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Interest rates, eurobonds and intra-European exchange rate misalignments: the challenge of sustainable adjustments in the eurozone

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Abstract: The euro zone crisis illustrates the deficiencies of adjustment mechanisms in a monetary union characterized by a large heterogeneity. Exchange rate adjustments being impossible, they are very few alternative mechanisms. At the level of the whole euro zone the euro is close to its equilibrium parity. But the euro is strongly overvalued for Southern European countries, France included, and largely undervalued for Northern European countries, especially Germany. The paper gives a new evaluation of these exchange rate misalignments inside the euro zone, using a FEER approach, and examines the evolution of competitiveness. In a second step, we use a two-country SFC model of a monetary union with endogenous interest rates and eurobonds issuance. Three main results are obtained. Facing a competitiveness loss in southern countries due to exchange rates misalignments, increasing intra-European financing by banks of northern countries or other institutions could contribute to reduce the debt burden and induce a partial recovery but public debt would increase. Implementation of eurobonds as a tool to partly mutualize European sovereign debt would have a rather similar positive impact, but with a public debt limited to 60% of GDP. Furthermore, eurobonds could also be used to finance large European projects which could impulse a stronger recovery in the entire euro zone with stabilized current account imbalances. However, the settlement of a European Debt Agency in charge of the issuance of the eurobonds would face strong political obstacles.

JEL Classification: F31, F32, F37, F41, E12.

Key words: Euro Crisis, Exchange Rate Misalignments, Eurobonds, Interest Rate.

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1. Introduction

The euro crisis illustrates the deficiencies of adjustment mechanisms in a monetary union characterized by a large heterogeneity. 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. Exchange rate adjustments being impossible, they are very few alternative mechanisms. Fiscal policy could play an active role. In a federal state like the USA its stabilization coefficient is around 20% (Italianer and Pisani-Ferry, 1992). But 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 would have stabilization coefficients around 20-30% each (Asdrubali and Kim, 2004). These results have been used during the 2000 by proponents of liberal economic policies in the EU to promote deeper financial integration without having to develop a federal budget (European Commission, 2007; Trichet, 2007). However, the theoretical basis and the results appear highly questionable (Clévenot and Duwicquet, 2011).

Consequently, relative wage and price flexibility are proposed in order to take 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 huge structural specificities. They are more inefficient when they are implemented simultaneously in interdependent countries, as it is the case in the eurozone, especially in the Southern European countries (Mazier and Saglio, 2008).

This situation reflects a simple diagnosis. At the level of the whole eurozone, the current account is close to equilibrium and the fiscal deficit is smaller than in many other OECD countries. The euro is close to its equilibrium parity. But intra-European imbalances are huge.

The euro is strongly overvalued for Southern European countries, France included, and largely undervalued for Northern European countries, especially 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 eurozone, and deficit are reduced. This situation is equivalent to implicit positive transfers in favor on the North and negative transfers at the detriment of the South, which are largely ignored in the public debate.

In order to investigate these issues, Duwicquet et al. (2013) have used an SFC model of a monetary union with two countries along the lines of Godley and Lavoie (2006, 2007a, 2007b), Lavoie (2003) and Duwicquet and Mazier (2010, 2011). The model described the real sector and 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 issuing. Three results have been obtained. The stabilizing role of such a federal budget has been confirmed facing asymmetric shocks or exchange rate misalignments inside the monetary union. Similarly, the stabilizing role of eurobonds used to finance European investment projects has been illustrated. But the model was limited to exogenous interest rates, which can only be regarded as a first step, as we have assisted to large movements of interest rates in Southern European countries since the onset of the euro crisis.

The paper is organized as follow. In a first part, we give a new evaluation of these exchange rate misalignments inside the eurozone, using a FEER approach, and we discuss the evolution of real effective exchange rates within the eurozone. In a second part, we present an extended version with endogenous interest rates of an SFC model of a monetary union. With this model, we examine to what extent asymmetric evolutions implied to intra-European

misalignments can be adjusted. Interest rates on public bonds are now endogenous. Fiscal policy is also partly endogenous and reacts to financial markets evolution. The possibility to increase intra-zone financing allows a reduction of the pressure on interest rates. Eurobonds are introduced and used in two ways, on the one hand, in order to pool a part of the European public debts and, in the other hand, to finance European investments in growth sectors.

2. Intra-European exchange rates misalignments

2.1. A structural heterogeneity

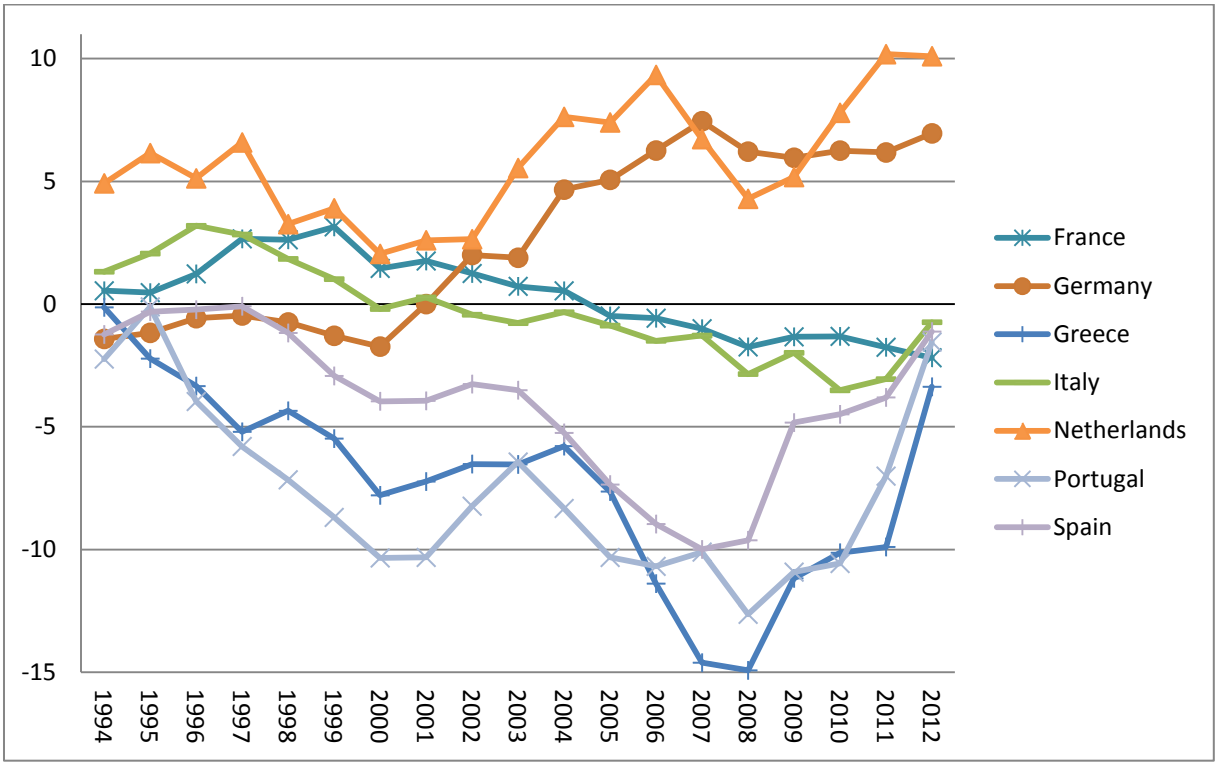
Since the beginning of the 2000s, we observe a surge of current account imbalances inside the Eurozone in spite of a rather balanced current account for the whole area. On the one side, Northern European countries have accumulated huge current account surpluses and on the other side, Southern European countries have ran important current account deficits (see figure 1). These evolutions reflect, at least partially, the increasing heterogeneity of exchange rate misalignments inside the Eurozone. By using a FEER approach, introduced by Williamson (1983), Jeong et al. (2010) have shown that Northern countries were increasingly undervalued and Southern countries increasingly overvalued.

