policy reactions (baseline scenario) after the competitiveness loss, external deficits of the southern country steadily increase and reach 3.5 percent of GDP in period 45. In other scenarios, we observe a stabilization of the external deficit around 2 percent in the long-term.

In figure 5, we can analyze the consequences of the various scenarios in the northern country in terms of growth and public debt. Again, drastic budget cuts in the southern country have a negative impact on economic activity (even) in the northern country. In the long-term, the fall of GDP will bring public debt to 65 percent of GDP. In other scenarios, public debt increases less thanks to a stronger growth, particularly in the fourth scenario. In figure 6, we can scrutinize the dynamic of public debt and the evolution of interest rates on T-bills and Eurobonds in the third and the fourth scenario.

As growth is stronger in the fourth scenario, interest rates on national T-bills are lower when Eurobonds play a role in financing new investment programs. Conversely, the interest

rate on Eurobonds is slightly higher in the fourth scenario (1.9 percent) than in the third scenario (1.6 percent). Regarding levels of public debt, again, European debt in Eurobonds is higher in the fourth (20 percent of GDP) relatively to the third scenario (10 percent of GDP) as there are more public investments to finance. Nevertheless, European indebtedness remains sustainable as well as national indebtedness in spite of the fact that national governments have to pay interests on these issued Eurobonds. However, this evaluation could be regarded as optimistic if the value of the national public debt not covered by Eurobonds collapses. This would create difficulties for banks holding these securities and an increase of the associate rate of interest.

[Insert figure 7 about here]

We now move towards the last scenarios with tax rebates and public expenditure cuts. In scenario 5, the reduction of the social contributions paid by firms partly offsets the effect of overvaluation of the euro for southern countries and their loss of competitiveness. The decline in GDP is less noticeable but the current account balance remains deteriorated while the public indebtedness increases considerably, inducing a substantial increase of interest rates (see figure 7). To avoid this unsustainable worsening of the public finance, we reduce public expenditures of an amount equivalent to the tax rebate (scenario 6). These cuts partially limit the rise of public debt and of the interest rate but at the expense of the GDP growth, which returns to the depressed baseline scenario.

This strategy of the French "Pacte de responsabilité et de solidarité" simultaneously uses the accelerator and the brake and can have only a limited effect. The initial tax rebate represents a high cost for the public finances without targeting the tradable sector, mainly due to European competition rules. The only way of escape would be the success of industrial and innovation policies able to improve at medium term the non-price competitiveness, as illustrated in the scenario 7.

4. Conclusion

If European authorities do not react by implementing sound economic policies to achieve sustainable adjustments, the intra-European exchange rate misalignments and the subsequent competitiveness loss in southern countries could induce economic stagnation in southern countries. Indeed, current account imbalances will continue to diverge and public debt dynamics could become explosive. Restrictive fiscal policies, as they have been implemented in southern countries, can contain interest rates and public indebtedness but at the cost of a deeper recession. This policy-mix based on tax rebates to improve competitiveness and public expenditure cuts, illustrated by the French CICE, has only a limited effect. In order to improve non-price competitiveness, it could (and should) be completed by more structural policies (industrial and innovation policies) which are complex to implement and only effective in the long-term.

Increasing intra-European financing by banks of northern countries, by the ESM or even by the intervention of the ECB itself could contribute to reduce the debt burden and induce a partial recovery. However, this solution does not solve the problem of competitiveness of the southern countries and public debt could increase (scenario 2). Implementation of Eurobonds as an instrument to pool European sovereign debt would have a rather similar positive impact, but with a public debt limited to 70 percent of GDP (scenario 3). Furthermore, Member States could use Eurobonds to finance relevant European projects, which could impulse a stronger recovery in the entire EMU with stabilized current account imbalances (scenario 4). However, this scheme could lead to financial instability for countries where the debt level is above the debt ceiling.

More broadly, the creation of a European institution in charge of the emission of Eurobonds would face political obstacles. The northern countries fear that Eurobonds would give the opportunity to the southern countries to continue irrelevant policies. They would link the launching of Eurobonds to more restrictive fiscal policy in the respect of the Stability and Growth Pact and by a stricter monitoring of national fiscal policies under the supervision of some independent European institution. This could generate political tensions between Member States. Actually, the ESM organizes the rescue of countries facing difficulties only under the condition of a strict control of the public finance. In such a configuration, Eurobonds would not be more efficient than the present institutional framework. On the opposite, the southern countries could argue that Eurobonds could finance a part of the debt induced by the overvaluation of their euro without experiencing tougher constraints.

Another approach would be based on democratic progress with the establishment of a parliament of the EMU, which would determine broad budgetary guidelines for the EMU as a whole and the allocation of corresponding targets to individual countries. In any case, whether the procedure is technocratic or more democratic, it would establish tutelary supervision over the broad structure of national budgetary policy. The importance of that problem should not be underestimated. Beyond these observations, two basic problems would remain unresolved: firstly, the macroeconomic stabilization, since because of the budgetary rules to be introduced, indebted countries would have no room for maneuver in case of a negative shock; and secondly, the heterogeneity of the EMU and competitiveness imbalances between Member States, or in other words, the persistence of misaligned real exchange rates.

Ultimately, as pointed out by Stiglitz (2016), we could compare the efficiency of these institutional innovations inside the monetary union with an alternative framework. Indeed, new types of monetary regime would reintroduce the possibility of intra-European exchange rate adjustments (cohabitation of a global euro with national euros, new European Monetary System with a euro reduced to a simple ECU, exit of Germany or exit of southern countries).

These alternative monetary regimes are a more straightforward solution to the competitiveness problem in southern countries and allow a more efficient adjustment at short term, with a more balanced growth regime at medium term (Mazier and Valdecantos, 2015). Sound structural policies to improve non-price competitiveness can complete these monetary regimes. However, the main difficulty, raised by this alternative strategy, is the transition period, which would be difficult to manage with the risk of capital flights and multiple bank crises.

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References

[1] Andrews, D. W. K. (1991). Heteroskedasticity and autocorrelation consistent covariance matrix estimation. *Econometrica*, 59(3), 817-858.

[2] Andrews, D.W. K., & Monahan, J. C. (1992). An improved heteroskedasticity and autocorrelation consistent autocovariance matrix. *Econometrica* 60, 953-66.

[3] Asdrubali, P., & Kim, S. (2004). Dynamic risk sharing in the United States and Europe. *Journal of Monetary Economics*, 51, 809–836.

[4] Bayoumi, T., Harmsen, R. T., & Turunen, J. (2011). Euro area export performance and competitiveness. IMF working paper 11-140. https://www.imf.org/external/pubs/ft/wp/2011/wp11140.pdf

[5] Blanchard, O., & Milesi-Ferretti, G.-M. (2012). (Why) should current account balances be reduced? *IMF Economic Review*, 60, 139-150.

[6] Carrion-i-Silvestre, J. L., del Barrio-Castro, T. & López-Bazo, E. (2005). Breaking the panels: An application to the GDP per capita. *Econometrics Journal*, 8, 159-175.

[7] Cenedese, G., & Stolper, T. (2012). Currency fair value models. In *Handbook of Exchange Rates*. Hoboken: John Wiley & Sons.

[8] Clark, P. B., & MacDonald, R. (1998). Exchange rates and economic fundamentals: A methodological comparison of BEERs and FEERs. IMF Working Papers 98/67.

[9] Clévenot, M., & Duwicquet, V. (2011). Partage du risque interrégional. *Revue de l'OFCE*, 119, 5-33.

[10] Cline, W., R., & Williamson, J. (2012). Estimates of Fundamental Equilibrium Exchange Rates, May 2012. PIIE Policy Briefs 12-14.

[11] Coudert, V., Couharde, C., & Mignon, V. (2013), On Currency Misalignments within the Euro Area. *Review of International Economics*, 21(1), 35-48. http://onlinelibrary.wiley.com/doi/10.1111/roie.12018/full

[12] Davidson, P. (2004). The future of the international financial system. *Journal of Post Keynesian Economics*, 26(4), 591-605. http://www.jstor.org/stable/4538896

[13] Draghi, M. (2012). Verbatim of the remarks made by Mario Draghi. President Speeches, ECB. https://www.ecb.europa.eu/press/key/date/2012/html/sp120726.en.html

[14] Draghi, M. (2015). Stability and prosperity in monetary union. Project Syndicate. https://www.project-syndicate.org/commentary/ecb-eurozone-economic-union-by-mario-draghi-2015-1-2015-01?barrier=accessreg

[15] Driver, R., & Westaway, P. (2005). Concepts of equilibrium exchange rates. Bank of England working papers 248.

