The Euro-Crisis: where do we stand?

Introduction to the special issue of Brussels Economic Review / Cahiers Économiques de Bruxelles:

The euro crisis: Where do we stand?

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The Great Recession sheds lights on several flaws in the architecture of the European Monetary Union (EMU, hereafter). Excessive risk taking in quiet/good times in both the public and private sectors underlines the need to improve risk prevention. Without a doubt, the sharp increase of financial instability within the eurozone (market failures, insufficient monitoring and enforcement tools, contagion between sovereign indebtedness and bank indebtedness, financial fragmentation) highlight the need to improve crisis resolution mechanisms.

Consequently, several changes have occurred since 2009 to correct the shortcomings in the EMU governance. A large range of tools has been created and imposed or proposed to Member States (MS, hereafter). Adjustment programs providing financial assistance under conditionality have been created with the European Financial Stability Facility (EFSF) and the European Stability Mechanism (ESM). New fiscal rules have been implemented with the Six Pack, the Two Pack and the Fiscal Compact of the Treaty on Stability, Coordination and Governance in the EU (TSCG). They aim at strengthening the two major objectives for fiscal policy in the EMU: sound fiscal policy and balanced public finance in the medium run. National reforms promoting growth, improving adjustment capacities and restoring fiscal sustainability are encouraged. The European Semester has been established to enable a better coordination of national policies. The Europe 2020 Strategy has been relaunched especially thanks to the Juncker's Investment Plan for Europe. In addition, on-going debates over further steps to strengthen EMU governance are in progress.

This special issue of Brussels Economic Review / Cahiers Économiques de Bruxelles aims at providing some theoretical and empirical perspectives on the euro crisis from a macroeconomic viewpoint. The contributions have been selected after the Macroeconomics Workshop: "The euro crisis: Where do we stand?" organized by the University of Strasbourg, the Bureau of Economic Theory and Applications (BETA-CNRS) and the ERMEES research team[1]. The ERMEES research team is an informal group of macroeconomist created in November 2013 and interested by European macroeconomics in Strasbourg[2]. The workshop took place in mid-October 2015 at the European Doctoral College in Strasbourg. We have received more than sixty submissions from around twenty different countries and international institutions. Some thirty researchers were gathered to explore and analyze the underlying macroeconomic causes of the first major crisis in the nascent history of the EMU.

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[1] More information on the Macroeconomics Workshop: http://www.jamelsaadaoui.com/?page_id=914

[2] More information on the ERMEES research team can be found here: https://udsermees.wordpress.com/

First of all, we would like to thank the University of Strasbourg and the Bureau of Economic Theory and Applications (BETA-CNRS) for their financial and logistical support[3]. We are very grateful to the keynote speakers, Ansgar Belke from the University of Duisburg-Essen and Gunther Schnabl from the University of Leipzig for their invaluable contributions to the workshop. We also want to thank all the participants of the workshop for their implications during the sessions and for the quality of the debates. We thank Sile O'Dorchai, the managing editor of Brussels Economic Review / Cahiers Économiques de Bruxelles, for providing to us the opportunity to publish this special issue on the euro crisis. We are grateful to Thierry Burger-Helmchen, the dean of the Faculty of Economics and Management Sciences, to Bertrand Koebel, the director of the Bureau of Economic Theory and Applications, to Géraldine Del Fabbro and to Pierre-Guillaume Méon. We thank the anonymous referees for their critical comments and remarks. Finally, we thank all the members of the ERMEES research team (Moïse Sidiropoulos, Francesco de Palma, Giuseppe Diana, Thierry Betti, Thomas Coudert, Nicolas Mazuy, Marine André) for their implication during the organization of the workshop.

Amongst the thirty communications of the Macroeconomics Workshop, we have retained six papers. The first two papers, by Ansgar Belke and by Catherine Mathieu and Henry Sterdyniak, give an analytic view of the euro crisis and offer different perspectives on the future of the euro. The next two papers, by Thierry Betti and by Paolo D'Imperio, particularly focus on fiscal issues: the sign and the size of fiscal multipliers in the EMU for the first one, the relevance of a fiscal transfer scheme to improve risk sharing in the eurozone for the second one. Finally, the two last papers deal more specifically with monetary issues. The first one of Thomas Coudert introduces a theoretical model to explain inflation persistence. The last one of Vivien Djiambou is an empirical investigation on the link between public debt and public bond spread during episodes of financial stress.

Ansgar Belke provides a useful analytic framework to address several aspect of the specter of a "Grexit". To this end, he first assesses critically the work of the Troika in Greece. He stresses that Greece is not a case of a textbook small open economy but a rare case small semi closed economy in which macroeconomic adjustments are more complex to analyze especially during fiscal consolidations. He also mentions that the notion of "Grexit" is nothing more than a "red herring" since its economic relevance is rather limited. Finally, he draws some perspectives to reduce competitiveness gaps between the German Ruhrgebiet and the Greek region of Central Macedonia.

Catherine Mathieu and Henry Sterdyniak demonstrate that the strong rise in public debts since 2008 crisis has been accompanied by low inflation and low interest rates (in contradiction with the "crowding-out" theory) thus they conclude that public debts are currently Keynesian and required macroeconomic stabilization. They also criticize the European fiscal rules and present the eight original sins of the single currency. Besides, they analyze different and more unconventional proposals to solve euro's current woes, especially for public debt governance. Finally, they question the survival of the euro if an intelligent and precise cooperation between MS is not implemented.

Thierry Betti uses a New-Keynesian DSGE model with a micro-founded labor market and a SVAR specification for the eurozone in order to give an assessment of fiscal multipliers (on output and unemployment) depending on the nature of public spending (consumption or

[3] This event has been supported by a grant from the University of Strasbourg: Initiative d'Excellence (IdEx) - attractivité 2014.

investment). He concludes that both public consumption and public investment trigger a significant decrease of unemployment but the effect is stronger in the case of public consumption. The empirical results partially confirm his conclusions since public consumption and public investment reduce unemployment but here the effect of public investment is stronger.

Paolo D'Imperio estimates a two-country DSGE for the eurozone core and periphery to assess the potential effects of a fiscal stabilization scheme in the EMU to strengthen risk sharing between MS. The paper uses Bayesian time series econometric techniques and found that the implementation of fiscal transfers between MS could lead to an absorption of seventy percent of asymmetric shock in the eurozone after a positive productivity shock in the eurozone core. Symmetrically, a negative productivity shock will lead to transfers to the core countries. He rightly underlines that the institution of a cyclical fiscal transfer mechanism is just one of the several reforms needed for the eurozone to be sustainable in the long run. His conclusions are particularly important since the question of fiscal federalism between MS remains open.

Thomas Coudert introduces a New-Keynesian DSGE model with a micro-founded labor market to explain inflation persistence in the eurozone. He analyzes with attention severance pay and bargained firing costs. Thus, he introduces a new source of rigidity in the wage dynamics which increases inflation persistence. He stresses that the implications of his results are twofold. Firstly, since there is a huge labor market heterogeneity in the eurozone, the unique monetary policy must take into account these differences. Secondly, a harmonization of labor markets in the eurozone could possibly improve the efficiency of the monetary policy.

Vivien Djiambou focuses on the impact of public debt on government bond spreads. More precisely, he investigates a nonlinear relationship between public debt and public bond spread during episodes of financial stress. Using dynamic panel threshold regressions, he found that high levels of public debt does not *per se* induces an explosive dynamic on bond spreads. This kind of "vicious circle" can be triggered by an increase of financial stress. In high regime of financial stress, an increase of level public indebtedness could lead to an increase of public bond spreads. He also underlines that the effects can be significantly different for core European countries and periphery European countries.

As a final point, we want to express our pleasure for having contributed to the Brussels Economic Review / Cahiers Économiques de Bruxelles. We sincerely hope that this special issue will contribute to the debates on the future of the euro.

The Specter of a Grexit*

by

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Abstract

The paper addresses several aspects of the specter of a "Grexit". For this purpose, it first assesses the work of the Troika in Greece. Moreover, it investigates whether "Grexit" is, in spite of all the recent drama, less probable and less economically and politically meaningful and thus does represent not more than a red herring. Finally, it draws some policy lessons from the structural change in the German Ruhrgebiet which may turn Northern Greece into an industrial champion and may help to avoid "Grexit".

JEL-Classification: E42, F02, F16, I25

Keywords: Argexit, creative accounting, devaluation, Drachma, education, Euro, exchange rate, Grexit, Troika, investment, optimum currency area

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I. Introduction

This paper deals with the specter of a "Grexit". The notion of "Grexit" has been invented by Willem Buiter and Ebrahim Rahbari from CitiBank, not earlier than on 6 February 2012 and has several economic and political dimensions. For instance, Belke and Verheyen (2013) describe the genesis of the doomsday scenario of a "Grexit" and deliver a full discussion of potential causes and motivations for a breakup of the euro area. For this purpose, they differentiate between the departure of weak and strong countries, and examine the impact of the reintroduction of a national currency on domestic debt, the domestic banking sector, EU membership and the freedom of trade. They also briefly analyse the social and political costs of the accompanying social disorder. This contribution, however, takes up some selective issues relevant at the current edge to discuss the specter of a Grexit.

Some even say that the original sin was the integration of Greece in the euro zone, whereas the structural differences were huge with the Northern part of Europe. There was almost no mechanism to solve this heterogeneity. The structural funds were limited and poorly managed, especially in the case of Greece. There was no fiscal federalism or Banking Union as, for instance, in the United States. And the single monetary policy clearly increased the divergent evolutions over time.

To start with, what developments have driven Greece to the brink of "Grexit"? For this purpose it is useful to look at the role of capital flows in competitiveness in a set of seven euro-area member countries (Estonia, Greece, Latvia, Lithuania, Portugal, Slovenia, and the Slovak Republic) in the context of real convergence and crisis with a specific focus on Greece. Belke, Haskamp, Schnabl and Zemanek (2015) extend the seminal Balassa-Samuelson model to include international capital markets, placing a particular focus on their impact on national wage policies. Capital flows are, as becomes obvious at the Greek example, able to invert the traditional direction of transmission of

real wage increases from the tradable sector to the non-tradable sector and to cause real wages to increase beyond productivity increases. Panel estimations for the period from 1995 to 2013 deliver empirical evidence of the Balassa-Samuelson effect if Greece is excluded from the panel. For Greece, this in turn provides evidence in favour of capital inflow-driven real wage increases in excess of productivity increases (Belke, Haskamp, Schnabl and Zemanek, 2015).

In other words: whereas international credit could have alternatively been used for high-yield investment (which would have ensured credit repayment), rising international debt was, in Greece, instead funnelled into real wage increases in the non-tradeables and the public sector that spilled over to the tradeables sector and exceeded productivity increases (Belke, Haskamp, Schnabl and Zemanek, 2015).

The remainder of this paper proceeds as follows. Section II assesses the work of the Troika in Greece, especially its efficacy with respect to its own goals. Section III asks whether "Grexit" is – in spite of all the drama – less probable and economically and politically meaningful and thus not more than a red herring. Section IV draws some policy lessons from the Strukturwandel in the German Ruhrgebiet, a region plagued by similar problems in the 1970s as Greece today, which may turn Northern Greece into an industrial champion and may help to lower the probability of "Grexit". Section V finally gives a brief outlook.

II. How to Assess the Work of the Troika in Greece?

The background to any answer to the question of how to assess the work of the Troika in Greece are two simple, overarching questions: 1) Are the programmes achieving the intended results?, and 2) Has the Greek economy been put on a path of sustainable growth?. The answers to both questions appear to be clearly negative.

One may be tempted to put the blame for this shattering result solely on the Troika, according to the motto: since 2010 the Troika has taken charge in Greece and determines economic policy. It follows directly that the Greek government cannot have conducted wrong economic policies! However, such an interpretation overlooks that the task of implementing reforms and the agreed rules falls „down to earth“ to the Greek government. Moreover, the conducted sequence of reforms primarily served the consideration of social aspects (backloading of pension reforms) or of specific interest groups (price cuts later than wage cuts). In the same vein, it was also problematic to front-load budget consolidation (mainly by tax increases!) and to conduct it before lowering wage costs (hostile to firms and export growth).

The programmes did not achieve the intended results, as can be seen from the difficult negotiations between the Greek Government and the Troika during the first half of this year. The only part of the programmes which was at least partially achieved was the (primary) fiscal surplus.

However, the main aim of the programme was to put the Greek economy on a path of sustainable growth, which would allow the country to service its debt. This is clearly not the case. Renewed political uncertainty has nipped the nascent recovery in its bud. And even the achievements on the fiscal side are threatened by the lack of a durable recovery.

A large part of the continuing difficulties emerges due to the fact that export growth has not provided an offset to the fiscal adjustment (and that investment was much too low) (Belke et al., 2014). Growth, employment, income and hence tax revenues are much below expectations as a consequence of sluggish exports. Hence, any studies of the Greek problems should focus on the external adjustment.

The cornerstone of the Greek adjustment programme(s) was the assumption that the external adjustment would go hand in hand with the fiscal adjustment. The dozens of adjustment programmes

supervised by the IMF over the last decades have all worked on the principle that the external adjustment should be underpinned by a devaluation, with the aim of engineering a fall in wages to foster exports. One could thus accuse the Troika of having applied an otherwise fitting concept to the, in the short- to medium-run, incurable patient „Greece“ (Belke and Gros, 2014, Belke et al., 2014).

One should have known in advance that Greece would have got back on its feet not earlier than after 8 to 10 years, even with a consequent application of the usual IMF-medicine – the usual duration it takes to re-allocate the Greek resources towards the export sectors. Only through exports can Greece gain foreign exchange proceeds, which are necessary for repaying the country's foreign debt. And repaying is necessary to regain credibility on the capital markets. This pattern even corresponds with the basic economic law that a transfer of resources to the foreign country is necessary under this scenario.

In Greece, the devaluation had to be 'internal', thus requiring a fall in domestic wages prices and wages. At the outset it was widely expected that this would be most difficult part to achieve. However, thorough economic analysis points to a different set of problems.

Broadly speaking it seems fair to report three main findings for the Greek case under the Troika (Belke et al., 2014). Firstly, wages fell over 20%, prices somewhat less, but a substantial real devaluation was achieved. Parts of the programmes seemed to have facilitated this result significantly. Secondly, in Greece, the overall numbers of exports need to be adjusted if one wants to measure the exports which create domestic employment and revenues. However, this real devaluation did not have the anticipated effect on exports. Properly measured exports have stagnated.

Thirdly, the disconnect between internal devaluation and exports is due to a number of elements (Belke and Gros, 2014, Belke and Kronen, 2015): the large weight of commodities in exports, the

lack of implementation of the structural reforms imposed formally by the programmes, but also the continuing deterioration in the quality of governance, despite the programmes and the existence of the Task Force Greece. Not least for these reasons, Greece is now confronted with a huge and pressing number of conditionalities which have to be fulfilled within weeks (or months).

In sum, it can observed that in Greece a substantial internal devaluation was achieved, but it did not lead to the growth in exports one would have expected (Belke and Gros, 2014, Belke et al., 2014). In addition, it is not easy to argue that the Greek economy was not able to recover through an export-led growth due to a credit crunch (for a deeper discussion of this issue see, for instance, Belke and Kronen, 2015). The overall availability of credit over the programme years was higher than GDP. Private sector interest rates stayed relatively low. In some cases, there are indications of a misallocation of bank loans and also the intertwined political and refinancing uncertainty may pose additional problems of credit provision to the Greek private sector. However, the responsibility for any mistakes in this direction has to be preponderantly attached to the Greek government and also the Troika, with an eye on the fact that the Greek banking system has been controlled by the Greek government already since 2012 (Gros, 2015a). So the Greek case can be regarded as a puzzle which in itself stifled "Grexit" phantasies of the markets.

Before elaborating briefly on the three main results it is worthwhile to stress one basic aspect of the Greek economy which should have formed the design of the programs: in small economies the export sector usually accounts for a large proportion of GDP. This implies that even a modest growth rate of exports can have a significant impact on GDP, thus providing an offset to and facilitating the fiscal adjustment (Belke and Gros, 2014, Belke at al., 2014).

Greece is a small economy, but constitutes a rare case of a 'small semi-closed' economy. The raw statistics suggest that at the start of the program, exports account for about 25 % of GDP, which is

very low for its size, but appears within the range of larger EU Member States. However, the true size of the export sector which created domestic employment and income is much smaller, probably less than one half of the headline number. This suggests that the program should have anticipated a stronger negative impact from the fiscal adjustment and should have put even more emphasis on the external adjustment (Belke et al., 2014).

We now return to some further main results.

No growth in exports

The overall numbers of the exports of goods and services suggest that there has been some growth (Belke et al., 2014). But this is misleading on several accounts. Most of the growth in goods exports comes from petroleum products. But Greece is not an oil producer. If one thus constructs a new series of exports of goods in which one adds to non-oil exports 10% of the value of exports of petroleum products, which corresponds to the actual value added of refined products of petroleum. These adjusted exports did not increase significantly since the start of the Greek programmes (Belke et al., 2014, Gros, 2015b).

Moreover, exports of (non-oil) goods constitute only a small part of overall exports of goods and services (and accounted for less than 6% of GDP at the start of the programme) and are dominated by two categories: food and 'manufactures classified chiefly by material'. This latter category consists mainly of raw materials, ferrous and non-ferrous metals (such as copper and aluminium). Since Greece is not a primary producer of these metals, these exports consist mainly of re-exports of raw materials, with little domestic value added. Greek goods exports are thus dominated by

commodities, with little domestic value added and thus depending little on domestic wage costs (Belke et al., 2014, Gros, 2015b).

A second peculiarity of the Greek export structure concerns the export of services, which is dominated by maritime transport, which have a very weak link with the Greek economy. The remainder of exports of services, mostly tourism, is likely to depend more on prices than labour costs (Belke et al., 2014, Gros, 2015b).

No export growth despite improvement in competitiveness

What are the reasons behind the bad export performance? Exports of commodities and maritime shipping could be expected to respond little to the real devaluation. Their high shares in goods and services exports could thus explain some sluggishness in overall exports. However, what remains difficult to explain is the lack of growth in the (small), non-oil, non-commodity goods exports and services like tourism (Belke and Kronen, 2015). Sluggish export markets were not the reason as the average growth rate of the Greek export markets (with a high weight for the EMENA region, covers the sub-regions of Europe and Central Asia and Middle East and North Africa) was actually higher than for most euro area member countries (Belke et al., 2014, Gros, 2015b).

The credit crunch which resulted from the combination of political uncertainty and the debt restructuring in 2012 may potentially have had a negative impact on the ability of entrepreneurs to undertake the necessary investments to increase exports from existing facilities or start new exporting activities (Belke and Dreger, 2011, Belke and Kronen, 2015).

Moreover, the improvement in competitiveness, which increases the profitability of exports, might in many cases not have been large enough to overcome threshold effects (hysteresis) which arise

when a firm considers entering export markets but must first sustain some costs to engage in international channels of distribution, marketing, etc. (Belke and Kronen, 2015).

Overall evaluation of the programmes

Both programmes went quickly off track. This means that the forecasts, especially for real variables, turned out to be wrong, both in absolute terms and relative to the experience of other countries under programme (Belke et al., 2014).

The programme went off track for a number of reasons. The key reason was that the recession was much deeper than anticipated and that Greek government expenditure reached significantly beyond 2009 (negative multiplier exaggerated). This, in turn was due to the exceptional fall in investment and the lack of export recovery. The larger than expected shortfall in tax revenue also contributed to disappointing budgetary results (Belke et al., 2014). The underlying reason is that compliance and actual implementation of structural reforms was at best partial and delayed. This was particularly important with respect to the liberalisation of product markets, as influential vested interests managed to avoid the implementation of market-opening legislation and the creation of new firms (Belke and Gros, 2014).

A final aspect concerns the timing of policy changes. Fiscal consolidation – with excessive reliance on tax increases rather than spending cuts – came first, and labour reforms came almost two years later. This placed a heavy burden on firms and stifled excessively – at the beginning – the development of new firms, and the ability of surviving firms to expand into foreign markets (Belke and Gros, 2014, Belke et al., 2014).

Providing an overall judgement on structural reforms is always difficult since they consist of literally hundreds of different measures. One finds that, in general, those indicators based on changes in laws and regulations suggest that there has been progress. However, survey indicators which purport to measure the perceived impact on the ground, show little improvement, if any. Moreover, more broadly based indicators, like the ones published by the World Bank, suggest that the quality of governance which had already fallen before the crisis, continued to deteriorate under the programmes, at least until 2013. These observations point to a broader based failure of the programmes than the often emphasised more technical, economic ones (Belke and Gros, 2014).

To summarise: both the „Institution formerly known as Troika" – maybe to a smaller part - and the Greek government(s) – maybe to a larger part - have to be held responsible for the bad results. One has diluded oneself with respect to the dimension of the problem. Greece is a special case and cannot be treated within a few years by means of a programme (Belke and Gros, 2014, Belke et al., 2014). This finding in turn implies that implications for a new EU governance cannot be drawn from the unique Greek example. Moreover, it has become clear that austerity per se is thus not the problem. Keynesianism is the cause (accumulation of high foreign debt) and may also be the cure (if multipliers are correctly calculated, fiscal stabilisation mechanisms may be implemented). There is also no reason to go for radically new macroeconomic thinking, except integrating financial frictions into macroeconomic models.

One current danger lies in the potential instrumentalisation of Syriza by the French and the Italian governments in order to install a new more centralised EU governance which is increasingly based on debt mutualisation. That these efforts may be moderated by the recent election results in Portugal, where for the first time a premier minister of a (former) programme country under austerity was re-elected, is interesting to note in this context.

III. Grexit as a 'red herring'?

These days we talk about Grexit, Argexit, Brexit, and a couple of other "Exits". Some analysts even discuss whether a Brexit would be more or less harmful than a "Grexit" for deepening EU governance. However, we leave the latter question to further research. Any assessment of "Grexit 2015" has to be conducted with a big caveat, namely the record number of asylum seekers commuting into the EU via Greece. This is simply because Greece's budget constraint gets weaker under these circumstances. Again, it seems as if Europe is as weak as its weakest part, in the same way as it was during the euro crisis.

Grexit 2015 - This time is different

2015 is different from 2012 because markets behave differently and because the fundamentals have changed. Contagion is almost absent because the other peripheral countries now run current account surpluses and thus are not in need of fresh capital. Moreover, the latter have proven their capability to adjust their economies. For several years, Greece has been dragging on reforms and displaying an abysmal export performance (Belke, 2015a, Gros, 2015). So what common arguments speak against any sense a "Grexit" could make?

Common knowledge "Grexit" cons

Greece does not export much, as seen in the previous analysis in section II. If the country left the European Union and returned to a sharply devalued drachma it would gain from some increase in

tourism (Alcidi and Gros, 2015). However, it has been shown in section II that Greece has already cut prices (which are more important than wages for the demand of tourism services) and tourism has gone up. But this was not very supportive because total revenue has not gone up. Let us now compare "Grexit" with the "Argexit", i.e. the Argentina's exit from the dollar peg one and a half decades ago. The "Argexit" has been a frequently used framework to comment on "Grexit" in the media (Stewart, 2015).

Greece with its population of just over 11 million and a gross domestic product of $242 billion in 2013 is tiny, compared with Argentina. Moreover, Argentina is a country rich of resources and can in emergency cases live on its own endowments. Finally, the economic survivability of Greece on its own has never been put under scrutiny since the country's EU entry in 1981 (Alcidi, Giovannini and Gros, 2011, Stewart, 2015).

There seems to be much agreement that the Greek economy would benefit if the country could devalue its currency, as Argentina did when it abolished its dollar peg one and a half decades ago. However, devaluing the Argentine peso by dissolving its link to the US dollar was rather easy for Argentina, because its peg that was unilateral (Alcidi, Giovannini and Gros, 2011, Stewart, 2015).[1] For Greece, the letting a new currency circulate would be a big practical challenge. What is more, Greek savings which are now denominated in euros and in many cases deposited in European banks outside Greece cannot be converted as smoothly into drachmas, as Argentine savings were exchanged to pesos (Belke and Verheyen, 2013, Stewart, 2015).

Converting euros into drachma would be a significant shock to the Greek private sector as well. This is because the latter is frequently financing its activities with euro-denominated loans from

[1] As Mr. Varoufakis expresses it, Greece does not have a currency that is pegged to the euro: "It has the euro." See Stewart (2015).

non-Greek banks. Servicing its debt with devalued drachmas would place a (too high) burden upon them. Nor could the private sector rely on Greek courts to have the final say in any ensuing litigation (Belke and Verheyen, 2013, Stewart, 2015). Beyond this, there would be other complications in the Greek case.

In the Argentine case, the government imposed as a rule that a bank or corporation that owed debts which are dollar-denominated were payable in pesos at a one-to-one exchange rate. It is of decisive importance in our context that they were able to do that using internal debt. Unfortunately, Greek companies are faced with a lot of cross-border obligations. As a side-effect, the ECB's collateral would be worth not more than a small fraction, if Greece exited the euro area. The Greek banks would be insolvent immediately, because the ECB in this case could not keep Greek banks alive anmymore (Belke and Verheyen, 2013, Stewart, 2015).

The Greek economy is unlikely to benefit from further devaluation - Argentina as a non-blueprint

At the time of July's the Greek referendum in July 2015, the Greeks appeared to have the choice between the devil and the deep blue sea: either being confronted with the chaos in the wake of the rejection of the programme, exit and collapse of the economy or to accepting another programme (Alcidi and Gros, 2015).

To a certain extent, the gentle optimism of analysts like Martin Wolf or Hans-Werner Sinn may be disappointed. They seem to suggest that the exiting costs are temporary and more than compensated by the benefits of the devaluation manifesting itself in ensuing increased international competitiveness and growth of exports. This is indeed what macroeconomics textbooks tell us for

the case of a small open economy, in which the export sector which benefits from lower domestic costs is of significant importance (Alcidi and Gros, 2015).

But Greece, as already stated, is one of the rare cases of a small economy which is quasi-closed. Greek exports these days make up for about 30% of GDP. However, a large part of this comprises oil and global maritime transportation services. With an eye on the fact that Greece is not an oil producer, oil exports in reality just represent re-exports with little domestic added value. In the same vein, global maritime services do not employ Greek sailors and are not connected with the domestic economy, too. This immediately implies that the part of exports which is indeed sensitive to domestic prices and wages tends to be rather small (see section II and Alcidi and Gros, 2015).

Exactly this idiosyncratic composition of Greek trade makes plausible why the first two Greek adjustment programmes failed to deliver. According to Section II this was not because wages and prices did not adjust: wages had already fallen by more than 20%, but exports have stayed nearly flat (Alcidi and Gros, 2015). It is thus rather unlikely that the Greek economy will benefit much from a further devaluation.

Nevertheless, the experience of Argentina is frequently referred to as evidence that devaluation can work to a significant extent. It is true that Argentine economy underwent a sharp turnaround following its 'Argexit'. But the main driver behind this development was that commodity prices lifted off at exactly the same time due to a demand surge from China (which initiated a global commodity boom). The significant rise in grain and oil prices over the next few years enabled a protracted period of growing living standards and unorthodox economic policies in Argentina.

What is more, the significant currency devaluation did actually not improve export performance. On the contrary, real export growth was on average 9% in the decade before the dissolution from the dollar-peg, whereas it diminished to merely 3.3% over the next decade. As a benchmark: global

trade growth remained close to 6% over that period (Alcidi and Gros, 2015, Alcidi, Giovannini and Gros, 2011). Moreover, Argentine exports were not diversified and remained mainly focused on commodities. And the share of manufacturing goods in total exports remained at 10% even after the devaluation and has dropped these days to merely about 6%, although, in principle, the devaluation should have stimulated the export of manufacturing goods (Alcidi and Gros, 2015, Alcidi, Giovannini and Gros, 2011).

Clearly, Greece cannot hope for a similar lucky exogenous positive (commodity or other) shock as met Argentina to support lifting its economy "out of the depths to which its financial system would plunge in the wake of an exit and breakdown" (Alcidi and Gros, 2015, Alcidi, Giovannini and Gros, 2011).

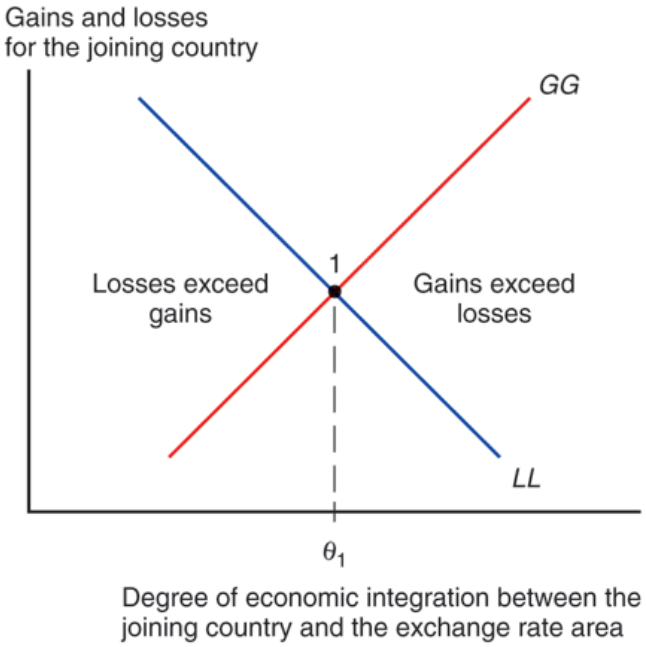
The Greek tourism sector as argued by many analysts, has been expanding even during the crisis and may thus represent a key driver of future recovery. For sure, tourism is important for the Greek economy, but its expansion may not be sufficient for a sustainable recovery on some indicators (Alcidi and Gros, 2015).

The economics of doomsday for Greece (and the Eurozone)

In a straightforward way,, "Grexit" can usefully be modelled within the "Theory of Optimum Currency Area" framework according to Krugman, Obstfeld and Mélitz (2015), Section 21. As is well-known, the critical threshold of the degree of integration is determined by the intersection of the efficiency gain function and the stability loss function. If this threshold is surpassed, it is worthwhile for a country to enter an irrevocably fixed-exchange rate system such as EMU.

However, it seems important to note that there are *different thresholds for entry and exit*, due to „sunk“ entry costs and high exit costs. There is a band of inactivity (compare the „play“ of the steering wheel of a car) which has to be passed fully, until an exit is beneficial for the respective country (explosive reaction). This “band of inaction” is of course widened by uncertainty (Belke and Kronen, 2015). In other words, until it will become beneficial for Greece to leave the euro area, things will have to become even worse. In a way, the country is caught in the common currency area, although its degree of integration denoted on the abscissa of Figure 1 has shrunk in the meantime (Belke and Kronen, 2015). Figure 1 must be adjusted accordingly, for instance by ex post leftward shifts of both curves, i.e. after the respective country has entered the common currency area.

Figure 1: Deciding When to Peg the Exchange Rate vs. Deciding when to Exit



Source: Krugman, Obstfeld and Mélitz (2014), p. 681.

Greek "anti-austerity fellows" will pay for a Grexit

What would be the costs of Greece exiting from the euro area? Would they be prohibitively high? This figure can certainly not be quantified through a single number (Belke and Verheyen, 2013). The effects of Greece's exit would of course decisively depend on the concrete circumstances of events in the country itself and on the general state of euro area financial markets. The 'immaterial' costs of a Greek exit cannot be quantified in one figure. In the short run "Grexit" may cause contagion in the shape of even higher risk premia for southern euro area member countries like Spain and Italy and create the risk of bank runs throughout the peripheral countries – at least this perspective was valid in 2011/2012. Section V modifies this picture from the perspective of 2015. The 'tangible' cost consist of a likely default of Greece on its outstanding foreign debt and a transfer of risk from the private to the public sector (Alcidi, Giovannini and Gros, 2012).

A much higher real burden of adjustment to a „Grexit" falls on the weaker Euro area member countries (due to higher costs of refinancing). They suffer twice: on the one hand from potential contagion effects and, on the other hand, from the much higher fiscal costs (Belke, 2012, Alcidi, Giovannini and Gros, 2012). In case of "Grexit", countries like Italy and France – close allies of Greece in terms of arriving at a more centralised EU governance - would be severely hit. Hence, it would not represent a rational strategy if the new Tsipras government would be heading for "Grexit". As a consequence, again, one should feel legitimised to argue that "Grexit" is nothing more than a "red herring" (this notion has been coined by Gros, 2015).

Grexit as a 'red herring'?

Let us start from the well-founded assumption that, at least officially, nobody is intending and/or actively promoting a "Grexit". Syriza wants Greece to stay in the euro and has been re-elected with this agenda. As expressed by Gros (2015): "It is 'only' asking for a reduction in Greece's official debt and an end to austerity". And also the German government does not favour "Grexit" either since European unification remains the central project for German policy-makers across all mainstream parties, among them also the Social Democrats – Merkel's partner in the current Grand Coalition (Gros, 2015).

It has to be noted in this context that German Finance Minister Schäuble's "Grexit" paper[2] was quite populist, not more than a threatening posture and thus is not distorting the general picture. Schäuble argued in summer 2015 that many economists, among them the IMF ones, questioned whether Greece's debts were sustainable without a real debt cut. A debt cut was, however, incompatible with eurozone membership. A temporary "Grexit", would hence perhaps be the better way for Greece Schäuble stated. Furthermore, there are strategic interests of the US and Russia (Greece is under heavy arms) which lets one assume that there are strong political forces to keep Greece in the euro area. And, as also this paper will draw upon later, the question emerges if Greek public debt is really as high as often claimed. Given very long maturities and concessional interest rates of outstanding Greek debt, the de facto debt burden may be very significantly lower. Accounting properly by applying, for instance, the International Public Sector Accounting Standards (IPSAS) could help Greece avoiding a "Grexit" (Ball, 2015).

Seen on the whole, thus, merely some protest parties and vocal economists argue that Greece (and also Germany and its northern euro area allies) would benefit from a new Drachma. The majority of arguments support the view that a "Grexit" does not make much sense. As a consequence, the

[2] See http://www.ft.com/intl/fastft/361101/schaeuble-temporary-grexit-might-be-better-option.

substantive issues are thus the requests for a reduction of the official Greek debt (i.e., a "haircut") and putting an end to austerity.[3] The short historical record with the Stability and Growth Pact and the Excessive Deficit Procedure has shown that both are, unfortunately in itself, eminently fudge-able (Belke, 2015, Gros, 2015).

However, the rhetoric on both sides about "Grexit" until summer 2015 might have led to a bank run, thereby forcing the ECB to limit financing for Greek banks. But even then, an exit from the euro area would not be preordained as it was ex ante clear that capital controls should be able to deal with this problem in the short- to medium run (Gros, 2015). And in the end they have actually been imposed.

Anyway, the argument that Greece is in need of a new currency to regain international competitiveness no longer applies because wages and, partly, also prices have already declined so much (see section II).

Debt reduction and official sector involvement – only relevant for the ESM

The demand for Greek debt reduction is usually justified by the argument that Greece's public debt (which is mainly external) is not sustainable. Greece's (gross) public debt/GDP ratio amounts to values close to 180%, which clearly surpasses the 120% of GDP threshold usually applied in debt sustainability exercises, for instance, by the Troika. And the Greek government also has large assets on its balance sheets, because it had to take large stakes in its commercial banks and keep cash under the PSI (private sector involvement) provisions. The de facto net debt ratio thus

[3] See Belke and Dreger (2011). With the benefit of hindsight it was a tactical mistake of the German government to insist on participation of the IMF, because it is insisting on the necessity of a haircut on Greek debt.

amounts to about 120 to 130% of GDP, a ratio even lower than the Italian one (Belke, 2015a, Gros, 2015).

Moreover, Greece has been granted very low interest rates by its official creditors. Due to these rate concessions, the country has to spend less on debt service than its euro area partner countries Italy or Ireland, which both are plagued by much lower debt-to-GDP ratios. For 2015, the payments on its official foreign debt are estimated to be tiny, namely 1.5% of GDP. Taking everything together, Greece should ultimately be able to service its debt (Belke, 2015a, Gros, 2015).

The only large payments and, hence, suitable default targets which Greece had to deliver in the year 2015 were to the IMF and the ECB (Gros, 2015). It was clear from the onset that it would make sense for both parties to 'extend and pretend'. And it was also quite intuitive that the Syriza government could not default on these bonds and still assume that the ECB would grant financing to Greek banks. The ECB in turn would also prefer not to incur the loss of face emerging from an outright loss on these bonds on its balance sheets (Gros, 2015).

Finally, restructuring of Greek debt would in the end open the Pandora box with similar claims by other euro area member countries whose problems are not insolvency as in the case of Greece but illiquidity.

Let us now address the bottom line on the debt reduction requested by the two Syriza governments. A de facto rescheduling of some payments due in 2015 was generally regarded as possible already at the start-of-year and was, later on, decided in the third Greek programme. But an outright reduction in the nominal amounts owed to the ESM and of other loans from euro area member countries will be hard to achieve with an eye on the fact that nothing is due to them anyway until the years from 2020 on. The creditors, which had to be paid first (the ECB and the IMF), are de facto

super senior, implying that the ESM will after all be the victim of official sector involvement (OSI). In other words, "Grexit" will become an issue again not earlier than around the year 2020.