Since 2009, current account deficits of Southern European countries have been reduced because of restrictive policies and internal devaluations. In this section, we give new estimations of FEERs for ten European countries (Austria, Finland, France, Germany, Italy, Ireland, Netherlands, Spain, Portugal and Greece) over the period 1994-2012 (see table 1). The FEER is defined as the exchange rate prevailing when the economy simultaneously reaches the external equilibrium and the internal equilibrium for all the trading partners. This measure was derived from a standard world trade model in which all the variables are endogenous except the external equilibrium (sustainable current account) and the internal equilibrium (full utilization of the productive potential). The external equilibrium is estimated with panel regression techniques. The internal equilibrium is reached when the output gap is

closed (see Jeong et al. (2010) for further details).

In this new estimation the underlying current account is obtained by taking into account the delayed effects of past exchange rate variations (in t-1 and t-2), as it was done in the previous estimations, but also the effects of domestic output gap on imports and foreign output gap on exports, as it has been proposed by Bayoumi and Faruqee (1998). This second correction is more significant in the present period due to the size of the output gaps since 2008 (see appendix A for a short presentation of methodology and corrections made on underlying current accounts).

Figure 1: Current account imbalances as percent of GDP



Source: authors' calculations based on IMF WEO October 2013.

Since the early 2000s, we have assisted to a sharp increase of the heterogeneity of misalignments in the Eurozone (table 1). A split within the eurozone between some countries increasingly undervalued (like Germany, Austria, Netherlands and Finland) and others increasingly overvalued (like Greece, Portugal, Spain and France). On average between 2005 and 2010, Germany, Austria, Netherlands and Finland have been undervalued by 13% while

Greece, Portugal, Spain and France have been overvalued by 23%.

Table 1: Misalignments in real effective terms (in %)

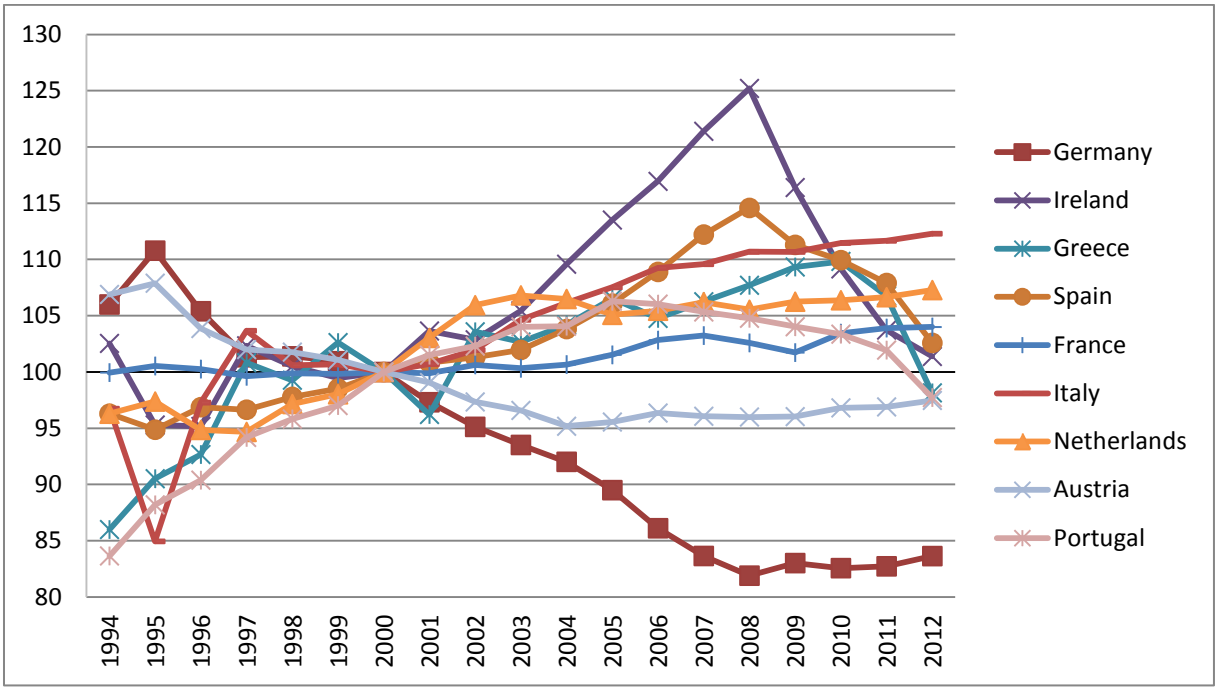
	EU	FRA	GER	ITA	SPA	AUT	FIN	IRL	NLD	PRT	GRC
1994	-3,4	3.1	-10.5	9.2	0.6	-3.1	-1.7	3.8	0.8	4.3	13.9
1995	1,2	1.4	-9.4	11.2	8.8	-8.3	7.2	3.8	0.8	7.0	1.3
1996	4,2	3.9	-4.8	9.4	-4.6	-9.2	9.3	0.8	0.4	-11.3	-12.5
1997	3,5	15.2	-3.2	8.2	-0.8	-8.8	16.9	0.6	1.8	-19.3	-12.7
1998	0,6	15.4	-5.2	5.1	-1.4	-3.5	17.4	-0.8	-2.2	-18.5	-8.4
1999	2,0	19.5	-8.1	1.8	-6.9	-2.9	17.6	0.4	-0.7	-23.7	-17.8
2000	0,1	7.4	-8.4	-0.7	-10.0	1.1	21.4	-2.2	-3.7	-28.7	-25.2
2001	6,9	7.6	-3.5	-1.2	-13.0	-3.5	22.2	-5.4	-6.4	-34.3	-24.3
2002	6,6	2.4	3.5	-4.2	-12.9	9.8	23.0	-6.2	-8.2	-27.4	-22.4
2003	2,2	-3.0	2.2	-6.9	-13.6	2.9	12.0	-6.8	-3.0	-23.8	-11.8
2004	6.6	-5.7	9.0	-1.9	-22.0	1.2	12.7	-7.2	-1.1	-33.8	1.0
2005	1.8	-11.2	11.6	-1.2	-30.7	3.8	5.5	-7.3	1.6	-44.2	-4.6
2006	0.3	-8.8	16.5	-0.7	-34.0	7.9	9.4	-5.1	6.1	-42.5	-5.1
2007	0.1	-12.8	18.4	-0.3	-42.0	10.4	11.5	-11.1	3.1	-33.8	-7.4
2008	-2.6	-19.8	14.3	-5.7	-46.7	12.6	4.5	-14.1	0.0	-45.9	-10.1
2009	0.6	-11.6	16.3	-2.0	-21.4	7.2	-0.4	-2.5	2.1	-35.4	-0.4
2010	1.6	-8.9	20.2	-3.2	-21.5	9.8	3.4	8.1	8.4	-26.8	-11.5
2011	8.2	-15.4	16.9	-4.1	-19.5	6.9	-7.3	3.9	6.6	-22.1	-46.2
2012	14.1	-14.1	19.9	4.3	-1.3	7.8	-5.2	13.0	7.1	2.7	-15.9

Note: Forecasts for 2012 based on IMF WEO October 2013; See Jeong *et al.* (2010) for a complete description of the model of world trade and the methodology used to compute ERMs. Source: authors' calculations. A positive (negative) number indicates an undervaluation (overvaluation) expressed in percent of the observed value.

These intra-European exchange rate misalignments reflect a strong structural heterogeneity between European countries at several levels (nature of the international specialization, size and productivity of the firms, R&D effort, and qualification of the labor force). They are at the heart of the current problems of the eurozone. However, since the onset of the euro crisis in 2010, a reduction of misalignments is observed for most of the Southern European countries. Irish, Spanish, Italian and even Portuguese euros seem no more overvalued in 2012.