[16] Duwicquet, V., Mazier, J. (2010). Financial integration and macroeconomic adjustments in a monetary union. *Journal of Post Keynesian Economics*, 33, 333-370.

[17] Duwicquet, V., Mazier, J. (2011). Financial integration and stabilization in a monetary union without or with bank rationing. In *Contributions in Stock-Flow Modeling: Essays in Honor of Wynne Godley*. New York: Palgrave Macmillan.

[18] Duwicquet, V., Mazier, J., & Saadaoui, J. (2013). Désajustements de change, fédéralisme budgétaire et redistribution. *Revue de l'OFCE*, 127, 57-93.

[19] Duwicquet, V., Mazier, J., & Saadaoui, J. (2016). Interest rates, Eurobonds and intra-European exchange rate misalignments: The challenge of sustainable adjustments in the Eurozone. BETA Working paper 2016-19. http://www.beta-umr7522.fr/productions/publications/2016/2016-19.pdf

[20] European Commission (2007). Quarterly report on the euro area. October. http://ec.europa.eu/economy_finance/publications/qr_euro_area/2007/pdf/qrea3_en.pdf

[21] European Commission (2015). Action plan on building a Capital Markets Union. September. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0468&from=EN

[22] France Stratégie (2016). Comité de suivi du CICE, Report, September. http://www.strategie.gouv.fr/sites/strategie.gouv.fr/files/atoms/files/rapport_cice2017_03102017_0.pdf

[23] Godley, W., & Lavoie, M. (2006). Comprehensive accounting in simple open economy macroeconomics with endogenous sterilization or flexible exchange rates. *Journal of Post Keynesian Economics*, 28, 241-276.
[24] Godley, W., & Lavoie, M. (2007a). *Monetary economics: An integrated approach to credit, money, income, production and wealth*. New York: Palgrave Macmillan.
[25] Godley, W., & Lavoie, M. (2007b). A simple model of three economies with two currencies: The Eurozone and the USA. *Cambridge Journal of Economics*, 31, 1-23.
[26] Ioannou S. (2018). Sovereign ratings, macroeconomic dynamics, and fiscal policy. Interactions within a stock flow consistent framework. *Metroeconomica*, 69, 151-177. https://doi.org/10.1111/meca.12174
[27] Isard, P., & Faruqee, H. (1998). Exchange rate assessment: Extension of the macroeconomic balance approach. IMF Occasional paper 167.
[28] Italianer, A., & Pisani-Ferry, J. (1992). Systèmes budgétaires et amortissement des chocs régionaux : implications pour l'Union économique et monétaire. *Économie Internationale*, 51, 49-69.
[29] Lavoie, M. (2003). A fully coherent post-Keynesian model of the Eurozone. In *Globalization, Regionalism and Economic Activity*. Cheltenham: Edward Elgar Publishing.
[30] Lee, J., Ostry, J. D., Prati, A., Ricci, L. A., & Milesi-Ferretti, G. M. (2008). Exchange rate assessments: CGER methodologies. IMF Occasional paper 261.
[31] Mazier, J., & Saglio, S. (2008). Interdependency and adjustments in the European Union. *International Review of Applied Economics*, 22, 17-44.
[32] Mazier, J., & Valdecantos, S. (2015). A multi-speed Europe: Is it viable? An SFC approach. *European Journal of Economics and Economic policies: Intervention*, 1, 93-112.
[33] Newey, W. K., & West, K. D. (1994). Automatic lag selection in covariance matrix estimation. *The Review of Economic Studies*, 61(4), 631-653.
[34] OECD (2010). OECD Economic Outlook, Vol. 2010/1, No. 87, May.
[35] Officer, L. H. (2012). Purchasing power parity in economic history. In *Handbook of Exchange Rates*. Hoboken: John Wiley & Sons.
[36] Plane, M. (2012). Evaluation de l'impact économique du Crédit d'Impôt pour la Compétitivité et l'Emploi, *Revue de l'OFCE*, 126, 141-153.
[37] Saadaoui, J. (2015). Global imbalances: Should we use fundamental equilibrium exchange rates? *Economic Modelling*, 47, 383-398.
[38] Saadaoui, J. (2017). Internal devaluations and equilibrium exchange rates: New evidences and perspectives for the EMU. BETA Working paper 2017-34. http://www.beta-umr7522.fr/productions/publications/2017/2017-34.pdf
[39] Stiglitz, J. (2016). The Euro and its threat to the future of Europe. London: Allen Lane.
[40] Storm, S. (2017). How a flawed structure is hurting the Eurozone? INET conference, Edinburgh. https://www.ineteconomics.org/uploads/papers/STORM-INET-2017-Storm-Panel-Future-of-the-Eurozone.pdf
[41] Storm, S., & Naastepad, C. (2012). Macroeconomics Beyond the NAIRU. Cambridge, Massachusetts; London, England: Harvard University Press. http://www.jstor.org/stable/j.ctt24hhs5
[42] Sul, D., Phillips, P. C., & Choi, C. Y. (2005). Prewhitening bias in HAC estimation. *Oxford Bulletin of Economics and Statistics*, 67(4), 517-546.
[43] Westerlund, J. (2008). Panel cointegration tests of the Fisher effect. *Journal of Applied Econometrics*, 23, 193-233.
[44] Williamson, J. (2004). The strange history of the Washington consensus. *Journal of Post Keynesian Economics*, 27(2), 195-206. http://www.jstor.org/stable/4538920
[45] Williamson, J. (2006). A worldwide system of reference rates. *International Economics and Economic Policy*. 3(3-4), 341-352. https://link.springer.com/article/10.1007%2Fs10368-006-0069-x

Tables and figures

	EU	FRA	GER	ITA	SPA	FIN	IRL	PRT	GRC
1994	-3.4	2.4	-7.4	6.9	1.4	-5.8	-0.7	0.9	15.1
1995	1.2	-0.7	-7.5	8.2	9.6	5.1	-1.7	3.8	-0.1
1996	4.2	3.2	-4.8	6.7	-0.1	8.3	-0.8	-10.4	-11.3
1997	3.5	12.9	-1.6	5.4	1.1	20.1	-1.5	-18.5	-8.2
1998	0.6	14.0	-4.3	2.1	0.5	22.9	-2.6	-16.8	-1.7
1999	2.0	19.2	-7.3	-1.5	-5.0	21.6	-0.3	-21.4	-7.2
2000	0.1	8.7	-8.1	-3.8	-7.6	24.9	-0.6	-29.3	-16.8
2001	6.9	6.8	-2.9	-3.1	-7.9	25.3	-4.0	-36.1	-17.4
2002	6.6	2.5	3.8	-6.3	-4.8	25.6	-4.8	-30.1	-19.0
2003	2.2	-2.9	1.3	-8.5	-3.2	15.2	-3.6	-26.1	-9.1
2004	7.2	-0.1	5.6	-5.4	-15.4	19.6	-3.8	-40.1	5.0
2005	1.9	-4.6	5.3	-4.1	-20.3	7.8	-4.8	-46.1	-7.6
2006	1.6	-4.8	9.1	-3.8	-24.6	9.7	-2.0	-47.9	-6.3
2007	-0.2	-6.0	13.1	-0.7	-26.4	15.5	-0.9	-34.5	-5.2
2008	0.9	-13.3	13.0	-4.5	-33.3	11.7	-4.7	-46.3	-3.7
2009	6.6	-8.3	13.9	-2.9	-10.2	0.2	-0.7	-34.4	-8.5
2010	4.9	-6.9	16.8	-4.2	-14.6	2.5	-0.9	-28.1	-21.1
2011	8.6	-10.1	16.8	-5.8	-22.9	-5.9	-2.5	-19.6	-53.1
2012	16.3	-12.6	19.3	-2.5	-14.1	-8.9	-7.9	-12.2	-30.9
2013	18.0	-5.0	18.7	1.5	-3.6	-7.2	1.4	6.8	-20.3
2014	20.1	-10.1	19.4	3.8	-2.7	-7.4	5.9	4.4	-15.4
2015	26.1	-8.2	18.7	2.4	6.1	-6.7	12.8	8.6	1.9

Notes: A positive (negative) number indicates an undervaluation (overvaluation) expressed in percent of the observed value. Source: authors' calculations.