Even more important in our context, Italy would in this case and from 2020 on have to shoulder 20% of the ESM losses and Spain another 10% (Belke and Dreger, 2011). The rhetoric but expedient question in this context is whether the Greek government really wants to default on its obligations to other highly indebted countries and "fellow sufferers" from austerity (Belke and Dreger, 2011, Gros, 2015).

Does an end to austerity imply a return to growth?

Does an end of austerity necessarily mean a return to growth? The clear answer is: not at all. One has to take into account that Greece is the only euro area member country whose problem for the markets was clearly excessive public, not private spending (Belke et al., 2014). Its fiscal adjustment had thus to be, and actually was, larger than that of any other euro area member country such as Ireland or Portugal. This was also the case because excessive government spending manifested itself even after 2009, the date of big spending cuts of many EU partner countries (Belke at al., 2014, Gros, 2015).

But, as explained in section II, the real reason behind the depth and length of the fall in GDP has been that export growth was insufficient to compensate the public sector deficit reduction. In addition, it was already clear at the start-of-year 2015 that there would be no clear-cut austerity imposed on Greece anymore.[4]

In reality, 'austerity' must be considered as a fuzzy notion (Gros, 2015). And even the detailed fiscal programmes under the Stability Pact have turned out to be loosened by political compromises reached by circumventing the DG ECFIN, as the experience with France and Italy has shown a few months ago. As the third programme has clearly shown, some creative accounting in combination with more optimistic revenue projections might well allow the second Syriza government to spend a bit more and the EU to pretend that the fiscal targets can still be reached (Belke, 2015, Gros, 2015). The probability of such a scenario has risen with an eye on the lax implementation of the Excessive Deficit Procedure (EDP) and political cycles in GDP revisions in general (Belke, 2015, De Castro, Perez and Rodríguez-Vives, 2013).

Although, until recently, European authorities claimed that "OSI does not work within the euro area, it can be concluded from the above that both OSI and the end of austerity can be fudged (Gros, 2015). Also from this end, "Grexit" will become an issue again not earlier than around the year 2020, because Greece will be kept within the euro area until 2020 most probably by a lot of "fudging".

Grexit is 'in the air' due to ELA

[4] As Gros (2015) correctly argues: "at any rate, austerity is ending naturally since the Troika programme foresees no further large reductions in expenditure (both social security and investment expenditure is supposed to remain constant). The surpluses expected for this year and next are based only on revenue increases, not on further expenditure cuts".

The link to a “Grexit” before 2020 is an indirect one. It may work through the banking system, and the central role of the ECB for Greece. In the year 2015 the ECB has been confronted with the same conundrum as in 2012 and again the focus has been on ELA (emergency liquidity assistance). The Greek national central bank has provided ELA under its own responsibility and is thus to be backed up by the national authorities. The main issue here is that the ECB has allowed the Greek National Bank to provide ‘emergency’ financing to Greek banks while the guarantee for this lending is provided by the Greek government which simultaneously intended to renege on its own debt (Gros, 2015). These kind of internal contradictions have the potential to move the markets up to an intensity which may enforce “Grexit”.

Greek banks still had almost € 40 billion of ELA outstanding at the start-of-year 2015. At that time, it was clear that more would be necessary if the Greeks started to take their money out (as it actually did later on). If the ECB would then cut Greek banks’ access to ELA, the latter might run out of money, rendering “Grexit“ inevitable (Gros, 2015). However, the example of Cyprus demonstrates that this outcome could be effectively avoided in the short- to medium run by employing capital controls. Imposing capital controls is equivalent to an indirect “Grexit”, because a Greek euro would be different from, for instance, a German euro. But they would also correspond with a more gradual “Grexit”, depending on the strictness of the controls. In the Cypriot case, the capital controls have creepingly been dismantled; they are now not more than a nuisance. Cyprus is thus returning gradually to become a ‘full’ member of the euro area again (Gros, 2015).

Already at the start-of-year 2015, the most likely outcome appeared to be a “typical European fudge on several fronts: some rescheduling of official debt payments, some relaxation of the fiscal targets, and if Greek depositors get nervous, some capital controls to pretend that Greece is still part of the Eurozone” (Gros, 2015). And in the end politics evolved exactly along these lines. It

was also a safe bet that the months preceding the instalment of the third programme were full of drama, but finally "the difference between a government that has never made good on its promises to pay and a government that promises not to pay might not be that large" (Gros, 2015).

IV. Lessons from the Strukturwandel in the Ruhrgebiet: Turning Northern Greece into an Industrial Champion?

Against the background of the (at least partially) successfully overcome structural change in the German Ruhrgebiet, this section analyses whether and to what extent Northern Greece, especially Central Macedonia with the city of Thessaloniki, can learn from the Ruhrgebiet when conducting the required structural reforms and coping with structural change and thus minimise the risk of "Grexit" (Belke, Christodoulakis and Gros, 2015).

In the Ruhrgebiet, the process of structural change seems to be almost complete. More than half of the workforce is now employed in the service sector - at a still positive trend. But some problems such as a high proportion of educationally disadvantaged households with a migration background remain due to the missed structural change in the 1960s. This study thus analyses the structural characteristics of the Greek economy and workforce with particular emphasis on the northern regions in Greece and compares them to the Ruhrgebiet and Northrhine-Westphalia (NRW) (Belke, Christodoulakis and Gros, 2015).

The key findings are first of all that there are some similarities in the problems (of the Ruhrgebiet in the 1970s and Northern Greece today). Similarities include, for example, the low level of qualifications of the workforce. But there are also notable differences, in particular the importance of

industry and manufacturing, whose weight in the local economy was excessive in the Ruhrgebiet, but appears rather low in Greece (Belke, Christodoulakis and Gros, 2015).

Moreover, it appears that Greece seems to have made great progress in tertiary education, at least in quantitative terms. The proportion of the workforce with a university degree is now about the same in Germany and Greece. In this sense, Greece has been quicker than the Ruhrgebiet. But the results in terms of productivity and innovation are very different (Belke, Christodoulakis and Gros, 2015).

It remains to be seen whether is this due to the quality of the university education or the fact that the universities in Greece constitute 'cathedrals in the desert' because there is no high-value added manufacturing base around them to make use of the graduates. This absence of a local manufacturing base in turn could be due to the fact that the middle level in terms of educational qualifications is much thinner in Greece (and in particular in the north of the country) where the proportion of the workforce without complete upper secondary education is still very large (Belke, Christodoulakis and Gros, 2015).

In Greece, and especially in Northern Greece, the key problem might thus be the absence of well-paying industrial jobs, which is both a cause and a result of a very thin industrial structure. Given that there is little industry to absorb those who do not have a University degree, but solid competences in practical tasks, the young tend to stay out of training (Belke, Christodoulakis and Gros, 2015).

But the secondary school system in Greece seems ill suited to turn out the kind of work force needed by technologically advanced manufacturing. Greek youth tend to underperform in international tests of the knowledge of mathematics and science. This problem does not seem to be due

to a lack of spending on education in general, but the quality of the school system and its management by the government (Belke, Christodoulakis and Gros, 2015).

The basic message suggested by this simple result is at the same time simple, and somewhat discouraging. If general government efficiency is the main determinant of educational achievement, it implies that partial reforms within the education sector are unlikely to improve student achievements fundamentally. Many aspects of public administration need to be overhauled and improved if one wants to improve educational outcomes. This is likely to require time and a general consensus. Partial reforms that improve, for example, the distribution of resources – by introducing more competition and greater transparency – can be designed and implemented in a rather short time and should have a positive impact (Belke, Christodoulakis and Gros, 2015).

The structural problems in the Greek educational system have of course been exacerbated by austerity. More attention should be paid by the Troika to where the money is spent, not just how much. Moreover, now might be time for EU and other institutions to help the local authorities in Northern Greece to improve the quality of the local school system and try to entice the many youth which have abandoned hope ‘back to school’ with the offer of a high quality practical education which does improve their chances to find a job (Belke, Christodoulakis and Gros, 2015).

However, the two regions, the Ruhr and Northern Greek, are quite opposite. The former had to restructure an obsolete manufacturing sector inside a strong economy with large transfers, the latter has a very weak productive sector inside an economy in crisis and has to create almost everything. In this perspective one could argue that launching new export sector implies sustainable strategies such as changes in the education system or to foster innovation to transfer resources from the non-tradable to the tradable sector to secure a competitive basis, instead of merely cutting wages. What

is more, the Ruhrgebiet has managed its structural change via a move to the services sector away from tradables whereas for Greece it is recommended to shift its resources towards tradables.

V. Outlook

So, the natural question now is: Can it work this time round? The answer should be 'possibly yes'. The current situation is completely different from 2010 and 2012. The economy is in worse shape, given the GDP losses, yet fundamentals have adjusted. Most of the fiscal and external imbalances have been corrected (Alcidi and Gros, 2015a).

Despite a lack of control over public finances during the first half of this year, the primary balance is not that far away from balance, whereas it had been in deficit for over 10% of GDP in 2009. The primary-balance targets contained in the new programme will not require much of an effort if the economy recovers, as should be the case given the considerable drop in wages already achieved (Alcidi and Gros, 2015a).

The task of structural reform should also be easier. Implementation has always been the main problem, with only a small fraction of the reforms really implemented. But if another small fraction, say a further 25%, is implemented over the next few years, the Greek economic context may look completely different compared to four years ago (Alcidi and Gros, 2015a).

The banking system which had been frozen by political uncertainty over "Grexit" for a long time should now also be able to function better once it has been recapitalised (Alcidi and Gros, 2015a).

And finally, the political context is changed. There is now bipartisan support for the programme. The political uncertainty that held back investment and exports should thus also abate. In 2014, the Greek economy had already shown some signs of recovery, which was nipped in the bud by the political drama that seized the country in the first half of this year. The same forces behind that

change should now become even stronger allowing for sustainable growth (Alcidi and Gros, 2015a).

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On public debts in the euro area

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Abstract*:* The 2008 crisis led to a strong rise in public deficits and debts in most developed economies. These debts and deficits are currently Keynesian (i.e. required for macroeconomic stabilisation), as shown by low inflation and interest rates levels. Euro area public debts are not guaranteed by a lender of last resort. The rules enshrined in the Stability Pact and the Fiscal Treaty have no economic basis. The paper discusses federalist proposals such as a European Debt Agency or a European Treasury, and unconventional solutions, such as debt monetisation, buyback by the ECB, and even debt cancellation. It concludes in advocating for a rule-free economic policy coordination.

Keywords: public debt, euro area governance, euro area fiscal policy, debt management.

JEL classification: E42 E62, H63.

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1. Introduction

The 2008 crisis led to a strong rise in public debts, by around 30 percentage points of GDP in terms of Maastricht debt for the euro area, 40 percentage points for the US, 45 for the UK, 65 for Japan (Table 1). At the end of 2014, public debts were above 60% of GDP in almost all euro area countries, but this was not specific to the euro area, and was also the case for the UK, Japan, and the US. Almost all developed countries run high public deficits, reaching, in 2014, 7.7% of GDP in Japan, 5.3% in the UK, 5.0% in the US, but 2.4% only in the euro area at the price of past heavy fiscal austerity.

Table 1. Public debts in 2007 and 2014, as % of GDP

	Gross debt, Maastricht definition		Net debt	
	2007	2014	2007	2014
Germany	64	75	42	46
France	64	96	32	78
Italy	100	132	89	131
Spain	36	99	17	81
Netherlands	42	68	24	44
Belgium	87	107	74	102
Austria	65	84	39	59
Greece	103	179	80	141
Portugal	68	130	55	108
Finland	34	59	-70	-55
Ireland	24	107	-1	82
Euro area	*66*	*95*	*42*	*73*
UK	44	88	30	76
US	64	105	45	86
Japan	183	246	81	129

Sources: EC DG-ECFIN, AMECO, November 2015; OECD, *Economic Outlook*, November 2015.

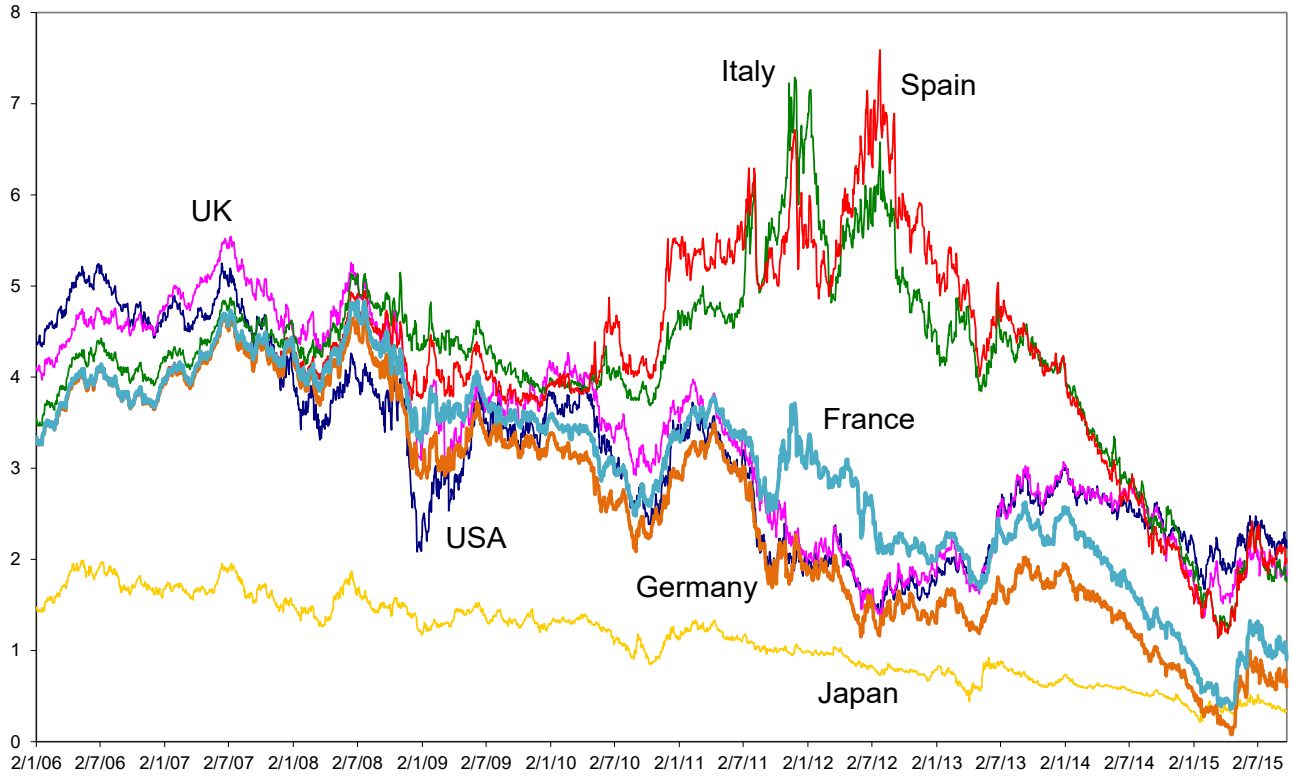
During the crisis, monetary policies have become strongly expansionary, with central banks' interest rates having been cut down to almost 0. In view of the depth of the recession, markets expect interest rates to remain durably low, and hence long-term interest rates have dramatically fallen (Figure 1).

The current situation raises two issues. The first concerns all developed countries: how can this rise of public deficits and debts be explained? Should developed countries aim to bring public debts back to their pre-crisis levels? The second issue concerns euro area Member States (MS): how to re-establish public debt homogeneity within the area? How to deal with public deficits and debts in an area with a single monetary policy and autonomous fiscal policies?

We will discuss the European institutions strategy (the Fiscal Treaty, fiscal austerity and structural reforms, fiscal federalism), mainstream proposals (Redemption Fund, Blue and Red debts, European Debt Agency, European Treasury,) and unconventional ones (public debts

monetisation and cancellation, future tax revenue capitalisation). We will conclude by advocating for a rules-free economic policy coordination based on an ecologist/social democrat/Keynesian strategy.

Figure 1. 10-year government interest rates (in %)



Source: Financial markets, Datastream.

2. About the rise in public debts and deficits

Two theories may explain the high level of public deficits and debts. From a liberal point of view, governments are demagogic, myopic, under the influence of lobbies and civil servants interests[1]. Public deficits are therefore an autonomous cause of macroeconomic unbalances. According to the 'crowding-out' effect theory, public deficits generate excessive demand, which induces too high interest rates. They are detrimental to capital accumulation and therefore to future growth. It is necessary to paralyze national fiscal policies by fiscal rules, by independent fiscal committees, or by financial markets surveillance.

However, these mechanisms of higher interest rates and crowding-out effects have hardly been observed in reality. From 2002 to 2005 and since 2008, both short and long-term interest rates have been historically low despite the rise in public debits and deficits in Europe, the US and Japan. It is difficult to pretend that the low levels of current interest rates are detrimental to investment. This theory does not explain why all governments would have suddenly become demagogic and increased too much public expenditure in 2002 or in 2009. In the recent past, the rise in government deficits has been due to fiscal stabilisation rather than to a spontaneous

[1] See, for instance, Alesina and Perotti (1995), Alesina and Tabellini (1990), Drazen (2004), Wyplosz (2011).

rise in expenditure or a spontaneous decrease in tax revenues. It is not obvious that OECD countries were characterized, before and after the 2008 crisis, by fiscal indiscipline (contrary to what Debrun and Kumar (2007) or Wyplosz (2111) pretend).

From a Keynesian perspective, public debt and deficit may be necessary to ensure that demand equals potential output (Box 1). Public debts and deficits result from the need to reduce macroeconomic imbalances and are not at the origin of these imbalances. In times of economic uncertainty or of entrepreneurs' pessimism, private demand cannot maintain a satisfactory level of employment. The optimal policy consists in cutting the interest rate until demand is sufficiently robust. This policy does not increase public debt; it lowers the profit rate requested by firms to invest and stimulates capital accumulation. However, it may lead to excessive companies' or households' debt accumulation. It may generate financial or housing bubbles. Interest rates cuts may be inefficient in times of strong economic depression, when private agents are reluctant to borrow. It may be insufficient because there is a floor to nominal and consequently to real interest rates. It may not be implementable in the euro area where the common interest rate cannot adjust the different business cycle situations in the 19 Member States. So the sharp rise in public debts must be related to lower inflation and growth (which prevents monetary authorities to reduce sufficiently the real interest rate adjusted for growth in depression episodes) and to the introduction of the euro. Furthermore, the public debt level desired by private agents has increased after the crisis as households wish to hold safer financial assets and companies wish to deleverage. Structurally, the ageing of populations induces increasing demand for safe public assets.

Box 1: A Keynesian perspective

From a Keynesian perspective, a certain level of debt and deficit are necessary to ensure that demand equals potential output.

If $y = g + d + cy - \sigma r + kh$, with *y*, GDP, *g* public deficit, *d*, private demand, *r,* real interest rate, *h*, public debt, full stabilisation implies that in the short-run: $g = -d + \sigma r$

If the country can freely manage its real interest rate, fiscal policy is not necessary. If this is not the case, either because the interest rate is set at the European level or because the nominal interest rate is already at zero, then an active fiscal policy is necessary.

If an active fiscal policy is implemented and if stabilisation is perfect, there is no link *ex post* between the deficit and the output gap. Let us note also that, in this case, g, government borrowing, is considered as structural according to the OECD or the EC methods, which makes no sense.

In the long run, g = 0 and $h = -(d - \sigma r) / k$

The long-term public debt level is not arbitrary, but depends on private agents' wishes: debt must equal desired debt at the optimal interest rate, i.e. the rate equal to the growth rate.

This simple model shows that a fiscal rule like: $g = g_{\circ} - \lambda y - \mu(h - \bar{h})$ cannot be proposed, since it would not allow for full stabilisation and since the government cannot set a debt target regardless of private agents' saving behaviour.

Such a deficit necessary to support output will not crowd out private spending: it will not raise interest rates, as in this situation they are as low as possible. It does not raise sustainability

issues: if the rise in public debt leads private agents to increase their spending, then the government will be able to cut its deficit accordingly. Public debt can be reduced only through higher firms' or households' borrowing or lower savings (owing to reduced uncertainty about the future). When public deficit is of a Keynesian type, it makes no sense to advocate fiscal *consolidation* without explaining how the resulting lack of demand will be offset.

Today's low inflation and interest rates show that public deficits are Keynesian (needed to resorb macroeconomic imbalances) and not classical (autonomous source of imbalances). Therefore the fundamental question remains: why are large public deficits necessary today at the world level in order to support demand? Prior to the crisis, six factors contributed to a lack of world demand:

- Many countries implemented neo-mercantilist strategies targeting current account surpluses accumulation: Asian countries learnt the lesson from the 1997 crisis and wish to be free of financial markets and IMF pressure; China's growth model is export-led; many countries wish to anticipate the costs of ageing populations (Japan, Germany, Austria, the Netherlands, and Nordic countries). Their surpluses add to oil exporting countries' ones.

- Trade globalisation increases the weight of international competitiveness. Each country has an incentive to put downward pressure on their wages. Countries like Germany, the Netherlands and Austria have succeeded in substantially lowering the wage share in value added since 2000. Consequently domestic consumption decreased as a share of GDP.

- Anglo-Saxon economies have chosen a growth strategy based on wage and incomes stagnation for households as a whole and the rise in inequalities. This implies a declining consumption trend, which was offset by higher households' borrowing and by financial and housing bubbles allowed by low real interest rates. When households' borrowing reach a paroxysm and when bubbles burst, public debt has to support demand.

- Population ageing and the rise in pension funds increase the level of available financial capital. These funds wish to own risk-free assets, i.e. public debt.

- Financial globalization induces all investments to compete on financial markets. Productive investments are compared without caution with financial investments associated with an illusory high profitability based on the rise in financial bubbles. Consequently investors request higher profitability while at the same time productive investment stagnates in developed countries due to slow growth, industrial projects' relocation in emerging countries, and decrease in investment goods relative prices.

- With the objective of free labour and capital movements, EU institutions have forbidden countries to implement measures needed to protect their tax policies. Hence EU governments have engaged in tax competition. Tax and contributions cuts have been intensified (on corporate taxation, on higher-income households, on wealth, on employers' contributions, etc.) with no positive impact on growth. These tax policies have therefore increased social inequalities and public deficits. Simultaneously these tax cuts policies were chosen by EU institutions, right-wing governments and leading classes with a view to cut tax revenues, and pretend afterwards that, in view of the resulting public deficit, expenditure need to be cut.

A structural imbalance has widened between savings and investment, which must be filled by low interest rates, by private and public debts, or by financial bubbles. After the 2008 crisis,

"private debt/financial bubbles" solutions came to a halt and only the "public debt" solution remained. The crisis led to a strong rise in public debts as governments had to rescue banks, to support aggregate demand and, above all, because of lower tax revenues due to the long-lasting depression. These effects add to the structural drifts induced by financial capitalism.

The crisis was not caused by a high level of public expenditures, debts or deficits, neither in the euro area, nor in other developed countries. For instance, in 2007, the public deficit for the euro area as a whole amounted to 0.6 % of GDP, well below the level ensuring debt stability.

3. The drawbacks of the euro area framework

The drawbacks of the euro area framework have been highlighted by widening divergences and imbalances between euro area Member States from 1999 to 2007 and in the 2007-2014 crises. Prior to, and after the beginning of the crisis, EU institutions and the MS have been able to implement neither a common economic strategy nor satisfactory economic policy coordination. The single currency suffers from eight original sins, which are difficult to correct:

- According to economic theory, there cannot be a single currency between countries with different economic situations and independent economic policies. The single currency requires the implementation of precise, well-defined and binding constraints, solidarity mechanisms or economic policy coordination. How to prevent otherwise the emergence and persistence of imbalances between countries running large external deficits and countries running large surpluses?

- These mechanisms cannot consist in rigid numerical rules enshrined in a Treaty, without economic rationale (such as: public deficits should not exceed 3% of GDP, public debts should not exceed 60% of GDP, and structural public budgets should be in balance in the medium-term). These mechanisms should be both soft (the objectives should account for the current economic context) and binding (each country should comply with decisions agreed in common). But how may governments with different interests and analyses reach agreement on economic policy strategies? How to convince a MS to modify its economic policy in order to meet common objectives?

- The common monetary policy cannot fit each MS situation. A country with stronger growth and inflation has a low real interest rate as compared to its GDP growth rate, which boosts GDP growth; it is the opposite for a country with low growth or inflation. Since 2010, this feature has been strengthened by the rise in interest rates spreads requested by financial markets, since capital flies away from fragile countries with zero or negative growth (which increases their interest rate) and rush to countries with a satisfactory growth such as Germany (which contributes to low interest rates). Northern EMU countries benefit from a relatively weak euro pulled down by Southern countries; Southern countries suffer from a strong euro due to Northern countries' external surpluses.

- On the one hand, there cannot be unconditional solidarity between countries with different social and economic systems. Northern countries may refuse to support Southern countries, blaming them for not having undertaken the necessary structural reforms, for having let imbalances grow and for being unable to meet their commitments. On the other hand, such solidarity is a prerequisite for the single currency to be guaranteed.

- According to the EU Constitution, the ECB is not entitled to finance directly governments (Article 123, TFEU); financial solidarity between MS is forbidden (Article 125, TFEU). Thus, each MS has to borrow on financial markets without a central bank acting as a "lender of last resort". This raises the risk that some MS may not be able to fulfil their commitments and may default. MS public debt is no longer a safe asset. Financial markets started to realise this from mid-2009. After the experience of the Greek default, they requested unsustainable interest rates to countries in difficulty, which increased further the difficulties of the latter.

- Euro area MS are now under financial markets' judgement and they do not control anymore their interest rates unlike Anglo-Saxon countries or Japan. But financial markets have no macroeconomic expertise, they are – and know that they are – self-fulfilling. However, Northern countries refuse a collective guarantee of MS public debts. They consider that the discipline imposed by financial markets is necessary. This induces disparities among interest rates, which is arbitrary and costly.

- The 2007-2009 crisis is a deep crisis of financial capitalism, which would have requested government strong policy responses to reduce the weight of finance and neo-liberalism domination, to implement a macroeconomic strategy aiming at full employment, social cohesion and ecological transition (see Mathieu and Sterdyniak, 2009). But EU authorities denied any questioning of the pre-crisis strategy.

- Two doctrines differed in Europe about the conduct of economic policy. For Keynesians, economic policy should stabilise demand at a satisfactory level through the common monetary policy and national fiscal policies, through automatic stabilisers but also through discretionary measures. This requires a precise coordination of economic policies. On the contrary, for the liberal, technocratic, and federalist ideology which prevails in EU institutions, growth should be obtained through public deficits cuts (the so-called 'growth-friendly fiscal consolidation') and through structural reforms: supply policy, public expenditure and tax cuts, product, labour and financial markets deregulation. Demand should not be supported, as this would allow MS to delay the necessary reforms. Europe should deprive democratic States (subject to demagogic temptations) of their powers (especially of fiscal autonomy) to concentrate them in EU bodies (ECB, Commission) which will move Europe towards a liberal model. This strategy has not delivered so far: the euro area remains in depression.

Strengthening fiscal discipline

According to the Commission, the crisis is due to fiscal indiscipline. It succeeded to introduce the Fiscal Pact (the Treaty on Stability, Coordination and Governance), ratified by the MS on 2 March 2012. This Pact is a new step forward from liberal views against Keynesian economic policies and from EU authorities against autonomous domestic fiscal policies.

Article 3.1 states that: "The budgetary position of the general government shall be balanced or in surplus. This rule shall be deemed to be respected if the annual structural balance of the general government is lower than 0.5% of GDP. The MS shall ensure rapid convergence towards their respective medium-term objective. The time frame for such convergence will be proposed by the Commission […]. A correction mechanism shall be triggered automatically in the event of substantial deviations from the adjustment path."

Thus, close-to-balance fiscal positions are enshrined in the Pact although it has no economic rationale. The true 'golden rule of public finances' justifies on the contrary that public investment is financed through borrowing. Besides, households, insurance companies, financial institutions wish to own public debt. If the desired public debt stands at around 60/80% of GDP and if nominal GDP grows by around 3.5% per annum (i.e. by 1.75% in volume and 1.75% in prices), it is justified to run a public deficit of around 2.1/2.8% of GDP. Besides, a public deficit is necessary when it allows reaching a satisfactory demand level leading to the highest non-accelerating inflation output level, at a real interest rate close to GDP growth. There is no evidence that running a structural public budget in balance is optimal. Since MS do not control interest rates and exchange rates anymore, they need degrees of freedom in the conduct of their fiscal policy.

The Pact is based on the structural deficit notion, i.e.: 'deficit corrected from the cyclical component, excluding one-off and temporary measures'. But measuring such a deficit requires evaluating structural output, which is problematic, especially after strong macroeconomic shocks. According to the Pact, the Commission's estimates must be used. But these estimates are not reliable: estimates for the pre-crisis period were revised substantially downwards after the 2008 crisis (Mathieu and Sterdyniak, 2015). The estimated structural output is always close to observed output, since, after a crisis, the methods consider as structural the fall in capital resulting from the fall in investment, the increases in the unemployment rate and often the decrease in the available active population: this underestimates the cyclical deficit and imposes pro-cyclical policies.

According to paragraph 3d, the structural deficit target can be lowered to 1% if debt stands below 60% of GDP. Let us consider a country with nominal GDP growing by 3.5% per year. If this country runs permanently a 1% of GDP deficit, its debt will come down to 28.6% of GDP. But nothing guarantees that the macroeconomic equilibrium could be ensured with *a priori* set constraints: public debt below 28.6% of GDP; public deficit below 1% of GDP.

Article 4 repeats the rule according to which public debts should fall below 60% of GDP. This rule was already part of the SGP, but the Commission was not able to impose it. Thus, a country running a higher than 60% of GDP debt ratio will have to reduce this ratio by at least one twentieth of the gap with 60% each year. This assumes that a 60% of GDP ratio is optimal for all MS and may be reached by all of them. But in Europe, countries like Italy or Belgium have run public debts of 100% of GDP for a long time (without mentioning Japan where it has reached 200% of GDP), without imbalances as these debts correspond to high domestic households savings (see also Box 1). Hence this does not introduce additional constraints in the medium-term as compared to the balanced budget target.

The Pact obliges MS to run quasi-automatic fiscal policies, prohibiting any discretionary fiscal policy, which is however needed to reach full stabilisation. According to the Pact, each country should implement restrictive measures without accounting for the economic situation and policy in the other MS. The Pact assumes implicitly that restrictive policies have no impact on GDP. The current crisis makes high public deficits and debts necessary. This is not taken into account by the Pact.

Improving economic policy coordination

Euro area economic governance involves a complicated set of procedures, reports, and dialogues between the EU and national institutions. This does allow neither for democratic or scientific debates, nor for strong economic policy responses. It does not embed real economic policy coordination, i.e. an economic strategy using monetary, fiscal, tax and wage policies to bring together countries towards full employment or to correct imbalances between countries. The "fiscal austerity/structural liberal reforms" ideology prevails without discussion. The whole process works as long as no MS questions this ideology. In June 2012, the new French government quickly accepted to remain in this framework. In 2015, it took six months for Greece to finally surrender. Democratic choices and economic alternatives are therefore strictly constrained.

Implementing some degree of financial solidarity

After the financial crisis, financial markets bet on the default and euro area exit of several MS. EU authorities and MS did not react sufficiently rapidly and strongly. They denied guaranteeing unconditionally public debts. Financial solidarity increased progressively since the beginning of the crisis, despite the reluctance of Northern economies.

The European Stability mechanism (ESM) launched in October 2012 introduces some degree of financial solidarity between MS, but this solidarity is conditional, limited and has a very high price. Countries may benefit from the ESM if they have adopted the Fiscal pact and have fulfilled it. The ESM support will be conditional: a country needs to commit to fulfil a drastic fiscal adjustment programme imposed by the Troika (the ECB, the IMF and the European Commission), and will therefore lose all domestic fiscal autonomy and have to accept a long austerity period. The Greek example shows that this type of plan is not the way out of the crisis. The solidarity implemented does not consist in donations but in loans. MS public bond issuance should now involve a collective action clause, i.e. in case of default, stated by the Commission and the IMF, the country will be entitled to agree with creditors on a change in payment conditions, the agreement applying to all creditors if a majority agrees. Government debts will become speculative assets in the euro area as was the case for developing economies, and will not be considered as a safe asset anymore by financial institutions. Interest rates on public debt will rise, will be more volatile and less easy to control. Why build the euro area to reach such a situation?

On 6 September 2012, the ECB announced a purchasing bonds programme on the secondary markets, for short-term bonds (1-3 years), the so-called OMT (outright monetary transactions). In putting no ceiling to its interventions, the ECB broke the spiral of financial markets self-fulfilling expectations, so that finally it did not have to intervene. Interest rates spreads decreased substantially (Table 2). But the ECB was able to impose its views on the economic strategy to be implemented: product and labour markets structural reforms; full commitment to government balance targets despite the recession; rapid implementation of the Fiscal Pact. Many German economists (see Doluca *et al*, 2012) consider that the ECB has gone beyond its mandate in committing itself to support public debt, which is an incentive for MS to delay the necessary reforms, and raises moral hazard issues; they claim that the ECB should focus strictly on price stability.

Table 2. 10-year government interest rates

	February 2012	May 2013	January 2014	March 2015	November 2015
Greece	40.8	9.6	7.9	10.8	7.3
Portugal	12.3	5.5	5.1	2.25	2.4
Spain	5.05	4.2	3.7	1.25	1.6
Italy	5.5	3.9	3.8	1.3	1.45
Ireland	7.8	3.45	3.2	0.8	1.0
Belgium	3.65	2.05	2.35	0.5	0.8
France	2.95	1.85	2.2	0.45	0.8
UK	2.1	1.9	2.8	1.55	1.9
Sweden	1.8	1.8	2.4	0.4	0.8
US	2.0	1.85	2.8	1.9	2.2
Austria	2.85	1.7	2.1	0.4	0.8
Netherlands	2.2	1.6	2.05	0.3	0.6
Finland	2.3	1.5	1.95	0.4	0.65
Germany	1.9	1.35	1.75	0.2	0.5
Japan	1.0	0.6	0.7	0.3	0.3

Source: Financial markets.

The ECB is powerless on four issues: it cannot resorb intra-area imbalances; it does not control MS long-term interest rates; it cannot cut nominal rates below 0; it cannot expand credit when demand for credit is at a standstill. The ECB cut its interest rates down to 0, but fiscal policies implemented under the Commission's recommendations and domestic wage policies maintained the euro area in depression, and consequently underlying inflation remained around 1.0% in 2015, well below the ECB's objective of inflation below, but close to 2%. In 2015, the ECB succeeded to lower the euro/dollar exchange rate, which could have the desired inflationary and expansionary effects. But euro area economic policies remain unbalanced: a zone with high unemployment and an external surplus should run an expansionary fiscal policy, rather than depreciate its exchange rate.

Fiscal austerity in the euro area

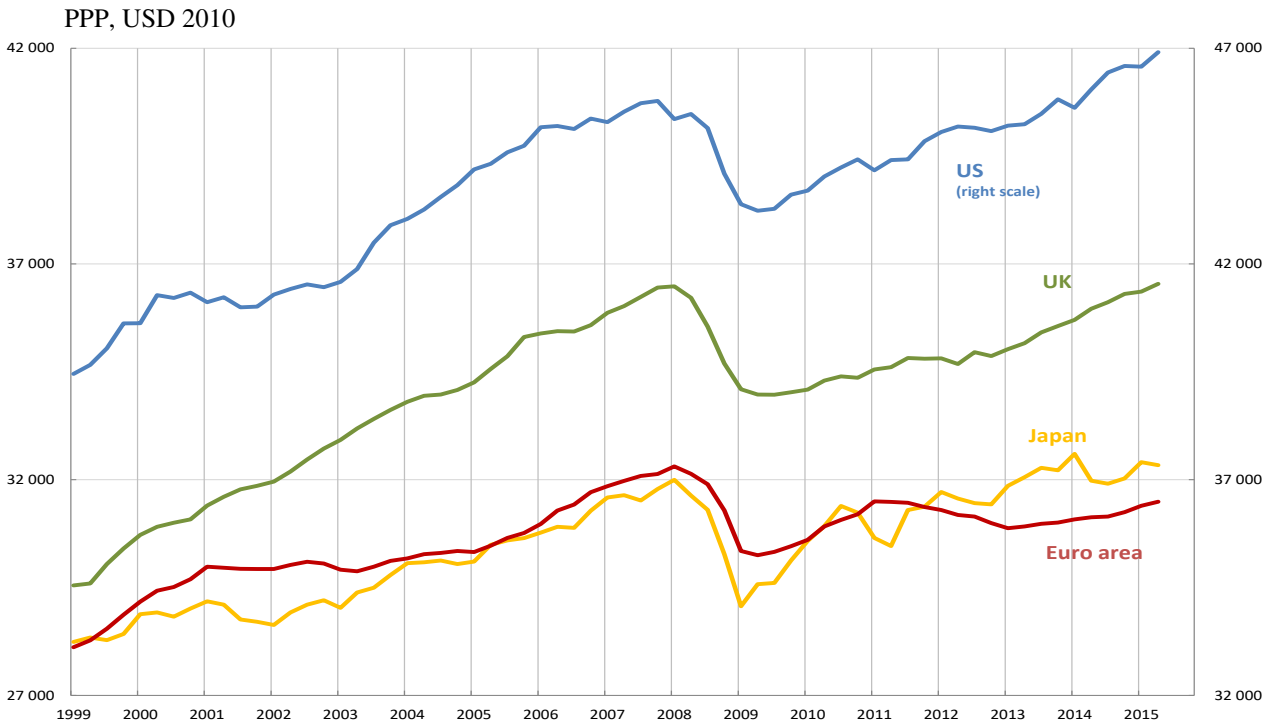
Since 2009, the output gap has remained significantly negative in almost all MS. At the euro area level, the estimates varied for 2012 between from -2.3% according to the Commission and OECD and -10.4% for OFCE. In 2015, the Commission estimates euro area potential GDP to have grown by around 0.6% per year since 2009. Such estimates suggest that Europe has no other choice but accept low growth and high unemployment. But there is no explanation as to how supply factors would have induced such a weakening in potential growth. If the only explanation is: "potential growth was affected by effective growth", then growth recovery would lead to higher potential growth.