But Greek and French euros remain overvalued around 15% and German euro undervalued around 20%. These movements have been mainly driven by large real effective devaluations in Ireland, Spain, Portugal and Greece, as shown in figure 2 with the evolutions of the relative unit labor cost (RULC) i.e. the real effective exchange rates based on ULC. These politics of internal devaluation are very painful and has led to a deep recession in Greece, as in other Southern European countries, with a reduction of current deficits mainly due to the shrink of imports, but with limited improvement of the public finance.

Figure 2: Real effective exchange rates based on unit labor cost

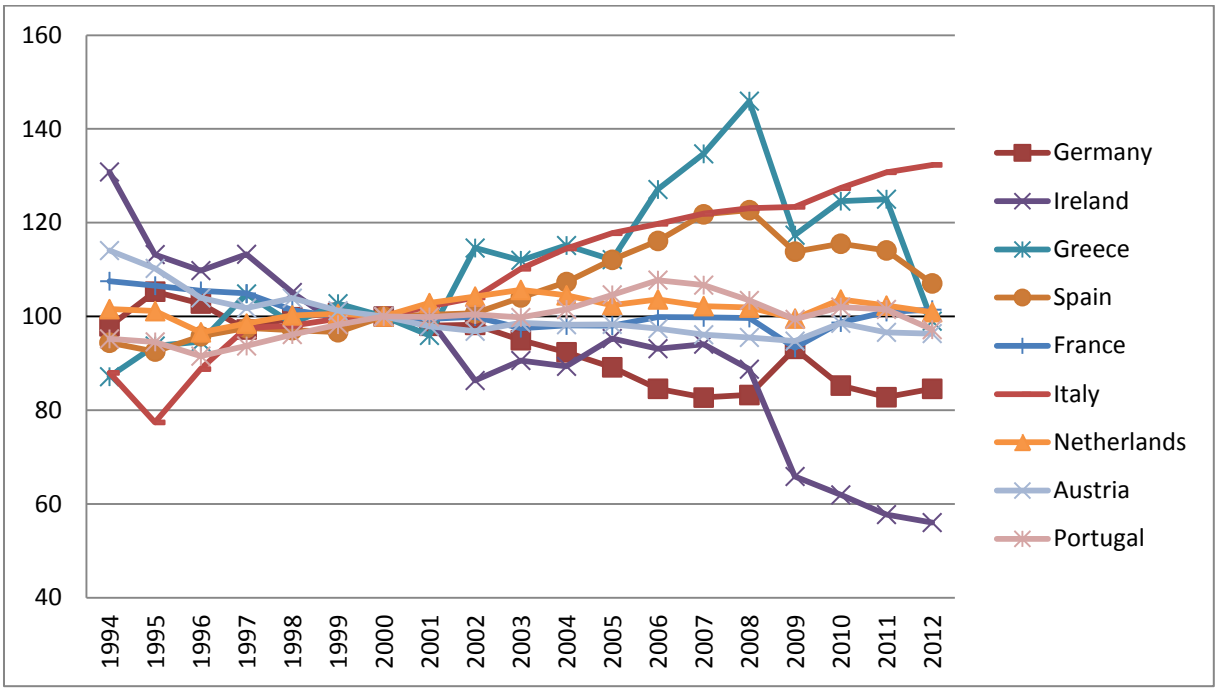


Source: authors' calculations based on European Commission data, basis 100 in 2000.

These evolutions can be analyzed in more details using other indicators of real effective exchange rates based on nominal unit wage cost (figure 3) and export price deflator (figure 4). In spite of large wage cut adjustment in Greece, the Greek euro remains overvalued. This implies that the Greek export firms have used the wage cuts mainly to increase their margins without improving their price competitiveness. To a less extent the Portuguese and Spanish firms have done the same, but with more success on the export shares for Spain, which can be explained by non-price competitiveness factors. On the opposite wage and employment

adjustments have been very large in Ireland and have been accompanied by an improvement of export price competitiveness which is reflected in a slight undervaluation. Italy has faced a drift of its relative ULC and export price competitiveness without any attempt to adjust it in the recent period. The limited overvaluation of the Italian euro reflects non price competitiveness factors.

Figure 3: Real effective exchange rates based on unit wage cost



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

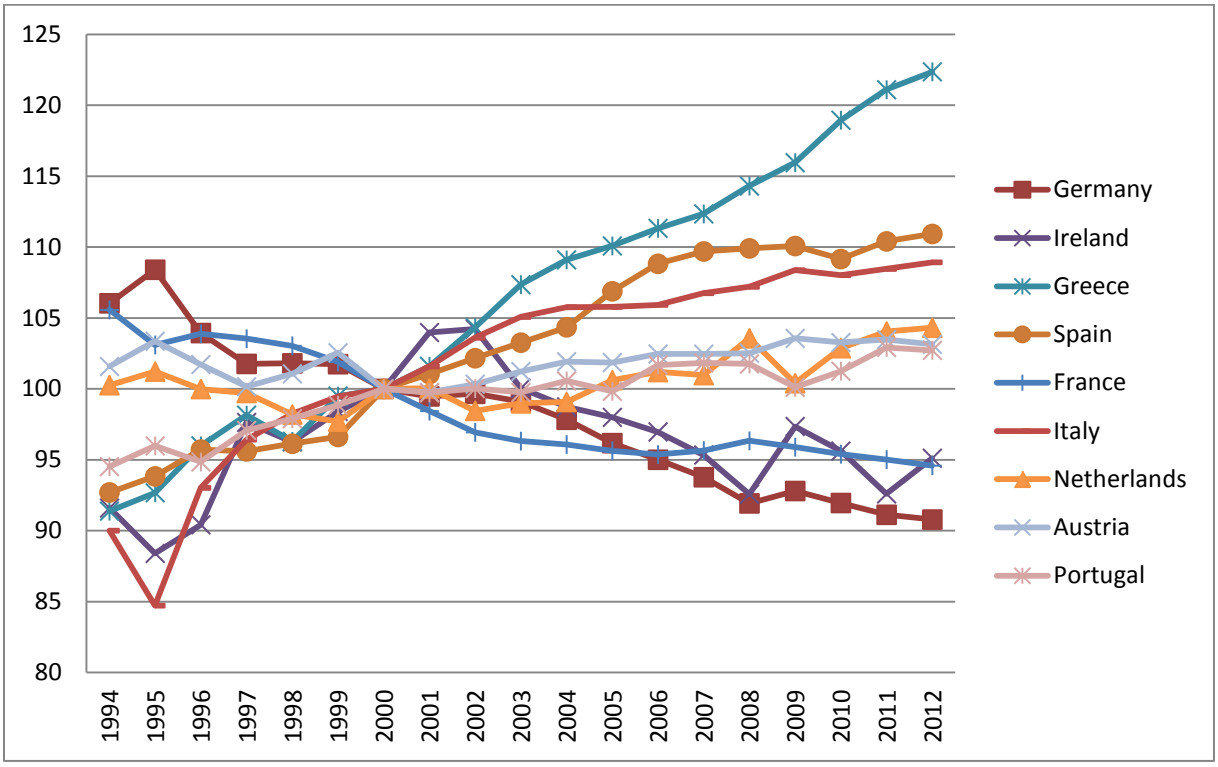
Apart from the French case which will be analyzed more in detail below, Germany is the last country to examine. From 2000 to 2008 sharp wage and productivity adjustments have led to a large reduction of the German relative unit labor cost which has been preserved during the crisis. Export price competitiveness has also been improved, although to a lesser extent than the RULC which has allowed an improvement of the export margin of the German firms.