Table 1. Misalignments in real effective terms (in percent)

Country	Break dates	
FRA	1996	
GER	1990	2000
ITA	1992	
SPA	1992	2006
FIN	1992	2002
IRL	1986	2006
NLD	1985	
GRC	1990	
	Quadratic Test (p-value)	
Breaks (homogeneous)		12.428 (0.000)
Breaks (heterogeneous)		20.657 (0.000)

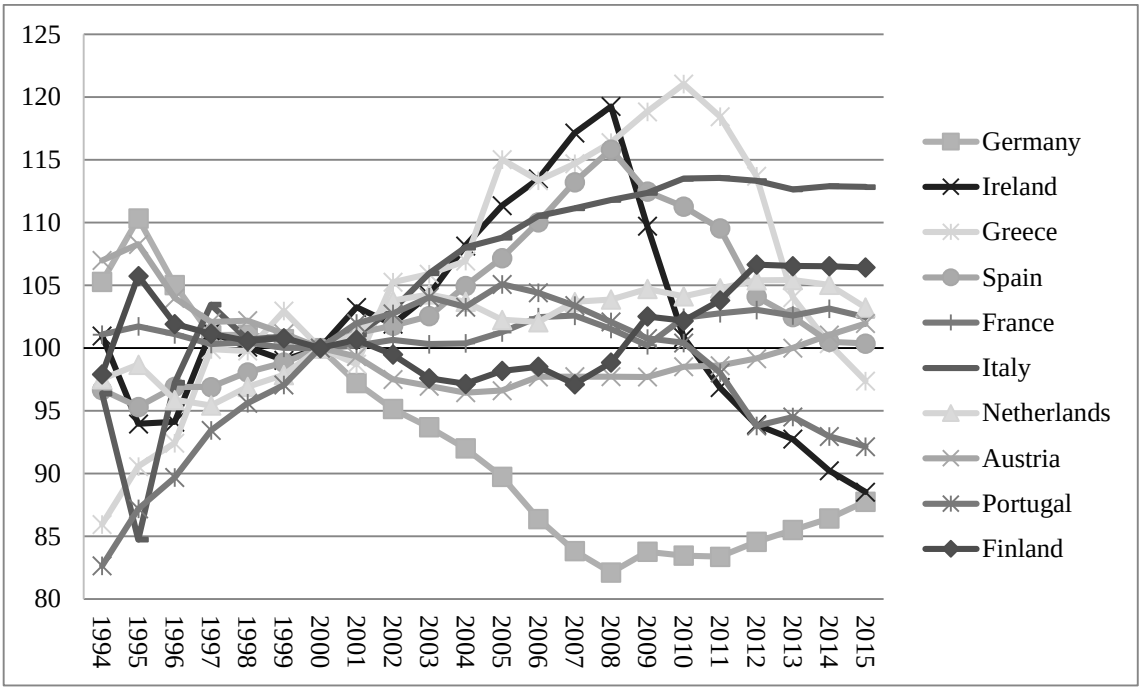
Notes: The number of break points has been estimated using the LWZ information criteria allowing for a maximum of m^{max}= two structural breaks. The long-run variance is estimated using the Quadratic spectral kernel with automatic spectral window bandwidth selection as in Andrews (1991), Andrews and Monahan (1992) and Sul *et al.* (2005). We exclude Austria and Portugal due to missing observations. P-values in parentheses. Source: authors' calculations.

Table 2. Panel unit root test with structural breaks

DHg	1.565 (0.058)
DHp	1.813 (0.034)

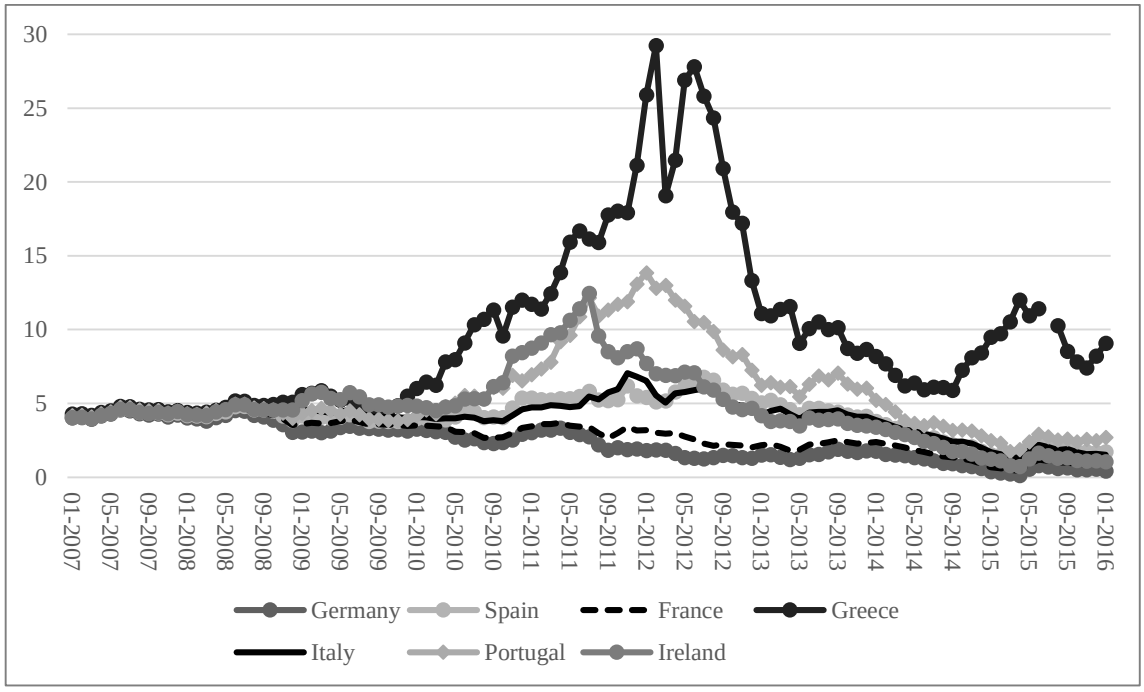
Notes: All tests use an intercept and the Newey and West (1994) procedure for selecting the bandwidth order. In implementing the Durbin-Hausman tests, the maximum for the estimation of the number of common factors is set to five. The p-values use the asymptotic normal distribution. P-values in parentheses. Source: authors' calculations.

Table 3. Panel cointegration tests



Source: authors' calculations based on European Commission data (AMECO), basis 100 in 2000.

Figure 1. Real effective exchange rates based on unit labor cost



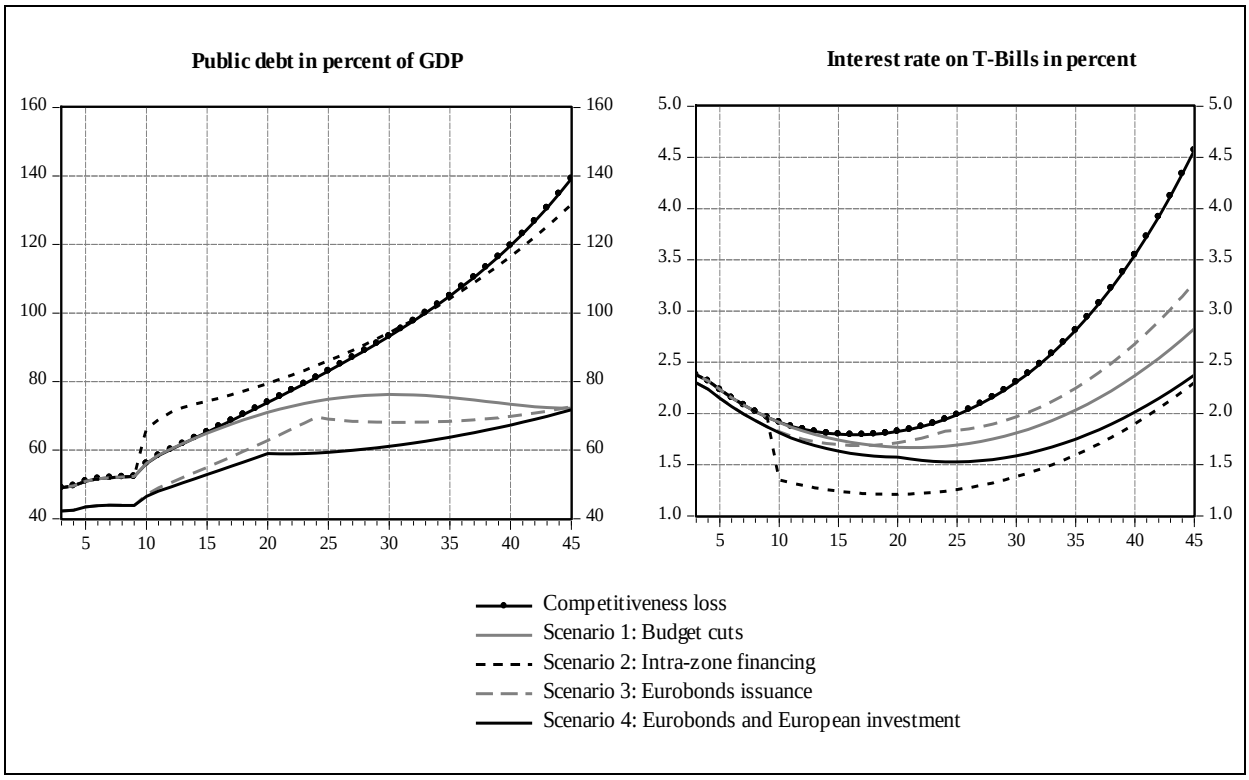
Source: ECB's Statistical Data Warehouse.