Under the pressure of financial markets, of the European Commission (and of the Troïka as concerns Greece, Ireland, and Portugal), all euro area MS have implemented restrictive fiscal consolidation policies since 2011. According to our estimates based on pre-crisis trend output and on the latest EC forecasts, these policies amounted on average to around 1.5% of GDP in 2011, 2.3% in 2012, 1.2% in 2013, 0.7% in 2014, 0,4 in 2015, i.e. 6 % in five years. These policies put to a halt the recovery which had taken place in the euro area in 2009-10 (see Figure

2). The cumulated negative GDP impact could be estimated to be 9.2 percentage points for the euro area (Mathieu and Sterdyniak, 2013). The *ex-ante* favourable impact of restrictive fiscal policies on public balances would be strongly reduced by this depressive effect: the *ex post* deficit reduction could be estimated to be only 1.5 point of GDP. The public debt-to-GDP ratio would increase, by 4 percentage points, due to the strong fall in output.

During this episode, economists (and international institutions) have re-discovered that the Keynesian multiplier is large, in the order of 1 to 1.5; that the multiplier is larger when unemployment is high than when the economy operates at full capacity (but why implement a fiscal stimulus in a full employment situation?); that the multiplier is larger for public consumption, investment and social transfers than for tax cuts.

Figure 2. GDP by head



Source: National Accounts, OECD, IMF.

Unfortunately, the European Commission persists in November 2015 to require strict compliance with arbitrary trajectories of public finances and to blame six MS (France, Spain, Italy, Portugal, Lithuania and Ireland) for not fulfilling the targets, regardless of their macroeconomic context.

Towards a federalist Europe?

The proposals made by the Commission in November 2012 in *A blue print for a deep and genuine monetary and economic and monetary union* and by the four presidents in December 2012: *Towards a Genuine Economic and Monetary Union,* suggested new steps towards a liberal and technocratic federalism:

- ‘All major economic and fiscal policy choices by a MS should be subject to deeper coordination, endorsement and surveillance process at the EU level’. The possibility of different economic or social strategies is forgotten.
- The needs for strengthened fiscal discipline and for *ex ante* fiscal coordination are asserted. But, after the fiscal Pact, what remains to be coordinated since all fiscal policies have to be run in autopilot mode?
- The Commission wishes to be entitled to oblige a MS to revise its national budget or to change its budget execution. It wants to be allowed to suspend programmes payments to MS not taking the corrective action required by the Commission.
- The euro area should have a fiscal power to absorb asymmetric shocks (with is rather ironic once national governments have been deprived of the ability to implement specific fiscal policies).
- The Commission considers the possibility for the euro area to have its own resources and to issue bonds.
- Short-term debts (Euro bills) could be mutualised under an EMU Treasury.
- The role of the vice-president of the Commission in charge of economic and social affairs in the euro area should be strengthened; he should be in charge of an EMU Treasury;
- A Euro Committee should be settled in the European Parliament, the Euro-Group should be strengthened.

The proposal to issue euro-bonds guaranteed by all MS or by the ECB has not been considered. Germany refuses to make unlimited and unconditional commitments to support the other MS. But how to strengthen the euro area without such commitments?

A new report was proposed by the five presidents on 25 June 2015: *Completing Europe's Economic and Monetary Union*. MS should accept that more and more decisions are taken at the European level, which would allow moving away from today’s governance by rules.

The report recommends the establishment of a new network of independent advisers: competitiveness councils. It proposes the introduction of a European fiscal council to coordinate national councils, remaining under the Fiscal Pact rules. Later, a fiscal stabilization mechanism could be put in place at the euro area level, but it should neither allow for permanent transfers, nor reduce incentives to run a sound fiscal policy, nor help countries in crisis.

The project is disappointing in terms of both institutional reforms and policy content. The project is at a standstill with most MS refusing to move towards more federalism, with virtuous States refusing to provide greater solidarity, and with its inability to propose a convincing supply policy to face ecologic and globalization issues.

Towards fiscal federalism?

In theory the Fiscal Pact prevents MS to implement stabilisation fiscal policies. Some economists and the Commission have proposed to implement at the euro area level a system of transfers between MS to ensure that countries in good economic situation support MS in economic depression (see European Commission, 2013). In the spirit of these promoters, this system should avoid permanent transfers; each country should alternatively be paying or

receiving transfers. Some (like Enderlein *et al.,* 2013) propose to base these transfers on output gap differentials, since, for a given country, the sum of output gaps is nil, by construction, over a long time period. But these authors forget that potential output is a vague concept, with a questionable and time-varying measurement: should there be refunds whenever the Commission revises its estimates? Should a country in depression wait for EU funds to support its activity and, meanwhile, run a restrictive pro-cyclical policy?

Some propose the unification of unemployment allowance systems, since they are pro-cyclical public expenditure, but national systems are currently very diverse and are often managed by social partners. Unification, under the EU umbrella, is likely to reduce the generosity of national systems. The unemployment concept should be standardised (what about vocational training, disability pensions, or early retirement schemes?). A country having made efforts to reduce its unemployment rate will refuse to pay for high unemployment rates countries, and will blame the latter for not having undertaken the necessary reforms.

Others propose transfers between countries based on differences in unemployment rates levels or on their variations or on the discrepancy between the effective unemployment rate and the structural one (as if the latter would be measurable): this raises the same problems. In order to avoid permanent transfers between countries, these projects are limited to the recent unemployed, for a limited time period (see Dullien, 2014). Transfers are generally small and disappear if the depression lasts and is widespread throughout the area. As these transfers must be balanced for each country in the long-term, they could only have a negligible impact.

Some economists consider that the Commission could manage stabilisation policies tools centrally, but this is an illusion as the Commission minimises the size of negative output gaps and prevents discretionary fiscal policies.

The French CAE (2013) recognizes euro area institutional weaknesses, but believes that the latter can be addressed by strengthening technocratic, federalist and liberal features. It proposes to set up an independent European Fiscal Committee, which would coordinate national committees, set limits to MS public government deficits, and so would be a new technocratic institution which would reduce further MS autonomy. The CAE does not specify the objective of the Committee: a growth strategy or the arbitrary norm of the Fiscal Treaty? This Committee should alert the European Court of Justice (should fiscal policy be set by the judiciary power?); their proposals should be validated by a euro area Parliament. The CAE proposes to offset the balanced budget requirement by setting up a euro area budget, which could be allowed to have cyclical imbalances. But how will it work in the case of specific shocks?

The euro area functioning cannot be based on transfers between Northern countries (in good economic health and running large trade surpluses) and Southern countries (in a situation of mass unemployment). Northern countries populations would not accept it. Southern countries cannot offset a situation of economic distress by transfers which would submit them to the diktat of Northern countries and EU institutions. Transfers between Member countries can be implemented only in exceptional circumstances or in the framework of productive development policies. Each country should aim at finding a satisfactory economic model, which requires today differentiated strategies. Economic policies coordination should aim at reducing

imbalances between MS. According to us, MS do no need fiscal federalism, but they need to regain full freedom to implement stabilisation fiscal policies.

Democratic federalism?

Can we imagine all major economic and social decisions being made at the EU level, by the Commission without accounting for national votes and debates? Some (like Autret *et al.,* 2014) propose a euro area political union where most decisions would be made democratically by a Government and an elected Parliament of the euro area. But can we imagine a federal power able to account for domestic specificities in an area made of heterogeneous countries? Can we imagine a single policy implemented in different countries? Or different policies implemented through a central process? In our opinion, accounting for current disparities in Europe, economic policies should be coordinated between MS and not decided by a central authority.

Europe is not a country; there is no European solidarity, while there is national solidarity; such solidarity cannot be accepted as long as functioning rules differ within MS. In fact, national specificities remain and the peoples are attached to them. They are not prepared to engage in reforms allowing for convergence towards a social or a fiscal Europe. Moreover, there is no consensus on the design of this Europe. So Europe must live in a painful contradiction between the monetary Union and the absence of political Union (which makes the European experience differ from the German, Italian or the US unifications).

We do not think that EU powers should be strengthened as long as the EU works as it currently does, as long as the EU does not implement a growth strategy, as long as it remains focused on liberal structural reforms, on public expenditure cuts and on irrelevant public finance criteria. EU institutions should show first that they can implement an efficient strategy before peoples and MS agree to enlarge their power. Europe's survival requires the European project to become popular again, therefore a source of growth, social progress and solidarity. It is only within this framework that institutional progresses could be made.

4. Public debt governance

Public debts in advanced economies have strongly risen during the crisis (Table 1). Except in the Greek case, this results from the depth of the crisis itself and not from the implementation of too expansionary fiscal policies before or during the crisis. Given the current interest rates levels on public debt for major countries, it is clear the public debt level does not induce any rise in interest rates. It is dangerous to try to cut public debt as long as the factors which have caused the debt to rise remain.

The rise in public debt increases the risk that public finances will be under financial markets' supervision in the future. But this supervision is not satisfactory: financial markets have no macroeconomic perspective; they are pro-cyclical (they impose efforts in bad times); their opinions are self-fulfilling which they are aware of; they react strongly to the pieces of information which are 'in the mood of time'; they are schizophrenic: they request fiscal consolidation and growth policies at the same time. They have their specific judgement on the needed appropriate economic policy, but is this necessarily the relevant one? There is a huge risk that MS set the objective of trying to escape financial markets' surveillance by cutting too

rapidly and too massively government borrowing which would postpone the recovery indefinitely. MS ability to run active fiscal policies will be reduced. What would have happened if countries had refused to rescue banks in 2009, in order to avoid borrowing on financial markets? Can financial markets be given the responsibility to assess public debt sustainability and public deficits usefulness?

Two strategies can be implemented today. We advocate for the first one: fiscal stabilisation policies should remain allowed (or rather be allowed again), monetary policy should remain expansionary, public debt guarantee by the ECB should allow to maintain interest rates below domestic growth rates in all euro area countries; wages should be increased in countries where the wage share in value added has substantially decreased; specific measures designed to support both public and private investment as part of the ecological transition should be implemented. The debt-to-GDP ratio will fall thanks to growth recovery.

The second strategy consists in setting a binding agenda in terms of debt-to-GDP ratio with a view to bring them back to their pre-crisis levels (see IMF, 2010). This raises three issues: it requests a negative fiscal shock, which would be substantial in the first years in order to be in line with the requested strategy, but such a shock will lead GDP to fall and hence public debt to rise. A rigid debt reduction path is inconsistent with short-term fiscal stabilisation needs, and may lead the commitment to be out of reach, or at a very high cost. There is no guarantee that the final debt ratio target, set *a priori*, is consistent with macroeconomic equilibrium.

The euro area needs also to choose between two frameworks: relying on financial markets to implement fiscal discipline or introducing reforms to re-establish the unity of public debts. In the first option, proposed for instance by the German Council of Economic Experts (GCEE, Doluca *et al*. 2012) any debt mutualisation would be avoided, the no bail-out principle would be reaffirmed. MS public debts should not be guaranteed in order to strengthen financial markets supervision; MS default should be explicitly envisaged in the Treaties. This proposal has several drawbacks: MS public debts would be risky assets; interest rates spreads in Europe would remain for an undefined time period, undermining the impact of fiscal policies. On the one hand, Europe and the ECB would declare that: the Greek case was an exception, from now on no euro area country will default. On the other hand, it would rely on financial markets to judge how serious this commitment is. Financial markets surveillance is not precise. A MS debt ratio can increase during a long time period without alarming markets, which can suddenly react with brutality.

The second option can be implemented in two ways: either through an ECB guarantee of always refinancing public debts or by issuing euro-bonds collectively guaranteed. It requires an issue to be settled first: according to which criteria could a MS public debt be guaranteed? Northern MS will refuse an automatic guarantee. Most MS will refuse to pay this guarantee by abandoning fiscal policy autonomy for stricter fiscal rules or for stricter controls from European Institutions. Several projects have not made a choice between these frameworks.

Redemption?

The GCEE (Doluca *et al.,* 2012) suggested the introduction of a European Redemption Pact, in order to guarantee the repayment of the share of public debts above 60% of GDP[2]. Countries where debt exceeds 60% of GDP (Germany, Austria, Belgium, Cyprus, Spain, France, Malta and the Netherlands), at the exception of countries under an adjustment programme (Greece, Ireland, and Portugal), would place the share of their debt over 60% of GDP in a Redemption Fund (RF) and, in counterpart, would transfer tax revenues allowing for debt repayment over 25 years. Besides, countries should firmly commit to the Fiscal Pact, i.e. to bring rapidly their structural deficit down to 0.5% of GDP. This would be introduced in their Constitution. Countries would transfer guarantees to the fund, such as part of their foreign and gold reserves, for 20% of the transferred debt. Moreover, they would have to implement structural reforms programmes agreed and monitored by the European Institutions. All euro area countries would be jointly and severally liable for the debt guaranteed under the RF, but each MS would keep the responsibility of serving its debt. This would reassure markets, who would agree to own this mutualized debt at an interest rate below current market rates.

Thus the debt ratio would fall rapidly: in 2035, it would reach 58.5% in Belgium (against 97% in 2012), 53.5% in France (against 88%), 50% in Germany (against 82%), 60% in Italy (against 120%). However, countries would commit to strongly restrictive policies in 2012-2015, amounting to 6.3% of GDP for Spain, 4.2% for France, 4% for the Netherlands.

The paper assumes that the Pact will allow interest rates to fall, as compared to a catastrophic basis scenario, where countries would implement similar austerity measures, while markets would continue to request high interest rates. Thus, it can be claimed that the RF would have expansionary effects as compared to the basis scenario. But it does not draw any lesson from the effects on past austerity policies on output, assuming implicitly that the fiscal multiplier is nil. What if MS are unable to cut the public deficit by as much as initially requested, due to the impact of these generalized restrictive policies on growth and on tax revenues?

The GCEE' paper does not consider the possibility that Europe goes through slowdown episodes in the next 25 years, which may require to undertake active fiscal policies. What would happen then with the redemption pact? MS would have to negotiate their fiscal policy with the RF, in addition to the Commission and Council monitoring. During the RF existence, the coexistence of national debts with the RF debt will allow speculation on the capacity of individual MS to fulfil their commitments. After the RF existence, domestic fiscal policies would have to strictly follow the Fiscal Pact, which is not questioned by the authors; the "no bail-out" rule would be restored; the RF is a temporary mechanism to correct past MS sins. The project does not question the factors which led public debts to rise. Are these sins that MS have to pay for? Or was the rise in public debts necessary because of the economic crisis?

In December 2012, the Commission Communication (2012) envisaged the introduction of such a fund, although its annex 3 criticized its principle: a temporary fund cannot solve a structural issue: the integration of euro area public bond markets. On 12 March 2013, the EU Parliament however agreed to vote the 'Two-Pack' in exchange of a commitment of the European

[2] See also Parello and Visco (2012) and Tober (2014).

Commission to settle a high level experts group to assess the feasibility of a Debt Redemption Fund and of Euro bills introduction (but not on Eurobonds). The report (Tumpel-Gugerell, 2014) was not conclusive and the project seems abandoned.

Euro-bonds and debt agency proposals

The simplest solution consists in introducing a European debt agency (EDA), which would be in charge of issuing a common debt for all euro area countries. This debt would be guaranteed by all MS; it would be considered as a safe asset by financial markets; it would be very liquid, with a wide market, hence it could be issued at low interest rates. But the EDA council would supervise domestic fiscal policies and would be entitled to deny financing *over-lax* countries, which would then have to issue bonds on markets. The EDA would raise the same problems as the SGP with more issues at stake. What would be the democratic and economic legitimacy of its council? What would be its assessment criteria? How would the EDA decide that a country runs an excessive deficit, if the country considers that such a deficit is necessary to support domestic output (like in Germany and France in 2002-2005) or to rescue its domestic banks? Would it implement rigid automatic rules - a country would be entitled to loans from the EDA up to 60% of its GDP- or softer ones - a country would be entitled to loans from the EDA without precise limit, which requires rewriting the SGP and the Fiscal Pact. Would the EDA be allowed to refuse to guarantee a specific debt issue if the MS fiscal policy induces macroeconomic imbalances? The EDA would benefit neither virtuous countries (which have no difficulty to borrow) nor countries in difficulty, which the EDA would refuse to finance and which would have to issue domestic bonds, without any European guarantee, without any potential financing from the ECB, in other words risky assets, bearing a high interest rate. The EDA makes sense only if it accepts to consider all public debts, but Northern countries refuse such a system on moral hazard grounds: 'sinner' MS would have no incentives to reduce their public debts or to introduce structural reforms.

The Tumpel-Gungerell report (2014) only studies the opportunity to issue Euro bills, with short-term maturity (up to one or two years). These Euro bills, collectively guaranteed, would be a safe and liquid asset which could be used for short-term ECB operations or banks' liquid reserves. MS will lose the right to issue short-term bills (which many MS may refuse) but will continue to issue longer maturity bonds. This distinction is arbitrary. The crucial point is to determine the quantity of Euro bills a MS will be allowed to issue. A MS having difficulties to issue national debt would be tempted, or obliged, to issue more Euro bills, which will be refused by virtuous MS and would be a bad signal for financial markets. On the contrary, virtuous MS may prefer to issue national debt, without any risk premium and collective guarantee, which will lower Euro bills quality. The report mentions the possibility that this joint debt issuance possibility is reserved to MS accepting an *ex ante* control of their fiscal policy by the European authorities, who would be entitled to oblige countries to modify their budget. But most MS would refuse this control.

Enderlein *et al*. (2012) suggest that the EDA should be headed by a Ministry of Finance of the euro area. The EDA would issue a collectively guaranteed debt. In normal times, each MS would receive a loan of 10% of its GDP, which could increase to 20% of its GDP in the event of a crisis, if the country fulfils the SGP and the Fiscal Pact. The loan could be larger than that

level but at a higher interest rate (200 basis points above the EDA rate) and with increasing conditionality: from 20 to 30% of its GDP, the country should fulfil a Memorandum of Understanding; from 30 to 40%, it should fulfil an adjustment programme dictated by the Troika and the EDA; for a loan above 40% of its GDP, its fiscal sovereignty would be transmitted to the EDA. But this project does not question the SGP and the fiscal Pact; it does not give more leeway to MS; it merely formalizes the existing situation. A country in difficulty could be helped only if it accepts to lose its fiscal sovereignty.

Delpla and von Weisäcker (2010) suggest the introduction of a 'blue debt, collectively issued and guaranteed, with a ceiling at 60% of GDP'. Each MS would also be allowed to issue a red debt under its own responsibility. Since such a red debt would bear a high interest rate, this would be a strong disincentive to issue public debt above 60% of GDP. This proposal does not account for economic stabilisation needs. The 60% level is arbitrary and is breached in 2015 by 11 of the original euro area MS (all except Luxembourg). The gap between blue and red debts would allow financial markets to speculate in permanence.

De Grauwe (2012) estimates that "the solution of the systematic problem of the Eurozone requires a far-reaching degree of political union" but recognizes that "there is no willingness in Europe today to significantly increase the degree of political union". But he accepts the blue/red suggestion and only adds that each country would have to pay a different interest rate on their blue debt, according to their debt level, as if public debt was always a sin and should be punished, as if public austerity should always be rewarded.

For Aglietta and Brand (2013), the euro cannot be a full currency without a political union. They propose to create a European Fiscal Institute (EFI) which would coordinate fiscal policies "according to a criterion of public debt long-term consolidation"; they write: "fiscal consolidation would require two decades", as if a long-term arbitrary objective can be useful to implement current fiscal policy. At the national level, committees of independent experts would evaluate the sustainability of the government's strategy, with macroeconomic assumptions being provided by the EFI. But sustainability is not easy to assess, as it depends on short-term output gap and long-term structural growth, which are both impossible to determine with certainty. A European Debt Agency would issue Eurobonds with an insurance premium to oblige countries at high risk to pursue a consolidation strategy and to reward low-risk countries from the protection they bring to others. The project is technocratic and has no macroeconomic logic as low-risk countries may be responsible for other MS difficulties.

Gros and Mayer (2010) propose a European Monetary Fund. Each 'sinner' country would have to pay a contribution: 1% of the share of the debt above 60% GDP + 1% of the share of the deficit above 3% GDP. A country in difficulty could borrow, without conditions, an amount corresponding to its past contributions. To obtain more, the country would have to accept an adjustment programme. If it did not fulfil this programme, penalties would apply like abolishing its structural funds, abolishing the acceptance of its debt as collateral by the ECB, abolishing its voting rights; the country could be expelled from the euro area. But the 3% and 60% figures remain arbitrary. It is difficult to impose fees on a country already in a difficult financial situation. Too much conditionality, too high fees will increase market speculation, which may make it impossible for the country concerned to restore its situation. Often, the country

concerned is not entirely responsible for its problems. Like most proposals, this one does not deal with countries running too restrictive policies.

Palley (2011) suggests creating a European public finance authority, which would issue euro-bonds and lend to governments. Thus, a limited share of the debt would be mutualised. The ECB would be able to buy such bonds in order to influence the interest rate level. The euro area Council of finance ministers would decide on debt issuance. But what would be the assessment criteria? Besides, countries would still issue national bonds, which would be subject to financial markets' moods.

Schulmeister (2013) suggests introducing a European Monetary fund (EMF), which would finance MS though issuing Eurobonds guaranteed by the MS and the ECB. The EMF would maintain long-term interest rates slightly below GDP growth. Individual MS financing would not be subject to a numerical constraint, but would be agreed within the EMF by the MS Finance ministers. This project hands over to finance ministers the responsibility of agreeing on public deficit targets for each country, which is problematic (what should be done in case of macroeconomic strategies divergences between countries?), undemocratic (each finance minister would impose to its national Parliament the fulfilment of the target set at the European level), difficult to implement (what to do in case of a specific or global shocks?).

The CIEPR (2013) proposes to introduce a European Sovereign Debt Restructuring Regime, based on a reform of the ESM and on the introduction of two thresholds. MS with below 60% debt/GDP ratios would have unconditional access to the ESM. For MS with debt ratios at between 60 and 90 percent, access to the ESM would be conditional on fiscal adjustment and structural reforms. For above 90% ratios, the ESM support will only be possible with a debt restructuring programme. As the debt restructuring possibility would be planned, financial markets would be more vigilant, would require high interest rates when debt comes close to 90% of GDP, which would strengthen discipline in lax States. But the new 90% figure for debt-to-GDP is as arbitrary as 60%. MS public debt would become riskier, more subject to financial markets' moods. MS would have difficulty to finance their public debts, which is the aim of this project, but is dangerous if public debt is necessary. At the end of 2014, seven MS ran debts above the 90% limit, although they did no run lax fiscal policies.

Bofinger (2014) considers that Germany will never accept any form of debt mutualisation. So he suggests creating a Basket Eurobond - where each MS will be liable for its share in the bonds (determined according to GDP weights or total public debt weights). We do not see how the proposal would help since investors can already create such a basket of public bonds if they wish (but in fact they do not). The project requires that MS agree on the amount of Eurobonds to be issued and lend to MS (for example up to 10% of GDP), which would be insufficient for the most highly indebted countries. The unity of MS public debts markets will not be entirely restored, as Bofinger suggests differentiating the interest rate according to country debt levels. For instance, a discount on the basket bond interest rate could be made for each percentage point of the national debt-to-GDP ratio below the euro area average. A surcharge would apply to countries with above-average debt levels. But it is arbitrary and counter-productive if the euro area needs more expansionary fiscal policies.

Bibow (2014) proposes to establish a European Treasury who will issue Eurobonds to finance

public investment in the euro area. In return, MS should bring their structural current budgets in balance. Thus, a significant part of public debts would progressively be settled at the European level[3]. The project has the advantage of being based on the "true golden rule of public finances": the structural deficit must be equal to public investment; it relaxes the budget constraint relatively to the Fiscal Treaty. Conversely it prohibits discretionary fiscal policies. But it is a sleight of hand, which Germany and the *virtuous* States are unlikely not to see. The MS public debts would be hidden in the European Treasury balance sheets. In fact, according to the Treaties, the European Treasury debt would be allocated among member States and be counted within the envelope of the 60% limit for public debt. This would be automatically the case if the European Treasury lends to Member States rather finance directly investment projects. A direct lending from the European Treasury to specific projects raises institutional issues: most public investments are made by local authorities; another issue concerns large infrastructures; another issue concerns military defence. Can MS accept a European Treasury to decide for them in these fields?

5. Public debt governance: unconventional proposals

A strange proposal: Padre

Pâris and Wyplosz (2014) consider that there is a debt problem in the euro area, but they refuse to understand why (the *ex-ante* macroeconomic imbalances). In their PADRE (Politically Acceptable Debt Restructuring in the Eurozone) project, the ECB will buy a share of MS public debts: half of the global public debts of the area, but for each country in proportion of their share in the ECB's capital (to avoid any transfer between MS). It will keep these debts in its book at perpetuity, without requiring any interest payments from MS. The ECB will issue bonds to finance this purchase; these bonds will be risk-free (as the ECB is always able to create money), so their interest rate could be very low.

The operation induces permanent losses for the ECB, and this will be offset by the cancelation of the ECB's profit transferred to MS and by annual MS transfers. For the future, MS will be strictly constrained to fulfil the Fiscal Compact; the "no-bailout rule" will be restored and enhanced. A new debt ratio ceiling will be set (for each MS, 10 percentage points above the post-restructuring level); if a MS breaches it by 1 percentage point, it will be obliged to reimburse 1 percentage point of GDP to the ECB. So financial markets will impose a higher interest rate on such domestic bonds. This would be a strong incentive to avoid any *slippag*e in public debt.

The project has the advantage of rapidly reducing the interest rate spreads paid on debts by some fragile MS who will be able, for a while, to be financed by the ECB. It makes clear that a country does not have to reimburse its public debt; it only has to pay the interest payments and to convince its creditors that it is not engaged in an unsustainable path.

[3] In fact, Bibow proposes to enlarge the investment definition so that the European Treasury lends automatically each MS 3% of their GDP each year; the European debt will converge towards 60% of MS global GDP if nominal GDP growth is 5%, but the author does not explain what shall be done if nominal growth is only 3.5%, which means that the European debt/GDP ratio will converge towards 86%.

Nevertheless, fundamentally, this project does not make sense. Public debts will not disappear if they are intermediated by the ECB; MS will always have to pay interest payments on this debt (even if the payment involves the abolition of seigniorage and the introduction of transfers from national governments to the Central bank); a new ceiling for the debt ratio would be arbitrary; what shall be done if a MS breaches the ceiling for good reasons (a strong depression)?

To stabilize their debt ratio, MS do not have to pay the nominal interest rate, but only the interest rate corrected by growth and inflation. If in the future, euro area growth returns to an equilibrium path with interest rates equal to a 3.5% nominal growth, MS will have to pay 1.75% of their GDP to the ECB (if the ECB owns a debt of 50% of its GDP), when 0% would be enough to stabilize the debt ratio. The authors assume implicitly that MS will hold a primary public surplus of 1.75% of GDP in the future allowing paying back the public debt in the long-term, but there is no evidence that this assumption is realistic from a macroeconomic point of view.

In principle, it will work only once; but MS and financial markets can anticipate that this process will be repeated, and so virtuous MS will refuse on moral hazard arguments and financial markets will add for each MS the debt hidden in the ECB's accounts with its explicit national debt and will always require high spreads on the latter.

Seven European Economists Experts published in March 2015: *A New Start for the Euro Zone: Dealing with Debt* (Corsetti *et al.,* 2015). They propose a policy to decrease the legacy sovereign debt in exchange for a credible mechanism that limits the build-up of excess debt, as if the current level of MS public debts resulted from fiscal indiscipline and not from macroeconomic imbalances.

They suggest creating a "stability fund" to bring public debt rapidly down below 95% of GDP (but why 95?). This fund will buy the share of national debt above 95% of GDP and will finance their interest payments and their refund by a commitment of national future revenues streams (seigniorage or VAT or real estate tax) over a long horizon. In fact, this is an accounting trick, without any economic meaning. The interest rates on the debt purchased by the fund would remain to be paid by the MS. Allocating specific tax revenues to the fund is fictitious without a commitment on the entire fiscal balance. If the project is to establish *ex ante* constraints on future public deficits, it does account for macroeconomic equilibrium. If the project obliges to increase taxes, it will have restrictive effects on the economy.

The authors propose to formalise MS classification as "in excess debt" (debt above 60% of GDP), "at risk of stress distress" (debt above 95% of GDP). The latter will have access to ESM and will envisage a debt haircut reduction operation. They expect that markets discipline can discourage over-borrowing, but this is an illusion as markets react only when they fear a default risk, which is not a usual situation and has nothing to do with the issue of an optimal fiscal policy. The authors accept that MS public debts remain risky, that government bonds interest rates will differ between countries and will be incontrollable by monetary policy.

The authors criticize the European banks "home-bias" which, according to us, is necessary to have efficient links between banks and non-financial agents in each country: the real problem

is the loss of the "lender of last resort". The authors propose to create a synthetic risk-free asset as the safer tranche of a bundle of sovereign bonds. Banks would be encouraged to hold it. "The junior tranches would harness market discipline by pricing sovereign default risk." Hedge funds would be required to hold junior tranches, so speculators would judge fiscal policies. According to us, MS sovereign risks should be eradicated, not priced.

Their proposal intends to give a new start to the euro area, but does not deal with any of the real problems of the area: lack of growth, de-industrialization of many countries, growing inequalities, and financial instability.

About public debt monetisation and cancellation

Grjebine (2015) proposes to reduce public debts through Central bank's purchases financed by monetisation. This proposal is difficult to understand. Public debt bonds held by the central bank remain public debt. Let us assume that the central bank buys 100 billion of public bonds from banks (Table 3). Bank refinancing by the central bank will decrease by 100 billion. The "Central Bank + State" wealth will not be affected. They will save interest payments on the public debt, but will lose interest payments on bank refinancing. These two components are roughly equal in the absence of sovereign bankruptcy risk.

According to Grjebine, "the monetization of government debt is equivalent to increase currency in circulation." But this is not true. There is no reason why money supply increases after this financial operation. Money supply increases only if the public deficit increases or if banks distribute more credit, but they have *a priori* no reason to do so as a result of this operation.

In normal times, central bank liabilities are of limited size: the central bank has only one free resource: banknotes in circulation, amounting to 10% of GDP in the euro area in 2015. These 10% have counterparts: external reserves (3% of GDP), refinancing of banks and government bonds. Central bank liabilities include also free banking deposits (beyond reserve requirement), which rose dramatically with the crisis, but are remunerated at a rate close to the money market rate. In ordinary times, the central bank's ability to hold public debt is therefore limited. Over 7% of GDP, the central bank must borrow from commercial banks and loses its ability to control the money market. Under normal circumstances, government debt cannot be monetized to a large extent. The central bank should simply guarantee it and ensure that the State will always find financing.

The public debt should find owners. This requires national treasuries to offer satisfactory remuneration conditions. They cannot find private agents willing to hold more banknotes to finance the state at zero interest rate.

Moreover, Grjebine advocates that the central bank cancels the public debts it has acquired. But the central bank's balance sheet would exhibit negative own assets, which according to the author, does not matter because the central bank is issuing money. This proposal is unfortunately false. A bank, even a central bank, must have a positive capital. If not, the State would be required to recapitalize it. We cannot get rid of public debts by replacing them by a deficit in the ECB's capital.

Let us assume that initially, the central bank holds deposits amounting to 10% of GDP. In normal circumstances, interest rates are 4%. The central bank refinances banks; makes a profit

of 0.4% of GDP, which is transferred to the State. Suddenly, the central bank must acquire public debt for 20% of GDP and cancel it. The State therefore saves interest payments of 0.8% of GDP. The central bank must now borrow for 10% of GDP from banks and pay banks interest payments of 0.4% of GDP. As the central bank has no additional resources, the State shall transfer it 0.4% of GDP interest payments. As the State loses also the 0.4% dividend, the operation is neutral for the State. It is a pure accounting artefact. Public debt has not disappeared. It is hidden in the central bank's balance sheet. But will anybody be fooled? Moreover, it would be inconsistent for an independent central bank to become financially dependent of the State.

Similarly, Watt (2015) tries to find a way to get around the SGP and the Fiscal Treaty. The authors proposes, like many others (see, for example FNH, 2011), to finance a large public investment programme of 7.5% of GDP in 5 years through ECB's money creation. In practice, the investment projects would be financed by EIB lending to MS; the EIB would issue bonds, which would be purchased by the ECB on the secondary market. According to Watt, the advantage of such funding is that public debt does not rise and generates no costs in terms of interest payments. Like Tober (2015), we think that this view is *simply* wrong.

Of course, the objective of the proposal is fully relevant: a strong revival of public investment in Europe focused on ecological transition. The funding should have a counterpart, not in the form of banknotes with zero interest rate, but in the form of interest-bearing deposits or bonds. The ECB will have to reduce banks refinancing, which entails lower incomes for the ECB, and for public finances through lower seigniorage incomes. Above all, the ECB is at risk of losing control of the money market. Monetary theory has shown that there is no difference between debt financing and monetary financing, when the central bank sets interest rates (with a Taylor rule or at a zero lower bound). Debt and monetary financings have the same macroeconomic impacts and the same costs in terms of public finances. Their impacts on output and inflation are the same. As non-financial private agents will not hold more central bank banknotes, money supply will not increase. If the central bank holds more bonds issued by the State or by a public bank (such as the EIB), the State (or the EIB) will issue less bonds on financial markets (Table 3). So financial investors will hold more companies' bonds, and companies will need less credit. For the central bank, the increase in government bonds holdings will be offset by lower commercial banks refinancing.

Table 3. The effect of public investment monetary financing relatively to debt financing

Central bank		State or EIB	
Credit to State (or EIB) : +100			CB Credit: + 100
Refinancing:-100			Bonds :-100
Commercial banks		Firms	
Credit:-100	Refinancing =-100		Credit:-100
			Bonds: + 100

Watt (2015, box page 18) assumes that people who own a public debt of 100% of GDP (at a market interest rate) would agree to own instead 100% GDP of central bank money, i.e. banknotes which pay no interest. This does not make sense. In fact, people would ask (public or private) remunerated bonds so that the manoeuvre would not work.

Moreover, EIB loans would be counted in public debt figures, and so that the operation does not allow circumventing the TSCG constraint for public debts. Possibly, the Commission could accept that, for this operation, the EIB loans are removed from public debt in its assessment of MS public finances (but public debt will not be affected, according to Eurostat). Once the EIB has granted the loans it can finance without difficulty by issuing bonds, the purchase of its bonds by the ECB has no macroeconomic impact.

Tober (2015) correctly criticizes the proposals made by Pâris and Wyplosz and by Watt. She raises the issue of the respective roles of fiscal and monetary policy. In fact, both must manage the growth/inflation tradeoff. In the short-term, a given level of output may be achieved with a high public deficit and a high interest rate or with a balanced budget and a low interest rate. Coordination between fiscal and monetary policy is therefore necessary. In the euro area, the rule cannot be today: "public budgets must always be in equilibrium and monetary policy manages the economic situation" as monetary policy is constrained by the nominal interest rate zero limit and as national economic situations differ. Therefore, the only possible rule is: "monetary policy maintains a near-zero interest rate as long as inflation does not converge towards the 2% target, increases the interest rate towards the GDP nominal growth rate in normal time; fiscal policies support economic activity as long as national inflation is not excessive".

Furthermore, the ECB who must guarantee public debts and commercial banks, should not commit to funding any investment programme. The ECB should ensure that banks can finance adequately the economy both in quantity and quality. A point has not been agreed by the banking Union: are MS, individually or collectively, entitled to orient banks financing? Either by developing public, local or cooperative banks, either by encouraging lending to sectors according to a national or European industrial policy or to firms engaged in the ecological transition.

On public debt defaul

Some authors propose that MS cut their public debts in a discretionary manner, by an arbitrary percentage at the expense of their creditors. But this would have no economic or legal justification. This would be done at the expense of agents who trusted European countries and often lent them without risk premium. It would destroy market confidence in euro aera MS, whose public debt would be, for a very long time, considered as risky. It would justify financial markets speculation against MS public debts.