2.2 The French deadlock

The French case is interesting. French RULC and unit wage cost have followed an intermediate path without large drift, but without cost adjustments. Facing this evolution, export margins have been regularly reduced to preserve, and even improve, export price

competitiveness. This has not been sufficient to avoid an increasing overvaluation of the French euro, due to the weakness of non-price competitiveness.

Figure 4: Real effective exchange rates based on export price deflator



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

Another way to illustrate these issues is to compare two estimations of the RULC, one measured in level using purchasing power parity (RULC), the other measured with the equilibrium exchange rate (FEER) and corresponding to an equilibrium value of the ULC (RULC*). These indicators have been estimated for France and Germany (figure 5). They show that the French RULC has remained during almost thirty years close to one, i.e. that the French unit labor cost was in level close to the ULC of the main partners. In that sense, it could be claimed that there was no problem of cost competitiveness, in spite of a slight drift during the 2000s. A more precise analysis leads to a different diagnosis. At the end of the 2000s the French RULC was very close to the German one, in contrast with what was observed during the 1990s when the German RULC was quite higher than the French one. The French firms had at that time a cost advantage in contrast with the German firms which

suffered of a cost disadvantage. It helped the French firms to survive and compensate their insufficiency in matter of non-price competitiveness while the German firms partly compensated their cost disadvantage by non-price competitiveness advantage. Consequently, the overvaluation of the deutschmark (changed in German euro in 1999) remained limited. At the end of the 1990s the French RULC was under its equilibrium value, which illustrated the undervaluation of the Franc (changed in French euro in 1999). During the 1980s and 1990s the equilibrium value of the French ULC has appreciated progressively, which was reflecting some effort to re-structure the manufacturing sector, but also the declining position of our main competitor, the German economy which was engaged during the 1990s in a painful reunification.

During the 2000s the reverse has been complete. The German equilibrium RULC* has appreciated, thanks to industrial restructuration (mainly with delocalization in Eastern Europe) and cost adjustments, which has led to a large undervaluation of the German euro. In sharp contrast, the French equilibrium RULC has depreciated due to a de-industrialization process and declining rates of investment and R&D. Without cost adjustments, as it has been seen, and, in spite of the reduction of the export margins, a structural overvaluation of the French euro has appeared.

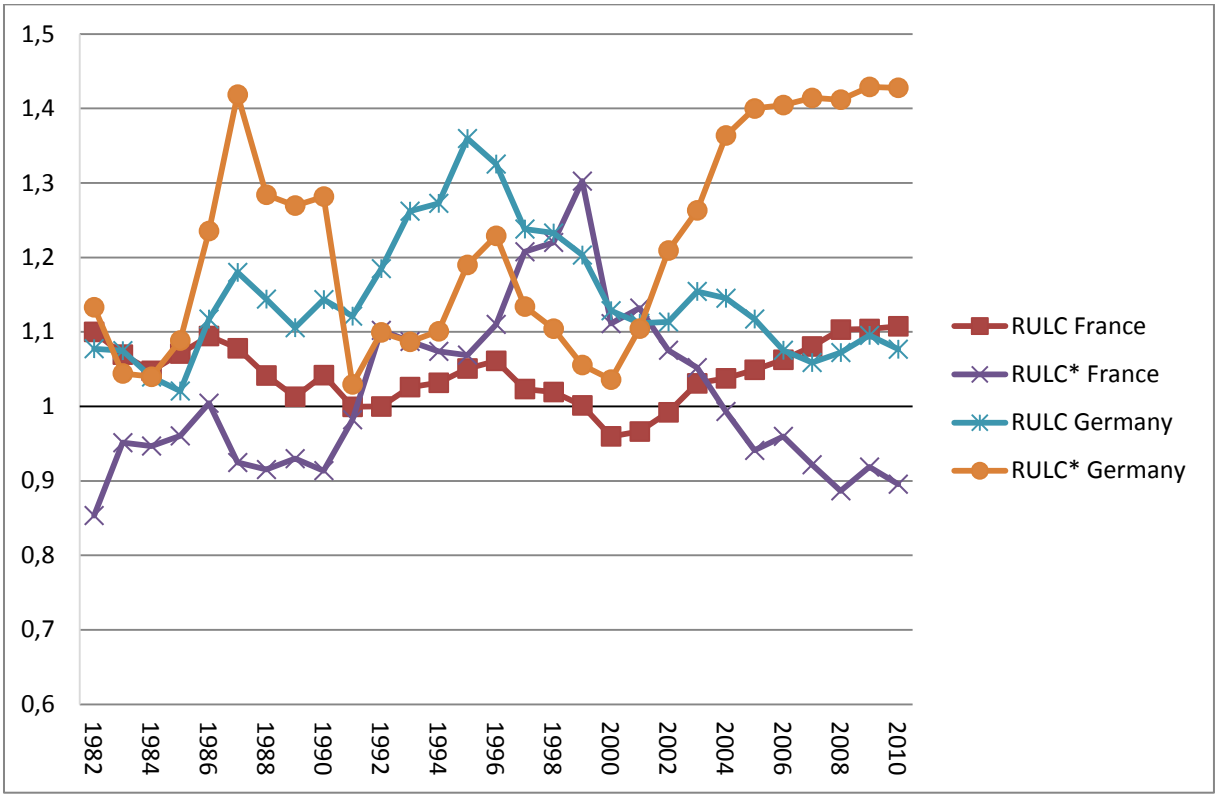
The French economy is clearly in a deadlock. There are three alternative issues. Like in other Southern European countries, cost adjustments through wage cut and productivity gains could be used. But as the social cost is high and their efficiency is limited, they will perpetuate the recession in France and in other European countries. They are not in the agenda of the present government.

The parity of the euro franc could be depreciated. This would mean a complete change in the

European monetary regime, which is not impossible but raises many problems[1]. It is not also in the agenda of the present government.

The third solution, which has been adopted, is the "employment-competitiveness tax rebate" (20 billion of euros, around 1% of GDP) followed by the "responsibility pact" in January 2014 (10 billion more of reduction of social contributions). The idea is to reduce costs through tax rebate. The target of these measures is not clear and they raise, at least, two questions. If the government wants to improve the competitiveness, the measure is inaccurate as all the firms, including those of the non-tradable sector like banks and retailers can benefit of the tax rebate. Consequently, the transfer in favor of the tradable sector is too limited, compared with the cost disadvantage which prevails actually.

Figure 5: Level (RULC) and equilibrium relative unit labor cost (RULC*)



[1] This is discussed in other papers (Mazier, 2013; Mazier and Valdecantos, 2014).

Source: authors' calculations based on Duwicquet et alii (2013)'s data. We thank Anna Su for providing data assistance.

A larger transfer would be necessary but could not be supported by the public finance. If the target is to improve employment, as it seems to be more the case with the "responsibility pact", the past experiences show that efficiency is not warranted and the problem of cost-competitiveness, which cannot be ignored, is not solved. The government is aware of these limits and has completed his array of measures by re-launching industrial policy measures (major industrial projects, innovation policy, etc.) to improve non-price competitiveness. This is welcome but this kind of measures takes a long time (around 10 years) to be fully operational.

The risk is therefore that any target can be reached. The competitiveness problem will remain and financing the current deficit might become more difficult. Tax rebates could have a limited impact on employment, at least as the profit margins have been reduced during the crisis, especially for the export sector. The financing of the tax rebates will imply public expenditures cuts with a negative impact on activity. The more likely outcome would be a long lasting period of stagnation. That is why it is worthwhile to explore, using a SFC model of monetary union, alternative regimes at the European level to face this problem of intra-European misalignments.

3. SFC modeling of adjustment mechanisms in a monetary union

3.1. The structure of the model

A two-country SFC model of a monetary union allows a consistent description of assets and liabilities of all associated real and financial flows. The 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 facilitates analyzing the adjustment mechanisms of the country S facing the rest of the monetary union.