Figure 2. Ten-years government real interest rates in percent

	Country n						*Country s*				
	HH	*F*	*G*	*B*	*FB*	*ECB*	*HH*	*F*	*G*	*B*	Σ
C		$+k_n$						$+k_s$			0
D	$+bd_n$			$-bd_n$			$+bd_s$			$-bd_s$	0
Cs	$+hh_n$			$+h_n$		$-h$	$+hh_s$			$+h_s$	0
Cr		$-l_n$		$+l_n^n$						$+l_s^n = 0$	0
				$+l_n^s$				$-l_s$		$+l_s^s$	
R				$-rf_n$		$rf_n + rf_s$				$-rf_s$	0
Bd	$+pb_n b_n^n$		$-pb_n b_n$				$+pb_n b_s^n$				0
	$+pb_s b_n^s$						$+pb_s b_s^s$		$-pb_s b_s$		
E				$+bte_n$	$-bte_n$					$+bte_s$	0
Bi			$-bt_n$	$+bt_n^n$						$+bt_s^n = 0$	0
				$+bt_n^s$					$-bt_s$	$+bt_s^s$	
Eq	$+pe_n eh_n^n$	$+pe_n ee_n^n$					$+pe_n eh_s^n$	$+pe_n ee_s^n$			0
		$-pe_n e_n$									
	$+pe_s eh_n^s$	$+pe_s ee_n^s$					$+pe_s eh_s^s$	$+pe_s ee_s^s$			0
								$-pe_s e_s$			
W	$-vh_n$	$-v_n$	$-d_n$	$-vb_n$	$-de_n$		$-vh_s$	$-v_s$	$-d_s$	$-vb_s$	0
Σ	0	0	0	0	0	0	0	0	0	0	

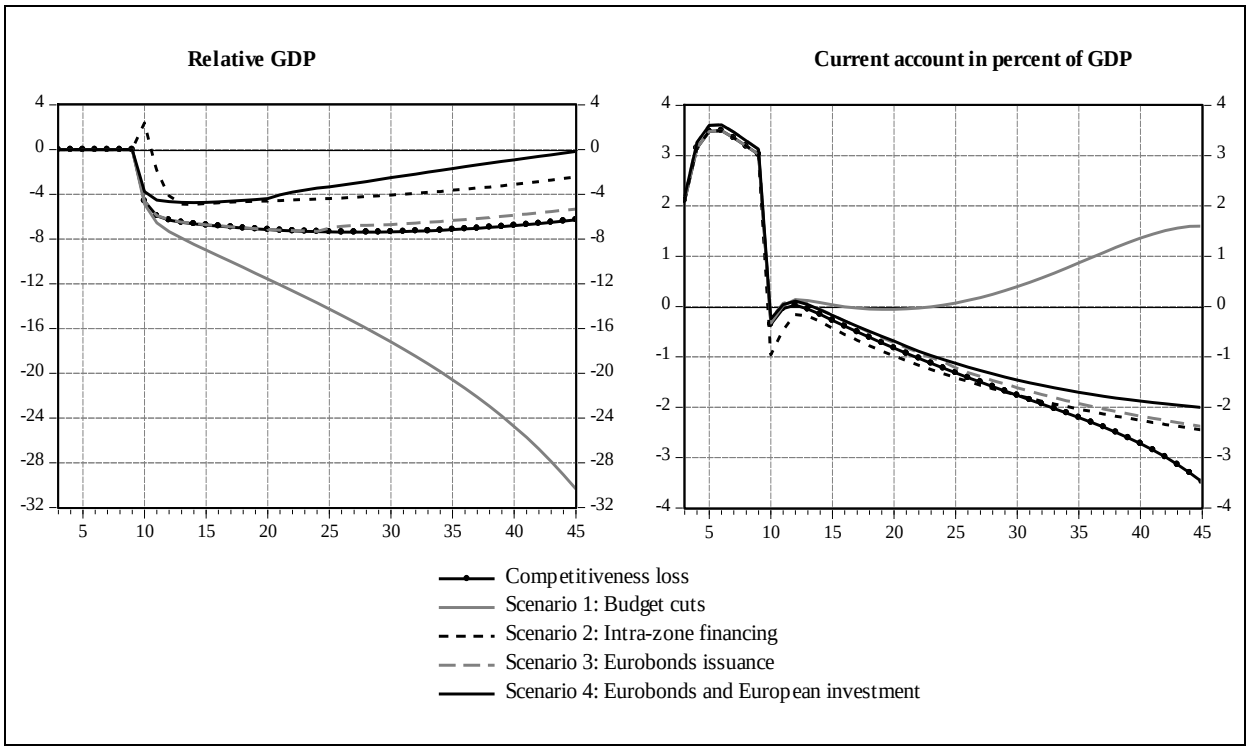
Notes: For the agents in the economy, *HH*, stands for households, *F*, for firms, *G*, for national governments, *B*, for private banks and *FB*, stands for federal budget or a federal institution in charge of the emission of Eurobonds. For the type of financial assets held and issued in the economy, *C*, stands for physical capital, *D*, for deposits, *Cs*, for cash, *Cr*, for credit, *R*, for advances of the central bank, *Bd*, for bonds, *E*, for Eurobonds, *Bi*, for bills, *Eq*, for equities and *W*, stands for wealth.

Table 4. Balance sheet of a monetary union



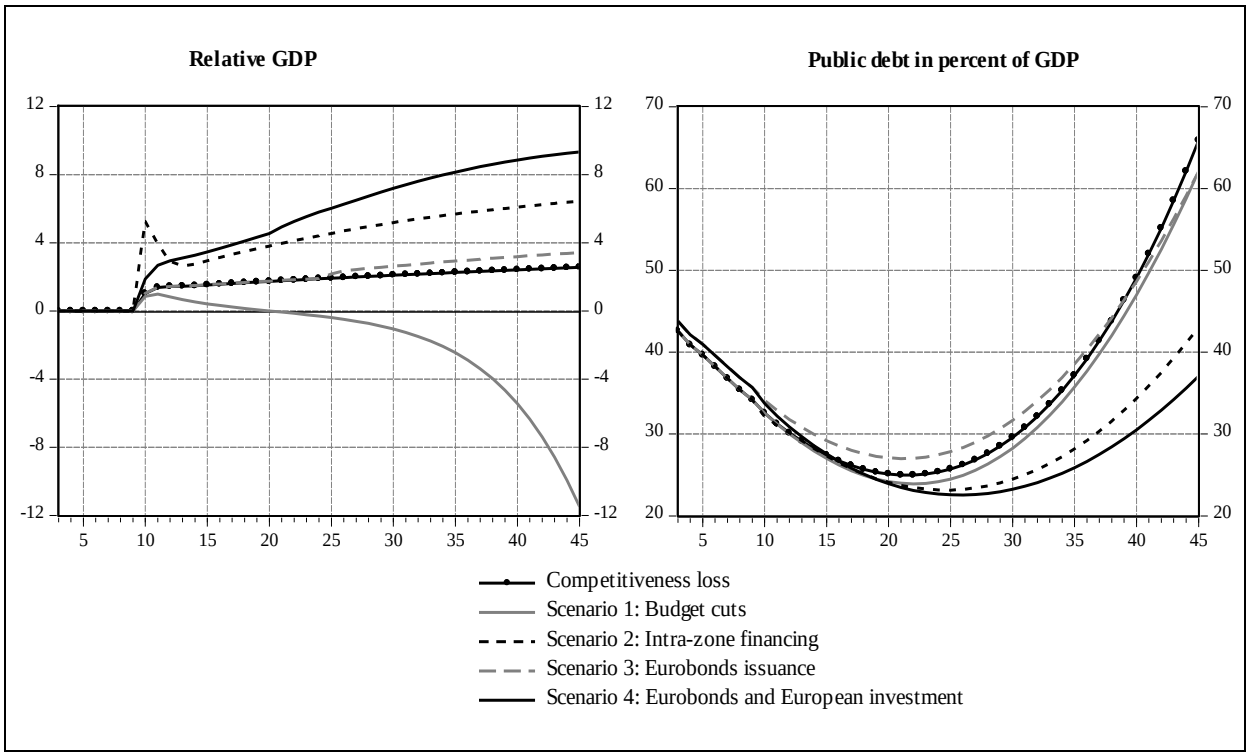
Source: authors' calculations.