One cannot argue that MS debts are *illegitimate,* because they have been issued by democratically elected governments. Even if some tax cuts and some public expenditure are questionable, creditors cannot be asked to pay for them, as it would justify the right for financial markets to assess national fiscal policies. One cannot argue that public debt is *unsustainable* when EU countries have been able to borrow at 1% interest rates for 10 years, with a higher than 2.5% trend nominal growth, and hence the primary balance required for the debt-to-GDP ratio stability is negative.

However, the concept of *illegal* debt can apply to the share of the public debt resulting from tax evasion; but the fraudsters should be expropriated, not the creditors. In some MS, a share of government debt results from private banks debts' take over. Rich depositors benefited from exorbitant interest rates and took part with banks to the rise in financial and real estate bubbles

(as in Iceland, Ireland, Spain, Greece, or Cyprus). Therefore, it is not legitimate that their assets become public debt. It is legitimate that banks' shareholders and important creditors bear losses (this is the example given by Iceland). Moreover, public debts result from partly from the excessive interest rates of the 1980-2005 time period, partly from tax competition and tax evasion, partly from banks debts, partly from the great depression, and so from neo-liberalism functioning. It is socially unfair and it is an economic nonsense to ask austerity efforts to peoples to reduce public debts. The only possible strategies for public debt reduction are on the one hand to increase taxation on wealthy households and large multinational companies, to combat tax evasion and to prevent tax competition, and on the other hand to maintain interest rates below the rate of growth, which should be accompanied by a strong political macro-prudential framework to avoid the rise in financial bubbles.

6. Can the single currency contradictions be overcome?

In developed countries, the system which worked until 1999 lied on unity between government, central bank and commercial banks. The central bank is the lender of last resort for the government and banks. The government guarantees banks; it can issue unlimited public debt. This debt is considered as safe and benefits from as low as possible market interest rates.

Of course this unity was undermined to some extent by central bank independence, which could have generated conflicts between the government (caring about supporting output) and the central bank (caring about maintaining low inflation). These conflicts could have led public finances to become unsustainable if the central bank had maintained high interest rates to fight inflation when the government had maintained high public deficits to support output; they could have led to a "fiscal dominance" situation if the central bank had been obliged to cut its interest rate to stabilize public debt and to accept a too high inflation level; they could have led to a "monetary dominance" situation if the government had been obliged to reduce the public deficit and to accept a too high unemployment rate to avoid public finances unsustainability. But such situations did not occur before 2007. They never questioned government solvency.

The euro area introduction led to a particularly difficult situation. On the one hand, countries need to run more active fiscal policies because they have lost control over their interest rates and exchange rates. Since 1973, the macroeconomic equilibrium has been requiring a certain level of public deficit and debt. The 2007 crisis strengthened this need. On the other hand, due to the single currency, current imbalances in one country affect the other countries of the area. Therefore excessive external deficits (or surpluses) should be avoided. Last, financial markets' functioning makes it necessary for public debts to become safe assets again, while at the same time Northern countries deny to give unlimited guarantee to their partners. In particular, the German constitutional court forbids any guarantee not expressively agreed by the German Parliament.

The solution adopted so far by Europe, i.e. the fiscal pact and the ESM, consists in ensuring solidarity to countries agreeing to implement a fiscal rule lacking economic rationale: keeping structural public deficits below 0.5% of GDP. But such a target is not optimal, there is no certainty that it may be reached; coordination should account for external balances rather than for public balances and should be symmetric.

Euro area countries should be able to issue safe sovereign bonds again, at an interest rate controlled by the ECB. They should be able to run a public deficit in line with their macroeconomic stabilisation needs. So a coordination process needs to be organised between MS. Coordination should target GDP growth and full employment; it should account for all economic variables; countries should follow an economic policy strategy allowing to meet the inflation target (at least to remain within a target of around 2%), to meet an objective in terms of wage developments (in the medium-run real wages should grow in line with labour productivity), in the short-run adjustment processes should be implemented by countries where wages have risen too rapidly, or not sufficiently; increases or cuts in social contributions may be used to facilitate the adjustment process; countries should announce and negotiate their current account balance targets; countries running high external surpluses should agree to reduce them or to finance explicitly industrial projects in Southern economies. The process should always reach unanimous agreement on a coordinated but differentiated strategy.

Public deficits resulting from this process should be financed through debt issuance guaranteed by all euro area countries and by the ECB. The Treaty needs to maintain an effective process in the event where no agreement is reached. In that case, the new debt issued by countries outside the agreement would not be guaranteed, but such a case should never occur.

It would be difficult, if not impossible, to reach such an agreement, based on a wise and precise cooperation rather than on rigid rules. It would require negotiations with uncertain outcomes. But this is the only way for a currency area to work properly. If open economic policies cooperation cannot be run within the euro area, the single currency will not survive.

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The effects of fiscal policy on the labor market in the Euro Area: government consumption vs. investment

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ABSTRACT

The aim of this paper is to disentangle the effects of government consumption and investment on output and on the labor market. First, I build a medium-scale DSGE model with a labor force participation decision and steady-state unemployment. A rise in government investment triggers a higher output multiplier than government consumption but a lower fall in unemployment. Government investment rises productuvity in the private sector, which induces a strong and long-lasting positive effect on employment. It also triggers a rise in the real wage and in the labor force participation in the long run, which mitigates the effects on unemployment. A second part of the paper is dedicated to the estimation of the effects of government consumption and investment with a structural vector autoregression model. A rise in government consumption produces a limited but negative response of unemployment while unemployment increases slightly when government investment hikes.

Keywords: Fiscal multipliers, labor market, DSGE models, public investment, unemployment

JEL classification: E32, F77

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1 Introduction

A very extensive literature has grown up since the late nineties and deals with the effects of fiscal policy in the short run. Firstly, DSGE models have been used extensively to investigate important issues, such as the size of the fiscal multiplier, the response of private consumption to a public expenditure shock,[2] or the effectiveness of fiscal policy during zero lower bound episodes.[3] Secondly, numerous empirical studies attempt to measure the effects of fiscal policy.

Especially, with the recent crisis, the strong rise in unemployment and the implementation of austerity plans in most developed countries, issues concerning the effects of fiscal policy on the labor market particularly matter and are receiving new attention from economists.

Most of Euro Area countries currently face very high rates of unemployment. It is complicated to know exactly to what extent current fiscal contractions contribute to this sharp rise in the unemployment rate. To investigate this issue requires a precise knowledge as to the effects of fiscal policy on the labor market.

A large body of papers have studied the effects of fiscal policy shocks on key labor market variables. If some discrepancies exist within the literature, most of studies argue for a comovement of employment, labor force participation and real wage. Existing studies face difficulties to provide a unified answer about the response of the unemployment rate to fiscal policy shocks. While some papers argue for a decrease in unemployment following a positive fiscal policy shock, other papers conclude for a rise in unemployment. Before going further in the description of the recent literature, this is important to notice one crucial element that could explain a rise in unemployment following a rise in public expenditure. Even in the presence of some crowding-out effects of fiscal policy on private activity, a positive fiscal policy shock tends to rise employment. Also, a negative wealth effect tends to increase the labor force participation and the real wage. Thus, total effect on unemployment depends on the relative strength of the response of employment and of the labor supply and some papers, cited in what follows, argue for a sufficiently large positive response of the labor force participation so that unemployment increases following expansionary fiscal shocks.

Mayer, Moyen and Stähler (2010) develop a large-scale DSGE model with a search and matching model for the labor market and investigate what parameters of the model drive the response of the unemployment rate to a public spending shock. In all cases, their model predicts a rise in unemployment following an increase in public consumption. Moreover, the response of the unemployment rate is mainly driven by several elements. Among them, the degree of price stickiness, the degree of wage stickiness, the introduction of non-Ricardian households and the financing of the fiscal expansion (debt or taxes). A positive response of unemployment following fiscal expansions are confirmed in some empirical studies and notably in Brückner and Pappa (2010, 2012). Using the Blanchard-Perotti (2002) SVAR approach for a panel of OECD countries,

[2] See Coenen and Straub (2005) or Gali, Lopez-Salido and Valles (2007) among others.
[3] See Hall (2009), Coenen and others (2010) and Woodford (2011) for recent contributions.

the authors find a significant increase in employment, in the labor force participation and in the unemployment rate. Then, in a New Keynesian model with matching frictions, the authors argue that a positive response of the unemployment rate can be generated in a DSGE model by introducing a labor force participation decision and heterogeneity in the pool of workers (new vs. old job seekers).

However, some other papers find significantly different results and conclude for a rather strong decrease in unemployment following a rise in government expenditure. Monacelli, Perotti and Trigari (2010) explore both empirically and theoretically the response of the labor market to public spending expansions. The authors use a Choleski decomposition to identify the fiscal exogenous innovations for the US economy. The empirical findings indicate a large decrease in the unemployment rate with a peak at -0.6%.[4] Then, the authors show that a New Keynesian model with a standard search and matching model framework for the labor market hardly reproduces a similar unemployment fiscal multiplier since a rise in public consumption triggers only a decrease in unemployment of -0.2%.

Ramey (2012) points out that economists have to take into account the way the government intervenes in the economy: *"[...] an increase in government spending raises total employment. However, the extent to which government spending raises private employment depends on whether the increase in G is due more to an increase in purchases of private sector output or more to an increase in government output and employment. We would expect private sector employment to raise in the first case but to fall in the seconde case"*.

This is likely that changes on the different expenditure components and taxes trigger different effects on key macroeconomic variables. Forni, Monteforte and Sessa (2009) show that the effects of fiscal policy on output and employment depend on the fiscal instrument used by the government. Bermperoglu, Pappa and Vella (2013) estimate the effects of spending-based austerity measures and especially the effects of a decrease in government consumption and investment on unemployment. Despite that a drop in government investment triggers a larger decline of output than public consumption, government investment affects less unemployment and real wage.

In this article, I introduce one non-productive spending (public consumption) and one productive public expenditure (public investment). The aim is to disentangle the respective effects of public consumption and public investment on the labor market. Bermperoglu, Pappa and Vella (2013) estimate the effects of different fiscal instruments on the labor market thanks to a SVAR model. The contribution of the present article is to investigate in a theoretical framework the respective transmission channels of public consumption and public investment. The methodology used in this paper is twofold. First, I use a New Keynesian model close to Gali, Smets and Wouters (2012). This model is relevant for our purposes since it introduces in a simple way a labor force participation decision and unemployment as an observable variable. The model is calibrated for the Euro Area, using the parameter estimates from Smets, Warne and Wouters (2013) who

[4] Ravn and Simonelli (2008) find rather similar results.

estimate the Gali-Smets-Wouters (2012) model for the Euro Area.

I simulate the model with both public expenditure in turn and assume that the VAT and a labor income tax respond to the degradation of debt. In the case of a rise in government consumption, simulations indicate a positive response of employment, of the labor force participation and of the real wage. The positive effect on employment prevails significantly over the positive response of the labor force participation so that the unemployment rate falls with a peak at -0.77%, in the line with Monacelli, Perotti and Trigari (2010). Similarly to the empirical findings in Bermperoglu, Pappa and Vella (2013), I find that a rise in government investment has a stronger effect on output but a lower unemployment fiscal multiplier than in the case of government consumption. A rise in productivity in the economy due to the accumulation of public capital, productive for the private sector triggers a positive and long-lasting effect on output. As a consequence, a temporary rise in public investment produces a significant increase in employment in the long-run. Government investment also put a long-run upward pressure on the real wage and then on the labor force participation. As a consequence, the response of unemployment tends to be relatively small in the long run, with an unemployment fiscal multiplier equals to -0.58 after ten quarters and equals to -0.22 in the long run (the cumulative multiplier computed over ten years).

The rise in the VAT and in the labor income tax following the degradation of the debt level affects greatly the multipliers. A rise in VAT increases the positive response of the labor force participation following the expansion in government expenditure through the existence of a wealth effect of consumption on the labor supply decision. Thus, VAT tends to diminish the unemployment fiscal multiplier. A rise in the labor income tax decreases the marginal utility for work, thus drops the labor force participation. The unemployment fiscal multipliers are then amplified by the response of the labor income tax to the increase in deficit.

Second, in an empirical section I estimate for the Euro Area the effects of both government consumption and investment on a large set of macroeconomic variables with a structural vector autoregression model. Impulse response functions indicate that a rise in government investment triggers a slight increase in unemployment. Especially, both employment and the labor force participation increase but the final response of unemployment is slightly positive. A rise in government consumption produces a negative but limited response of employment and the labor force participation falls.

Section 2 presents the derivation of the model. Section 3 presents the results of the theoretical exercise. Section 4 describes the empirical approach and the obtained results. Finally, section 5 concludes this article.

2 The DSGE model

The model described in this article is a medium-scale DSGE model. Following Gali, Smets and Wouters (2012), the model includes the unemployment theory of Gali (2011). This modeling is relevant for our purposes since it enables to model in a simple way a labor force participation decision and to implement involuntary unemployment at the steady-state of the model. As described later on, government consumption is merely the purchase of goods and services. A rise in public investment implies also the purchase of goods and services for the building and accumulation of public capital. The main difference between both government spending is that the implied accumulation of public capital is assumed to enhance productivity in the private sector of the economy. This assumption of a productive public capital causes quite different effects and transmission channels between both public spending.

2.1 Optimizing households

There is a continuum of Ricardian households on the interval $[0,1[$ maximizing their preferences given the following lifetime utility function for the household (i):

$$E_0 \sum_{t=0}^{\infty} \beta^t U_t(\tilde{C}_t(i), L_t(i)) = E_0 \sum_{t=0}^{\infty} \beta^t \left(log \tilde{C}_t(i) - \frac{\Delta_t(i) N_t(i)^{1+\phi}}{1+\phi} \right) \quad (1)$$

The households earn utility from consumption $\tilde{C}_t(i)$ and disutility of labor $N_t(i)$. $\tilde{C}_t(i)$ contains habit formations for consumption such as: $\tilde{C}_t(i) = C_t(i) - hC_{t-1}$ with C_{t-1} the aggregate (average) past consumption. β^t is the discount factor and ϕ denotes the inverse of the Frisch labor elasticity of substitution.

In the spirit of Merz (1995) is assumed that there is a perfect risk-sharing for consumption among households. The subscript (i) can then be deleted in what follows to represent the problem as that of a representative agent. Aggregate employment is defined as $N_t = \int_0^1 N_t(i) \mathrm{d}i$ and with the. The optimization program for the representative household's can be expressed as:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left(log \tilde{C}_t - \frac{\Delta_t N_t^{1+\phi}}{1+\phi} \right) \quad (2)$$

Δ_t introduces the wealth effect of consumption on labor supply. Δ_t is function of households consumption, such as:

$$\Delta_t = Z_t / \tilde{C}_t \quad (3)$$

with $Z_t = Z_{t-1}^{1-\nu} (C_t - hC_{t-1})^{\nu}$. Z_t defines a smoothed consumption index. If consumption hikes above its steady-state value, the marginal utility of labor decreases and the disutility of work increases. In the polar case where $\nu = 1$, the wealth effect is strong and the preferences are

similar to the King-Plosser-Rebelo (1988) preferences In the other polar case, that is with $\nu = 0$, there is no wealth effect, thus consumption and labor are perfectly additively separable as in preferences *à la* Greenwood-Hercowitch-Huffman (1988). The size of the parameter ν thus defines the strength of the wealth effect on labor supply. The representative household faces the following budget constraint:

$$(1+\tau_t^c)P_tC_t + P_tI_t + \frac{E_tB_{t+1}}{1+R_t} \leq (1-\tau_t^w)W_tN_t + B_t + R_t^kK_{t-1} + Div_t \tag{4}$$

P_t is the general level of prices, R_t the quarterly nominal interest rate, W_t is the nominal wage and B_t is the government bonds in nominal terms held by the households. I_t defines private investment and K_t the accumulated capital. Households loan capital to firms at the rate R_t^k. Div_t is the profit from firms redistributed to households.

The law of motion for private capital is described by:

$$K_t = (1-\delta)K_{t-1} + \left[1 - S\left(\frac{I_t}{I_{t-1}}\right)\right]I_t \tag{5}$$

with $S(\frac{I_t}{I_{t-1}}) = \frac{\psi}{2}\left(\frac{I_t}{I_{t-1}}\right)^2$ a cost function related to changes in investment decisions with ψ a fixed cost, in line with Christiano, Eichenbaum and Evans (2005), and where δ defines private capital depreciation.

Maximizing (2) subjects to (4) and (5) yields the following FOCs respectively for C_t, B_t, I_t and K_t:

$$\lambda_t = \frac{U'_{C,t}}{P_t(1+\tau_t^c)} \tag{6}$$

$$\lambda_t = \lambda_{t-1}(1+R_t) \tag{7}$$

$$\lambda_t P_t = \Omega_t \varepsilon_t^i \left(1 - S\left(\frac{I_t}{I_{t-1}}\right) - S'\left(\frac{I_t}{I_{t-1}}\right)\left(\frac{I_t}{I_{t-1}}\right)\right) + E_t\Omega_{t+1}\left(1 - S'\left(\frac{I_{t+1}}{I_t}\right)\left(\frac{I_{t+1}}{I_t}\right)^2\right) \tag{8}$$

$$\Omega_t = R_t^K \beta E_t[\lambda_{t+1} + \Omega_{t+1}(1-\delta)] \tag{9}$$

where λ_t and Ω_t are respectively the Lagrangian multipliers associated with the budget constraint and with the capital accumulation equation.

Including (6) in (7) gives the following consumption Euler equation:

$$\frac{U'_{c,t}}{U'_{c,t+1}} = \frac{1+R_t}{\Pi_{t+1}} \frac{1+\tau_t^c}{1+\tau_{t+1}^c} \tag{10}$$

where $\Pi_{t+1} = \frac{P_{t+1}}{P_t}$ represents the consumer price index (CPI) inflation.

2.2 Labor force participation and wage-setting

The introduction of the unemployment rate and of the labor force participation decision follow closely Gali, Smets and Wouters (2012).

Labor force participation decision

Following Gali, Smets and Wouters (2012), I assume that a worker i will accept to participate in the labor market if his utility for labor revenue is higher than his disutility of work, such as:

$$\left(\frac{1}{C_t(i) - hC_{t-1}(i)}\right)(1-\tau_t^w)\left(\frac{W_t(i)}{P_t}\right) \geq \Delta_t(i)(L_t(i))^{\phi} \tag{11}$$

with $L_t(i)$ the labor force participation decision of a worker (i).

Re-expressing equation (11) and saturing the condition, the (aggregate) labor force participation is defined by:

$$\frac{(1-\tau_t^w)W_t}{P_t} = Z_t(L_t)^{\phi} \tag{12}$$

The participation condition (12) triggers a labor force participation function of the net-of-tax real wage, the inverse of the Frisch elasticity of substitution of labor supply and of the wealth effect present through the variable Z_t.

Unemployment

Once is defined the aggregate labor force participation, unemployment noted U_t^i is simply defined as:

$$U_t^i = L_t^i - N_t^i \tag{13}$$

Wage-setting

Wage's dynamic is introduced through a Calvo-style wage setting. Workers can only reoptimize their nominal wage in each period with a probability $(1-\theta^w)$, regardless the number of periods since they last reoptimized. In this model, when a worker cannot reoptimize his nominal wage, there is a partial indexation of the nominal wage on past inflation, the degree of indexation being defined by the parameter γ^w. Wage in the period k of a worker who has not reoptimized his

wage since the period t is of the form $W_{t+k/t}(i) = W_{t+k-1/t}(i)(\Pi_{t-1})^{\gamma^w}(\Pi)^{1-\gamma^w}$ with Π inflation at the steady-state. Since we assume a zero inflation steady-state such as $\Pi^p = 1$, nominal wages are only indexed on past inflation. The individual worker faces the following sequence of isolelastic demand schedules:

$$N_{t+k/t}(i) = \left(\frac{W_{t+k/t}(i)}{W_{t+k}}\right)^{-\varepsilon^w} N_{t+k} \tag{14}$$

where ε^w is the wage elasticity of the relevant labor demand schedule.

The first order condition associated to the optimizing process is expressed as:[5]

$$\sum_{k=0}^{\infty}(\beta\theta_w)^k E_t\left[\left(\frac{N_{t+k/t}}{C_{t+k}}\right)\left(\frac{W^*_{t+k/t}}{P_{t+k}} - \frac{\varepsilon^w}{\varepsilon^w - 1}MRS_{t+k/t}\right)\right] = 0 \tag{15}$$

with W_t^* the optimal nominal wage, $MRS_t = -\frac{U_{N,t}}{U_{C,t}}$ the marginal rate of substitution between consumption and labor and where $\frac{\varepsilon^w}{\varepsilon^w - 1}$ corresponds to the (constant) wage mark-up. The wage inflation dynamic is based on fluctuations of the effective mark-up in relation to the natural mark-up $\frac{\varepsilon^w}{\varepsilon^w - 1}$. In this case, the effective markup noted MU_t is expressed as:

$$MU_t = \frac{W_t}{P_t} - MRS_t \tag{16}$$

The marginal rate of substitution between consumption and labor MRS_t can be re-expressed as:

$$MRS_t = -\frac{U^i_{N,t}}{U^i_{C,t}} = Z_t N_t^{\phi} \tag{17}$$

After some algebra, one obtains:

$$MU_t = \frac{W_t}{P_t} - MRS_t = \phi U_t \tag{18}$$

Nominal wages are thus driven by the unemployment rate. This modeling provides a microfoundation of the original Phillips curve, *i.e.* the link between nominal wages and unemployment.

The last step is to introduce the condition (15) in the following law of motion of the aggregate nominal wage that takes into account for the automatic indexation of the nominal wage on past inflation, that is:

$$W_t = [\theta_w(W_{t-1}(\Pi_{t-1})^{\gamma_w})^{1-\varepsilon^w} + (1-\theta_w)(W_t^*)^{1-\varepsilon^w}]^{\frac{1}{1-\varepsilon^w}} \tag{19}$$

[5] A total derivation of this step can be found in Erceg, Henderson and Levin (2000).

2.3 Firms

2.3.1 Final goods firms

Final goods firms package the intermediate goods $(j) \in [0,1[$ in a final homogeneous commodity Y_t sold to the households and to the government. If intermediary firms evolve in a monopolistic environment, final packagers are in a perfectly competitive environment. Firms seek to maximize their profit such as:

$$\max_{Y_t(j),Y_t} P_t Y_t - \int_0^1 P_t(j) Y_t(j) \mathrm{d}i \tag{20}$$

$$s.t. \left[\int_0^1 G\left(\frac{Y_t(j)}{Y_t} \right) \mathrm{d}i \right] = 1 \tag{21}$$

where G is a function characterizing the demand for the different goods (i). In the spirit of Kimball (1995), I assume that G is increasing and strictly concave. Combining the two first-order conditions, the demand for an intermediary commodity (i) is:

$$Y_t(j) = Y_t G^{'-1}\left[\frac{P_t(j)}{P_t} \int_0^1 G^{'}\left(\frac{Y_t(j)}{Y_t} \right) \frac{Y_t(j)}{Y_t}, di \right] \tag{22}$$

Thus, the demand for an input (j) is negatively function of its relative price $\frac{P_t(j)}{P_t}$.

2.3.2 The intermediary sector

A continuum of (j) differentiated intermediate firms over [0,1[produce goods in a monopolistic competition and thus are allowed to set their price *à la* Calvo (1983). Their production technology is a standard Cobb-Douglas function to which is added the public capital.

The technological process of the productive firms is defined by the following Cobb-Douglas function:

$$Y_t(j) = K_{t-1}^{\alpha}(j) N_t^{1-\alpha-\alpha_g}(j) (K_{t-1}^{g}(j))^{\alpha_g} \tag{23}$$

As said previously, public capital enters the production function assuming it is productivity-enhancing for the private sector. The parameter α^g defines the elasticity of output to public capital. Public investment implies a demand effect (see the market clearing condition in which public investment appears) and also a supply effect by affecting the level of production of the intermediary firms. However, in a Cobb-Douglas production function, inputs are imperfectly substitutable. Thus, a raise in public capital triggers a decline in demand for private capital and labor. This channel is of first importance in the following analysis to explain the response of the labor market to a raise in public investment.

The profit of the firm is expressed as:

$$\Pi_t^f(j) = P_t(j)Y_t(j) - W_t N_t(j) - R_t^k K_{t-1}(j) \tag{24}$$

Maximization of (24) subject to (23) gives the following FOCs for capital and labor, such as for a representative firm:

$$\frac{\partial \Pi_t^f}{\partial N_t} = 0 \Leftrightarrow (1-\alpha) K_{t-1}^{\alpha} N_t^{-\alpha} (K_{t-1}^g)^{\alpha_g} = \frac{W_t}{P_t} \nabla_t \tag{25}$$

$$\frac{\partial \Pi_t^f}{\partial K_t} = 0 \Leftrightarrow \alpha K_{t-1}^{\alpha-1} N_t^{1-\alpha} (K_{t-1}^g)^{\alpha_g} = R_t^k \nabla_t \tag{26}$$

where ∇_t is the Lagrangian multiplier associated with the technological constraint (23). With equations (25) and (26) is determined the demand for inputs such as:

$$K_{t-1} = \frac{W_t}{P_t} \frac{N_t}{R_t^k} \tag{27}$$

By using and rearranging the two previous FOCs, the firms' marginal cost is expressed as:

$$MC_t = \frac{(R_t^k)^{\alpha} \left(\frac{W_t}{P_t} \right)^{1-\alpha}}{\alpha^{\alpha} (1-\alpha)^{1-\alpha} (K_{t-1}^g)^{\alpha_g}} \tag{28}$$

2.3.3 Price setting

Each firm seeks to maximize its future flow of profits by setting its optimal price $P_t^*(j)$. Under a Calvo price setting, there is only a fraction $(1-\theta^p)$ of firms that can reoptimize their price at each period. Similarly to the wage-setting, In the absence of reoptimization, there is a partial indexation of prices on past aggregate inflation with a degree of indexation γ^p and that there is also an indexation on long term inflation at a degree $1-\gamma^p$. For simplicity purposes, I assume that the steady-state is non-inflationary so that this term is neglected in the following price-setting mechanism. The optimization problem for a firm (j) is:

$$\max_{P_t^*(j)} E_t \sum_{k=0}^{\infty} \theta^p \frac{\beta^k \lambda_{t+k} P_t}{\lambda_t P_{t+k}} [P_t^*(j) (\Pi_{l=1}^k \Pi_{t+l-1}^{\gamma^p}) - MC_{t+k}] Y_{t+k}(j) \tag{29}$$

subject to the demand function of the final firms for the individual commodity (j) function of

the level of the aggregate demand and of the real price for the commodity (j):

$$Y_{t+k}(j) = Y_{t+k} F^{'-1}\left(\frac{P_t(j) X_{t,k}}{P_{t+k}} \int_0^1 G^{'}\left(\frac{Y_t(j)}{Y_t} \right) \frac{Y_t(j)}{Y_t} \mathrm{d}j \right) \tag{30}$$

where $X_{t,k}$ denotes the automatic indexation on past inflation. Since the indexation only begins at the second period, $X_{t,k} = 1$ for $k = 0$ and $X_{t,k} = \Pi_{l=1}^{k} \pi_{t+l-1}^{\gamma^p}$ for all the following periods.

Maximization of (29) subject to (30) yields the following first-order condition:

$$E_t \sum_{k=0}^{\infty} \theta^p \frac{\beta^k \lambda_{t+k} P_t}{\lambda_t P_{t+k}} Y_{t+k}(j) \left[X_{t,k} P_t^*(j) + (P_t^*(j) X_{t,k} - MC_{t+k}) \frac{G^{'}(F_{t+k})}{G^{'-1}(H_{t+k}) G^{''}(F_{t+k})} \right] = 0 \tag{31}$$

with $F_t = G^{'-1}(H_t)$ and $H_t = \frac{P_t(j)}{P_t} \int_0^1 G^{'}\left(\frac{Y_t(j)}{Y_t} \right) \frac{Y_t(j)}{Y_t} \mathrm{d}j$.

Finally, the law of motion of the general level of prices, P_t, is defined as:

$$P_t = (1-\theta^p) P_t(j) G^{'-1}\left[\frac{P_t(j) \int_0^1 G^{'}\left(\frac{Y_t(j)}{Y_t} \right) \frac{Y_t(j)}{Y_t} \mathrm{d}j}{P_t} \right] + \theta^p \Pi_{t-1}^{\gamma^p} P_{t-1} G^{'-1}\left[\frac{\Pi_{t-1}^{\gamma^p} P_{t-1} \int_0^1 G^{'}\left(\frac{Y_t(j)}{Y_t} \right) \frac{Y_t(j)}{Y_t} \mathrm{d}j}{P_t} \right] \tag{32}$$

2.4 Economic policies

The nominal interest R_t is assumed to react to changes on output and on CPI inflation, such as, in logs:

$$r_t = \Phi^r r_{t-1} + \Phi^y y_t + \Phi^\pi \pi_t \tag{33}$$

where Φ^r is a degree of inertia of the nominal interest rate. Φ^y and Φ^π define respectively the weight given in the Taylor rule for the stabilization of output and of inflation. Variables in lowercase letters denote its log-deviation around its steady-sate value.

As previously said, government expenditure is composed of public consumption and public investment, which are assumed to follow an AR(1) such as, in logs:

$$c_t^g = \rho^{c,g} c_{t-1}^g + \xi^{cg} \tag{34}$$

$$i_t^g = \rho^{i,g} i_{t-1}^g + \xi^{ig} \tag{35}$$

where $\rho^{c,g}$ and $\rho^{i,g}$ define the duration of the exogenous shocks and where ξ^{cg} and ξ^{ig} are the associated white noises.

Both government consumption and investment do not affect the utility of households. Government consumption has no effect on the production side of the economy in contrary to government investment which affect the production function through public capital, as shown in equation (23).

Similarly to Erceg and Lindé (2012), I assume that the government does not have to balance its budget each period and is allowed to issue debt B_{t+1} in nominal terms at the end of the period t. As a consequence, the budget constraint in nominal terms for the government is expressed as:

$$B_{t+1} - (1+R_t)B_t = P_t C_t^g + P_t I_t^g - P_t \tau_t^c C_t - \tau_t^w W_t N_t \tag{36}$$

VAT and the labor income tax are assumed to respond to the creation of debt, such as:

$$\tau_t^c = \rho^{\tau,c} \tau_{t-1}^c + \alpha^{\tau,c} (\hat{b}_t - b^*) + \xi^{\tau^c} \tag{37}$$

$$\tau_t^w = \rho^{\tau,w} \tau_{t-1}^w + \alpha^{\tau,w} (\hat{b}_t - b^*) + \xi^{\tau^w} \tag{38}$$

with $\rho^{\tau,c}, \rho^{\tau,w}, \alpha^{\tau,c}, \alpha^{\tau,w} \in [0;1]$. Taxes are assumed to react to $\hat{b}_t = \left(\frac{B_t}{P_t \bar{Y}} \right) - \bar{b}$ which define the log deviation of debt expressed as a share of steady-state GDP in nominal terms $(P_t \bar{Y})$ around its steady-state value $\bar{b}$. b^* denotes the target debt/GDP ratio.

The law of motion of the public capital accumulation is assumed to be similar to the capital accumulation of private capital. For simplicity purposes, I assume that the depreciation rates of capital are identical across sectors, such as:

$$K_t^g = (1-\delta) K_{t-1}^g + \left[1 - S\left(\frac{I_t^g}{I_{t-1}^g} \right) \right] I_{t-k}^g \tag{39}$$

Following recent contributions on the effects of public investment on economic activity, like Leeper, Walker and Yang (2010) or Bouakez, Guillard and Roulleau-Pasdeloup (2014), I introduce a "time-to-build" delay for the formation of public capital, associated with the completion of

public investment projects (for instance, building highways and bridges may take up to 10 years). This assumption has a significant effect on the results obtained when one simulates the model with a public investment shock. For the first ten quarters (a bit less due to expectations), a raise in public investment will trigger only demand effects, similarly to a public consumption shock. Then, when public capital is effective, it impacts the supply side of the economy including a negative impact on marginal cost and then prices.

2.5 Market clearing condition

The aggregate demand for goods is defined such as, in logs:

$$y_t = \bar{c} c_t + \bar{i} i_t + \bar{c}^g c_t^g + \bar{i}^g i_t^g \tag{40}$$

where $\bar{c}$, $\bar{i}$, $\bar{c}^g$ and $\bar{i}^g$ are the steady-state values of the different demand components ,expressed as a share of total GDP.

3 Effects of public expenditure shocks

3.1 Calibration of the model and simulation strategy

Most of parameter values are taken from Smets, Warne and Wouters (2013) who estimate the Gali-Smets-Wouters (2012) model for the Euro Area. Table (1) displays the baseline calibration of the model. In comparison with the estimation of the model for the US in Gali, Smets and Wouters (2012), some significant differences arise between the US and the Euro Area. For instance, the Euro Area faces a larger price and wage rigidities than the US (respectively the parameters θ_p and θ_w) and a greater share of capital α in the production function.

For comparison purposes, the public expenditure shocks are assumed to have the same duration with $\rho^{c,g} = \rho^{i,g} = 0.6$. For the parameters included in the tax rules, I follow Forni, Monteforte and Sessa (2009) who estimate a DSGE model for the Euro Area with tax rules close to those introduced in this article, so that I set $\rho^{\tau,c} = 0.96$ and $\rho^{\tau,w} = 0.91$ accordingly. For the parameters which determine the response of taxes to the government deficit, I set $\alpha^{\tau,c} = 0.50$, $\alpha^{\tau,w} = 0.28$, $\rho^{\tau,c} = 0.96$ and $\rho^{\tau,w} = 0.91$. The target debt/GDP ratio $b*$ is set to 60% of steady-state GDP in nominal terms.

The calibration of the Taylor rule follows also Smets, Warne and Wouters (2013) and values are rather usual: the behavior of the monetary authority is characterized by a strong degree of inertia ($\Phi^r = 0.9$), a value of $\Phi^\pi = 1.25$ superior to 1 and a rather weak response of the nominal interest rate to output, with $\Phi^y = 0.19$.

Despite the size of the productivity-enhancing effect of public capital is central in our analysis, there is only little guidance about the value of the parameter α^g. Leeper, Walker and Yang

(2010) discuss this issue and point out that available micro and macro estimates do not reach a clear conclusion. I set first $\alpha^g = 0.05$ which seems to be a reasonable value. This value for the elasticity of output to public capital is sufficiently large to produce a significant rise in productivity in the economy and long-term effects of government investment on output and employment. If the value of α^g tends to 0, the effects of public investment are then quite similar to those of government consumption. Since the real value of this parameter is unsure, I also control for a larger value and simulate the model also with $\alpha^g = 0.1$. The depreciation rate of capital is assumed to be the same across sectors even if the depreciation rate could slightly differ according to the sector.

Data for the Euro Area are used to compute the different steady-state values of the market clearing equation in equation (40). The GDP share of consumption is set to 0.56 and the GDP share of private investment to 0.2. Government consumption represents 20% of GDP on average and government investment around 3% on average over the sample.[6]

According to Smets, Warne and Wouters (2013), the degree of habit formation in consumption is set to 0.75 and the Frisch elasticity of substitution of labor supply is set to 4.65. The wealth effect of consumption on labor supply ν is set to 0.1. In Gali, Smets and Wouters (2012), the posterior mean for this parameter with US data equals 0.02 with the baseline model. However, in an alternative estimation in which the unemployment rate in non-observable, the posterior mean indicates $\nu = 0.73$. Also, the authors estimate the model with an alternative version of the Jaimovich-Rebelo preferences in which the variable Z_t is now driven by aggregate productivity and not by aggregate consumption. In this case, estimation yields $\nu = 0.9$. For this reason and since the response of the labor force participation is one of the focus of this article, I also simulate the model with a higher wealth effect of consumption on labor supply, *i.e* with $\nu = 0.9$. In the case of public consumption, the model is simulated also with a higher value for the elasticity of subsitution of labor supply, in order to boost the positive response of the labor force participation.

The model is log-linearized around its perfect foresight steady state and the software Dynare is used to simulate the model. The latter is firstly simulated with both public expenditure shocks in turn. As said previously, VAT and the labor income tax respond to the degradation of the deficit. Then, in order to discuss the importance of the financing following the expenditure shocks, the model is simulated with a positive exogenous shock for each tax in turn.

[6] GDP share for government consumption and investment are computed using the fiscal dataset from Paredes, Pedregal and Pérez (2009). Means are computed with data from 1980 to 2005.