We introduce in the present model the possibility of public federal expenditures and

eurobonds. This will permit to investigate stabilizing effects of eurobonds. Firms 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. A single central bank (ECB) refinances the commercial banks. Households hold banking deposits, bonds and equities. The two national governments issue bonds and Treasury bills. Lastly, the model has been calibrated to represent the structure of the European Monetary Union.

Table 2: Balance sheet

	Households N	Firms N	State N	Banks N	Federal budget	ECB	Households S	Firms S	State S	Banks S
Capital		$+K^N$						$+K^S$		
Deposits	$+BD^N$			$-BD^N$			$+BD^S$			$-BD^S$
Currency	$+H_h^N$			$+H^N$		$-H$	$+H_h^S$			$+H^S$
Credits		$-L^N$		$+L_N^N$						$+L_S^N$
				$+L_N^S$				$-L^S$		$+L_S^S$
Refinancing				$-RF^N$		$+RF^N+RF^S$				$-RF^S$
Bonds	$+p_b^N.B_N^N$		$-p_b^N.B^N$				$+p_b^N.B_S^N$			
	$+p_b^S.B_N^S$						$+p_b^S.B_S^S$		$-p_b^S.B^S$	
EuroBonds	$+BT_{Nh}^E$			$+BT_{Nb}^E$	$-BT^E$		$+BT_{Sh}^E$			$+BT_{Sb}^E$
Bills			$-BT^N$	$+BT_N^N$						$+BT_S^N$
				$+BT_N^S$					$-BT^S$	$+BT_S^S$
Equities	$+p_e^N.E_{hN}^N$	$+p_e^N.E_{eN}^N$					$+p_e^N.E_{hS}^N$	$+p_e^N.E_{eS}^N$		
		$-p_e^N.E^N$								
	$+p_e^S.E_{hN}^S$	$+p_e^S.E_{eN}^S$					$+p_e^S.E_{hS}^S$	$+p_e^S.E_{eS}^S$		
								$-p_e^S.E^S$		
Wealth	$-VH^N$	$-V^N$	$-D^N$	$-VB^N$	$-D^E$		$-VH^S$	$-V^S$	$-D^S$	$-VB^S$
Total	0	0	0	0	0	0	0	0	0	0

Table 2 describes 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. Beyond fixed capital (K), eight kinds of monetary or financial assets are distinguished[2]: bank deposits (BD) held by

[2] 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_N^S represents the

households, bonds issued by governments (p_b.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 (p_e.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 (H_h) as well as by commercial banks (reserve requirements), advances supplied by the central bank to commercial banks (RF) and finally eurobonds issued by a federal authority and held by banks and households.

The present model relies on the main features of the contributions of Duwicquet and Mazier (2010, 2011) and Duwicquet et al. (2013). Nevertheless, several crucial changes are included to examine current developments in the eurozone 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 is linked to financial markets. When interest rates on sovereign debt increase, the State can reduce public spending in reaction.
- The possibility to increase intra-zone financing is introduced in order to reduce the pressure on interest rates. This can be achieved through foreign banks purchases of public bonds or Treasury bills, through the European Stability Mechanism or even through direct intervention of the central bank on the public bond market.
- The role of eurobonds is examined in two ways. On the one hand, eurobonds are aimed at pooling a part of sovereign debt in the eurozone. On the other hand, eurobonds could be used to finance European investment projects in various sectors

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amount of bills held by country N and issued by the country S.

namely education, health and innovation (see Mazier and Petit (2013) for some new proposals).

Baseline scenario

The model dynamics relies essentially on the investment function. As we can see below, investment reacts positively to the rate of profit (UP/K_{-1}) and to variation of aggregate demand ($\Delta Y/Y_{-1}$). It responds negatively to the debt structure (L/K_{-1}) and to credit costs (r_l).

$$\frac{I^{Nd}}{K^N_{-1}} = k_0 + k_1 * \frac{UP^N}{K^N_{-1}} + k_2 * \frac{\Delta Y^N}{Y^N_{-1}} - k_3 * \frac{L^N}{K^N_{-1}} - k_4 * rl$$

I/K_{-1} = accumulation rate, I^d = desired investment, K = fixed capital stock, UP = undistributed profit, UP/K_{-1} = non-financial profit rate, L = debt, r_l = credit cost, Y = GDP.

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, retained.

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.

$$C^N = a_0 + a_1 * YHSh^N + a_2 * VH^N_{-1}$$

VH = households' wealth, $YHSh$ = disposable income with capital gains.

The disposable income of households is defined as the sum of after-tax labor incomes (wages) and after-tax capital incomes (interest rates and dividends). A part of disposable income augmented with capital gains is consumed (the marginal propensity to consume is equal to 0.75) 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 deposit, money, equities and bonds).

Regarding the monetary sphere, the central bank supplies money and provides an unlimited amount of financing to private banks at the key interest rate acting as the lender of last resort. The central bank does not make any profit as in Godley and Lavoie (2007). Thus interests paid to the Central Bank are equal to taxes paid to the State. This is in line with the practice of most modern central banks in the world economy. Commercial banks supply the entire amount of demanded credit. 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 ($L_S^N = 0$). Bank loans are allocated 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 public bonds' rate of each country.

Treasury bills play a key role in the model resolution. Supply of Treasury bills balances the gap between public deficit and bonds issuance thus:

$$\Delta BT^N = G^N + rn * BT_{-1}^N - T^N - TB^N - TEB^N - pbn\Delta B^N$$

BT = issued Treasury bills, G = public expenditures, rn = interest rate on Treasury bills, $p_b.B$ = bonds, T = taxes paid by households, TB = taxes paid by commercial banks, TEB = taxes paid by the Central Bank.

Banks purchase a limited amount of Treasury bills with a demand which depends positively on the rate of interest. Thus interest rates become endogenous, as they adjust supply of Treasury bills determined by the public deficit (which has to be financed) and 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_N^S) depends on the interest differential between the two countries:

$$\frac{BT_S^S}{Y^S} = a1_{ss}.rs - a2_{ss}.rn$$

$$\frac{BT_N^S}{Y^N} = a1_{ns}.rs - a2_{ns}.rn$$

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

$$BT^S = \left(a1_{ss}.rs - a2_{ss}.rn\right).Y^S + \left(a1_{ns}.rs - a2_{ns}.rn\right).Y^N$$

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

$$rs = \frac{BT^S + a2_{ss}.rn.Y^S + a2_{ns}.rn.Y^N}{a1_{ss}.Y^S + a1_{ns}.Y^N}$$

Regarding the rest of the union (the northern country), we assume that the southern country does not hold bills issued by the northern country which 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 (rn) and the national income (Y^N):

$$BT_N^N = \frac{\left(rn - a1_{nn}\right).Y^N}{b2_{nn}}$$

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

$$rn = a1_{nn} + \frac{b2_{nn}.BT^N}{Y^N}$$

Interest rates on private banks loans depend on interest rates on T-Bills and on their own lagged value:

$$rln = rln_{-1}.\left(1 - a\right) + a.rn_{-1}$$

$$rls = rls_{-1}.(1-a) + a.rs_{-1}$$

After an increase of public deficit, banks still finance the public deficit. However the level of interest rates is now higher. This tightening of financial conditions is partially transmitted to rates on bank loans granted to firms.

Our model represents a monetary union characterized by a sluggish growth in the baseline scenario (around 1 percent per year). From this baseline scenario, we simulate an asymmetric loss of competitiveness in the southern country due to an exchange rate misalignment. To illustrate the loss competitiveness, the term TI is equal to 10 between periods 10 and 50:

$$\log\left(IM^N\right) = \mu_{0n} + \mu_{1n}\ .\log\left(Y^N\right) + \mu_2.\log\left(\frac{W^N + TI}{Y^N}\right) - \ \mu_2.\log\left(\frac{W^S - TI}{Y^S}\right)$$

$$\log\left(IM^S\right) = \mu_{0s} + \mu_{1s}\ .\log\left(Y^S\right) + \mu_2.\log\left(\frac{W^N - TI}{Y^N}\right) - \ \mu_2.\log\left(\frac{W^S + TI}{Y^S}\right)$$

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 eurozone crisis, we compare the effect of this shock in different versions of the model. In addition to the baseline scenario, four versions of the model will be examined.