Figure 3. Evolutions of public debt and interest rate in the southern country



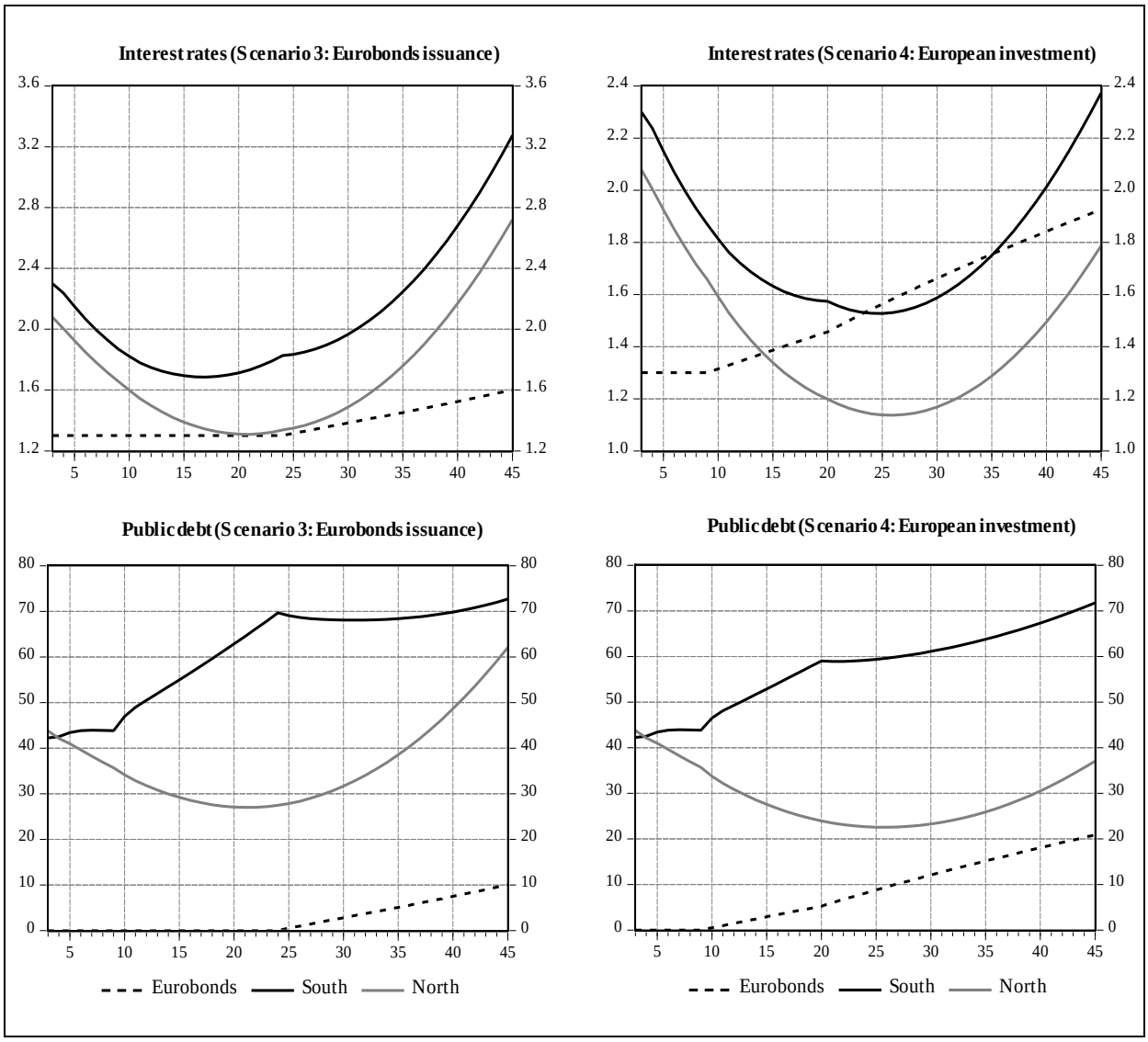
Source: authors' calculations.

Figure 4. Relative GDP and current account in the southern country



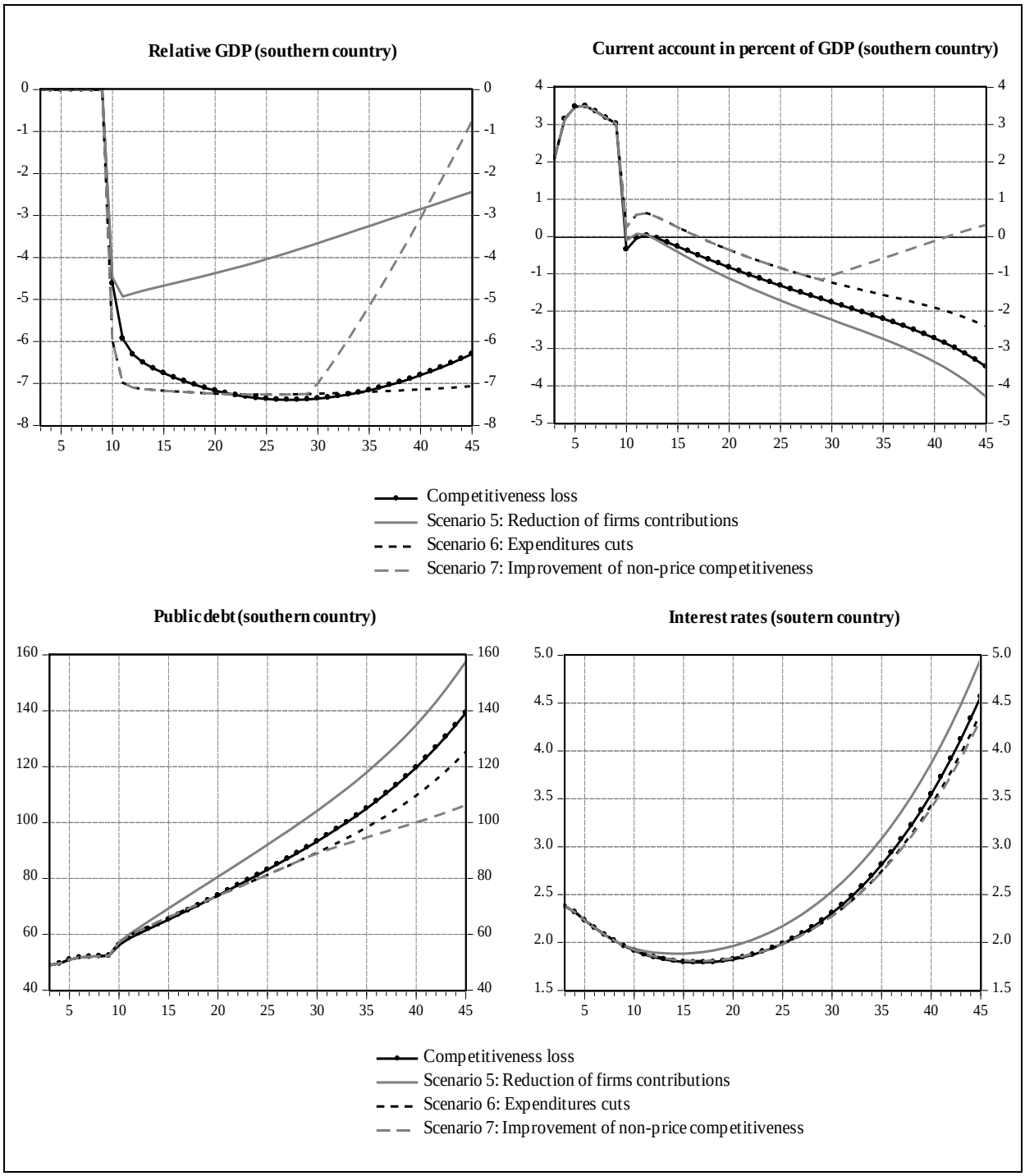
Source: authors' calculations.