Parameters	Values	Definitions
Households' preferences		
h	0.65	Habit formation
ϕ	4,65	Frish elasticity of substitution
ν	0.1	Degree of wealth effect on labor supply
β	0.995	Discount factor
Price and wage setting		
θ_p	0.75	Price rigidity
γ_p	0.22	Indexation of prices on past inflation
θ_w	0.74	Wage rigidity
γ_w	0.22	Indexation of wages on past inflation
Investment and capital		
ψ	6	Constant investment cost
δ	0.025	Depreciation of private and public capital
α	0.2	Share of capital in the production function
Monetary and Fiscal policy		
Φ^y	0.19	Output elasticity of the Taylor rule
Φ^π	1.25	Inflation elasticity of the Taylor rule
Φ^r	0.9	Degree of smoothing of the Taylor rule
$\rho^{c,g}$	0.6	Duration of the public consumption shock
$\rho^{i,g}$	0.6	Duration of the public investment shock
$\rho^{\tau,c}$	0.96	AR(1) parameter of the VAT rule
$\rho^{\tau,w}$	0.91	AR(1) parameter of the labor income tax rule
$\alpha^{\tau,c}$	0.50	Response of VAT to government deficit
$\alpha^{\tau,w}$	0.28	Response of labor income tax to government deficit
α^g	0.05	Elasticity of output to public capital

Table 1: Model calibration

3.2 A rise in public consumption

The cumulative multipliers on Table (2) are computed following Mountford and Uhlig (2009). For instance, the cumulative multiplier after k quarters for output following a government consumption shock is equal to:

$$\frac{\sum_{i=1}^{k}\left(\prod_{i=1}^{k}(R_{t+i-1})^{-1}\right)\Delta Y_{t+i-1}}{\sum_{i=1}^{k}\left(\prod_{i=1}^{k}(R_{t+i-1})^{-1}\right)\Delta C^{g}_{t+i-1}} \tag{41}$$

	Output	Unemployment
5 periods	0.86	-0.77
10 periods	0.45	-0.44
20 periods	0.38	-0.40
40 periods	0.43	-0.42

Table 2: Cumulative output and unemployment multipliers for a 1% of GDP increase in public consumption

As reported in Table (2), the short-run (5 periods) output multiplier is equal to 0.86 and the unemployment multiplier to $-0,77$. This value for the unemployment multiplier is in line with the empirical findings found in Monacelli, Perotti and Trigari (2010) or Ravn and Simonelli (2008). Figure (1) displays the impulse response functions following a 1% of GDP increase in government consumption. Basically, the rise in demand through government spending rises employment thanks to the presence of nominal rigidities on prices. The negative wealth effect and the rise in the real interest rate triggers a decrease in consumption and an increase in labor supply. In addition, the positive effect on employment produces a rise in the real wage in the short run, which puts an upward pressure on labor supply. The rise in labor supply is however limited so that the unemployment rate decreases significantly. As said in introduction, other studies[7] argue for a positive response of the unemployment rate following a government expenditure shock. In the model this is hardly feasible to generate a positive response of unemployment. Figure (1) displays also the impulse response functions in the case of a higher value of the elasticity of substitution of labor supply and a stronger wealth effect on labor supply. The results are not changed substantially and the response of unemployment remains signifcantly negative.

[7] Mayer, Moyen and Stähler (2010) in a New Keynesian model with matching frictions and Brückner and Pappa (2010) among others.

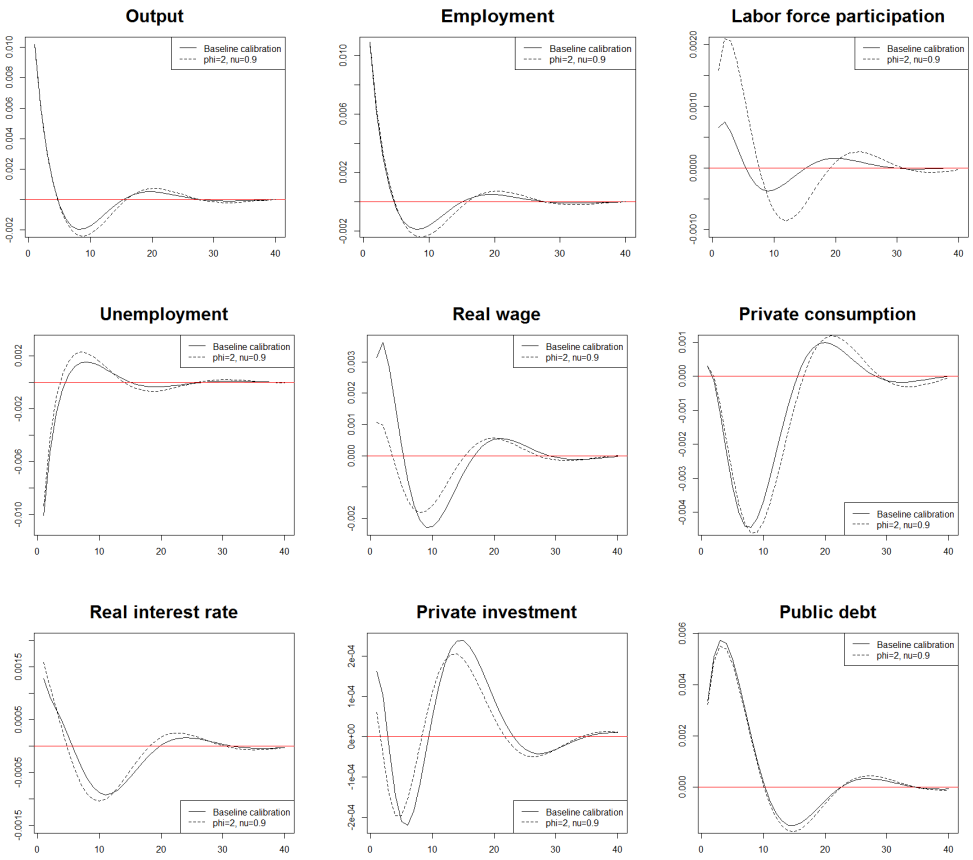

Figure 1: Effects of an increase in public consumption (corresponding to 1% of GDP)

3.3 A rise in government investment

Since is introduced an implementation delay for building public capital (10 periods), the effects of government investment for the first periods are similar to those of a government consumption shock. Output and employment increase despite a crowding out effect on private consumption and investment. The negative wealth effect and the slight increase in the real wage trigger a higher labor force participation in the short run.

The progressive accumulation of public capital triggers two additional effects on output as highlighted already in Straub and Tchakarov (2007) or Leeper, Walker and Yang (2010). First, the accumulation of public capital increases production and rises the marginal productivity of labor and of private capital in the long-run. With a value for the elasticity of production to public capital $\alpha^g = 0.05$, this rise in productivity triggers a long-run positive effect on output and employment.

Secondly, public capital enters negatively in the marginal cost function so that it triggers a drop in prices. Then, the real interest rate decreases which generates a rise in private consumption.

	Output	Unemployment
5 periods	0.47	-0.52
10 periods	0.37	-0.58
20 periods	2.81	-0.54
periods	5.44	-0.22

Table 3: Cumulative output and unemployment multipliers for a 1% of GDP increase in public investment

However, and as shown in Figure (2), the increase in employment is weakened for few periods when public capital becomes. This temporary drop in employment is similar to the case of a total factor productivity shock in the short run. Production rises more sharply than demand so that public capital crowds out the two other inputs in the production function.[8]

The key point to explain the negative but low unemployment fiscal multipliers reported in Table (3) is the response of the real wage and of the labor force participation. In contrary to government consumption, government investment triggers a strong increase in the real wage in the long run. First, this long-lasting rise in the real wage is due to the long-run rise in productivity in the economy. Moreover, a rise in public investment generates a long-lasting decrease in the marginal cost and then in prices. The drop in unemployment triggers an upward pressure on the nominal wage and in addition, with a low indexation of the nominal wage on past inflation ($\gamma_w = 0.16$), the nominal wage responds only slightly to the drop in prices. Since the downward pressures on prices are long-lasting, the real wage increases sharply in the long run. It should be noted that this channel could be strongly dependent to the presence of nominal rigidities on the nominal wage. However, even in the absence of nominal wage rigidities, the real wage tends to rise in the long run following a rise in government investment. In Betti and Coudert (2015) we use a New Keynesian framework with a standard search and matching model for the labor market. The real wage is set with an usual efficient Nash bargaining process and no nominal rigidities on wages are introduced.

[8] See for instance Barnichon (2012) for a discussion about the existence of a positive unemployment-productivity correlation in the short run.

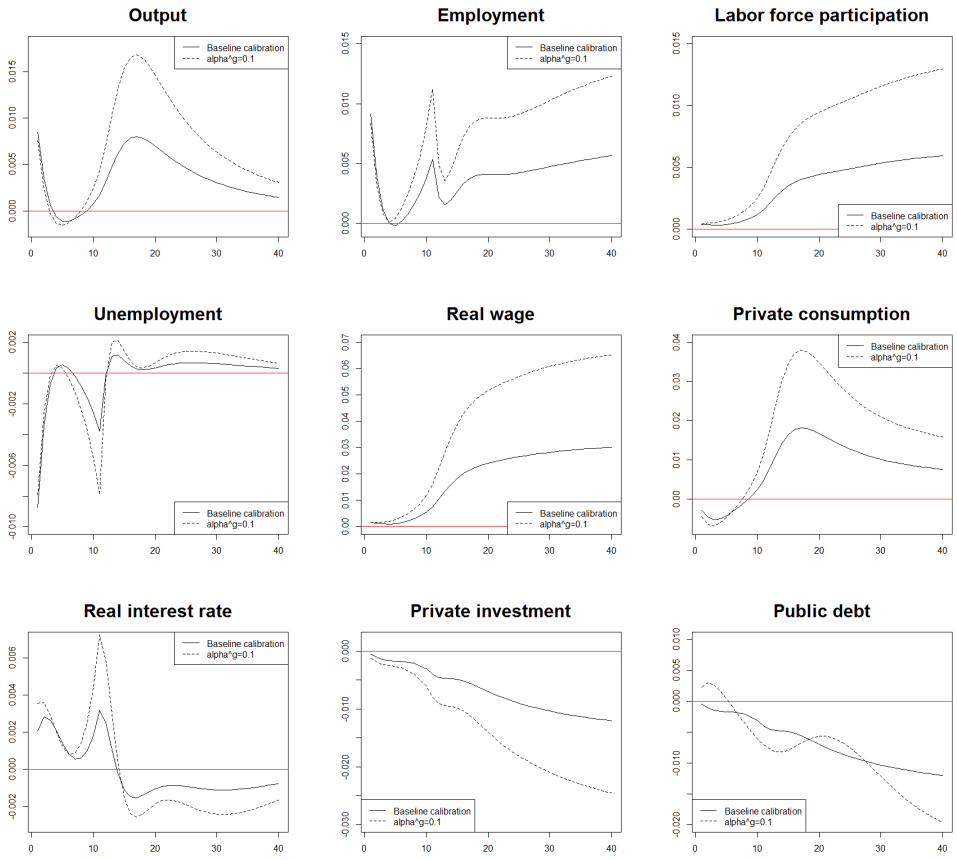

Figure 2: Effects of an increase in public investment (corresponding to 1% of GDP)

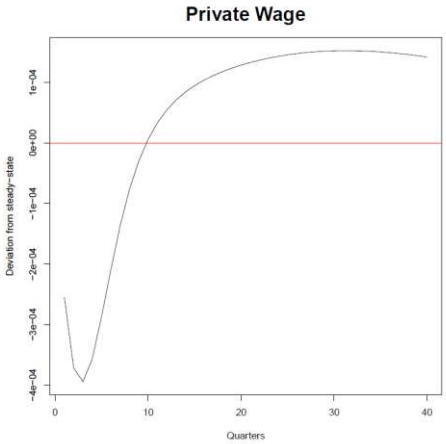

Figure 3: Response of the real wage to a rise in government investment in a search and matching model in absence of nominal rigidity (the model used is described in Betti and Coudert, 2015)

Figure (3) indicates the response of the real wage to a government investment shock in this search and matching model. Despite a decrease in the short-run, the real wage rises in the long run.

As a consequence and despite the positive wealth effect on labor supply, the labor force participation increases significantly in the long run. Then, this rise in labor force participation offsets the positive long-run effects on employment.

With a higher value for the parameter α^g, the response of unemployment is quite similar. Employment increases more in the long run but the effects on the labor force participation and the real wage are amplified as well. The stronger effect on long-run productivity also implies a larger effect on activity.

3.4 The importance of financing

The literature on fiscal policy has pointed out the crucial role of the fiscal adjustment to explain the effects of fiscal expansions on output and employment at the different time horizons. For instance the speed of the fiscal adjustment and the fiscal instrument used for this purpose influence the dynamic of the economy following a fiscal shock. In this model, VAT and a labor income tax respond to the rise in government debt. In DSGE models other taxes are often introduced such as a tax on capital or social security contributions but fiscal adjustments can be also expenditure-based (for instance the case of a spending reversal) or even deficit-based.

This section aims at demonstrating that a rise in VAT or in the labor income tax following the expansion in government expenditure trigger different effects on the labor market and especially on the unemployment rate. I simulate the model with a 1% rise in VAT then with a 1% rise in the labor income tax. Results are reported in Figures (4) and (5).

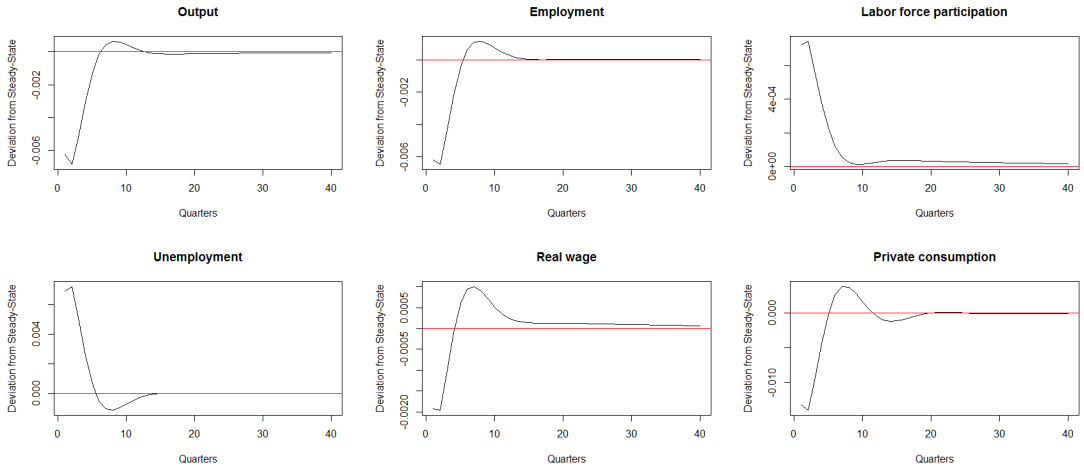

Figure 4: Effects of a 1% increase in VAT

A 1% increase in VAT decreases private consumption, output and employment. This negative aggregate demand shock implies a drop in prices and the real interest rates according to the Taylor principle. This decrease in real interest rates eases the drop in private consumption which

triggers a slightly positive response of output and employment for a few periods. The response of the real wage can be explained as follows: the rise in unemployment implies a drop in nominal wage in the short run despite the existence of nominal rigidities on wages. However, Figure (4) indicates that the real wage goes up from the fifth period. First, the weak indexation of nominal wages on past inflation ($\gamma_w = 0.16$) triggers an automatic rise in real wages following the drop in prices. Also, the slight rise in employment after a few periods triggers an upward pressure on the nominal wage. The mixed response of the real wage and of the drop in private consumption implies a slight increase in the labor force participation.

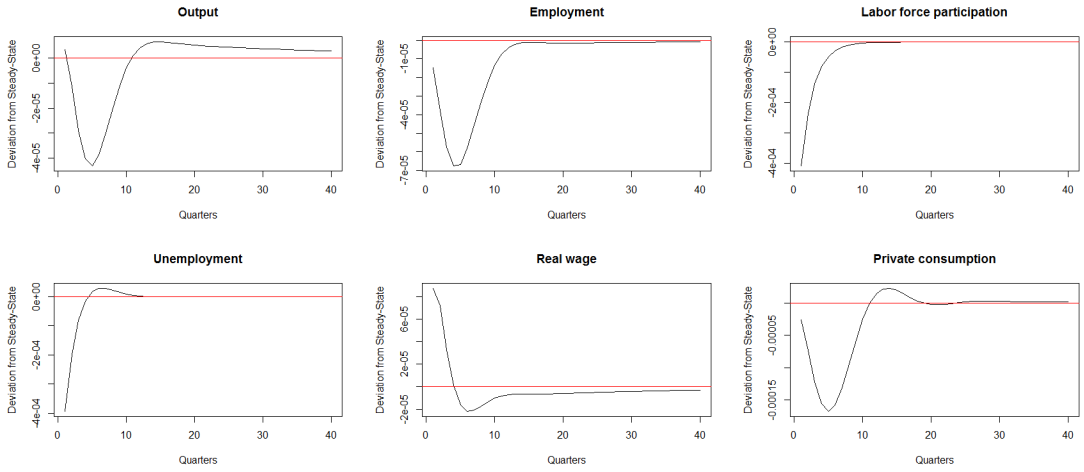

Figure 5: Effects of a 1% rise in labor income tax

In the case of a rise in the labor income tax, the marginal utility from working is lower, thus the households address a lower labor supply. However, the drop in disposable income reduces private consumption causing a lower GDP fiscal multiplier and a lower labor demand than in the initial (debt-based) case. The effect on the labor supply is larger in absolute value than the effect on labor demand, producing higher negative effects on the unemployment rate in the case of a shock partly funded by a tax on labor income.

4 Empirical framework

4.1 Data descpription

In the spirit of Fatas and Mihov (2001), I apply a structural vector autoregression approach in order to estimate the effects of fiscal policy shocks on a large set of variables including labor market variables for the Eurozone as a closed economy. It is common in the literature to consider public expenditure as the sum of government consumption and of government investment. I attempt to disentangle the effects of these two components of public spending by estimating the baseline VAR with each spending variable in turn. Other variables included in the SVAR are general government total tax revenue, real GDP, the GDP deflator, the short-term nominal interest rate, real compentations to employees, total employment, the labor force and the unemployment rate.

Quarterly data for the general government are extracted from the new dataset contructed by Paredes, Pedregal and Pérez (2009, PPP hereinafter).[9] Public expenditure is defined either as public consumption (GCR) or as public investment (GIN). Euro-Area general government public consumption is directly computed in real terms in PPP (2009). However, available data for EA general government public investment are in nominal terms and I use the GDP deflator to express it in real terms. For the rest of the variables, time series come from the Area Wide Model (AWM) database.[10] Table (4) summarizes the set of variables considered in the SVAR.

The Phillips-Perron and Augmented Dickey-Fuller tests indicate unit roots for almost all series. Series are then taken in log differences.[11]

Variables	Source	Code	Symbol in the paper
Public consumption	PPP (2009)	GCN	C^g
Public investment	PPP (2009)	GIN	I^g
Government total revenues	PPP (2009)	TIN	T
Real GDP	FHM (2005)	YER	Y
GDP deflator	FHM (2005)	YED	Π
Short term interest rate	FHM (2005)	STN	R
Unemployment rate	FHM (2005)	URX	U
Labor force participation	FHM (2005)	LFN	L
Employment	FHM (2005)	LNN	N
Compensation to employees	FHM (2005)	WIN	W

Table 4: Data description

4.2 Identification methodology

Following Fatas and Mihov (2001), structural fiscal shocks are identified using a Structural VAR model. By ordering first public expenditure, one assumes that the government cannot react contemporaneously to changes in economic variables. I then identify the structural fiscal shocks by applying a Choleski decomposition. This is well-known that when identifying structural innovations by using a Choleski decomposition, the ordering of the variables in the SVAR can greatly affect the results. For this reason, I estimate a SVAR with each fiscal variable in turn. Thus, each estimated SVAR contains 6 variables: the government expenditure (public consumption or public investment), tax revenues, real GDP, the GDP deflator, the nominal interest rate and finally

[9] I am grateful to the authors for providing me the dataset

[10] See Fagan and al. (2005) for a clear description of the different variables.

[11] I also run estimates with data detrended with the Hodrick-Prescott filter. Results are however very close.

the labor market variable.

Let us represent the following baseline VAR process:

$$X_t = A(L)X_{t-1} + U_t \tag{42}$$

In the following, I consider the case of a public consumption shock and in which the introduced labor market variable is the real wage, such as $X_t \equiv (C_t^g, T_t, Y_t, \Pi_t, R_t, W_t)$ defines the vector of variables, $A(L)$ is a autoregressive lag polynomial and $U_t \equiv [u_t^{cg}, u_t^t, u_t^y, u_t^\pi, u_t^r, u_t^w]$ the vector of residuals associated with each variable. According to the LM tests and the Akaike and Schwarz information criteria, 4 lags are included in the VAR.

I identify structural government spending shocks *via* a Choleski decomposition. The AB model[12] can be defined as: $AU_t = Be_t$, with $e_t \equiv [e_t^{cg}, e_t^t, e_t^y, e_t^\pi, e_t^r, e_t^w]$ the vector of structural innovations. Applying a Choleski decomposition yields the following constraints:

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ . & 1 & 0 & 0 & 0 & 0 \\ . & . & 1 & 0 & 0 & 0 \\ . & . & . & 1 & 0 & 0 \\ . & . & . & . & 1 & 0 \\ . & . & . & . & . & 1 \end{bmatrix} \tag{43}$$

and

$$B = \begin{bmatrix} . & 0 & 0 & 0 & 0 & 0 \\ 0 & . & 0 & 0 & 0 & 0 \\ 0 & 0 & . & 0 & 0 & 0 \\ 0 & 0 & 0 & . & 0 & 0 \\ 0 & 0 & 0 & 0 & . & 0 \\ 0 & 0 & 0 & 0 & 0 & . \end{bmatrix} \tag{44}$$

where A is a upper triangular matrix and B a diagonal matrix. The model is just-identified with a number of contraints equal to $2k^2 - \frac{k(k+1)}{2}$ with k the number of variables.

4.3 Results

[12] See Lütkepohl (2007) for details about the SVAR modeling and the AB model.

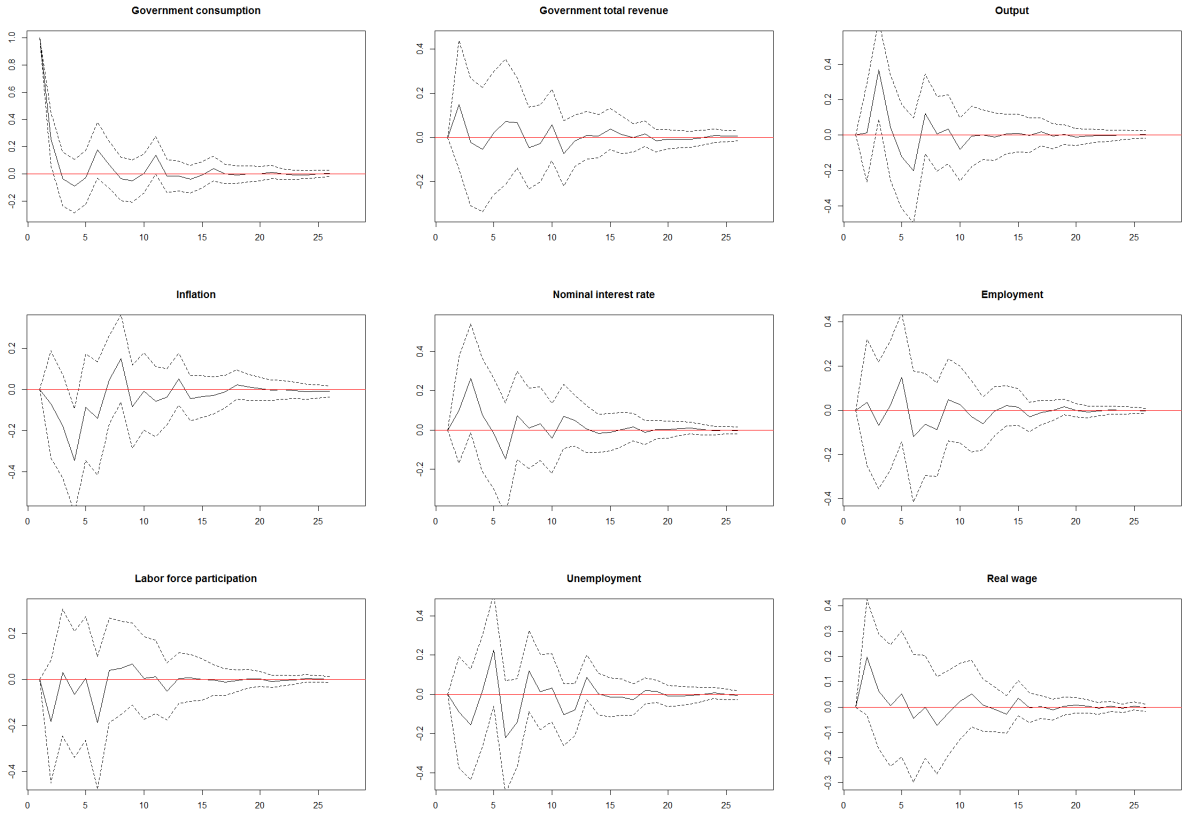

Figure 6: Effects of a 1% rise in government consumption

Figures (6) and (7) display the impulse response functions from the Choleski decomposition. A rise in government investment triggers a slight rise in unemployment (with a cumulative multiplier equals to 0.12). At the opposite, in the case of government consumption, unemployment falls with a cumulative multiplier equals to -0.24. Government consumption has a negative effect on employment. As pointed out in Ramey (2012), a rise in government spending could produce an increase in public employment but a fall in private employment.[13] Moreover, the labor force participation also decreases despite a slight increase after 7 periods. This is particularly surprising since the real wage increases and that public consumption tends to produce a negative wealth effect so that private spending fall (not estimated here). This is at odds with results found in Brückner and Pappa (2012) who estimate for most of countries a rise in the labor force participation following an increase in government spending. However, this is close to the estimates in Berperoglou, Pappa and Vella (2013), who find with a Choleski identification a rise in the labor force participation after both government consumption and investment cuts.[14]

[13] In Ramey (2012), the author uses several specifications and this result holds in most cases.

[14] The authors also show that, with a sign-restriction approach, the participation rate decreases significantly following the public expenditure cuts.

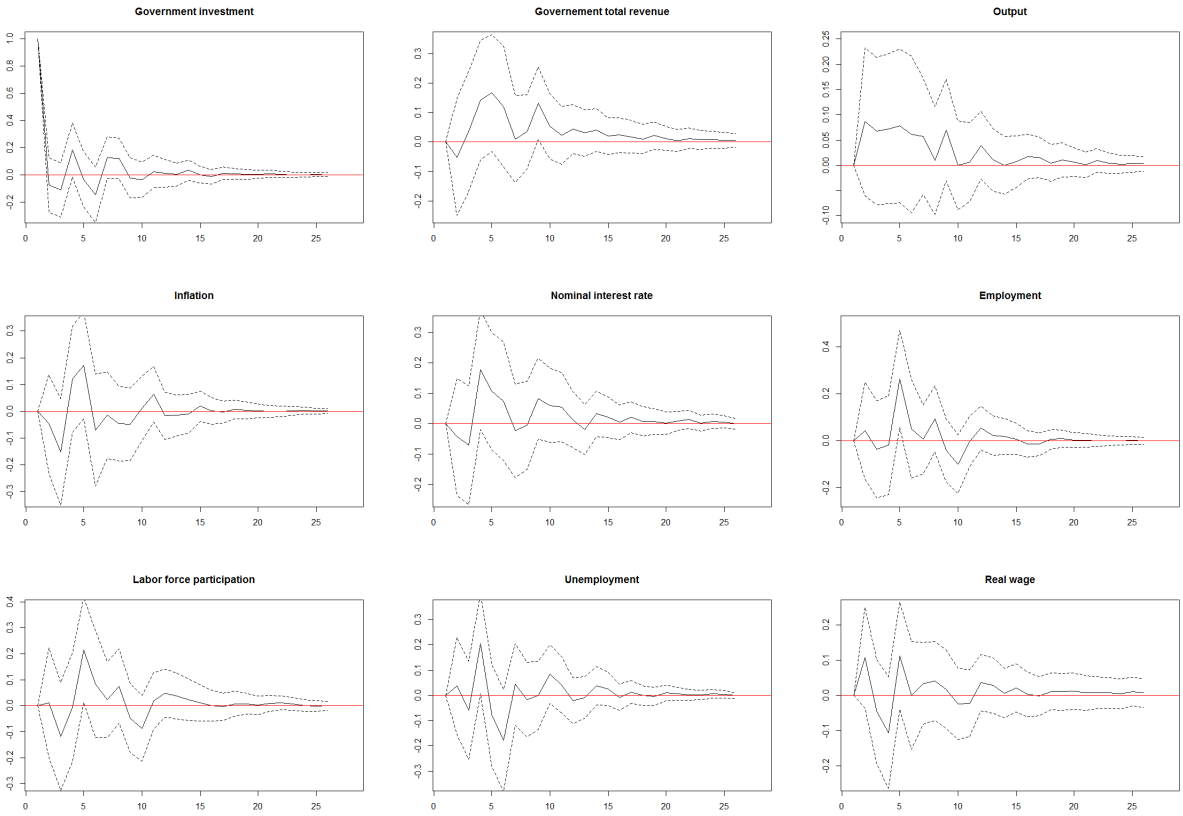

Figure 7: Effects of a 1% rise in government investment (Choleski decomposition)

As already said, government investment triggers a slight rise in unemployment. In contrary to the case of government consumption, public investment generates a rise in both employment and of the labor force participation.These results confirm partly at this stage the results from the DSGE model. We observe a comovement of employment, the labor force participation and the real wage but it tends to rise slightly unemployment. In other words, the rise in employment is counteracted by the rise in the labor force participation.

5 Conclusion

The aim of this chapter is to disentangle the effects of government consumption and investment on output and the labor market in a closed economy. I provide in a New Keynesian model with a labor force participation decision and unemployment an explanation as to a higher response of output but a lower effect on unemployment in the case of a rise in government investment. Despite a long-lasting rise in employment due to an increase in productivity in the economy, a rise in government investment also rise significantly the real wage and the labor force participation. In the case of public consumption, the New Keynesian model indicates a positive increase in employment, the labor force participation and the real wage. The positive effect on employment prevails over a slight rise in labor supply so that unemployment falls. The effects of a temporary increase in government consumption are however short-lasting.

Results from the SVAR indicate that unemployment decreases in the case of a rise in government consumption while the unemployment rate increases slightly with government investment. Especially, one observes a positive comovement of employment, of the labor force and of the real wage with government investment while employment is reduced with government consumption.

This article attempts to show that different fiscal instruments produce different effects on employment and on labor supply. Cuts in government consumption and investment have been extensively implemented in the Euro Area last years in the context of austerity plans. The present study argues for harmful short-run effects of cuts in government consumption on employment while reducing public investment triggers large negative effects on long-run employment and productivity.

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Risk Sharing towards the European Fiscal Union

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Abstract

The aim of this research is to estimate a two-country Dynamic Stochastic General Equilibrium Model (DSGE) for the euro area, core and periphery. The estimation is performed with Bayesian techniques using eleven macroeconomic time series. The model implements an automatic fiscal transfer mechanism, able to deal with idiosyncratic shocks affecting the two economies. The mechanism is able to improve the aggregate welfare in the economy, by reducing consumption variability and increasing cross-country risk sharing. Simulating the model with estimated parameters, we reach the conclusion that an optimal fiscal sharing mechanism should absorb 70% of idiosyncratic shocks when agents are credit constrained. The implementation of a risk sharing system would lead to greater fiscal coordination, marking a first step towards greater fiscal integration in the euro area.

Key Words: euro area, risk-sharing, DSGE, RBC, Bayesian Estimation

JEL codes: E6 C5

Introduction

The euro area (EA) is a monetary union with no precedents in its history (Bordo et al. 2011). The coexistence of one independent and centralized monetary policy and several national fiscal policies proved to work well in normal times, but has revealed its shortcomings during the last economic recession. One of these is the lack of international risk sharing among member countries, namely, the ability to smooth output shocks through income and consumption smoothing.

There are several channels by which countries smooth their income and consumption. First, households are able to insure their income by holding productive assets of another state. The cross-country ownership of productive assets reduces the correlation between households' income and national GDP. We will refer to this channel as capital markets, since the degree of financial markets development strongly affects the functioning of this channel. Second, international fiscal transfers are able to smooth income when they are countercyclical and triggered by country specific shocks. The result of these two income smoothing channels is that cross-country income variability is lower than cross-country output variability. Finally, households and government are able to smooth their consumption over time by saving and borrowing on national and international credit markets. As it is often the case, these three channels[1] (capital markets, international transfers, credit markets) are not be able to absorb the total amount of shocks to GDP and part of the disturbance is transmitted to final consumption (unsmoothed shocks).

[1] For simplicity, as it is common in the literature, in what it follows we will refer to all the three channels as risk sharing channels.

The methodology to analyze and measure cross country risk sharing was developed by Asdrubali, Sorensen and Yosha in 1996 and their results on the US can be used as a benchmark for the euro area. What they found for the period 1981-1990 is that 48% of country specific shocks were smoothed through capital markets, 14% via international transfers and 19% through credit markets, leaving 19% of shocks to GDP unsmoothed[2]. Sorensen and Yosha (1998) use the same methodology for a group of eight European countries finding, for the same period, an 8% of income smoothing through capital markets, 7% via international transfers, 3% through credit markets and 82% of unsmoothed shocks. Afonso and Furceri (2008) repeat the same study on the EMU countries for the period 1995-2009, finding that 11.4% of shocks were absorbed through capital markets, 1.3% by international transfers, 24.7% through credit markets, leaving 64.4% of shocks unsmoothed. In a recent study, Furceri and Zdzienicka (2015) measure the role of risk sharing in the EA, distinguishing between normal times and downturns. What they find is that risk sharing in the euro area is low in normal times and that it falls sharply during severe crisis periods. Given these results, they propose the implementation of an automatic fiscal transfer mechanism in the euro area, able to complement capital and credit markets channels.

Other studies have analyzed risk sharing in the euro area, taking into consideration different periods and groups of countries. Kalemli-Oczan et al. (2013) focus their attention on the recent crisis, with results that are qualitatively similar to the ones of Furceri and Zdzienicka on the aggregate sample. Diverging results emerge, when they split the sample into core and peripheral countries[3]. Prior to the crisis, international factor income had a significant and positive impact for peripheral countries while

[2] See also Melitz and Zumer (2002)

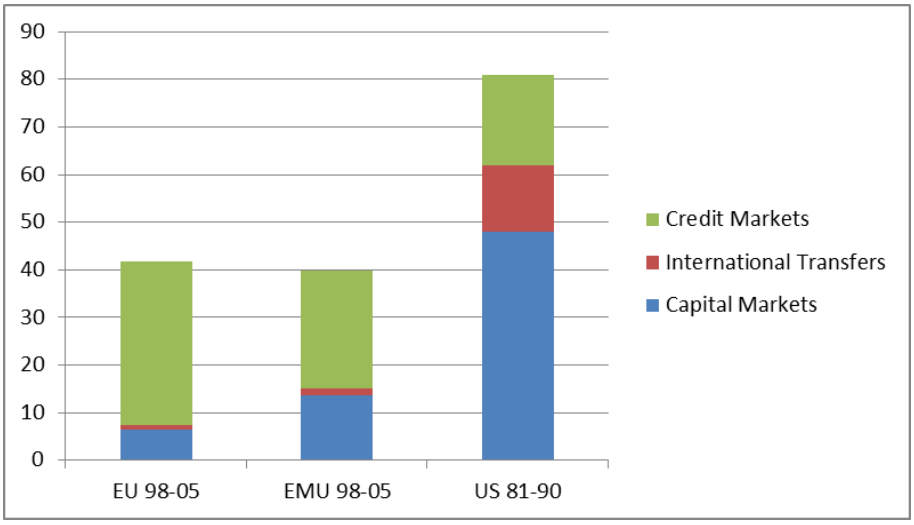
[3] Core: Austria, Belgium, Denmark, Finland, France, Germany, the Netherlands, Sweden, and the United Kingdom. Periphery: Portugal, Ireland, Italy, Greece, and Spain.

the contribution was negative among core countries[4]. The savings channel had a positive and substantial impact on consumption smoothing for both core and peripheral countries, with 60% and 31% of shocks absorbed. The pictures changed during the 'Great Recession' (2008- 2009) with international factor income that smoothed consumption significantly in the core while its impact was negative in the periphery. Savings were the only working channel in the years 2008-2009 for both groups of countries but fell considerably in the periphery after 2009-2010. As expected, international transfers were not significant in the period under analysis.

What the empirical literature suggests is that risk sharing among euro area countries is low compared to other federations; the channel that contributed most to risk sharing is consumption smoothing through savings (credit markets) while in the US capital markets play a predominant role, together with savings and fiscal transfers. International transfers in the US contribute, on average, 15% of risk sharing while they are absent in the euro area. The following graph summarizes the results on risk sharing for the US, European Union, and EMU. The key difference is the role of capital markets, predominant in the US and very low among European countries. International transfers contribute to absorb 15% of shocks in the US while their impact is not significant in Europe. Another interesting point emerging from the studies is the (well known) dependence from credit markets for consumption smoothing in Europe compared to the US.

[4] A negative impact means that a channel amplifies the shocks instead of absorbing them.