3.2. Alternative scenarios of economic policies

Scenario 1: Budget cuts

Here, public expenditures become endogenous and react to rising interest rate on Treasury bills:

$$G^N = G^N_{-1} * 1.018 - \beta * (rn * BT^N_{-1});\ G^S = G^S_{-1} * 1.018 - \beta * (rs * BT^S_{-1})$$

In line with objectives of the revised Stability and Growth Pact as well as aims of the Fiscal Compact, we assume that the government targets to reach a debt-GDP ratio of 60 percent in t

= 50. To achieve this challenge, the government progressively reduces its public expenditures. The speed of public expenditures reduction is governed by the evolution of interest rates. The year of the shock, public expenditures decrease by 0.2 percent of GDP relatively to the baseline scenario. In the baseline scenario, publics expenditures amount to 20 percent of GDP in t = 50. In the first scenario, they drop to 12 percent of GDP in t = 50.

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 the deficit. We assume that private banks of the northern country will sustain this supplementary demand to bring down interest rates. This scenario can also be seen as an illustration of the European Stability Mechanism where northern countries grant loans with low rates of interest to southern countries. Similar effects are also expected if the Central Bank purchases directly Treasury bills of southern countries. In each case, the southern country receives financial aid to reduce the debt burden substantially.

Scenario 3: Issuance of eurobonds

In this scenario, eurobonds are issued in order to mutualize partially sovereign debt of southern countries. We assume that there is threshold (a debt-GDP ratio of 60 percent) from which eurobonds are issued to finance public debt in the eurozone 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.

$$\Delta BT^N = \left(G^N + r^N.BT^N_{-1} - T^N - TB^N - TEB^N - pb^N.\Delta B^N\right) \text{ if } \frac{D^N}{Y^N} < 0.6 + r^e.BT^{EN}$$

$$\Delta BT^S = \left(G^S + r^S.BT^S_{-1} - T^S - TB^S - TEB^S - pb^S.\Delta B^S\right) \text{ if } \frac{D^S}{Y^S} < 0.6 + r^e.BT^{ES}$$

Each government may appeal the issuance of Eurobonds (BT^{EN} for North's government and BT^{ES}

for South's government).

$$\Delta BT^{EN} = \left(G^N + r^N . BT_{-1}^N - T^N - TB^N - TEB^N - pb^N . \Delta B^N \right) \text{ if } \frac{D^N}{Y^N} > 0.6$$

$$\Delta BT^{ES} = \left(G^S + r^S . BT_{-1}^S - T^S - TB^S - TEB^S - pb^S . \Delta B^S \right) \text{ if } \frac{D^S}{Y^S} > 0.6$$

The global offering of Eurobonds is obtained by the sum of the two countries

$$BT^E = BT^{EN} + BT^{ES}$$

Eurobonds are purchased by domestic banks (BT_{Nb}^E for North and BT_{Sb}^E for South) and domestic households (BT_{Nh}^E for North and BT_{Sh}^E for South):

$$BT^{EN} = BT_{Nh}^E + BT_{Nb}^E$$

$$BT^{ES} = BT_{Sh}^E + BT_{Sb}^E$$

Demand for Eurobonds simply depends on the interest rate (r^e) and the level of GDP of the entire eurozone ($Y^E = Y^N + Y^S$).

$$BT^E = \frac{\left(r^e - a0_e \right) . Y^E}{a1_e}$$

In the model, we use the following determination of interest rates:

$$r^e = a0_e + a1_e . \frac{BT^E}{Y^E}$$

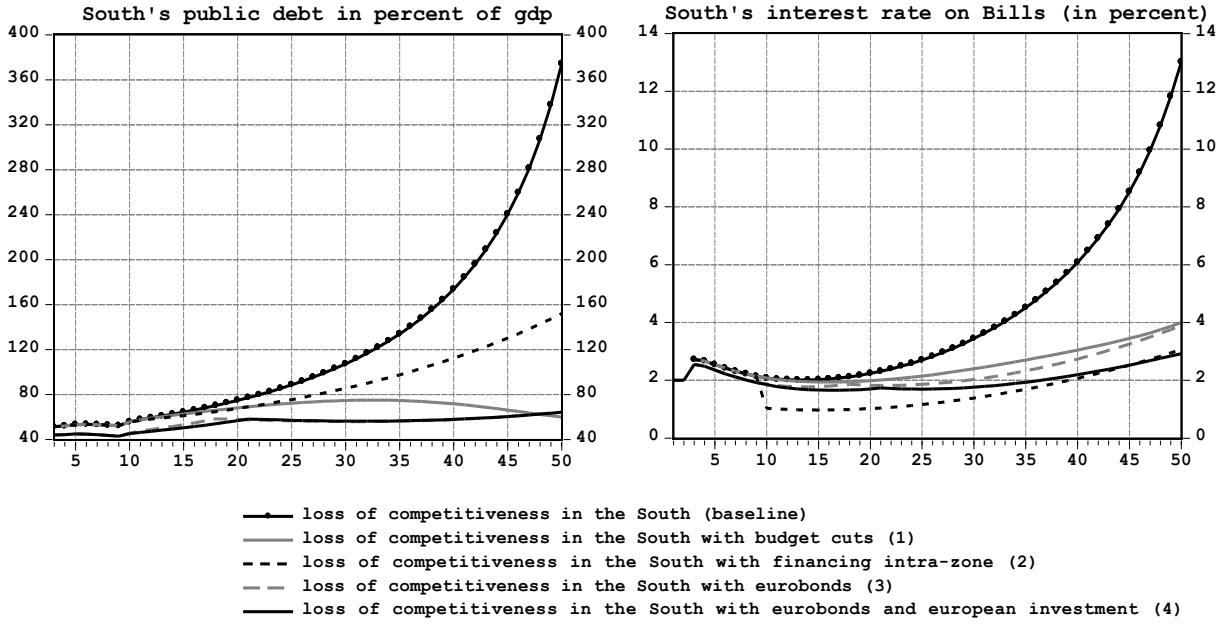
Scenario 4: Issuance of eurobonds and European projects

To complete the previous scenario, eurobonds are used as a tool to finance European projects in growth sectors. Southern countries as well as northern countries can use eurobonds in order to stimulate their economic growth.

3.3. Adjustments in monetary union and economic policies

In figure 6, we can observe the evolution of interest rates and public debt in the southern country in the baseline scenario (loss of competitiveness in the southern country) and in the four versions of the model.