Figure 5. Relative GDP and public debt in the northern country



Source: authors' calculations.

Figure 6. Interest rate and public debt in scenario 3 and 4



Source: authors' calculations.

Figure 7. Tax rebates and public expenditure cuts (scenarios 5 to 7)

Appendix A. Underlying current account balance

To consider the reduction of business cycles synchronization in the euro area since the onset of the crisis, we implement the correction proposed by Tamim Bayoumi and Hamid Faruqee in Isard and Faruqee (1998). This correction uses a parsimonious model of world trade in which trade volume equations for goods and services react to real exchange rates. Besides, imports in volume depend on domestic output gap and exports in volume depend on a trade-weighted average of foreign output gaps.

In order to take into account that the impact of exchange rate movements on the current account are not instantaneous, delayed effects of exchange rate variations are spread out over three years (60%, the first year; 25%, the second year and 15%, the third year). The real exchange rate does not influence the export price in domestic currency while it affects the import price immediately and completely. Thus, we can write the current account balance in percentage of GDP as follows:

$$ca/y = \alpha + \left[(m/y)\beta_m + (x/y)\beta_x\right](0.6r + 0.25r_{-1} + 0.15r_{-2}) - (m/y)r \\ -(m/y)\psi_m ygap + (x/y)\psi_x ygapf \qquad [A.1]$$

Where *ygapf* is the average output gap of the main partners; *r*, the logarithm of the real exchange rate (an increase of *R* indicates a depreciation); β_x, β_m, the long run export and import price elasticities, respectively; ψ_x, ψ_m, and long-term export and import volume elasticities, respectively.

In case of real appreciation (a decrease of *r*), imports in volume (*m*) increase while exports in volume (*x*) decrease with lagged effects of the exchange rate variations but current account is improved thanks to cheaper imports. Lastly, a rising domestic output gap (*ygap*) has a negative impact on the current account balance while the foreign output gap has an opposite effect.

The underlying current account (ca/y_{und}) is the current account corrected for the effects of past and present exchange rate variations and for the effects of the domestic and foreign output gaps:

$$ca/y_{und} = \alpha + \left[(m/y)\beta_m + (x/y)\beta_x\right]r - (m/y)r \qquad [A.2]$$

Thanks to equation [A.1] and equation [A.2], we can obtain the Bayoumi-Faruqee correction to compute the underlying current account balance (ca/y_{und}):

$$ca/y_{und} = ca/y + \left[(m/y)\beta_m + (x/y)\beta_x\right](0.4\Delta r + 0.15\Delta r_{-1}) \\ +(m/y)\psi_m ygap - (x/y)\psi_x ygapf \qquad [A.3]$$

In equation [A.3], we can easily observe that a country with an output gap relatively weaker than that of its trade partners will have a lower underlying current account balance, since its induced imports will increase when it closes its relative output gap (i.e. the difference between *YGAP* and *YGAPF*). Symmetrically, a country with an output gap relatively higher than that of its trade partners will have a higher underlying current account balance.

Appendix B. Main Parameters and Robustness checks

Main parameters				
Investment made by firms of country N(S)				
k_{0n}	k_{0s}	Autonomous component	0.055	0.057
k_{1n}	k_{1s}	Marginal impact of firms' profit	0.525	0.525
k_{2n}	k_{2s}	Accelerator effect	0	0
k_{3n}	k_{3s}	Marginal impact of firms' indebtedness	0.1	0.1
k_{4nn}	k_{4ss}	Marginal impact of rate on loans granted by country N(S) banks	0.375	0.475
k_{4sn}	k_{4ns}	Marginal impact of rate on loans granted by country S(N) banks	0.125	0.025
δ_n	δ_s	Rate of depreciation	0.05	0.05
External trade of country N(S)				
μ_{0n}	μ_{0s}	Autonomous component	-1.39	-3
μ_{1n}	μ_{1s}	Income elasticity	1	1
μ_2	μ_2	Price elasticity	0.5	0.5
Consumption				
a_{1n}	a_{1s}	Marginal propensity to consume out of disposable income	0.75	0.75
a_{2n}	a_{2s}	Marginal propensity to consume out of wealth	0.04	0.04
Cash money held by households				
λ_{0n}	λ_{0s}	Cash to consumption ratio	0.15	0.15
Rate of interest on T-bills issued by country N(S)				
a_{1nn}	-	Autonomous component (country N)	0.3	-
a_{1ss}	-	Marginal impact of growth (country S)	0.3	-
b_{2nn}	-	Marginal impact of supply of T-bills in percent of GDP (country N)	0.2	-
a_{1ns}	-	Marginal impact of growth of country N on rate of country S	1	-
a_{2ss}	a_{2ns}	Marginal impact of rates of country N on rate of country S	1.3	1
Eurobonds				
a_{1e}	-	Autonomous component	0.2	-
a_{2e}	-	Marginal impact of supply of T-bills in percent of GDP	0.15	-
Rate of interest on bank loans				
a	-	Marginal impact of rate on T-bills	0.1	-
High powered money (HPM)				
λ_n	λ_s	HPM-bank deposit ratio	0.05	0.05
m_{2b}	-	Banks margin	0.005	-

Table B1. Value of the main parameters for the model of a monetary union

Main parameters				
Tax rates				
θ_{bn}	θ_{bs}	Banks	0.176	0.176
θ_{n}	θ_{s}	Personal income tax rate	0.13	0.13
θ_{nf}	θ_{sf}	Firms tax rate	0.35	0.35
χ_{n}	χ_{s}	Social contributions rate	0.36	0.36
sf_{n}	sf_{s}	Rate of undistributed firms' profit	0.419	0.419
r_{0n}	r_{0s}	Wage share	0.646	0.646

Demand of country N bonds by households of country N		
v_{0nnb}	Autonomous demand	0.047
v_{1nnb}	Marginal impact of rate on country N bonds	2
v_{2nnb}	Marginal impact of rate on country S bonds	2
v_{3nnb}	Marginal impact of rate on bank deposits	0.2
v_{4nnb}	Marginal impact of rate on return of country N equities	0.1
v_{5nnb}	Marginal impact of rate on return of country S equities	0.1
Demand of country S bonds by households of country N		
v_{0nsb}	Autonomous demand	0.047
v_{1nsb}	Marginal impact of rate on country S bonds	2
v_{2nsb}	Marginal impact of rate on country N bonds	2
v_{3nsb}	Marginal impact of rate on bank deposits	0.2
v_{4nsb}	Marginal impact of rate on return of country N equities	0.1
v_{5nsb}	Marginal impact of rate on return of country S equities	0.1
Demand of country S bonds by households of country S		
v_{0ssb}	Autonomous demand	0.081
v_{1ssb}	Marginal impact of rate on country S bonds	2
v_{2ssb}	Marginal impact of rate on country N bonds	2
v_{3ssb}	Marginal impact of rate on bank deposits	0.2
v_{4ssb}	Marginal impact of rate on return of country N equities	0.1
v_{5ssb}	Marginal impact of rate on return of country S equities	0.1