Figure 1: Risk Sharing EMU, EU, US



Source: Asdrubali Sorensen and Yosha (1996) for the US; Afonso and Furceri (2008) for EMU and UE

Mechanisms of income insurance and consumption smoothing among households and governments are crucial for the stability of a currency union (Sala-i-Martin and Sachs (1991)). Both market and fiscal mechanisms contribute little to the stabilization of the euro area consumption compared to other currency unions. In this paper we focus our attention on fiscal coordination, trying to assess the impact and optimal size of a fiscal transfer mechanism among euro area countries. In order to achieve this goal we estimate, using Bayesian techniques, a two-country Dynamic Stochastic General Equilibrium Model (DSGE). The model embeds a fiscal transfer mechanism among the governments of the two states, representing euro area core and periphery.

1 A Two-Country Real Business Cycle, DSGE Model

To study the welfare implications of international fiscal transfers in a currency union and to quantify the optimal size of a fiscal transfer mechanism we will make use of a two-country, Real Business Cycle model. The theoretical framework is the one suggested by Baxter and Crucini (1995) and further developed by Kim and Kim (2002); the main departure from the original setup is the introduction of three structural shocks. Our main contribution is a Bayesian estimation of the two-country model, using aggregated data on EA core and periphery[5]. The estimated model is a simplified representation of the euro area currency union, composed of two pseudo-countries: core and periphery. The two economies share part of their fiscal revenues through an automatic fiscal transfer mechanism, following a sharing rule. This latter feature will enable us to analyze the impact of fiscal transfers in a currency union.

1.1 The Model

The original model was developed by Kim and Kim (2002) and represents a world composed of two identical countries that have the same preferences and production technologies. We depart from this setup allowing for differences in the deep parameters of the two economies. In the economy there is a single non-durable tradable good with the role of numeraire. The two countries are composed of a representative household, a representative firm and a government. Households establish the level of consumption, labor, investment and bond holdings, subject to a budget constraint. The government is not explicitly modeled, tax on consumption, labor and capital are collected to finance public expenditure and surplus (deficit) is rebated to households with a lump-sum transfer (tax). Bond

[5] Core Countries: Germany. France, Finland, Belgium, Netherlands, Austria. Peripheral countries: Italy, Greece, Spain, Portugal, Ireland

holdings are subject to adjustment costs as well as investment. There is a single good in the economy and capital movements across countries are allowed. Agents are able to trade only non-contingent bonds in incomplete financial markets.

1.2 Households

Throughout this section we will describe the core economy. We should recall, however, that for each of the following equations, there is an equal equation describing the peripheral economy. In the cases in which peripheral variables are explicitly described, these will be marked with an asterisk. In each period a representative household chooses its level of consumption, leisure, investment and savings maximizing the following expected lifetime utility:

$$E_0 \sum_{t=0}^{\infty} \beta^t U_t, \text{ where } U_t = \chi \frac{[C_t^{\theta}(1-\eta L_t)^{1-\theta}]}{1-\sigma} \quad (1)$$

C_t is consumption, L_t are hours worked. The time endowment is normalized to one and households are able to choose the fraction of time devoted to work. In both countries households have the same discount factor while the utility function differs in the other parameters. The utility to which we refer is a constant relative risk aversion (CRRA) transformation of a Cobb-Douglas function of consumption and leisure. Wealth is the primary determinant of the level of consumption and leisure. In order to obtain a proper estimation, we need to slightly modify the model in order to have shocks related to the observable variables. We depart from Kim and Kim adding two preference shocks. An inter-temporal shock affecting the marginal utility of consumption and leisure χ_t and an intra-temporal shock affecting the disutility of labor η_t. Households are subject to the following budget constraint:

$$(1 + \tau_{ct})C_t + I_t + B_t + \frac{\zeta}{2}(B_t)^2 = (1 - \tau_{lt})w_t L_t + [(1 - \tau_{kt})r_t + \tau_{kt}\delta]K_t + R_{t-1}B_{t-1} + T_t \quad (2)$$

On the left side of the constraint are reported households expenses: consumption, investment, bond accumulated at time t and taxes on consumption τ_{ct}. As previously mentioned, bond holding is subject to adjustment costs that will reduce the ability of households to use this channel. On the right side of the equation, earning coming from wages, rented capital and bond purchased at time $t-1$, where R_t is the gross interest rate on bonds and $r_t$the rental rate. Earnings are reduced by labor and capital taxes while a depreciation allowance reimburses taxes paid on depreciated capital. Finally T_t is the lump-sum transfer (tax), equal to the government budget surplus (deficit). In this setup, $B_t$are the international bonds and denote the net-quantity of purchased bonds irrespective of the issuing country. Interest rates process adjusts to clear the bond market. Households accumulate capital according to the following equation:

$$K_{t+1} = \left[\gamma_t \delta (\frac{I}{\delta})^{1-\phi} + (1 - \delta)K_t^{1-\phi}\right]^{\frac{1}{1-\phi}} \quad (3)$$

ϕ are the adjustment costs on investment that range from zero to one. We depart from the baseline model of Kim and Kim adding an 'investment shock' (γ)affecting the marginal productivity of investments. The introduction of this additional shock enables us to estimate the model using data on investment. We follow Justiniano, Primiceri and Tambalotti (2009) assuming that this shock might arise from technological factors specific to the production investment goods or from disturbances to the process by which these investment goods are turned into productive capital. We do not take an explicit position on the ultimate source of the disturbances. Finally a No-Ponzi-Game condition is imposed on the households borrowing.

1.3 Firms

The production function is a standard Cobb-Douglas with labor and capital.

$$Y_t = A_t L_t^{\alpha} K_t^{1-\alpha} \quad (4)$$

Labor is not mobile across countries while capital is fully mobile, meaning that domestic investments can be financed by foreign households.

1.4 Equilibrium

Labor market equilibrium is achieved using the same notation L_t for labor demand and supply while domestic equilibrium is achieved following households and firms optimization. Government behavior is implicitly considered having inserted its budget constraint in the household's. Taking into consideration the transfer mechanism, the budget constraint becomes:

$$Y_t + R_{t-1} + B_{t-1} = C_t + I_t + G_t + B_t + k\frac{X_t - X_t^*}{2} \quad (5)$$

Bond market-clearing establishes that bonds are always in zero-net supply given the changes on bonds interest rate.

$$B_t + B_t^* = 0 \quad (6)$$

By the Walras law, equilibrium condition for bond market leads to the goods market equilibrium:

$$(Y_t - C_t - I_t - G_t) + (Y_t^* - C_t^* - I_t^* - G_t^*) = 0 \quad (7)$$

Shocks dynamics and steady state relations are discussed in the appendix.

1.5 Fiscal Transfers

The two countries share part of their fiscal revenues through a risk sharing mechanism based on an ex-ante agreement. If one of the two countries is affected by a negative (idiosyncratic) shock it will receive a fiscal transfer from the other economy, with the result of higher synchronization in the business cycles. Fiscal transfers between the two economies will be triggered each time a shock alters the steady state equilibrium of government finances. The amount of transfers depends on a sharing parameter. When such agreement is in place, the Government budget constraint is the following:

$$\tau_{ct}C_t + \tau_{lt}w_tL_t + \tau_{kt}(r_{t-\delta})K_t + \frac{\zeta}{2}(B_t)^2 = G_t + X_t \quad (8)$$

The left side of the equation shows government earnings coming from taxes and from bond holding costs, assumed to be owned by government. The right side of the equation outlines government spending G_t and budget surplus or deficit X_t. Holding taxes and government spending fixed, X_t is positive when government earnings (left side of the equations) are higher than government spending. The two governments share part of their fiscal revenues on the basis of the following sharing agreement:

$$T_t = (1-k)X_t + k\frac{X_t + X_t^*}{2}$$

$$T_t^* = (1-k)X_t^* + k\frac{X_t + X_t^*}{2} \quad (9)$$

The degree to which fiscal resources are shared is ruled by the parameter κ. When $k = 0$ transfers to households (possibly negative) are equal to national government surplus or deficit $T_t = X_t$. When $k > 0$ transfers to households will depend on the sharing agreement. Transfers from one economy to the other are functions of country-specific surplus and deficit. The following table shows transfers for

different values of k, in three different scenarios. In the first case both countries have a budget surplus, in the second they both face a deficit and in the third, the core country faces a surplus while the periphery runs a deficit. In all three cases, the core economy has a better balance. X and $X^*$are core and periphery surplus-deficit, T is gross transfer, k is the sharing parameter while $T_{net} = T - X$, are transfers net of initial budget position. In the first case under analysis, both countries register a surplus; when $k = 1$, surplus is equally shared among countries, with a negative net-transfer from the core country and a positive net-transfer for the periphery. The two extremes are the cases with no sharing and $k = 2$; in the latter case, the surplus of the two countries simply shift from one economy to the other. In the second case, both countries have a deficit and the results are symmetrical to the first. The last case is the most interesting. When a country faces a surplus and the other a deficit, resources are shifted from the first to the second economy. In the case of $k = 1$, income is perfectly shared amongst the two economies, with negative net transfer for the economy in surplus. As in the previous case, when $k = 2$ the two countries fiscal positions are inverted, with a negative fiscal transfer of 150 for the core. In this case the core fiscal surplus is not enough to finance the transfer and core's agents will face a negative transfer (tax) in order to finance the fiscal mechanism. We should think of this mechanism as an insurance system in which the two economies agree to help each other in case of need. If shocks are random, in the long-run, each of the two countries will benefit from the insurance agreement. We do not bind the level of k, however, we interpret a level of k greater than 2 as not economically feasible. Additional information on the model can be found in the appendix and in the paper of Kim and Kim.

Table 1: Fiscal Transfer Mechanism

X	X^*	T	T^*	k	T_{net}	T^*_{net}

100	50	100	50	0	0	0
100	50	75	75	1	-25,00	25,00
100	50	62,50	87,50	1,5	-37,50	37,50
100	50	50	100	2	-50	50
100	50	37,5	112,5	2,5	-62,5	62,5
-50	-100	-50	-100	0	0	0
-50	-100	-75	-75	1	-25	25
-50	-100	-87,5	-62,5	1,5	-37,5	37,5
-50	-100	-100	-50	2	-50	50
-50	-100	-112,5	-37,5	2,5	-62,5	62,5
100	-50	100	-50	0	0	0
100	-50	25	25	1	-75	75
100	-50	-12,5	62,5	1,5	-112,5	112,5
100	-50	-50	100	2	-150	150
100	-50	-87,5	137,5	2,5	-187,5	187,5

The model outlined has strong connections with the empirical literature reported in the introduction. Exogenous (productivity) shocks hit the output in the two economies; agents smooth their final consumption through cross-border investments and adjusting their consumption over time through credit markets. Fiscal transfers contribute to the level of risk sharing, absorbing part of the country-specific shocks. In what it follows we will focus our attention on fiscal transfers, trying to estimate the value of k delivering an optimal degree of risk sharing in the aggregate economy.

The paper by Furceri and Zdzienicka mentioned in the introduction, shows that the functioning of market risk sharing channels in the euro area declines during periods of economic downturn, suggesting a non-linear relation between shocks and risk sharing channels. However, the study by Kalemli-Oczan et al. for the period 2008-2009 does not confirm this thesis, with an increase and stable role of credit markets for core countries during and right after the 'Great Recession'. It is likely that the nature of shock has an impact on the functioning of the different channels, as well as it is possible that different risk sharing channels are better fit to deal with different kind of shocks. However, given that empirical results are not yet conclusive on this issue, we do not attempt to modify the model to account for the different nature and sign of the shocks.

2 Model Estimation and Simulations

2.1 Observable Variables and Measurement Equations

We aggregate data for different European countries in two groups representing EA core and peripheral countries. We define core countries as those member states that were not affected by the sovereign debt crisis, measured as the sharp increase in public bonds interest rates after 2009. Core is composed of Belgium, Germany, Austria, France and Netherlands. Periphery is composed of Portugal, Spain, Greece, Italy and Ireland. The aggregation is done by weighting for real GDP of each country in the group. The observations are quarterly data for the period 1999:1 - 2013:4. We use aggregate time series on real GDP per capita, investment on GDP, wages, hours-worked, public surplus-deficit, and long term interest rates. To each of these variables correspond two time series: one for the core and one for the periphery, with the exception of interest rates that refers to an average of 10 years sovereign bonds

real interest rates for both countries. Unfortunately, no data is available on hours worked and we use employment as a substitute as it is common in the literature.

Summarizing, the model is estimated on a total of eleven time series: log differences of output, investment and wages: $\Delta y^{obs}, \Delta y^{*\,obs}, \Delta i^{obs}, \Delta i^{*\,obs}, \Delta w^{obs}, \Delta w^{*\,obs}$ and observations for surplus, hours worked and interest rates: $s^{*\,obs}, s^{obs}, l^{obs}, l^{*\,obs}, rb^{obs}$. The series on GDP, wages and investment are log-differentiated and the sample mean removed using proper measurement equations. Following Tancioni and Beqiraj (2014) in order to respect the assumption of a balanced growth pact, we build measurement equations that remove positive-negative excess trends with respect to the steady state output growth rate μ. In order to obtain hours worked from the employment time series we use a one sided HP filter. Data on surplus-deficit is percentage of GDP; we assume a stationary dynamic around a balanced budget for fiscal finances, thus no data transformation is needed. Annualized quarterly data on interest rates is treated using the following transformation, in order to obtain stationary and scaled quarterly data. Assuming a sample mean equal to the variable steady state, we obtain a stationary cycle that does not need further measurement transformations.

$$rb_t^{obs} = \log\left(1 + \frac{rb_t^{data}}{400}\right) - mean(\log\left(1 + \frac{rb_t^{data}}{400}\right)) \quad (10)$$

Given the observed variables and relative transformations, we set the following measurement equations, linking the observable variables to the states of the model.

$$\begin{bmatrix} \Delta y^{obs} \\ \Delta i^{obs} \\ \Delta w^{obs} \\ l^{obs} \\ s^{obs} \\ rb^{obs} \end{bmatrix} = \begin{bmatrix} \tilde{y}_t - \tilde{y}_{t-1} + \log(\mu) \\ \tilde{\imath}_t - \tilde{\imath}_{t-1} + \log(\mu) + \log(\mu_{iy}) \\ \tilde{w}_t - \tilde{w}_{t-1} + \log(\mu) + \log(\mu_{wy}) \\ \tilde{l} \\ \tilde{s} \\ \tilde{r} + \epsilon^{me} \end{bmatrix} \quad (11)$$

With the exception of interest rates (common to the two countries), measurement equations refer to core and periphery variables for a total of eleven measurement equations. $\log \mu_{wy}$ and $\log \mu_{iy}$ are excess trend of the observed variable with respect to real per capita output growth rate. We estimate the model using ten structural shocks while a measurement error ε^{me} is added to the interest rate measurement equation to avoid singularity.

2.2 Calibrated Parameters

As it is common in the literature, some of the parameters are calibrated; in the context of a Bayesian estimation these can be seen as strict priors. Parameters are calibrated on euro area quarterly frequencies while the original model of Kim and Kim was calibrated on US yearly data. The discount factor is calibrated to match a quarterly steady state gross real interest rate equal to 1.01. The autoregressive parameter related to inter-temporal shocks (ρ^{χ}) result to be not identified and we calibrate it at the standard value of 0.75. Depreciation δ and labor share α are set following Smets and Wouter (2003). The following table summarizes the calibrated parameter values, common to the two economies.

Table 2: Calibrated Parameters

Parameter	Value
β	0.99
δ	0.02
α	0.70
ρ^{χ}	0.75

Calibrated parameters have the same values for core and periphery.

2.3 Estimated parameters

Before moving onto the structural parameters estimation, we need to set the prior distributions. For elasticity, persistence and standard error we follow Smets and Wouters (2003, 2007). Elasticity is defined on the positive domain, however with a mean equal to 2 the Normal distribution is in line with the estimation and in our case performs better than other options. A standard Beta distribution is set for all the autoregressive parameters with mean 0.5 and variance 0.15, while an Inverse Gamma with mean 0.01 and variance 2 is used for standard errors. We set relatively narrow distributions for the parameters of market activities share θ and investment adjustment costs ψ to be in line with the relevant literature, suggesting a time devoted to leisure equal to 2/3 and adjustment costs close to 0.3. The following table summarizes prior distributions setting[6]:

Table 3: Prior Distributions

		Domain	Distribution	Mean	Variance
σ	CRRA	$\mathbb{R}+$	Normal	2	0.4
θ	Market Activities Share	[0,1]	Beta	0.3	0.05
ψ	Investment Adj. Costs	[0,1]	Normal	0.2	0.1
ρ^a	TFP	[0,1]	Beta	0.5	0.15
ρ^η	Intratemporal Shock	[0,1]	Beta	0.5	0.15
ρ^g	Governnment	[0,1]	Beta	0.5	0.15
ε^a	TFP	$\mathbb{R}+$	Inv. Gamma	0.010	2
ε^η	Intratemporal Shock	$\mathbb{R}+$	Inv. Gamma	0.010	2
ε^χ	Intertemporal Shock	$\mathbb{R}+$	Inv. Gamma	0.010	2
ε^g	Governnment	$\mathbb{R}+$	Inv. Gamma	0.010	2
ε^γ	Investment Shock	$\mathbb{R}+$	Inv. Gamma	0.010	2
ε^{me}	Measurement Error	$\mathbb{R}+$	Inv. Gamma	0.010	2

[6] For each parameter in the table there exists a corresponding parameter for the periphery with same prior distribution.

2.4 Bayesian Estimation Results

Transition and measurement equations of our model are linear and the shocks are assumed to be normally distributed. We can thus valuate the likelihood function through the Kalman Filter. To obtain the derivation of the posterior distribution mode we use the "cmsinwel" algorithm developed by C. Sims. Graphics diagnostics of the modes calculation are reported in the appendix. The derivation of the posterior density is obtained through the implementation of the Metropolis-Hastings algorithm. We run the M-H algorithm with two chains and 250.000 iterations. Diagnostics graphs are reported in the appendix. The following table shows the estimation results.

Table 4: Posterior Distributions

	mode	std	10%	mean	90%
σ	2.1845	0.3817	1.5948	2.2151	2.8406
σ^*	2.6546	0.3529	2.0693	2.6613	3.2092
θ	0.2534	0.2534	0.1726	0.2598	0.3474
θ^*	0.3687	0.3687	0.2798	0.3708	0.4601
ψ	0.4798	0.4798	0.3925	0.4850	0.5737
ψ^*	0.3083	0.3083	0.2459	0.3178	0.3937
ρ^a	0.9578	0.0155	0.9290	0.9544	0.9798
ρ^{a*}	0.9048	0.0351	0.8334	0.8937	0.9562
ρ^η	0.9094	0.0255	0.8645	0.9066	0.9483
$\rho^{\eta*}$	0.9463	0.0164	0.9166	0.9436	0.9702
ρ^g	0.9337	0.0181	0.9003	0.9309	0.9613
ρ^{g*}	0.9521	0.0166	0.9177	0.9465	0.9767
ε^a	0.0038	0.0004	0.0033	0.004	0.0047
ε^{a*}	0.0040	0.0004	0.0034	0.0041	0.0047
ε^η	0.0054	0.0007	0.0044	0.0056	0.0067
$\varepsilon^{\eta*}$	0.0080	0.0009	0.0067	0.0083	0.0098
ε^χ	0.0372	0.0048	0.0297	0.0383	0.0461
$\varepsilon^{\chi*}$	0.0649	0.0072	0.0547	0.0671	0.0791
ε^g	0.0088	0.0009	0.0074	0.0090	0.0106
ε^{g*}	0.0077	0.0008	0.0066	0.0079	0.0093
ε^γ	0.0038	0.0011	0.0025	0.0043	0.0061
$\varepsilon^{\gamma*}$	0.0040	0.0009	0.0026	0.0042	0.0057
ε^{me}	0.0048	0.0005	0.0040	0.0049	0.0058

The results of the main parameters are consistent with the relevant literature and in line with the calibrated model of Kim and Kim. Table 5 compares our estimated parameters with the ones calibrated by Kim and Kim. In their model the two economies are symmetric while we allow for divergences in the two economies, thus estimating two values per each parameter, corresponding to core and periphery. The parameter σ represents the household's coefficient of relative risk aversion, in the calibrated model, it is set to 2, in line with empirical estimates. Our estimations are higher, but still in an acceptable range. A higher risk aversion coefficient is found for households in the euro area periphery with respect to core countries. Empirical findings suggest that 2/3 of time is devoted to market activities and a value of 0.3 is set in the calibrated model. Our estimations are not far from empirical findings, with an average value for the two economies close to 0.3. Households in the periphery devote a higher amount of time to market activities compared to core and this could be explained by the lower productivity. Investment adjustment costs ψ in the calibrated model are set to match the volatility of investment for US data. Our estimates for the euro area are higher, in particular for the core countries. This is coherent with the investment data in our sample, with a higher variability for peripheral countries compared to core. After the beginning of the financial crisis, investment in the periphery slowed down while it continued to follow the historical trend in the core.

Table 5: Calibrated and Estimated Parameters

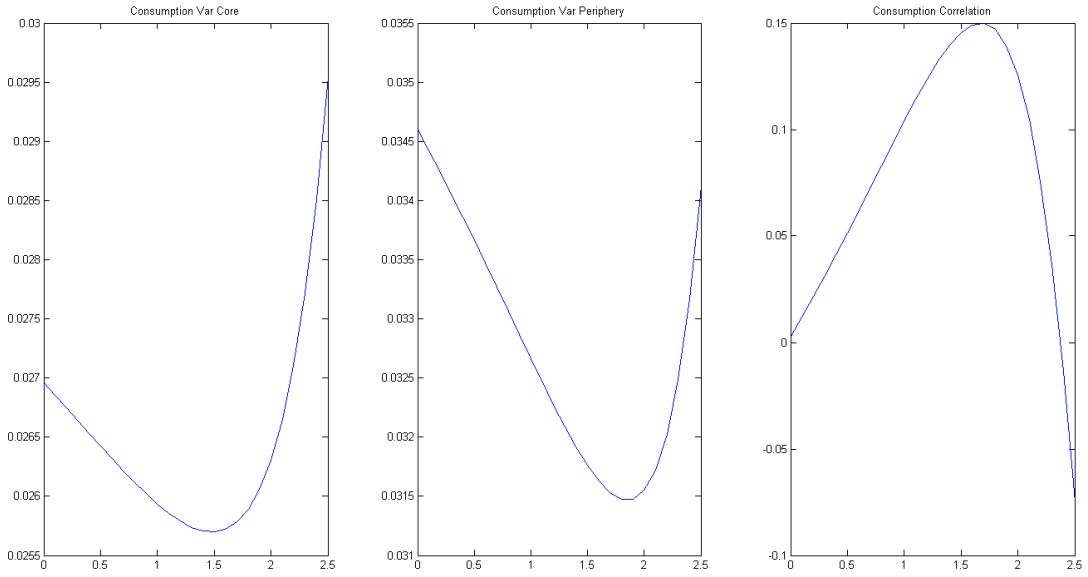
	Variable	Kim and Kim (2002) - Calibrated on US data	Estimated Parameters for EA Core and Periphery
σ	CRRA	2	2.22
σ^*			2.66
θ	Market Activities Share	0.3	0.26
θ^*			0.37
ψ	Investment Adj. Costs	0.2	0.49
ψ^*			0.32

2.5 Model Simulations

We are now in the position to simulate the model with the estimated parameters obtained through the Bayesian estimation. First, we need to find the optimal value for the sharing parameter k. To do this we simulate our model for different levels of k, and analyse consumption variability, and consumption correlation across the two countries. We are looking for the value of k that minimizes national consumption variability and maximizes the cross-country correlation of consumption among the two countries, as this is the point that maximizes aggregate welfare in the economy[7]. Table 2.1 shows consumption variability and correlation, generated by simulating the estimated model for different values of k. Increasing values for k are reported on the horizontal axis. As shown in the graphs, increasing values for the risk sharing parameters allow a reduction in the consumption variability and an increase in the cross country correlation of consumption. The maximum cross-country risk sharing is achieved for values of k close to 1,5 in the core country and 1.8 in the periphery. Maximum consumption correlation is achieved for level of k equal to 1.7. Taking an average of the first two results and combining it with the correlation, we can conclude that an optimal fiscal transfer mechanism should have a share parameter close to 1.7, the degree of fiscal sharing that maximizes aggregate welfare in the economy under the model parameterization.

[7] Kim and Kim (2002) perform an analytical welfare analysis to find the value for k that maximizes aggregate welfare in the economy. It is possible to show that maximum welfare is achieved at the point where consumption variability is minimized and cross country correlation of consumption maximized.

Figure 2: Consumption Variability and Correlation



The Impulse Response Functions (IRFs) in Figure 3 and Figure 4 show the dynamic response to a one-percent shock on productivity in the core country. The simulation is done in the two cases of unrestricted and restricted international borrowing, represented by low and high bond holding costs. We simulate the model in the two cases of no risk sharing k = 0 and optimal fiscal sharing k = 1.7. Figure 3 shows the IRFs following a one percent productivity shock in the core country, for the case of unrestricted borrowing ($\zeta = 0.001$). After a positive productivity shock, agents produce and consume more, exploiting the persistent but temporary shock. Capital is fully mobile across countries and is shifted from the periphery towards the more productive economy. Core investment increases, dampened by the investment adjustment costs. Agents in the core face an increase in output and consumption and smooth their spending accumulating bond over time. Peripheral agents are able to slightly increase their consumption by increasing their stock of debt over time. They know that shocks are random and temporary thus they found optimal to increase their stock of debt in view of future positive shocks in their economy. In the case of optimal fiscal sharing ($k = 1.7$) agents in the core

produce more and consume less, sharing part of their revenues with periphery through the risk sharing mechanism. In the case of a country specific positive shock to productivity (as showed in Figure 3) the country positively affected shares part of its income with the other economy. As we can see from the graphs on transfers, core country agents face a negative transfer while, symmetrically, periphery agents receive a positive inflow of income. It is clear from the IRF on bond that the fiscal transfer mechanism substitutes the credit channel. Kim and Kim show that when international borrowing is not constrained, fiscal transfers reduce the welfare in the economy. Consumption smoothing is already in place and fiscal transfers have a distortionary effect.

Figure 3: IRFs 1% Productivity Shock in the Core - Unrestricted Borrowing

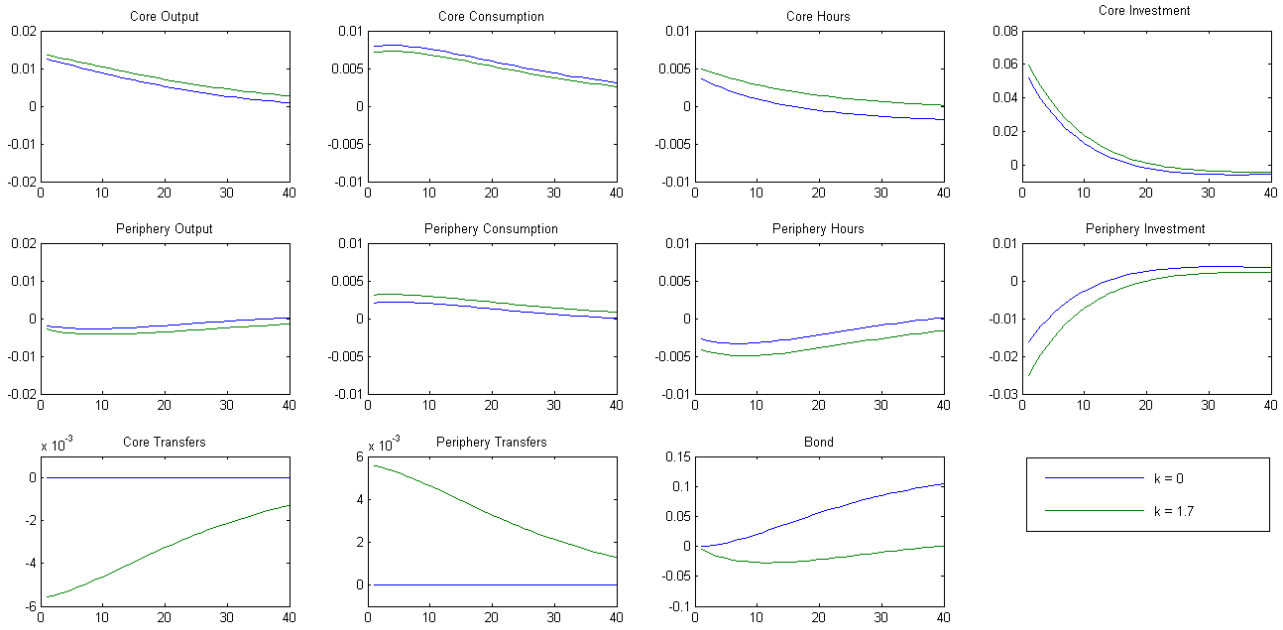
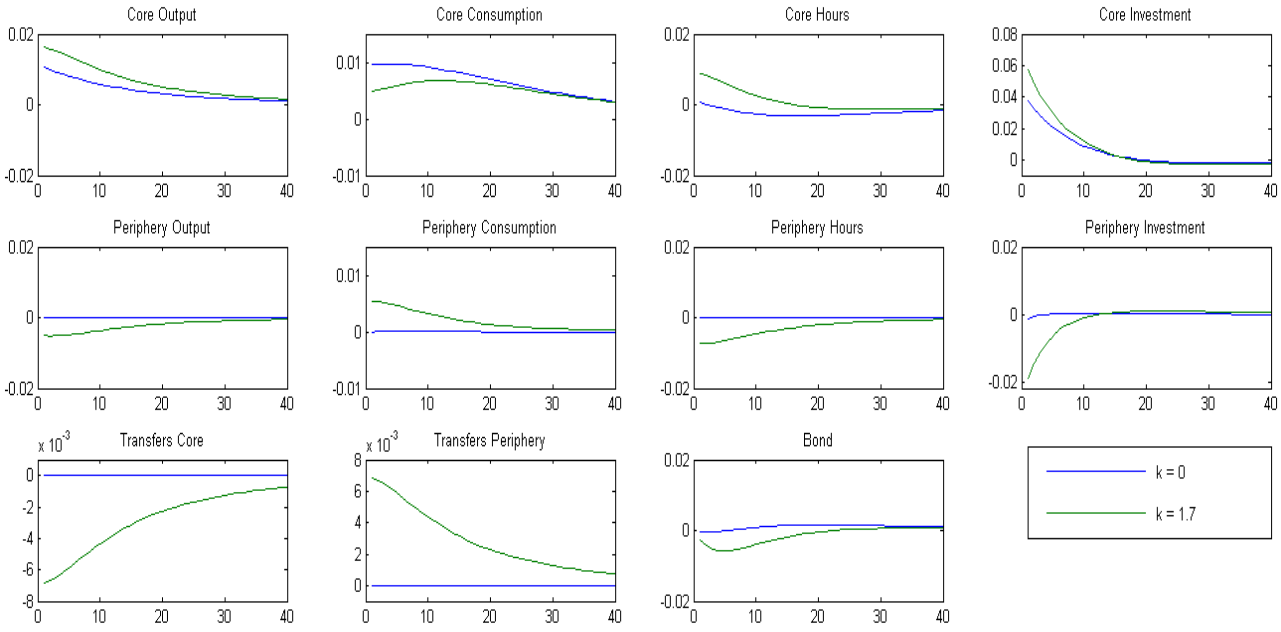


Figure 4 shows the IRFs for the case of high bond holding costs ($\zeta = 0.1$), where borrowing is restricted. As expected, the bond channel is not exploited, given the high bond holding costs, agents are not able to use the credit channel to smooth their consumption over time. We start with the case of no revenue sharing $k = 0$. Core dynamics for output, consumption and investment are qualitatively similar to the previous case. However, we note that in this case output and investment respond less

and consumption responds more to the productivity shock, while labor is reduced on impact. The reason is that agents are not able to exploit the consumption smoothing channel and tend to consume more in the present. IRFs for periphery do not react to the positive productivity shock in the core, since there are no transmission channels among the two economies[8]. If we move to the case of optimal fiscal sharing $k = 1.7$, IRFs for the core country move to a pattern similar to the one of unrestricted borrowing. When the sharing system is in place, core agents optimally decide to work and produce more, while consumption is lower. The increase in domestic income is shared to periphery through fiscal transfers, and this allows an increase of consumption for peripheral households. Hours worked, output and investment decrease in the periphery. The reason is that with fiscal transfers in place, it is optimal to produce more in the country affected by the productivity shock and share income with the other country that will thus enjoy increased consumption. In this setup, fiscal transfers are welfare improving, since the revenue sharing allows consumption smoothing when the borrowing channel is constrained.

[8] Shocks among the two countries are assumed to be uncorrelated

Figure 4 : IRFs 1% Productivity Shock in the Core - Restricted Borrowing



According to the empirical findings outlined in the first section, international risk sharing through markets is low in the euro area, in particular risk sharing through cross country ownership of productive assets (capital investments). For this reason we believe the setup that better represents the euro area is the one with high bond holding costs where borrowing is constrained. We are aware that this is an extreme case and will treat the results as such. As we can see in Figure 4, a one percent productivity shock in the core triggers a fiscal transfer to the periphery equal to 0.7% of GDP when k is set at its optimal value of 1.7. The same is true for a negative productivity shock that would trigger a transfer equal to 0.7% of GDP towards the core. Given the model structure and parameterization, the optimal amount of resources shifted from one economy to the other in the case of an idiosyncratic shock should be equal to 70% of the disturbance. This means that a one percent positive productivity shock should trigger a negative transfer from the affected country close to 0,7% of its GDP. On the contrary, a one percent negative productivity shock would entail a transfer to the affected economy equal to 0,7% of its GDP. An automatic optimal fiscal transfer mechanism should embed this result.

Conclusions

The share of idiosyncratic shocks smoothed in the euro area is low compared to other similar institutions and this leaves the currency union subject to asymmetric shocks and strong divergences among member countries. To fill this gap, in line with other studies, we propose the institution of a countercyclical fiscal transfer mechanism: an inter-state insurance fund able to improve international risk sharing. The system is able to narrow business cycles' heterogeneity among euro area member countries, thanks to temporary and random redistribution of fiscal resources, triggered by asymmetric shocks.

To study the impact that such a mechanism would have on the euro area and to find out the optimal size that such a mechanism should have, we performed a Bayesian estimation of a two- country, Real Business Cycle, DSGE model, in which economies agree to share part of their income through a fiscal transfer mechanism. The estimation was carried out using data from eleven euro area economies, aggregated in two groups: core and periphery, weighting for the relative size of each economy in the relative group. The estimation underlined the structural differences among core and peripheral EA countries and gave us the following results: a fiscal transfer mechanism is able to reduce consumption variability and increase international risk sharing in a world represented by two countries, rational agents, flexible prices and a credit market restrained to non-contingent bonds.

Having simulated the model using the parameters obtained through the Bayesian estimation, we found that an optimal risk sharing mechanism should smooth 70% of idiosyncratic shocks, when the access of

agents to the credit markets is constrained. This means that a one percent negative country-specific shock should trigger a positive transfer to the affected economy close to 0.7% of its Gross Domestic Product. This figure has to be seen as an extreme case, where agents are not able to smooth consumption through financial markets. Empirical studies suggest that part of the country specific shock in the euro area are absorbed through credit markets and likely in the future a greater fraction of shocks will be absorbed through capital markets, reducing the size of optimal fiscal transfers.

The setup of an effective and politically feasible fiscal transfer mechanism should take into consideration the nature, persistence and magnitude of the shocks, as well as the distribution of the disturbances across countries. It is out of the scope of this study to discuss the actual features of the sharing mechanism. However, as suggested by precedent studies, a fiscal transfer mechanism should be simple, automatic and should not lead to unidirectional or permanent transfers. Allard et al. (2013) examine which countries of the euro area would have benefitted from a hypothetical fiscal transfer mechanism in place since 1980. What they find is that all EA countries would have been beneficiaries at a certain point in time, with national costs that tend to zero in the long run. This is a crucial finding, because it shows that all the EA countries would benefit from an automatic fiscal transfer mechanism. Moreover, a fiscal transfer mechanism would reduce the spillover effects of negative shocks, reducing the systemic risk associated with large country specific shocks. Finally, a fiscal transfer mechanism would contribute to the synchronization of business cycles of euro area countries, facilitating the role of the centralized monetary policy.

Several questions remain unanswered. The model outlined in this study could be extended in several ways to better describe the market risk sharing mechanisms, the interaction between channels and the effects of the monetary policy on risk sharing. For instance, in a New Keynesian framework it would be

possible to study the interaction between monetary policy and risk sharing and to test the hypothesis that better functioning risk sharing channels contribute to monetary policy objectives. A more detailed model of credit and capital markets frictions would allow the analysis of the interaction among different risk sharing channels.

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3 Appendix

3.1.1

3.1.2 Shocks

As in Kim and Kim (2002) productivity in the two countries follows a vector Markov process:

$$\begin{bmatrix}\log(A_t)\\ \log(A_t^*)\end{bmatrix} = \begin{bmatrix}\rho_a & \upsilon_a\\ \upsilon_a & \rho_a\end{bmatrix}\begin{bmatrix}\log(A_{t-1})\\ \log(A_{t-1}^*)\end{bmatrix} + \begin{bmatrix}\varepsilon_{A_t}\\ \varepsilon_{A_t}^*\end{bmatrix}$$

where $E(\varepsilon_{A_t}) = (\varepsilon_{A_t}^*) = 0\ and\ E(\varepsilon_{A_t}^2) = E(\varepsilon_{A_t}^{*2}) = \sigma_{\varepsilon_{A_t}}^2$, and $\rho(\varepsilon_{A_t}, \varepsilon_{A_t}) = \psi_A$. ν_A are the spillover effects, namely the degree of transmission of productivity from one country to another with one period lag.