Figure 6: Evolutions of public debt and interest rate in the southern country



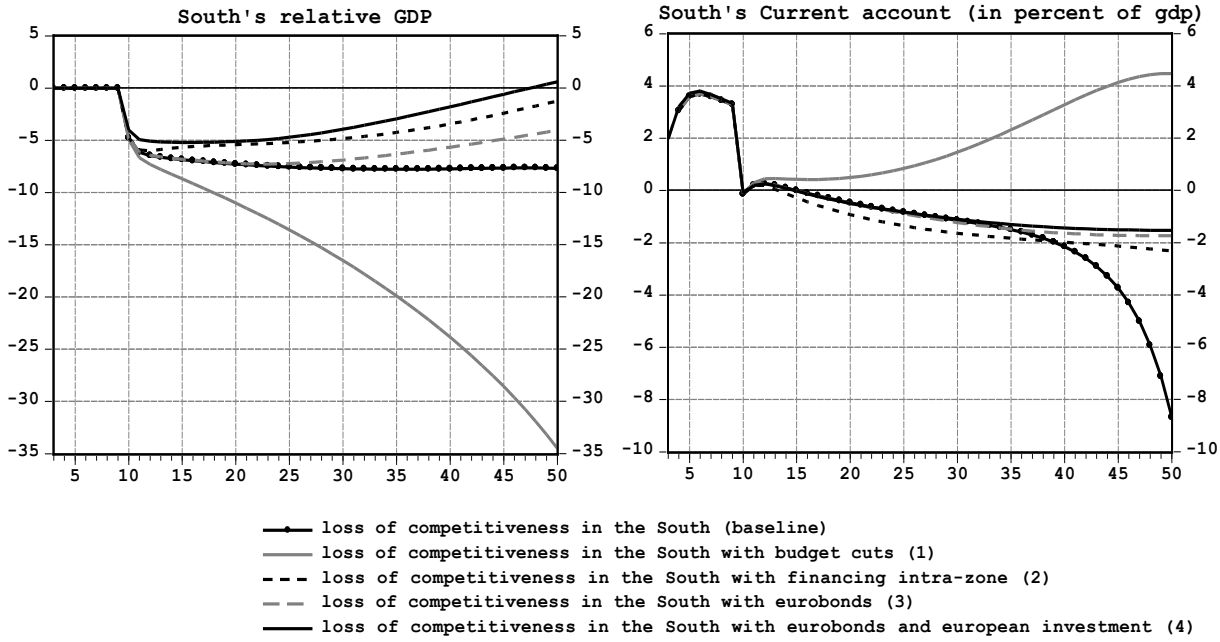
Source: authors' calculations

In the baseline scenario, we assume that any adjustment mechanism is used to face the loss of competitiveness. Thus, this loss of competitiveness widens the external deficit and in the same time increases the need of external financing. 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 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 (370 % of GDP in t = 50) and of interest rates (13 % in t = 50).

In order to eschew another "Greek drama", European authorities can react by implementing various economics policies 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 60 %. However, due to the Keynesian multiplier effect, public expenditures reduction puts a huge strain on economic activity as we can see in figure 7. Interest rates are reduced compared with the baseline scenario but still rise in the medium run and reach 4 % in t = 50 due to a smaller demand of Treasury bills induced by the decline of the activity.

Figure 7: Relative GDP and current account in the southern country



Source: authors' calculations

In the second scenario, we assume that intra-zone financing is large thanks to a facilitated demand from private banks of the Northern countries or to the implementation of a European Stability Mechanism. This allows to keep interest rates at low level (2.8 % in t = 50) in spite of a huge increase of public debt-to-GDP ratio (160 % in t = 50). The negative impact on economic growth is largely offset in the long run but the competitiveness problem is not solved (figure 7). We can notice that the Treaty ratified in March 2012 which gives an institutional background to the European Stability Mechanism stipulates that members States must reach a debt-to-GDP ratio of 60 % in the medium run. The results of the second scenario will be greatly affected if the objective fixed by the European Stability Mechanism was respected. In such a case the result in terms of relative growth rates would be largely similar to those of the first scenario.

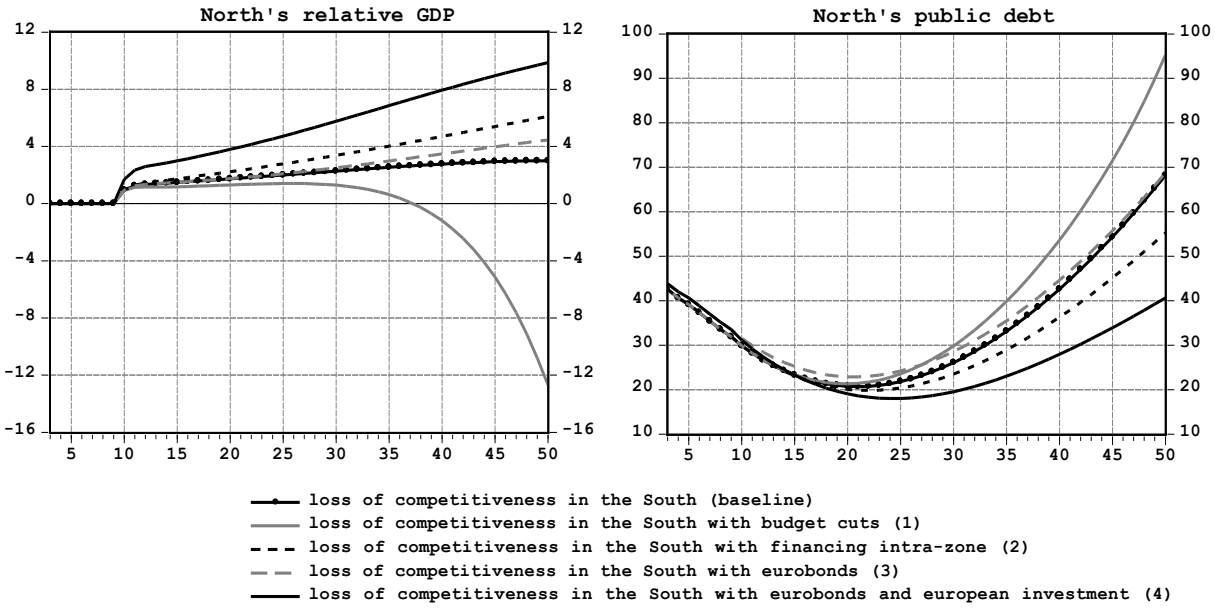
The third and the fourth scenario analyze the impact of an issuance of eurobonds in the eurozone. We can observe that interest rates increase less rapidly in the fourth scenario than the third scenario. In the fourth scenario, eurobonds finance investments in growth sectors therefore economic growth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

These growth gaps can be observed in the figure 7. We compute adjustments on GDP thanks to the following formula:

$$Relative\,GDP = \frac{GDP_{with\ competitiveness\ loss} - GDP_{without\ competitiveness\ loss}}{GDP_{without\ competitiveness\ loss}}$$

Initially, the GDP drops after the negative competitiveness shock. The implementation of European projects financed by eurobonds (scenario 4) absorbs completely the competitiveness loss in the long run as GDP returns to its value before the shock in t = 50. Eurobonds issuance to mutualize partially sovereign debt (scenario 3) permits a partial adjustment. We can notice that intra-zone financing (scenario 2) appears to be more efficient than eurobonds issuance alone (scenario 3). The implementation of a European Stability Mechanism aimed at providing low interest rates to governments and firms stimulates investment. 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 60 % in the long run. The GDP drops by 35 % in relative terms in t = 50. 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 southern countries steadily increase and reach 8 % of GDP in t = 50. In other scenarios, we observe a stabilization of the external deficit around 2 % in the long run.