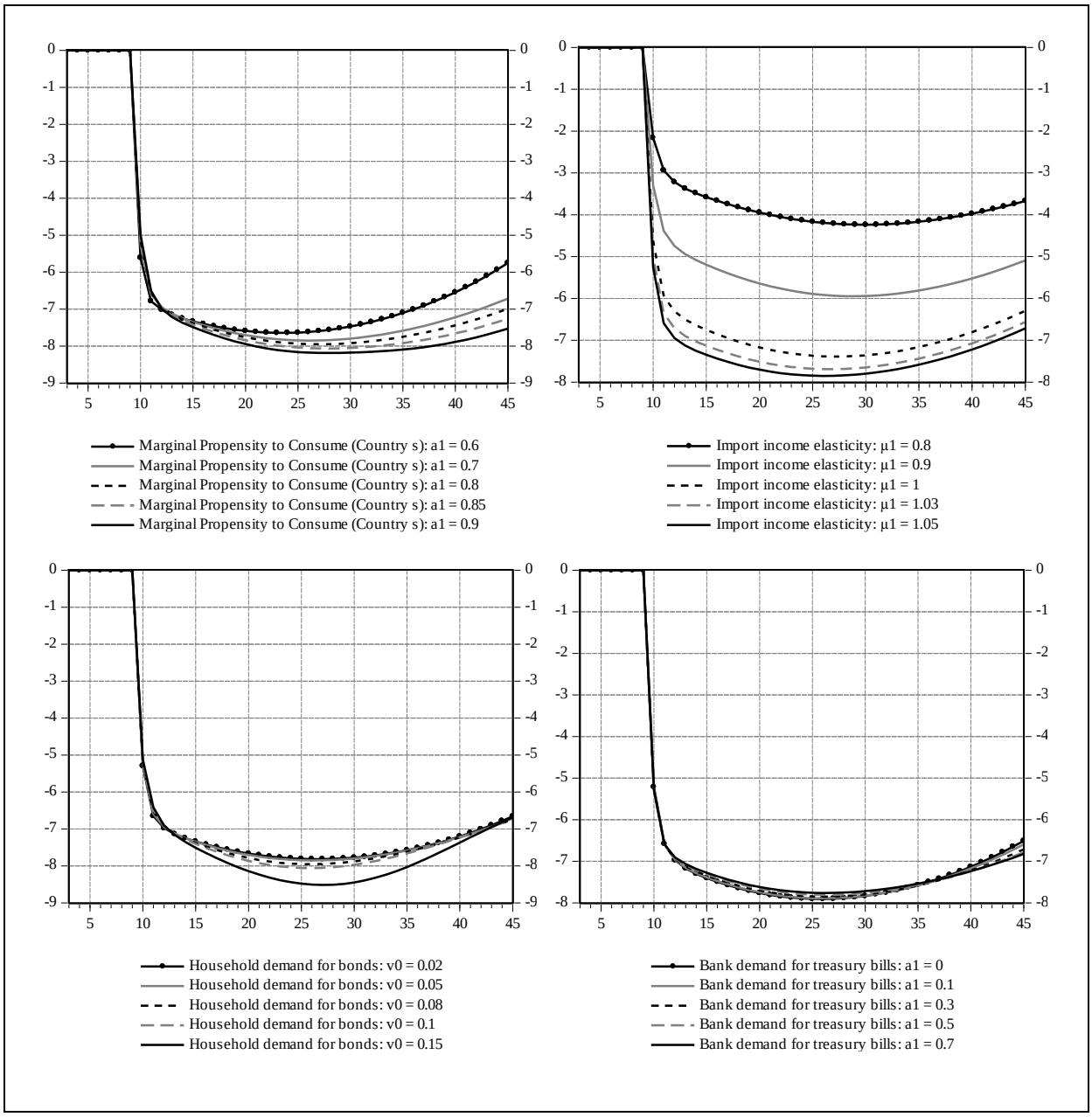
Table B2. Value of the main parameters for the model of a monetary union (continued)

Main parameters		
Demand of country N equities by households of country N		
ν_{0nne}	Autonomous demand	0.476
ν_{1nne}	Marginal impact of rate on country N bonds	0.01
ν_{2nne}	Marginal impact of rate on country S bonds	0.01
ν_{3nne}	Marginal impact of rate on bank deposits	0.2
ν_{4nne}	Marginal impact of rate on return of country N equities	0.02
ν_{5nne}	Marginal impact of rate on return of country S equities	0.02
Demand of country S equities by households of country N		
ν_{0nse}	Autonomous demand	0.213
ν_{1nse}	Marginal impact of rate on country N bonds	0.01
ν_{2nse}	Marginal impact of rate on country S bonds	0.01
ν_{3nse}	Marginal impact of rate on bank deposits	0.2
ν_{4nse}	Marginal impact of rate on return of country N equities	0.02
ν_{5nse}	Marginal impact of rate on return of country S equities	0.02
Demand of country S equities by households of country S		
ν_{0sse}	Autonomous demand	0.625
ν_{1sse}	Marginal impact of rate on country N bonds	0.01
ν_{2sse}	Marginal impact of rate on country S bonds	0.01
ν_{3sse}	Marginal impact of rate on bank deposits	0.2
ν_{4sse}	Marginal impact of rate on return of country N equities	0.02
ν_{5sse}	Marginal impact of rate on return of country S equities	0.02
Demand of country N equities by households of country S		
ν_{0sne}	Autonomous demand	0.0315
ν_{1sne}	Marginal impact of rate on country N bonds	0.01
ν_{2sne}	Marginal impact of rate on country S bonds	0.01
ν_{3sne}	Marginal impact of rate on bank deposits	0.2
ν_{4sne}	Marginal impact of rate on return of country N equities	0.02
ν_{5sne}	Marginal impact of rate on return of country S equities	0.02
f_{3ss}	Marginal impact of firms' profit	0.6

Table B3. Value of the main parameters for the model of a monetary union (continued)

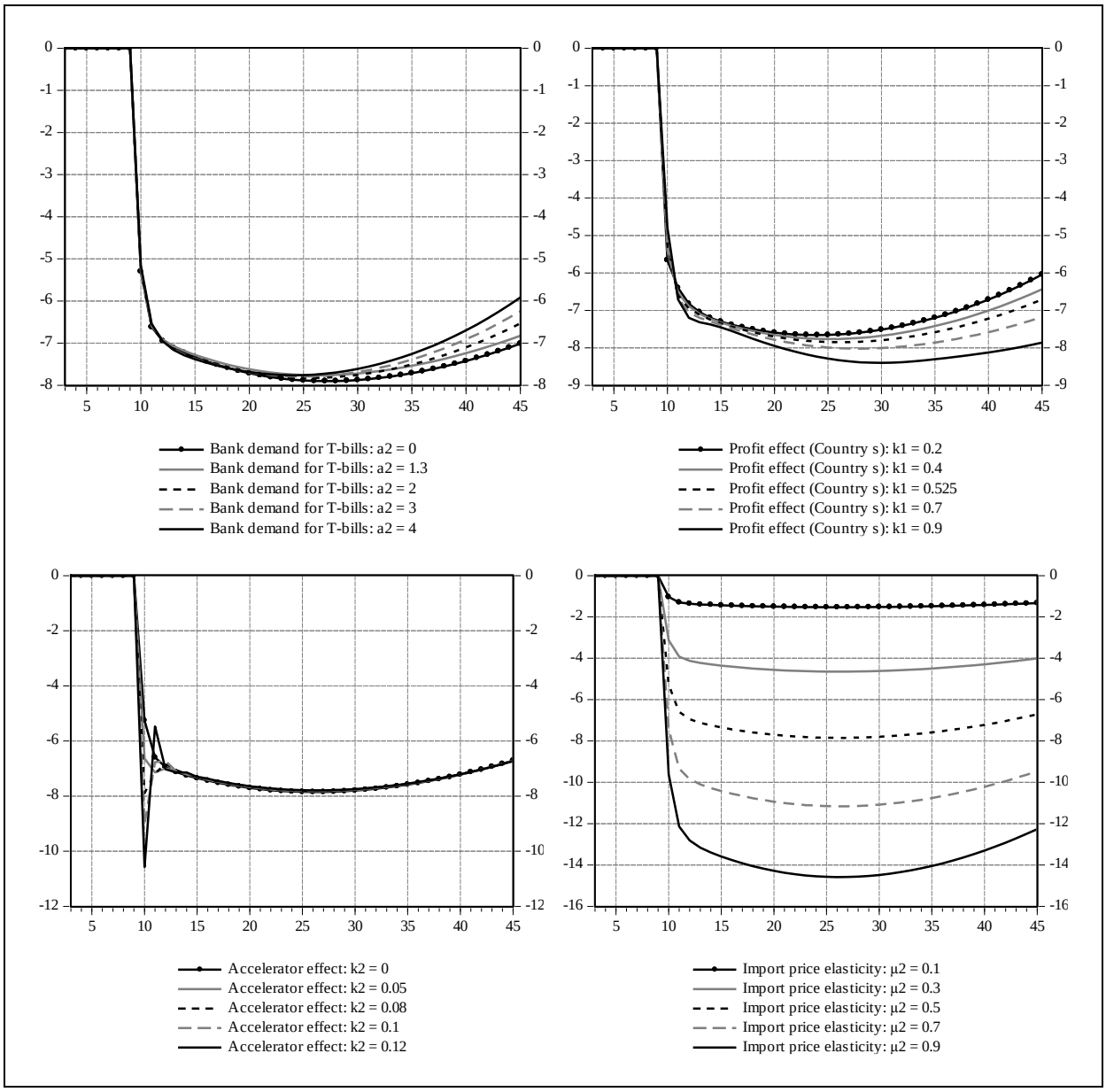
Main parameters		
Price of firms' equities		
σ_n, σ_s	Growth rate	1.003
Government expenditures		
a_{gg1}	Growth rate	1.018
a_{gg2}	Marginal impact of debt service	0