Tax rates on consumptionτ_{kc} , capital τ_k and labor τ_l follow a stationary stochastic autoregressive process of order one.

$$\tau = \rho\tau_{t-1} + (1-\rho)\bar{t} + \varepsilon_t$$

Where $\bar{t}$ is the steady- state tax rate and ε_t follows a normal distribution with mean 0 and variance σ_ε^2.

3.1.3 Steady State Relations

$$B = 0$$

$$R\beta = 1$$

$$I/K = \delta$$

$$\frac{K}{Y} = \frac{\beta(1 - \alpha)(1 - \tau_k)}{1 - \beta(1 - \delta(1 - \tau_k))}$$

$$r = (1 - \alpha)\left(\frac{K}{Y}\right)^{-1}$$

$$\frac{X}{Y} = \tau_C \frac{C}{Y} + \alpha\tau_l + (1-\alpha)\tau_k - \delta\tau_k \frac{K}{Y} - \frac{G}{Y}$$

$$\frac{L}{1-L} = \frac{\alpha\theta}{1-\theta}\left(\frac{C}{Y}\right)^{-1} \frac{1-\tau_l}{1+\tau_c}$$

Moreover

$$\frac{G}{Y} = 0.375$$

$$\frac{G^*}{Y^*} = 0.375$$

3.1.4 Linearized Equations

3.2

$$0 = \widehat{U_t} - \hat{\chi}_t\theta(1-\sigma)\hat{C}_t + (1-\theta)(1-\sigma)\frac{L}{1-L}\hat{L}_t + (1-\theta)(1-\sigma)\frac{L}{1-l}\hat{\eta}_t$$

$$0 = \hat{Y}_t - \hat{A}_t - \alpha\hat{L}_t - (1-\alpha)\hat{K}_t$$

$$0=\hat{L}_t + \hat{C}_t + \frac{1}{1+\tau_c}\hat{t}_{ct} - \hat{U}_t$$

$$0=\hat{\lambda}_t + w_t - \frac{L}{1-L}\hat{L}_t - \frac{L}{1-L}\hat{\eta}_t - \frac{L}{1-L}\hat{\tau}_{lt} - \hat{U}_t + \hat{\eta}_t$$

$$0= \hat{K}_{t+1} - \frac{\delta}{1-\delta}\hat{\gamma}_t - (1-\delta)\hat{K}_t - \delta\hat{I}_t$$

$$0=\hat{\lambda}_{t+1} - \hat{\lambda}_t - (\gamma Y)\hat{B}_t + \hat{R}_t$$

$$0=\hat{G}_t + \hat{X}_t - \tau_c\frac{C}{Y}\hat{C}_t - (\alpha\tau_l + (1-\alpha)\tau_k)\hat{Y}_t + \tau_k\delta\frac{K}{Y}\hat{K}_t - \frac{C}{Y}\hat{C}_t - \alpha\tau_{lt} - (r-\delta)\frac{K}{Y}\hat{\tau}_{kt}$$

$$0=\hat{Y}_t - \frac{C}{Y}\hat{C}_t - \frac{I}{Y}\hat{I}_t - \hat{G}_t - \hat{B}_t + R\hat{B}_{t-1} - \frac{k}{2}\left[\hat{X}_t - \left(\frac{Y^*}{Y}\right)\hat{X}_t\right]$$

$$0=\hat{Y}_t - \hat{w}_t - \hat{L}_t$$

$$0= \hat{Y}_t - \hat{r}_t - \hat{K}_t$$

$$0= \hat{\lambda}_t - \hat{\gamma}_t - \hat{\mu}_t + \phi(1-\delta)\left(\hat{I}_t - \hat{K}_t\right) - \frac{\delta\phi}{1-\phi}\hat{\gamma}_t$$

$$0=\hat{\mu}_t - \beta\phi(1-\delta)\left(\hat{I}_{t+1} - \hat{K}_{t+1}\right) - \hat{\lambda}_{t+1} - \left[1-\beta\left(1-\delta(1-\tau_k)\right)\right]\hat{r}_{t+1} + \beta(r-\delta)\hat{\tau}_{k,t+1} - \beta(1-\delta)\hat{\gamma}_{t+1}$$

Where:

$$\hat{\tau}_t = \tau_t - \tau$$

$$\hat{X}_t = \frac{X_t - X}{Y}$$

$$\hat{G}_t = \frac{G_t - G}{Y}$$

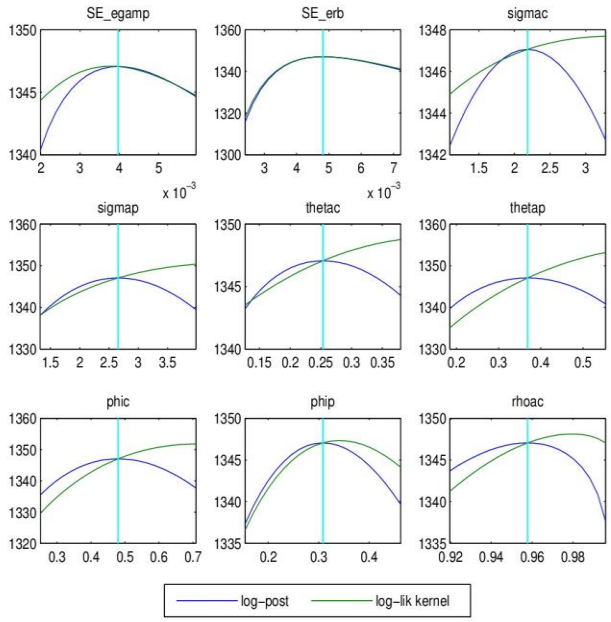
$$\hat{B}_t = \frac{B_t}{Y}$$

A set of corresponding equations exists for periphery.

World resource constraint:

$$0=\left[\hat{Y}_t - \frac{C}{Y}\hat{C}_t - \frac{I}{Y} - G_t\right] + \frac{Y^*}{Y}\left[\hat{Y}_t^* - \frac{C^*}{Y^*}\hat{C}_t^* - \frac{I^*}{Y^*}\hat{I}_t - \hat{G}_t^*\right]$$

Figure 5 Bayesian Estimation, Mode Graphical Diagnostic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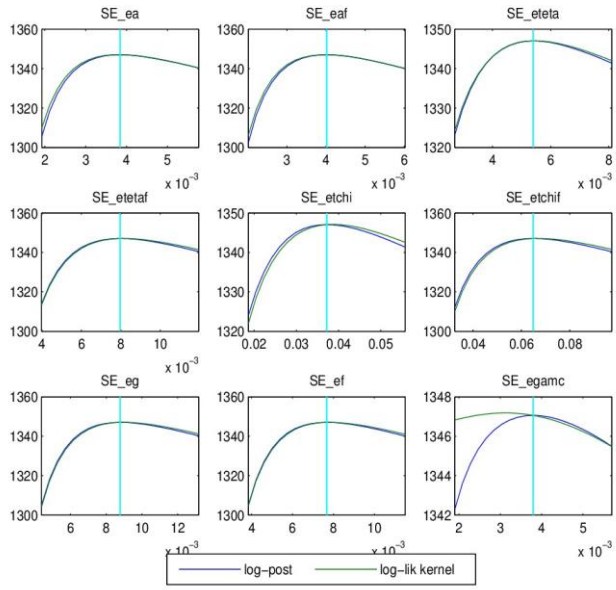
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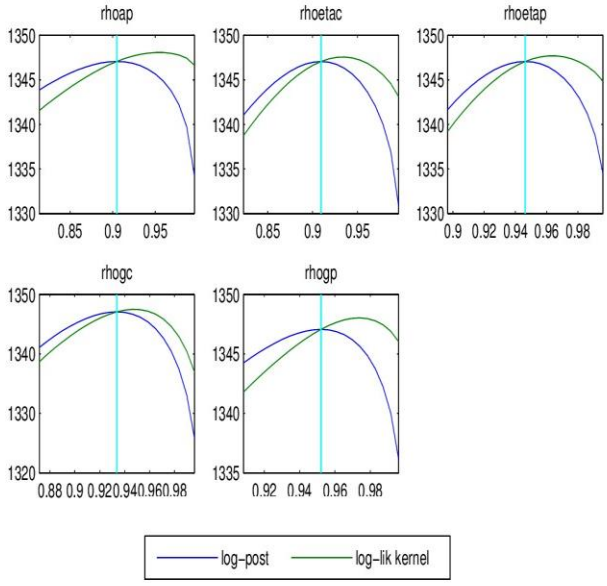
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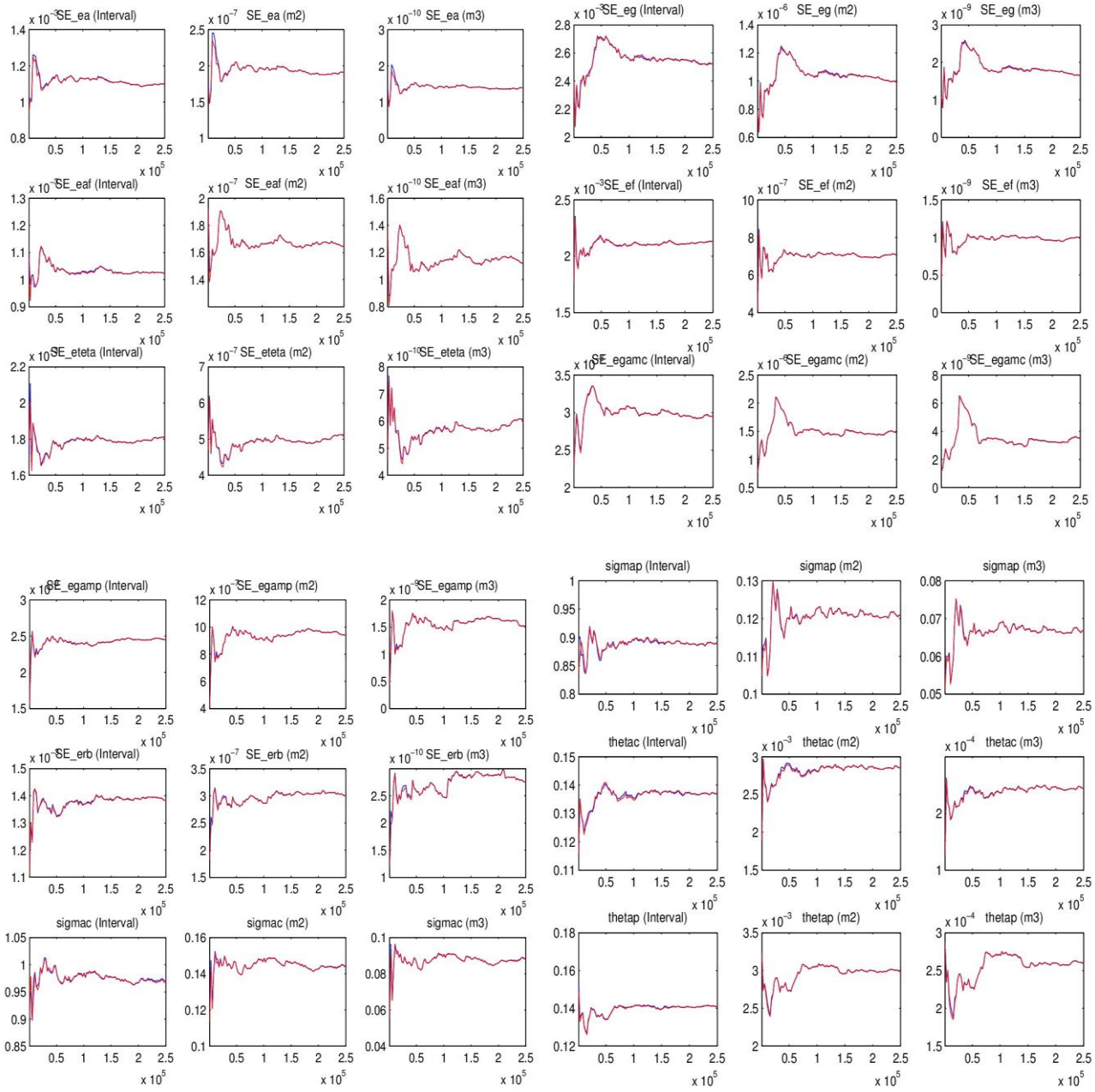
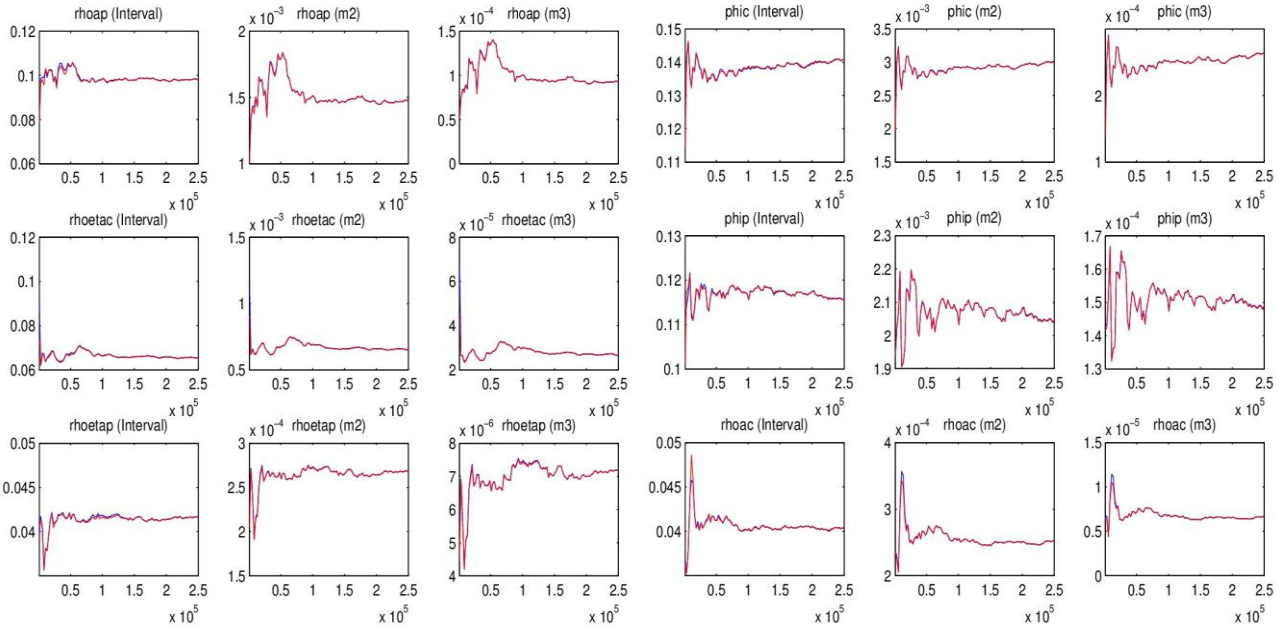
Figure 6 Bayesian Estimation - Convergence Diagnostic




rhoap (Interval)
x 10^-3 rhoap (m2)
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phic (Interval)
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rhoetac (Interval)
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x 10^-3 phip (m2)
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rhoetap (Interval)
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x 10^-5 rhoac (m3)
x 10^5

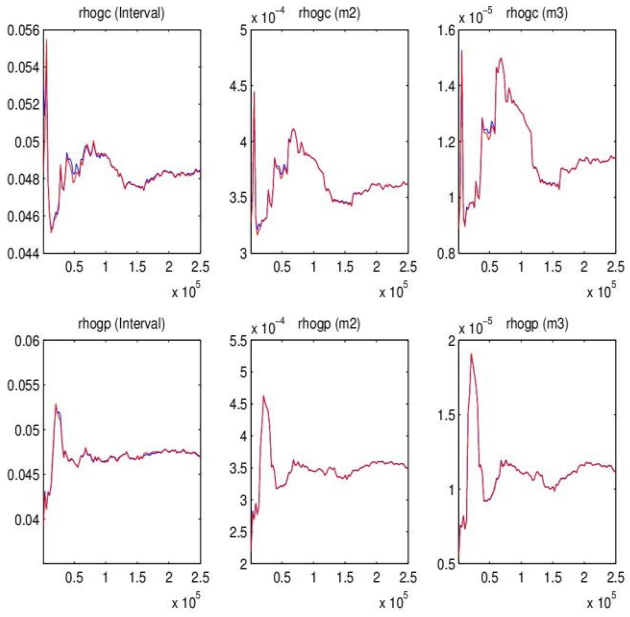
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Figure 7 Bayesian Estimation, Priors and Posteriors

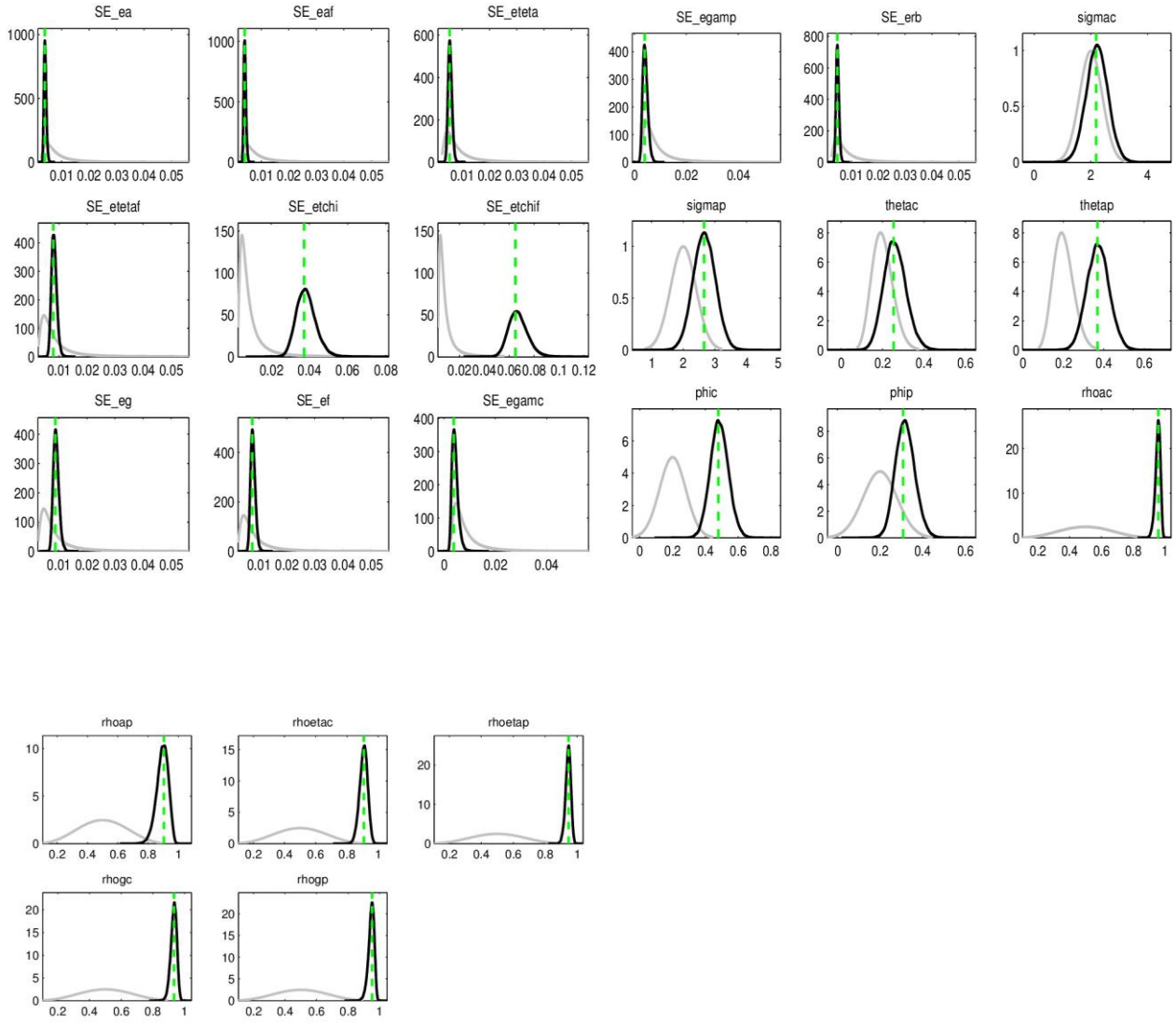
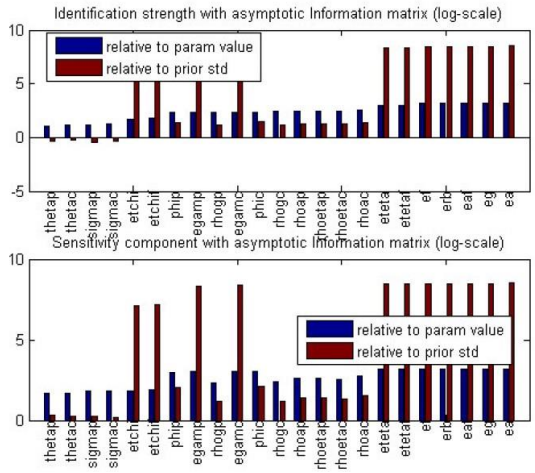


Figure 8 Identification Analysis



A new insight on the inflation persistence: the role of severance pay

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The aim of this paper is to highlight the interaction between inflation persistence and the labor market institutions in a New Keynesian model with a search and matching labor market. In this framework, I reintroduce severance pay and show that the negotiation of this severance pay creates a new real rigidity into wage dynamics. Indeed, following the *bonding critique*, in a context of free negotiation and in presence of firing costs, workers agree to pay a share of severance pay in order to reduce the burden on firms. Then, a contribution system appears, affecting the real wage dynamics and inflation persistence through the New Keynesian Phillips curve.

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1 Introduction

Recent literature focuses on factors driving inflation persistence because of two main reasons: first, from a theoretical point of view[2], recent DSGE models are unable to replicate the sluggish response of inflation in concert with a large response of output. Secondly, in order to stabilize inflation central bankers need to understand what drives inflation dynamics. For instance, the amplitude of monetary policy response to a shock will directly depend on the degree of inflation persistence. From a pure european point of view, inflation persistence is a central preoccupation for policymakers as it is highlighted by Altissimo et al. (2006). In this article, the authors present the different results of the Eurosystem Inflation Persistence Network (IPN *hereafter*). One of them is the uncertainty about the qualitative and the quantitative nature of inflation persistence. This uncertainty affects the conduite of the monetary policy such as a more gradually response to economic shock.

The aim of this paper is to provide a theoretical framework able to replicate inflation persistence as measured in empirical data. Thus, I stress the role of firing costs and, in particular, of severance pay in explaining inflation persistence. Following Garibaldi and Violante (2005), I extend the model of Trigari (2006) with right-to-manage bargaining. I compare three situations : a first one in which firing costs are set by the law; a second one in which bargained firing costs are introduced but where the real wage is efficiently bargained; a third one in which firing costs are efficiently bargained but where the real wage is set thanks to right-to-manage bargaining. I show that right-to-manage bargaining combined with bargained firing costs are able to increase inflation persistence in DSGE models.

The structural form of inflation persistence highlights three sources of persistence: the central bank behavior, intrinsic persistence (that is transmitted from inflation itself) and inherited persistence from other variables such as the output gap or marginal cost. As expounded by Fuhrer (2010), in a world *à la* Calvo (1983), the New Keynesian Phillips Curve (NKPC *hereafter*) takes the form of a pure forward-looking curve where inherited persistence as only source of inflation persistence, where marginal cost is the key variable. Because of this NKPC that links the inflation level and firms' marginal cost, both labor market institutions and the real wage play a fundamental role in inflation persistence. For instance, Trigari (2006) shows that wage bargaining has a great impact on inflation persistence. The author distinguishes two different Nash bargaining process : the efficient bargaining where workers and firms negotiate conjointly both the real wage and the hours worked; and the right-to-manage bargaining where firms and workers negotiate together the real wage but where firms set the hours worked unilateraly and according to the level of the real wage. Right-to-manage bargaining triggers a wage channel and links the real wage to firms' marginal cost. This channel engraves wage dynamics into inflation dynamics thanks to the NKPC. Following this literature, Christoffel and Linzert (2006), Blanchard

[2] For a detailed review of literature, see Fuhrer (2010).

and Galí, Christoffel et al. (2009b), Tsoukis et al. (2011) among others show the importance of the real wage rigidity for explaining inflation persistence.

As expounded by Galí (2010), the introduction of wage rigidity has been realized thanks to two main approaches: a stream of the literature suggests to introduce rigidity on the intensity in which the real wage is renegotiated. Among them, Christoffel and Linzert (2006) introduce a wage norm into a DSGE model. In this case, the real wage is forced to stay close to its recent history. In a right-to-manage framework, the authors show that wage norm significantly increases inflation persistence. The second approach assumes that the real wage is no longer continuously bargained. A nominal rigidity *à la* Calvo (1983) is assumed so that, while a share of the real wages is re-optimized, another share of the real wages remains unchanged for several periods. In this paper, I suggest a third approach using severance pay. Specifically, wage rigidity is *per se* obtained thanks to the model and there is no "*ad hoc*" rigidity added concerning wage dynamics.

This approach is motivated by an empirical assessment: as expounded by Thomas (2006), there is a negative correlation between the level of firing costs and the business cycle fluctuations. In a search and matching model, the author shows that firing costs decrease the volatility of job destruction. In turn, this reduction translates into a lower volatility of business cycle fluctuations. Veracierto (2008) finds similar results in a real business cycle model following a productivity shock. Macit (2010) emphasizes that there is a negative correlation between the OECD's Employment Protection Legislation (EPL *hereafter*) index and the real wage and inflation volatilities. Macit (2010) introduces a lay-off tax into a DSGE model with search and matching frictions in order to analyse how firing costs affect the real wage negotiation. In an efficient bargaing framework, firing costs increase insiders' real wage while their decrease outsiders' one. However, even if firing costs impact the real wage dynaics, they do not improve the degree of inflation persistence into New Keynesian models. Two mains reasons can explain this fact. First, in the efficient bargaining framework, real wage does not affect directly the firms' marginal cost, which is the key variable in the NKPC. Secondly, lay-off tax is assumed to be constant[3] and does not vary depending on the business cycle fluctuations. Starting from this assessment, I propose to analyse the impact of severance pay on inflation persistence in a right-to-manage bargaining framework.

Since the work of Lazear (1990), severance pay have been neglected from theoretical models. Severance pay represents a transfer from firms to workers that can be undone freely by workers in case of perfect flexible wage bargaining framework. Thus, severance pay has no impact on firms' decisions. This theoretical point is known as the bonding critique. From a theoretical perspective, the consequence of the bonding critique is straightforward: firing costs are modeled as a tax, without transfers from firms to workers. However, Garibaldi and Violante (2002, 2005) recently showed that severance pay must be reintroduced into theoretical models for two main reasons. First, from a quantitative point of view, severance pay is at least as important as taxes in

[3] Lay-off taxes are used to represent mandatory periods of advance notice before a lay-off. These mandatory periods represent in return a cost for firms and are imposed by policy-makers. Thus, this cost is assumed to be constant not depending on business cycle fluctuations.

global firing costs. In Italy, they represent approximately 80% of global firing costs. Secondly, severance pay and tax component of firing costs do not have the same impact on employment expect in the case of full wage rigidity. Thus, transfers induced by severance pay play a crucial role in labor market's dynamics. Moreover, Fella (2007) also argues that severance pay has no impact in firms' decisions because the theoretical framework in which they are studied is not relevant. Finally, I show that the optimal behavior highlighted by Lazear, which allows workers to avoid the effects of severance pay, can be understood as a contribution system to the worker's job protection. This contribution system will introduce a new intrinsic rigidity in wage dynamics that will be turned into inflation persistence thanks to the wage channel and the NKPC.

For this purpose, I model firing costs similarly to Garibaldi and Violante (2005). I assume they are composed by two elements: a tax component and a transfer component. The tax component generally represents a notice period that is a cost for firms in case of lay-off. It does not affect workers' decisions. By contrast, severance pay is both a cost for firms and a temporary new income for workers. Then, I compare four different situations. I take as reference the model of Trigari (2006): I model a labor market in which the real wage is efficiently bargained and in which there is no firing cost. Then, I compare this situation to three others. I gradually introduce severance pay in order to identify which bargained severance pay characteristic affects inflation persistence. First, I reintroduce into a New Keynesian model a fix severance pay in order to study the impact of the transfer resulting from this severance pay. Then, I allow workers and firms to efficiently negotiate the level of severance pays, following Garibaldi and Violante (2005). Thereafter, two situations are distinguished: a first situation in which the real wage is efficiently negotiated and a second situation in which the real wage is negotiated following the right-to-manage bargaining framework. This distinction is essential in order to evaluate the importance of the wage channel expounded by the literature.[4][5]

My findings can be summarized as follows: in the right-to-manage bargaining framework, the contribution system implied by bargained severance pay improves inflation persistence in the standard New Keynesian model. When firing costs are fixed, their two components act similarly on wages: they both increase insiders' the real wage and they decrease outsiders' the real wage. When severance pay is bargained, the impact of firing costs on insiders' wage becomes ambiguous: as it has usually been shown in the literature, the contemporary impact of firing cost on wage is positive. However, because workers and firms can optimally bargain the level of severance pay, workers agree to contribute for a part of the job protection of the next period. This effect decreases the level of the real wage. This contribution system introduces a new source of rigidity in the wage dynamics that, in return, increases the level of inflation persistence when the wage channel is present.

The rest of the paper is structured as follows. Section 2 presents the New Keynesian framework and section 3 focuses on the negotiation of wage and hours worked. Section 4

[4] Another case can be found in the literature: Macit (2010) investigates the case where there is only a fixed tax on lay-off and where wage is efficiently bargained. Especially, the author shows that firing costs affect differently outsider and insiders. However, this distinction does not allows the model to replicate infation persistence.

[5] Only the last case will be presented in the paper. The three others cases that I study are presented in Appendix A.

presents the wage channel under the right-to-manage bargaining. Section 5 presents the calibration choice while section 6 presents my results. Section 7 concludes.

2 The New Keynesian framework

In this section, I give details about the New Keynesian framework that closely follows Trigari (2006). The economy is composed of a representative household, a Central Bank and three industrial sectors: an intermediate goods sector, a retail goods sector and a final goods sector. For simplicity's sake, firms producing in the intermediate goods sector are simply called *firms*; firms producing in the retail goods sector are called *retailers*; and finally the firm producing in the final good sector is called the *final goods firm*. This separation allows me to study distincly the labor market *à la* Mortensen and Pissarides (1994) and the price setting.

Retailers evolve in a monopolistic competition market. Nevertheless, firms and retailers meet each other in a perfect competitive market, so as the representative household and the final goods firm do. One can note that this artificial separation is neutral with regard to inflation persistence.[6]

2.1 The representative household

I assume that there is a representative household composed by a continuum of homogeneous workers indexed on the unit interval. As in Merz (1995), each worker insures each other members of the household by sharing his earned income, namely his wage or his unemployment benefits. Following Christoffel et al. (2009a), the instantaneous utility function is separable in consumption and leisure. The latter is given for each member of the representative household by:

$$U(c_t, c_{t-1}) - g(h_t), \tag{2.1}$$

with

$$g(h_t) = \kappa_h \frac{h_t^{1+\phi}}{1+\phi}, \tag{2.2}$$

and

$$U(c_t, c_{t-1}) = \log(c_t - e c_{t-1}), \tag{2.3}$$

where (c_t, c_{t-1}) represents the utility derived from consumption and $g(h_t)$ represents the disutility derived from the labor supply h_t. The degree of habit formation in consumption is represented by $e > 0$. The labor supply elasticity is $1/\phi$, and $\kappa_h > 0$ is a scale parameter. I assume that there are some consumption habits in the household members' behavior in order to let retailers adjust their production to a shock thanks to the extensive margin rather than the intensive margin, that is to say employment rather than hours worked. This assumption is consistent with Trigari (2009) for the US economy and Rogerson and Shimer (2011) for the OECD

[6] This neutrality has been showed by Sveen and Weinke (2007), Christoffel et al. (2009a), Kuester (2010) and Thomas (2011).

countries.

The representative household's maximization problem is

$$\max_{c,t,B_t} E_t \sum_{s=0}^{\infty} \beta^s [U(c_{t+s}, c_{t+s-1}) - G_{t+s}], \tag{2.4}$$

subject to

$$c_t + \frac{B_t}{p_t r_t^n} = d_t + \frac{B_{t-1}}{p_t}. \tag{2.5}$$

The utility of the representative household depends on the level of consumption per capita as well as the total cost of labor supply G_{t+s}. Here, I assume there is no inactive worker in the economy. A member of the representative household can only be employed or unemployed.

The discount factor is represented by $\beta \in [0,1]$. The representative household holds one-period bonds B_t with price $1/r_t^n$, where r_t^n is the nominal interest rate. The Consumer Price Index is noted p_t and d_t is the real income per capita in t.

The maximization of the household's program yields the standard Euler equation

$$\lambda_t = \frac{1}{c_t - ec_{t-1}} - E_t \beta \frac{e}{c_{t+1} - ec_t} \tag{2.6}$$

$$\lambda_t = r_t E_t \lambda_{t+1}, \tag{2.7}$$

where λ_t is the marginal utility of consumption in t and where

$$r_t = \frac{r_t^n}{E_t[\pi_{t+1}]}. \tag{2.8}$$

2.2 The labor market

In the model, workers can be either employed or unemployed. When they are unemployed, workers seek for a job without paying any cost in terms of utility whereas the supply of labor is painful. Firms can have their job filled or vacant. Unlike workers, firms have to pay a cost to post a vacancy. This cost is assumed to be constant.[7]

I assume that firms and workers meet each other in the labor market according to the following standard matching function:

[7] Authors as Gertler and Trigari (2006) have made the assumption of variable vacancy costs. Indeed, Gertler and Trigari (2006) assume that hiring costs can be a convex function of the firms' hiring rate. They assume that the more the hiring rate increases, the more costly hire will be. However, for sake of simplicity, I assume that no such costs are present in the economy since it makes no difference in terms of inflation persistence.

$$m_t = \sigma_m u_t^{\sigma} v_t^{1-\sigma}, \tag{2.9}$$

where m_t is for the number of new matches in the labor market, $\sigma_m > 0$ measures the efficiency of the matching process, u_t is the number of job seekers and v_t is the number of vacancies. I assume that there is no on-the-job search: a worker looks for a new job only when he is fired. The job separation rate is assumed to be exogenous and equal to ρ.

According to the matching function, I define the probability q_t for a firm to fill its job and the probability s_t for a worker to find a job, respectively, as:

$$q_t = \frac{m_t}{v_t} \tag{2.10}$$

and

$$s_t = \frac{m_t}{u_t}. \tag{2.11}$$

Moreover, employment dynamics are given by:

$$n_t = (1-\rho)n_{t-1} + m_{t-1}, \tag{2.12}$$

where n is the level of employment. Equation (2.12) reads that employment is function of the number of jobs that are not destroyed during the previous period plus the number of new matches during the previous period. Here, I assume that new matches are made at the end of the period. It implies that a new match can only be productive at the beginning of the following period and that hiring a worker is costly in terms of time.

Furthermore, the number of job seekers is equal to the $(1-n_t)$ workers unemployed at the beginning of the period plus the ρn_t workers who lost their job at the beginning of the period. Thus, I can define the number of job seekers as

$$u_t = 1-(1-\rho)n_t. \tag{2.13}$$

Finally, the level of unemployment is given by

$$\Omega_t = 1-n_t. \tag{2.14}$$

2.3 The different firms

I present the relationship between the different kind of firms. Firms on the intermediate goods sector and firms on the retail goods sector are separated in order to distinguish the labor market interactions from the price setting.

Intermediate goods firms are hiring workers on the labor market. These firms produce intermediate goods only thanks to labor services and sell them to retailers. Then, retailers turn these goods into differentiated goods thanks to a one-to-one technology to finally sell these goods to the final good firms. At the end, the final goods firm aggregates the differentiated goods

and sells the final goods to the representative household.

2.3.1 The intermediate goods firms

There is an continuum of firms in monopolistic competition in the intermediate goods sector. Following Mortensen and Pissarides (1999), I assume that firms can hire only a unique worker. When it is the case, they produce only thanks to labor services and according to the production function:

$$f(h_t) = zh_t^{\alpha}, \tag{2.15}$$

where z is the technological factor for all the firms and with $\alpha \in (0,1)$ a scale parameter. When firms do not find a worker, they produce nothing.

2.3.2 Retailers, the final good firms and the price setting

I assume there is a continuum i of retailers indexed on the unit interval. These retailers produce their goods according to a technology that changes an intermediate good x_t in a perfect competitive market into a differentiated good y_{it}. Differentiate goods are then imperfect substitute goods and give retailers a market power. Thus, retailers become price setters and can maximize their profits according to their price.

Then, differentiate goods are sold to the final goods firm that aggregates them into final goods y_t.

The final goods firm produces thanks to the following CES production function:

$$y_t = \left[\int_0^1 y_{it}^{\frac{\varepsilon-1}{\varepsilon}} di \right]^{\frac{\varepsilon}{\varepsilon-1}}, \tag{2.16}$$

with $\varepsilon > 1$ the elasticity of substitution between each differentiate goods.