Figure 8: Relative GDP and current account in the northern country



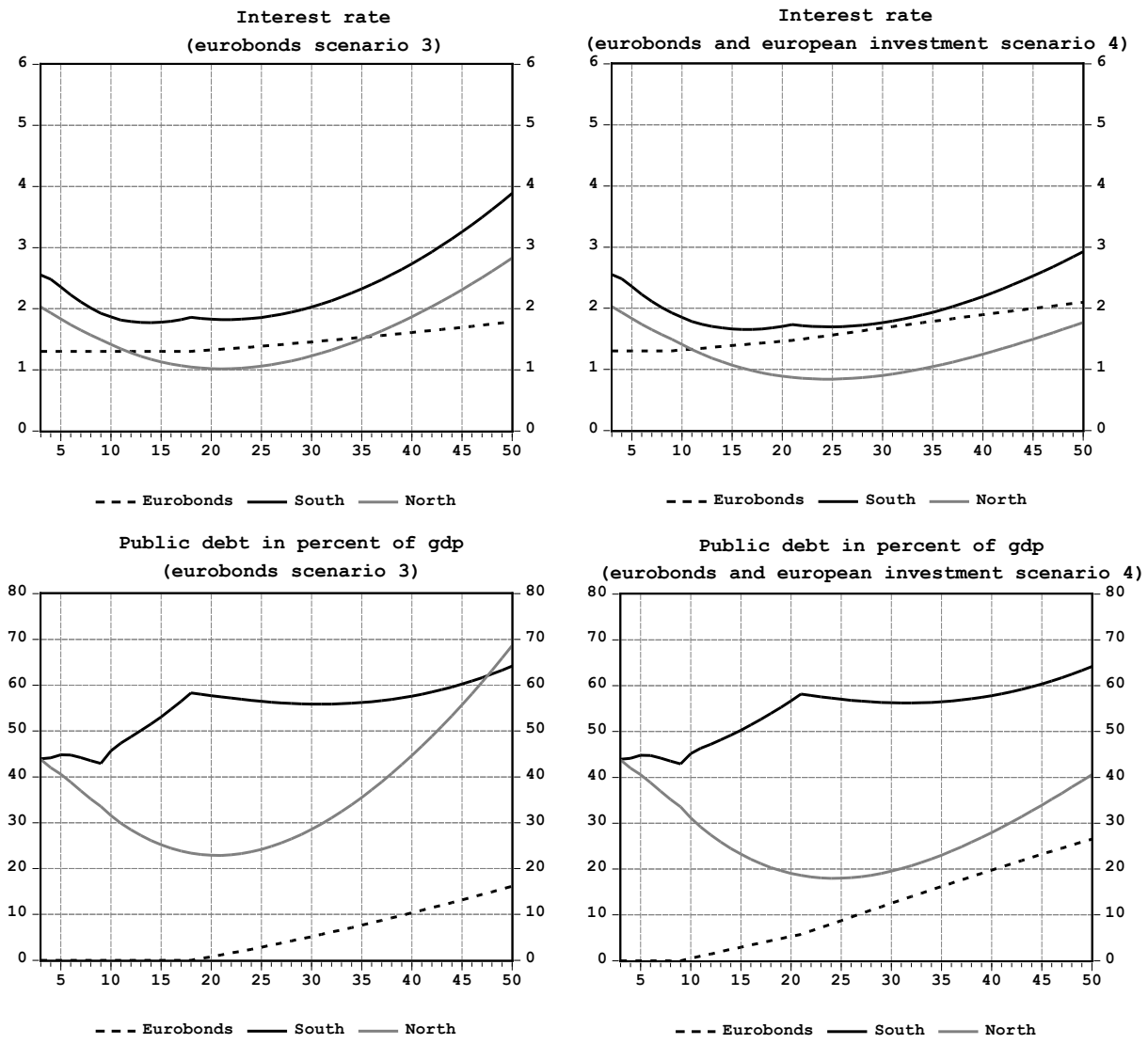
Source: authors' calculations

In figure 8, 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 negative impact on economic activity even in the northern country. In the long run, the fall of GDP will bring public debt to 95 % of GDP. In other scenarios, public debt increases less thanks to a stronger growth, particularly in the third scenario.

According to our numerical simulations, issuance of eurobonds constitutes a useful tool to reignite growth in the entire eurozone. Figure 9 shows levels of public debt and evolution of interest rates on Treasury 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 the real economy. Conversely, the interest rate on eurobonds is slightly higher in the fourth scenario (2.1 %) than in the third scenario (1.8 %). Regarding levels of public debt, again, European debt in eurobonds is higher in the fourth (28 % of GDP) relatively to the third scenario (18 % of GDP). Nevertheless, European indebtedness remains sustainable as well as national indebtedness in spite of the fact that national governments have to pay interest on these issued eurobonds.

Figure 9: Interest rate and public debt in scenario 3 and 4



Source: authors' calculations

4. Conclusion

If European authorities do not react by implementing new economic policies to achieve sustainable adjustments, a competitiveness loss in southern countries due to exchange rates misalignments will induce stagnation in southern countries and diverging current account imbalances between southern and northern countries

Increasing intra-European financing by banks of northern countries or by the European Stability Mechanism or even by the intervention of the ECB itself could contribute to reduce the debt burden and induce a partial recovery. But the problem of competitiveness of the southern countries would not be solved and public debt would increase (scenario 2).

Implementation of euro-bonds as a tool to partly mutualize European sovereign debt would have a rather similar positive impact, but with a public debt limited to 60% of GDP, which could be considered a an important advantage (scenario 3). Furthermore, euro-bonds could also be used to finance large European projects which could impulse a stronger recovery in the entire euro zone with stabilized current account imbalances (scenario 4). 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 long lasting.

However, the settlement of a European Debt Agency in charge of the issuance of the euro-bonds would face strong political obstacles. The northern countries fear that euro-bonds would give to the southern countries the opportunity to continue irrelevant policies. They would ask that the launching of euro-bonds would be accompanied by more restrictive fiscal policy in the respect of the Stability pact. Actually, the European Stability Mechanism organizes the rescue of countries facing difficulties only under the condition of a strict control of the public finance. In such a configuration, euro-bonds as tool to mutualize the debt would not be of a large help compared with the present institutional framework. On the opposite the southern countries could argue that a part of the debt induced by the overvaluation of their euro could be financed by eurobonds without being subjected to more constraints linked to the Stability pact whose cost presently appears too high.

Last, the efficiency of these institutional innovations inside the monetary union could be compared with an alternative framework where the possibility of intra-European exchange rate adjustments would be reintroduced thanks to a new type of monetary regime (cohabitation of a global euro with national euros, new European Monetary System with an euro reduced to a simple ECU, exit of the Germany or of southern countries). These various monetary regimes are a more straightforward solution to the problem of competitiveness of southern countries and allow a more efficient adjustment at short term, with more balanced

growth regime at medium term (Mazier and Valdecantos, 2014). They could also be completed by structural policies to improve non price competitiveness. However the main difficulty raised by this alternative strategy is the transition period which would be delicate to manage with the risk of capital outflows and bank crisis.

Appendix A: Methodological note on the underlying current account

A simple foreign trade model is used for all the countries with export and import equations for goods and services related to real exchange rates, domestic output gap for import and foreign output gap for export. Lagged effects of exchange rate variations are spread on three years (t: 60%; t+1: 25% and t+2: 15%). Export price in domestic currency is independent from the real exchange rate while on the contrary import price in domestic currency depends immediately and completely of the exchange rate variation. The current account in % of GDP can be written:

$$CA/Y = \alpha + \left[(M/Y)\beta_m + (X/Y)\beta_x\right](0,6R + 0,25R_{-1} + 0,15R_{-2}) - (M/Y)R - (M/Y)\psi_m YGAP + (X/Y)\psi_x YGAPF$$

With YGAPF: average output gap of the main partners, R: logarithm of the real exchange rate (↑R = *depreciation*), βx, βm: long term export and import price elasticities, ψx, ψm: long term export and import volume elasticities.

In case of real appreciation (↓R), import in volume increases while exports decreases with lagged effects of the exchange rate variations but current account is improved thanks to cheaper imports. Last rising domestic output gap has a negative impact on current account while foreign output gap has an opposite effect. The underlying current account is the current account corrected by the effects of past and present exchange rate variations and by the effects of the domestic and foreign output gaps:

$$CA/Y_{UND} = \alpha + \left[(M/Y)\beta_m + (X/Y)\beta_x \right] R - (M/Y) R$$

By substitution we obtain:

$$CA/Y_{UND} = CA/Y + \left[(M/Y)\beta_m + (X/Y)\beta_x \right](0,4\Delta R + 0,15\Delta R_{-1}) + (M/Y)\psi_m YGAP - (X/Y)\psi_x YGAPF$$

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