Table B4. Value of the main parameters for the model of a monetary union (continued)



Source: authors' calculations.

Figure B1. Impact of a competitiveness loss on the GDP in the southern country (in percent relative to the baseline model)



Source: authors' calculations.

Figure B2. Impact of a competitiveness loss on the GDP in the southern country (in percent relative to the baseline model) (continued)

Appendix C. Main Results at a Glance

	Relative GDP			GDP Growth		
Southern country	**t=10**	**t=30**	**t=45**	**t=10**	**t=30**	**t=45**
Baseline : Competitiveness loss	-4.6	-7.4	-6.3	-4.0	0.7	1.1
Scenario 1 : Budget cuts	-4.9	-17.2	-30.4	-4.3	-0.05	-0.8
Scenario 2 : Intra-zone financing	2.4	-4.1	-2.4	3.1	0.8	1.1
Scenario 3 : Eurobonds issuance	-4.6	-6.7	-5.3	-4.0	0.8	1.1
Scenario 4 : Eurobonds and European projects	-3.8	-2.5	-0.2	-3.1	0.9	1.2
Scenario 5 : Reduction of firms contributions	-4.5	-3.7	-2.4	-3.8	0.8	1.1
Scenario 6 : Expenditure cuts	-6.0	-7.2	-7.1	-5.4	0.7	1.0
Scenario 7 : Non-price competitiveness	-6.0	-7.0	-0.8	-5.4	1.0	1.4

Source: authors' calculations.

Table C5. Competitiveness loss in the southern country: Relative GDP and GDP Growth (expressed as percentage) in the southern country

	Public Debt			Public expenditures		
Southern Country	**t=10**	**t=30**	**t=45**	**t=10**	**t=30**	**t=45**
Baseline : Competitiveness loss	56.1	93.2	139.2	101.8	145.4	190.1
Scenario 1 : Budget cuts	56.1	76.2	72.2	100.2	101.9	93.1
Scenario 2 : Intra-zone financing	66.1	94.2	131.7	101.8	145.4	190.1
Scenario 3 : Eurobonds issuance	46.9	68.1	72.7	101.8	145.4	190.1
Scenario 4 : Eurobonds and European projects	46.5	61.1	71.8	105.3	149.7	195.0
Scenario 5 : Reduction of firms contributions	57.1	104.2	157.6	101.8	145.4	190.1
Scenario 6 : Expenditure cuts	57.1	89.2	125.3	91.2	130.3	170.3
Scenario 7 : Non-price competitiveness	57.1	88.9	106.2	91.2	130.3	170.3

Source: authors' calculations.

Table C6. Competitiveness loss in the southern country: Public Debt (as percent of GDP) and public expenditures (basis 100 in t=9) in the southern country

	Current account			Interest rate		
Southern country	**t=10**	**t=30**	**t=45**	**t=10**	**t=30**	**t=45**
Baseline : Competitiveness loss	-0.3	-1.8	-3.5	1.9	2.3	4.6
Scenario 1 : Budget cuts	-0.3	0.4	1.6	1.9	1.8	2.8
Scenario 2 : Intra-zone financing	-1.0	-1.8	-2.4	1.3	1.4	2.3
Scenario 3 : Eurobonds issuance	-0.2	-1.6	-2.4	1.8	2.0	3.3
Scenario 4 : Eurobonds and European projects	-0.2	-1.5	-2.0	1.8	1.6	2.4
Scenario 5 : Reduction of firms contributions	-0.1	-2.2	-4.3	1.9	2.5	5.0
Scenario 6 : Expenditure cuts	0.3	-1.2	-2.4	1.9	2.3	4.4
Scenario 7 : Non-price competitiveness	0.3	-1.0	0.3	1.9	2.3	4.3

Source: authors' calculations.

Table C7. Competitiveness loss in the southern country: Public Debt (as percent of GDP) and public expenditures (basis 100 in t=9) in the southern country

	Relative GDP			GDP Growth		
Northern country	**t=10**	**t=30**	**t=45**	**t=10**	**t=30**	**t=45**
Baseline : Competitiveness loss	1.0	2.1	2.5	1.1	0.4	1.0
Scenario 1 : Budget cuts	0.9	-1.1	-11.5	0.9	0.2	-0.8
Scenario 2 : Intra-zone financing	5.2	5.2	6.4	5.2	0.5	1.0
Scenario 3 : Eurobonds issuance	1.0	2.6	3.4	1.1	0.5	1.0
Scenario 4 : Eurobonds and European projects	1.9	7.2	9.3	1.9	0.6	1.1
Scenario 5 : Reduction of firms contributions	0.8	2.3	3.0	0.9	0.4	1.0
Scenario 6 : Expenditure cuts	0.8	1.8	2.0	0.8	0.4	1.0
Scenario 7 : Non-price competitiveness	0.8	1.7	0.3	0.8	0.3	0.8

Source: authors' calculations.

Table C8. Competitiveness loss in the southern country: Relative GDP and GDP Growth (expressed as percentage) in the northern country

	Public Debt			Public expenditures		
Northern country	**t=10**	**t=30**	**t=45**	**t=10**	**t=30**	**t=45**
Baseline : Competitiveness loss	32.6	29.6	65.9	101.8	145.4	190.1
Scenario 1 : Budget cuts	32.5	28.3	62.1	100.7	138.4	148.6
Scenario 2 : Intra-zone financing	32.2	24.5	43.0	101.8	145.4	190.1
Scenario 3 : Eurobonds issuance	34.1	31.7	62.1	101.8	145.4	190.1
Scenario 4 : Eurobonds and European projects	33.7	23.2	37.1	105.8	149.7	195.0
Scenario 5 : Reduction of firms contributions	32.6	28.9	65.3	101.8	145.4	190.1
Scenario 6 : Expenditure cuts	32.6	30.7	68.4	101.8	145.4	190.1
Scenario 7 : Non-price competitiveness	32.6	30.7	72.1	101.8	145.5	190.1

Source: authors' calculations.

Table C9. Competitiveness loss in the southern country: Public Debt (as percent of GDP) and public expenditures (basis 100 in t=9) in the northern country

	Current account			Interest rate		
Northern country	**t=10**	**t=30**	**t=45**	**t=10**	**t=30**	**t=45**
Baseline : Competitiveness loss	0.1	0.4	0.7	1.6	1.5	3.2
Scenario 1 : Budget cuts	0.1	-0.1	-0.3	1.6	1.3	2.5
Scenario 2 : Intra-zone financing	0.2	0.4	0.5	1.5	1.1	1.9
Scenario 3 : Eurobonds issuance	0.0	0.3	0.5	1.6	1.5	2.7
Scenario 4 : Eurobonds and European projects	0.0	0.3	0.4	1.6	1.2	1.8
Scenario 5 : Reduction of firms contributions	0.0	0.5	0.9	1.6	1.6	3.2
Scenario 6 : Expenditure cuts	0.0	0.2	0.5	1.6	1.5	3.2
Scenario 7 : Non-price competitiveness	0.0	0.2	-0.1	1.6	1.5	3.3

Source: authors' calculations.

Table C10. Competitiveness loss in the southern country: Public Debt (as percent of GDP) and public expenditures (basis 100 in t=9) in the northern country