The final goods firm maximizes its profit by choosing the level of each differentiated good that it will include as factor of production. The maximization of profit yields the following demand function for each good y_{it}:

$$y_{it} = \left(\frac{p_{it}}{p_t} \right)^{-\varepsilon} y_t, \tag{2.17}$$

The CPI is defined as follows

$$p_t = \left[\int_0^1 p_{it}^{1-\varepsilon} di \right]^{\frac{1}{1-\varepsilon}}. \tag{2.18}$$

I assume that the economy is subject to some nominal rigidities following Calvo (1983). Retailers can re-optimize their price each period given the probability $1-\varphi$. Then, a share φ of

retailers is stuck with its previous price while a share $(1-\varphi)$ of retailers can optimally re-optimize its price. The maximization of the retailers' program yields the optimal level of p_{it}^{*}:

$$p_{it}^{*} = \mu \frac{E_t \sum_{s=0}^{\infty} (\beta\varphi)^s u'(c_{t+s}) x_{t+s} p_{t+s}^{\varepsilon-1} y_{t+s}}{E_t \sum_{s=0}^{\infty} \beta\varphi c_{t+s} p_{t+s}^{\varepsilon-1} y_{t+s}}, \tag{2.19}$$

where x_t is the retailers' marginal cost and where $\mu = \frac{\varepsilon}{\varepsilon - 1}$ is the optimal mark-up. One can note that in this economy, the retailers' marginal cost is equal to the firms' price.

Finally, given that the law of motion for p_t can be expressed as

$$p_t = \left((1-\varphi) p_t^{*1-\varepsilon} + \varphi p_{t-1}^{1-\varepsilon}\right)^{\frac{1}{1-\varepsilon}}, \tag{2.20}$$

after log-linearizing equations (2.19) and (2.20) and after some rearrangements, one can obtain the NKPC

$$\hat{\pi}_t = \frac{(1-\varphi)(1-\beta\varphi)}{\varphi} \hat{x}_t + \beta E_t \hat{\pi}_{t+1}. \tag{2.21}$$

Finally, a resource constraint for the whole economy is given by

$$y_t = c_t. \tag{2.22}$$

The clearing condition for the retailers market is

$$y_t = n_t (1-\rho) f(h_t), \tag{2.23}$$

where the aggregate demand y_t is equal to the production $f(h_t)$ of each $n_t(1-\rho)$ firm that actually produces.

2.4 Monetary policy

I assume that the monetary authority sets the nominal interest rate according to the following standard Taylor rule:

$$\frac{r_t^n}{r_s^n} = \left(\frac{r_{t-1}^n}{r_s^n}\right)^{\rho_m} \left(\frac{y_t}{y_s}\right)^{\gamma_y (1-\rho_m)} \left(\frac{\pi_t}{\pi_s}\right)^{\gamma_\pi (1-\rho_m)}, \tag{2.24}$$

with ρ_m the interest rate smoothing. The relative weights given by the monetary authority to the stabilization of output and inflation are γ_π and γ_y, respectively. ε_t^m is an *iid* monetary shock.

3 The severance pay bargaining

In this section I present how severance pay is negotiated. I assume that severance pay is renegotiated each period as in Garibaldi and Violante (2005).

First, let us define *ex post* and *ex ante* firing costs according to a court decision. The former refer to firing costs that are imposed by a judge after a lay-off is judged unfair while the latter are referring to firing costs that are negotiated with the fired worker.

Following Goerke (2006), I assume that *ex post* firing costs noted $\hat{F}_t$ are equal to

$$\hat{F}_t = \hat{S}_t + T, \tag{3.1}$$

with

$$\hat{S}_t = w_t^{\Upsilon}. \tag{3.2}$$

$\hat{S}_t$ represents legal severance pay and Υ the wage elasticity of legal severance pay.

However, these costs are valuable only if a judge declares the lay-off unfair with a probability ρ_u. As emphasized by Garibaldi and Violante (2005), many lay-off are not contested. In that case, severance pay can be bargained between the two parties. Assuming that *ex ante* severance pay bargaining follows a Nash process, whose maximization program is

$$\max_{S_t} \left(S_t - \rho_u \hat{S}_t\right)^{\eta} \left[-S_t + \rho_u \left(\hat{S}_t + T\right)\right]^{1-\eta}, \tag{3.3}$$

where S_t is the level of bargained severance pay. The bargaining will answer to two contradictory objectives: workers' objective is to maximize the difference between what they could obtain from a court decision and what they could obtain from the negotiation; for firms, the objective is to minimize the difference between legal firing costs, if the lay-off is judged unfair, and the bargained severance pay. Each objective is balanced by the bargaining power of each party.

The maximization of the previous program yields

$$S_t = \rho_u \left(\hat{S}_t + \eta T\right). \tag{3.4}$$

Equation (3.4) defines *ex ante* severance pay. One can note that it is profitable for each party to bargain rather than to stand in front of a court:

$$\rho_u \hat{S}_t < \rho_u \left(\hat{S}_t + \eta T\right) < \rho_u \left(\hat{S}_t + T\right), \tag{3.5}$$

that means that the two parties obtain more from the bargaining than from the court's judgment.

Finally, in order to fully define *ex ante* firing costs, I need to define the probability ρ_a that an agreement is found between firms and workers without resorting to a court. Moreover, I assume that if the court judges the lay-off fair, neither firms nor workers will pay something to the other parties. Finally it yields

$$F_t = \rho_a \rho_u \left(\hat{S}_t + \eta T_t\right) + (1-\rho_a)\rho_u \beta_{t,t+1} E_t[\hat{F}_{t+1}]. \quad (3.6)$$

4 The Right-to-Manage Wage Bargaining

Following Trigari (2006), Christoffel and Kuester (2008) and Christoffel et al. (2009a), I explore the wage channel deeper, which links directly the marginal cost of firms to the real wage. During the right-to-manage bargaining, the real wage is used as a proxy of the marginal rate of substitution by firms and workers. I discuss here the impact of dynamic firing costs *à la* Garibaldi and Violante (2002) into the right-to-manage bargaining framework.

4.1 The Bellman equations

As in Macit (2010), the introduction of firing costs leads to distinguish insider workers, who can enjoy EPL, to oustider workers who just find a job. Indeed, here I assume that firms will have to pay firing costs when the relationship is broken, only when workers were working during the previous period. Otherwise, firms can freely break the relationship.

Firms:

The marginal value of job J_t is defined by

$$J_t = x_t f(h_t) - w_t h_t + E_t \beta_{t,t+1}[(1-\rho)J_{t+1} - \rho F_{t+1}], \quad (4.1)$$

where w_t is the real wage for a continuing match and x_t the relative price for intermediate goods. The stochastic discount factor $\beta_{t,t+1}$ is defined by $\beta_{t,t+s} = \beta^s \frac{\lambda_{t+s}}{\lambda_t}$. The marginal value of a job is equal to the sum of the instantaneous profits $x_t f(h_t) - w_t h_t$ plus expected average gains linked to the status of the job at the next period. If the job is destroyed, firms will receive the marginal value of a vacancy minus firing costs. If the job is not destroyed, firms will get the marginal value of job at the next period.

Moreover, the marginal value of a vacant job is defined by V_t. I assume that the cost for firms to post a vacancy is constant, expressed in terms of consumption goods and is equal to κ. Expected average gains depend on firms' ability to fill their job, with a probability q_t. If the job is filled and if it is not destroyed at the end of the period, the firm will receive the marginal value of a job at the next period, J_{t+1}^n. If firms cannot fill their job, they will receive the marginal value of a vacant job at the next period. Thus, V_t is defined such as

$$V_t = \frac{-\kappa}{\lambda_t} + E_t \beta_{t,t+1}[q_t(1-\rho)J_{t+1}^n + (1-q_t)V_{t+1}]. \quad (4.2)$$

Moreover, I assume that the free entry condition is achieved. This assumption implies that

the marginal value of a vacant job is null. It yields the job creation condition such as

$$\frac{\kappa}{\lambda_t q_t} = E_t \beta_{t,t+1}[(1-\rho) J_{t+1}^n], \tag{4.3}$$

Equation (4.3) implies, for λ_t and κ constant, that if the expected profits of a filled job increase, a new firm will enter the market and will create a new job. Therefore, the number of vacancies will increase, reducing the probability for firms to find a worker. In return, when the expected profit of a filled job decreases, some firms leave the market and the probability for the other firms to match a worker increases. Consequently, the real cost of posting a vacancy decreases and the equilibrium is achieved again.

The marginal value of a new job J_t^n is defined by

$$J_t^n = x_t f(h_t) - w_t^n h_t + E_t \beta_{t,t+1}[(1-\rho) J_{t+1} + \rho(V_{t+1} - F_t)]. \tag{4.4}$$

One can note that firing costs are present in equation (4.4). Indeed, if at the end of the period t, firms decide to break the relationship with the new worker, this worker would have lost his outsider status and he would be protected by EPL.

Workers:

The marginal utility of a job for workers is W_t for a continuing match and W_t^n for a new job. Furthermore, the marginal utility for an unemployed worker is equal to U_t.

When a worker has a job, he receives $w_t h_t$ minus the disutility linked to the labor supply in terms of goods of consumption. The expected utility linked to the job depends on whether the relationship is broken or not. It yields

$$W_t = w_t h_t - \frac{g(h_t)}{\lambda_t} + E_t \beta_{t,t+1}[(1-\rho)(W_{t+1} - U_{t+1}) + U_{t+1} + \rho S_{t+1}], \tag{4.5}$$

The same pattern holds for a worker newly in a job with a difference in terms of wage:

$$W_t^n = w_t^n h_t - \frac{g(h_t)}{\lambda_t} + E_t \beta_{t,t+1}[(1-\rho)(W_{t+1} - U_{t+1}) + U_{t+1} + \rho S_{t+1}] \tag{4.6}$$

Finally, the situation for an unemployed worker is such as:

$$U_t = b + E_t \beta_{t,t+1}[s_t (1-\rho)(W_{t+1}^n - U_{t+1}) + U_{t+1}]. \tag{4.7}$$

When a worker is unemployed, he receives unemployment benefits b. Moreover, expected gains for an unemployed worker is the value of a job at the next period weighted by the probability s_t that he finds a job and by the probability $(1-\rho)$ that the new match is successful. In the case where the new match is unsuccessful or that the worker does not find a

job, with a probability $(1-s_t)$, this worker will stay unemployed and he will receive the marginal value of unemployment at the next period.

4.2 The wage channel

Under the right-to-manage bargaining, firms and workers negotiate only the real wage. Firms unilaterally set the level of hours worked in order to maximize their own surplus linked to employment. For sake of simplicity, I assume that differentiation between old and new workers is just made through wage and not through hours worked.

The maximization of this program yields the following optimal condition:

$$w_t = x_t mpl_t \tag{4.8}$$

Equation (4.8) presents the wage channel that links directly the wage level to the firms marginal cost. Thus, the real wage becomes a proxy of the marginal rate of substitution of workers since the latter is not present in the hours worked setting process.

4.3 The wages bargaining in the right-to-manage bargaining framework with dynamic firing costs

I present here the wage bargaining. The two parties will jointly maximize the Nash product that, in the case of a continuing match, can be defined as:

$$\left[W_t - (U_t + S_t)\right]^{\eta}\left[J_t - (V_t - F_t)\right]^{1-\eta}, \tag{4.9}$$

where η represents the workers' bargaining power.

In the case of a new job, the Nash product is defined as

$$\left[W_t^{\eta} - U_t\right]^{\eta}\left[J_t^{\eta} - V_t\right]^{1-\eta} \tag{4.10}$$

Here, one can note the difference between an insider worker and an outsider worker accordingly to the EPL. When an insider worker and a firm disagree on a wage level and when the relationship ends, the firm has to pay F_t. When an outsider worker and a firm disagree on a wage level, the separation goes freely.

The continuing match case:

The maximization of the Nash product in the case of a continuing match yields:

$$\eta\delta_t^W[J_t + F_t] = (1-\eta)\delta_t^F[W_t - U_t - S_t], \tag{4.11}$$

where

$$\delta_t^W = \frac{h_t}{(1-\alpha)}\left(\frac{mrs_t}{w_t} - \alpha\right) \tag{4.12}$$

and

$$\delta_t^F = h_t. \tag{4.13}$$

δ_t^W and δ_t^F are the expected gains for workers and firms after an increase of the real wage, respectively. Substituting J_t, W_t and U_t by their value and after some algebra, one can obtain

$$w_t = \chi_t\left[\frac{x_t mpl_t}{\alpha} + \frac{\kappa\theta_t}{\lambda_t h_t} + \frac{F_t}{h_t}\right] + (1-\chi_t)\left[\frac{mrs_t}{1+\phi} + \frac{b}{h_t} + \frac{S_t}{h_t}\right]$$
$$+ (1-s_t)\frac{\kappa}{\lambda_t q_t h_t}[\chi_t - (1-\chi_t)\xi_{t+1}] - \mathsf{A}_t E_t \beta_{t,t+1}[F_{t+1}]$$
$$-\mathsf{B}_t E_t \beta_{t,t+1}[S_{t+1}] \qquad (4.14)$$

with $mpl_t = f'(h_t)$ the marginal productivity of labor, $mrs_t = \frac{g'(h_t)}{\lambda_t}$ the marginal rate of substitution and $\theta_t = s_t/q_t$ the labor market tightness. Furthermore,

$$\chi_t = \frac{\eta\delta_t^W}{\eta\delta_t^W + (1-\eta)\delta_t^F}, \qquad (4.15)$$

$$\xi_t = \frac{\eta\delta_t^W}{(1-\eta)\delta_t^F}, \qquad (4.16)$$

$$\mathsf{A}_t = \frac{1}{h_t}[\chi_t\rho + (1-s_t)(1-\rho)(1-\chi_t)\xi_{t+1}] > 0 \qquad (4.17)$$

and

$$\mathsf{B}_t = \frac{[\rho + (1-s_t)](1-\rho)(1-\chi_t)}{h_t}(1-\chi_t) > 0 \qquad (4.18)$$

Moreover, one can note that EPL increases the real wage of an insider. One can note that firms prefer to promote only legal severance pay whereas workers promote the whole firing costs.

- As in Trigari (2006), the real wage remunerates some traditional items such as a share of the marginal productivity of labor and a share of the marginal rate of substitution of workers. The situation in the labor market is also taken into account thanks to the labor market tightness. Finally, in order to encourage workers to participate in the labor market, firms agree to pay a share of unemployment benefits. In order to analyze the impact of firing costs on the real wage, one has to distinguish the impact during the current period to the impact at the next period. Indeed, during the current period, firing costs increase the real wage. This result matches the result of Macit (2010). However, thanks to the severance pay bargaining, a contribution system appears. Indeed, following Lazear (1990), since workers and firms freely negotiate the level of severance pay, workers agree to reduce their level of the real wage in order to reduce the burden that EPL imposes upon firms. This component

simply tells that workers will pay today a share of their tomorrow job protection. From this point of view, the bonding critique still holds: the optimal contract between firms and workers leads to avoid a part of firing costs.

The new job case:

The maximization of the Nash product in the case of a new job yields

$$\eta\delta_t^W J_t^n = (1-\eta)\delta_t^F (W_t^\eta - U_t), \tag{4.19}$$

Replacing J_t^n, W_t^n and U_t by their values and after some algebra yields

$$w_t^n = \chi_t\left[\frac{x_t mpl_t}{\alpha} + \frac{\kappa\theta_t}{\lambda h_t}\right] + (1-\chi_t)\left[\frac{mrs_t}{1+\phi} + \frac{b}{h_t}\right]$$

$$+ (1-s_t)\frac{\kappa}{\lambda_t q_t h_t}\left[\chi_t - (1-\chi_t)\xi_{t+1}\right]$$

$$- \frac{\chi_t}{h_t} E_t\beta_{t,t+1}[\rho F_{t+1}] - \frac{(1-\chi_t)}{h_t} E_t\beta_{t,t+1}[\rho S_{t+1}]. \tag{4.20}$$

Equation (4.20) shows that EPL negatively affects outsiders' wage, as it is usually the case. However, here, outsiders do not pay for the insiders protection. Outsiders pay contribution for their own protection of the next period and not for the EPL of the current period.

5 The calibration choices

In this section, I present the calibration values that I chose as well as the targeted values at the steady-state.

Table 1 presents the different calibration choices. Regarding the preference of the representative household, I set the degree of habit formation in consumption to 0.7 in accordance with the empirical evidence that can be found in Smets and Wouters (2003, 2007) for instance. Besides, I follow Card (1991), who estimates the elasticity of substitution, $1/\phi$, between 0.1 and 0.5. Following Trigari (2006) and Christoffel et al. (2009b), I set ϕ equal to 10. Moreover, I set $\beta = 0.99$ in order to have a quarterly real rate of interest of almost 1%.

Table 1: Parameters and their calibrated values

Preferences		
e	0.7	Consumption habits persistence
ϕ	10	Inverse of the labor supply elasticity
β	0.99	Discount factor
Labor Market		
ρ	0.08	Job destruction rate
κ	0.16	Vacancy posting cost
η	0.1	Workers' bargaining power
σ	0.1	Matching function elasticity
Υ	0.35	Severance pay elasticity
ρ_u	0.5	Probability for a lay-off to be considered as unfair
ρ_a	0.5	Probability to find an agreement about severance pay
T	0.18	Firing costs tax component
b	0.3 Y_s	Unemployment benefit
Firms and Production		
φ	0.85	Calvo's coefficient
α	0.3	TFP elasticity
Monetary Authority		
ρ_m	0.85	Interest rate smoothing
γ_π	1.5	Response coefficient to inflation
γ_y	0.5	Response coefficient to the output gap

Regarding the labor market parameters, I set the employment destruction rate ρ to 0.08, as Trigari (2006). This value is an intermediate value to the one chosen by Christoffel et al. (2009b), Krause and Lubik (2010) and Macit (2010) who set ρ between 0.06 and 0.1, respectively. This choice allows me to take into account the exit from employment to unemployment as the exit of the labor market. Following Krause and Lubik (2010) and Macit (2010), I set hiring costs equal to 0.16 in order to take into account both costs of recruitment and of training. Regarding the bargaining power, I follow Hagedorn and Manovskii (2008) and set $\eta = 0.1$. Following Petrongolo and Pissarides (2001), Trigari (2006) and Christoffel and Kuester (2008), I set $\sigma = 0.5$. Finally, following Garibaldi and Violante (2005), I set $\rho_u = \rho_a = 0.5$.

According to OECD (2013), I set Υ to 0.35 in order to obtain an average severance pay equal to 4.2 month's wage by years worked.

Regarding Calvo's coefficient, I set the average duration between each optimal price adjustment to 4 quarterly and set $\varphi = 0.85$, following Trigari (2006). Furthermore, I assume that firms have returns to scale almost constant and I set $\alpha = 0.99$, following Christoffel and Kuester (2008) and Christoffel et al. (2009a).

Moreover, the Taylor rule parameters are set according to Clarida et al. (2000) and Trigari (2006): the elasticity ρ_m of the gross nominal interest rate with regards to its own lag to 0.9. Besides, the elasticity of the nominal interest rate with regards to inflation and the output gap are set to 1.5 and 0.5, respectively.

Then, I set T to 0.18 in order to have legal costs equal to 20% of the average wage, following Thomas and Zanetti (2009). Finally, following Garibaldi and Violante (2005), I set $\hat{F}$ equal to 0.6 and I compute the other steady-states accordingly.

The long-run targeted values are presented in Table 2.

Table 2: Targeted Values

π_s	1	Inflation
p_s	1	Prices
y_s	1	Output
q_s	0.7	Job filling probability
Ω_s	0.06	Unemployment
w_s	2.2	Real Wage
h_s	1	Hours Worked
r_s^n	1	Nominal interest rate

6 Simulation Results: the importance of bargained firing costs and the wage channel for the explanation of inflation persistence

Simulations represent the case of an expansionary monetary shock. I follow Fuhrer (2010) and I take as a definition of inflation persistence the auto-correlation function. While Pivetta and Reis (2007) retained only the first order auto-correlation coefficient as a measure of inflation persistence, I choose to adopt the first five coefficients as a measure since the auto-correlation function sums up a great part of the information.

6.1 The auto-correlation functions

Table 3: The auto-correlation coefficients

	i=1	i=2	i=3	i=4	i=5
Case 1: Fixed firing costs	0.27	0.17	0.08	0.03	0.04
Case 2: Dynamic firing costs and EB[8]	0.29	0.17	0.08	0.02	0.03
Case 3: Dynamic firing costs and RTMB[9]	0.60	0.37	0.20	0.08	0.06
Case 4: No firing costs	0.27	0.17	0.09	0.03	0.04

Table 3 shows the different auto-correlation functions according to the different cases. Index *i* refers to the time lag of the different inflation auto-correlation functions.

The first results provided by Figure 3 are given by the comparison of case 1 and case 4. One can see that simply introducing severance pay in a New Keynesian model does not improve inflation persistence. All the coefficients of auto-correlation are quite similar.

The comparison of case 1 and case 2 shows that the introduction of bargained firing costs increase the first lag of inflation dynamics. This result shows that it is the contribution system to the worker protection that affects the most inflation persistence and not the transfer from firms to workers in case of lay-offs.

Indeed, after an expansionary monetary shock, the nominal interest rate decreases that positively impacts households' consumption. In return, this stimulation will positively impact aggregate demand and then firms' production. Since the whole economy is in expansion, this will be translated into an increase of the real wage as well as an increase in job protection. Because of the existence of the contribution system, this increase of the job protection yields an increase in the workers' contribution. This increase will end the real wage increase and so it will increase wage rigidities.

However, this increase is quite weak and holds only for the first auto-correlation coefficient. This can be explained by the fact that in the efficient bargaining framework, the real wage has no direct impact on marginal cost. Accordingly, any change in wage dynamics will have no significant impact on inflation dynamics.

Finally, the introduction of the wage channel with bargained firing costs leads to double inflation for the whole auto-correlation function. The impact of bargained firing costs is thus well exploited by the wage channel.

[8] *EB* means Efficient Bargaining
[9] *RTMB* means Right-To-Manage Bargaining

Figure 1: The auto-correlation functions

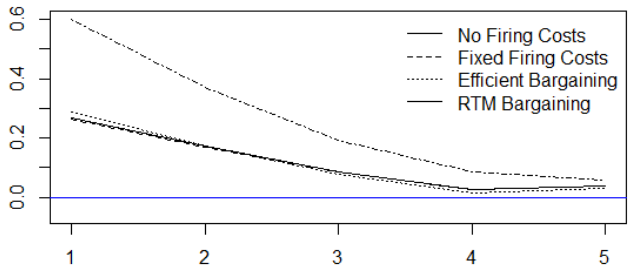
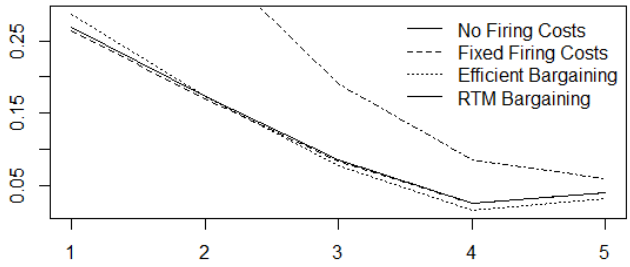


Figure 2: Detailed auto-correlation functions



6.2 The Impulse Response Functions

This section presents the impulse response functions of the economy after the expansionary monetary shock. First, I present the global behavior of the model accordingly to the three cases: fixed firing cost (FFC), the efficient bargaining (EB) and the right to manage bargaining (RTBM) with bargained firing costs.

6.2.1 The stylized facts and the whole economy reaction

I compare the different cases with the stylized facts highlighted by Christiano et al. (2005), Trigari (2009) and Christoffel et al. (2009a). These authors show that:

1. after a positive monetary shock, **output** increases significantly with a peak response around 0.3 and 0.7 percentage point;
2. **inflation** rises - with a peak response around 0.2 percentage point - but less than output as well as **wages**;
3. **employment** rises while **unemployment** falls. However, the variation of the number of job seekers is stronger than the employment's one - with a peak response around 3-

4.5 percentage points;

4. finally, the **intensive margin** increases but greatly less than the extensive margin.

The different impulse response functions are presented in Appendix D. First, as the IRF shows, the economy reacts qualitatively in the same way for the three cases (fixed firing costs, efficient bargaining and right-to-manage bargaining), except for the wage dynamics. In the fixed firing cost and the efficient bargaining cases, the economy also reacts in a same amplitude. After the monetary shock output increases instantaneously in the three different cases. This can be explained by a stimulation of the private consumption linked to the fall of the nominal interest rate, since here the economy is composed only by a Ricardian representative household. Regarding both the fixed firing cost case and the efficient bargaining case, the response peak is reached at the second period for a deviation from the steady state around 0.6 $\%$. In the right-to-manage bargaining framework, the response peak is reached at the third period for a deviation from the steady state around 0.5 $\%$ that is below the stylized facts. The inflation reaction is the same as the fixed firing cost and the efficient bargaining cases and, as previously, the reaction in the right-to-manage framework is below the stylized facts.

Regarding the wage reaction, one can note that the efficient bargaining framework wage reaction is quite different from the two other cases. Indeed, in the efficient bargaining framework, the real wage is driven by the global firing costs. Moreover, in this case, global firing costs react instantaneously, strongly and positively to the monetary shock. From the second period, the negotiation of firing costs leads to correct this over-reaction. In the right-to-manage bargaining framework, the global firing costs reaction are more balanced during the first period and do not need to be corrected. This mainly explains the difference in the wage reaction between the two different frameworks.

6.2.2 Releasing the nominal rigidities

As it has been expounded in Table 1, the combination of bargained firing costs and the right-to-manage bargaining is the most able to reproduce inflation persistence. Nevertheless, this framework provides too weak responses to the monetary shock.

In order to solve this problem, I choose to release the nominal rigidity, especially by reducing the Calvo's coefficient.

Table 4: Alternative Calibration for the Calvo coefficient

	φ = 0.85	φ = 0.7
Inflation first Autocorrelation Coefficient	**0.5991**	**0.5870**
Inflation peak Response	**0.0373**	**0.1753**

Table 4 shows that the degree of nominal rigidities has not an important impact on inflation persistence. Moreover, choosing a value closer to Christoffel et al. (2009b) and Macit (2010)'s choices yields an inflation peak closer to the stylized facts.

Appendix E presents the impulse response functions under the right-to-manage bargaining framework with both the baseline calibration and the alternative calibration with $\varphi = 0.7$.

7 Conclusions

In this paper, I reintroduce severance pay which has been neglected by the economic literature since the bonding critique. I consider four cases: in the first one, I introduce the severance pay into a DSGE model within a frictional labor market; in the second and the third cases, following Garibaldi and Violante (2005), I introduce a negotiation of severance pay. The second and the third cases are different in the wage bargaining process since the second case corresponds to the case where the real wage is efficiently negotiated while the third case is for the right-to-manage bargaining. Finally, I compare these first three models to a model close to the model of Trigari (2006) where there is no firing costs.

The simple introduction of severance pay into the New Keynesian framework does not allow to increase inflation persistence. Indeed, comparing with the model of Macit (2010), the simple introduction of a transfer from firms to workers in case of lay-off does not introduce strong rigidities into wage's dynamics. However, the negotiation of severance pay gives to firing costs new dynamics. As expounded by Lazear (1990), the introduction of the transfer component of firing costs leads to the introduction of a contribution system into the economy. Workers agree to reduce the impact of firing costs for firms by reducing the level of the real wage. However, these dynamics are not strong enough in the efficient bargaining framework because the real wage does not play a crucial role in firms' marginal cost. The contribution system yields an improvement of inflation persistence in the right-to-manage bargaining framework where the wage channel is active and where the real wage has a direct impact on firms' marginal cost. In this case, through the NKPC, the firing cost bargaining process impacts directly inflation persistence.

Political implications of the model for the Euro-zone are double. First, the Euro-zone is known as an economic zone with a single monetary policy and labor markets that are structurally different. As it has been shown in the model, the labor market institutions affect directly inflation dynamics. These differences regarding the labor market must be taken into account in order to optimize the monetary policy. Secondly, in return, a harmonization of the labor market in Europe will have some consequences in terms of monetary policy that the European Central Bank should take into account.

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A Fixed firing costs

This section presents the case where severance pay is imposed by an external authority.

Firing costs are composed by a fixed tax component (*e.g.* a notice period) and a fixed transfer component (a legal severance pay).

A.1 The Bellman equations

Firms:

$$J_t = x_t f(h_t) - w_t h_t + E_t \beta_{t,t+1}[(1-\rho)J_{t+1} + \rho(V_{t+1} - F)] \tag{8.1}$$

$$J_t^n = x_t f(h_t) - w_t^n h_t + E_t \beta_{t,t+1}[(1-\rho)J_{t+1} + \rho(V_{t+1} - F)]. \tag{8.2}$$

$$V_t = \frac{-\kappa}{\lambda_t} + E_t \beta_{t,t+1}[q_t(1-\rho)J_{t+1} + (1-q_t)V_{t+1}]. \tag{8.3}$$

$$\frac{\kappa}{\lambda_t q_t} = E_t \beta_{t,t+1}[(1-\rho)J_{t+1}]. \tag{8.4}$$

Workers:

$$W_t = w_t h_t - \frac{g(h_t)}{\lambda_t} + E_t \beta_{t,t+1}[(1-\rho)(W_{t+1} - U_{t+1}) + U_{t+1} + \rho S] \tag{8.5}$$

$$W_t^n = w_t^n h_t - \frac{g(h_t)}{\lambda_t} + E_t \beta_{t,t+1}[(1-\rho)(W_{t+1} - U_{t+1}) + U_{t+1} + \rho S] \tag{8.6}$$

$$\begin{aligned} &U_t = b + E_t \beta_{t,t+1}[s_t(1-\rho)W_{t+1} + s_t \rho U_{t+1} + (1-s_t)U_{t+1}] \\ &\Leftrightarrow U_t = b + E_t \beta_{t,t+1}[s_t(1-\rho)(W_{t+1} - U_{t+1}) + U_{t+1}] \end{aligned} \tag{8.7}$$

A.2 Efficient bargaining

In this case, the wage is assumed to be efficiently bargained. The Nash product is

$$\left[W_t - (U_t + S)\right]^{\eta}\left[J_t - (V_t - F)\right]^{1-\eta}, \tag{8.8}$$

In the case of a new job, the Nash product is defined as

$$\left[W_t^{\eta} - U_t\right]^{\eta}\left[J_t^{\eta} - V_t\right]^{1-\eta} \tag{8.9}$$

One can see here that the difference between an insider worker and an outsider worker still holds.

A.3 Wages bargaining

The continuing match case:

According to the efficient bargaining and supposing that the free entry condition holds, the maximization of the Nash product with respect to wage leads to the following optimal condition

$$(1-\eta)\left[W_t - U_t - S\right] = \eta\left[J_t + F\right]. \tag{8.10}$$

Substituting the expression for J_t, W_t and U_t by their values yields

$$w_t = \eta\left[\frac{x_t mpl_t}{\alpha} + \frac{\kappa\theta_t}{\lambda_t h_t}\right] + (1-\eta)\left[\frac{mrs_t}{1+\phi} + \frac{b}{h_t}\right]$$
$$+\eta\frac{s_t(1-\rho)}{h_t}F + (1-\eta)\frac{s_t(1-\rho)}{h_t}S, \tag{8.11}$$

The new job case:

Here, the Nash product is defined by

$$\left[W_t^n - U_t\right]^{\eta} J_t^{1-\eta}. \tag{8.12}$$

The maximization of this product with respect to wage yields

$$w_t^n = \eta\left[\frac{x_t mpl_t}{\alpha} + \frac{\kappa\theta_t}{\lambda_t h_t}\right] + (1-\eta)\left[\frac{mrs_t}{1+\phi} + \frac{b}{h_t}\right] - \frac{\eta\rho}{h_t}F - \frac{(1-\eta)\rho}{h_t}S \tag{8.13}$$

B Bargained severance pay and the efficient bargaining

The continuing case:

In the case of a continuing wage, the Nash product is

$$[W_t - (U_t + S_t)]^{\eta}[J_t + F_t]^{1-\eta}. \tag{9.1}$$

The maximization of this product leads to the following condition

$$(1-\eta)\left(W_t - U_t - S_t\right) = \eta\left(J_t + F_t\right) \tag{9.2}$$

$$\Leftrightarrow W_t - U_t = \frac{\eta}{1-\eta}(J_t + F_t) + S_t \tag{9.3}$$

Replacing J_t, W_t and U_t by their values yields

$$w_t = \eta\left[\frac{x_t mpl_t}{\alpha} + \frac{\kappa\theta_t}{\lambda_t h_t}\right] + (1-\eta)\left[\frac{mrs_t}{1+\phi} + \frac{b}{h_t}\right] + \frac{(1-\eta)}{h_t}S_t + \frac{\eta}{h_t}F_t$$
$$-\frac{[1-(1-\rho)s_t]}{h_t}\left\{(1-\eta)E_t\beta_{t,t+1}[S_{t+1}] + \eta E_t\beta_{t,t+1}[F_{t+1}]\right\}. \tag{9.4}$$

The new job case:

The Nash product for the new job wage bargaining is

$$\left(W_t^n - U_t\right)^{\eta}\left(J_t^n\right)^{1-\eta}, \tag{9.5}$$

where

$$J_t^n = x_t f(h_t) - w_t^n h_t + E_t\beta_{t,t+1}[(1-\rho)J_{t+1} - \rho F_{t+1}] \tag{9.6}$$

$$W_t^n = w_t^n h_t - \frac{g(h_t)}{\lambda_t} + E_t\beta_{t,t+1}[(1-\rho)(W_{t+1} - U_{t+1}) + U_{t+1} + \rho S_{t+1}] \tag{9.7}$$

The maximization of the Nash product with respect to the outsiders wage yields after some algebra

$$w_t^n = \eta\left[\frac{x_t mpl_t}{\alpha} + \frac{\kappa\theta_t}{\lambda_t h_t}\right] + (1-\eta)\left[\frac{mrs_t}{1+\phi} + \frac{b}{h_t}\right]$$
$$-\frac{(1-\eta)\rho}{h_t}E_t\beta_{t,t+1}[S_{t+1}] - \frac{\eta\rho}{h_t}E_t\beta_{t,t+1}[F_{t+1}]. \tag{9.8}$$

B.1 The hours worked bargaining and the extensive margin

This section presents the determination of hours worked in the framework of the efficient bargaining. In this framework, firms and workers maximize jointly their surplus according to the hours worked.

The maximization of the Nash product leads to the following optimal condition

$$\eta\left[w_t - \frac{g'(h_t)}{\lambda}\right](J_t + F) = (1-\eta)\left[w_t - x_t f'(h_t)\right]\left[W_t - U_t - S\right] \tag{9.9}$$

According to equation (8.10), one can obtain *in fine* the channel of the extensive margin

$$x_t mpl_t = mrs_t \tag{9.10}$$

Equation (9.10) emphasizes the channel of the extensive margin, according to Trigari (2006). In this economy where x_t is both the intermediate goods price and the retailers marginal cost, the existence of the channel of the extensive margin will push firms to adjust their production *via* the employment rather than the hours worked. Besides, an increase of employment is without additional costs for firms whereas an increase in the hours worked will lead to an increase in the retailer marginal cost.

Moreover, one can note that the determination of hours worked for a new worker or for an old and a new worker in the case of bargained firing costs leads to the same optimal condition. The EPL has thus no impact on the determination of hours worked in the case of efficient bargaining process.

C Steady-State Calculations

Starting from the long-run targeted values described in table 1, I now describe the steady-state calculations.

From equations (2.14) and (2.13), one can define the value of employment and the number of job seekers at the steady-state such as

$$n_s = 1 - \Omega_s \tag{10.1}$$

$$u_s = 1 - (1-\rho)n_s. \tag{10.2}$$

From the clearing market condition given by equation (2.22), I obtain

$$c_s = y_s \tag{10.3}$$

The value of the marginal utility of consumption at the steady-state is given by

$$\lambda_s = \frac{(1-\beta e)}{(1-e)c_s} \tag{10.4}$$

$$r_s = \frac{1}{\beta} \tag{10.5}$$

From the employment law of motion which firms are facing, which is $n_t^f = (1-\rho)n_{t-1}^f + q_t v_t$, at the steady state value, one can get

$$v_s = \rho \frac{n_s}{q_s} \tag{10.6}$$

Thanks to the definition of the job filling probability, given by equation(2.10), and to the matching function defined by equation (2.9), I can define the matching technology parameter

such as

$$\sigma^m = q_s \frac{v_s^{(\sigma-1)}}{u_s^{(1+\sigma)}}. \tag{10.7}$$

Equation (10.7) allows me to define the number of new matches at the steady state such as

$$m_s = \sigma^m u_s^{\sigma} v_s^{(1-\sigma)}. \tag{10.8}$$

Finally, thanks to equation (10.8), I can define the probability for a worker to find a job as well as the labor market tightness at the steady state such as

$$s_s = \frac{m_s}{u_s} \tag{10.9}$$

$$\theta_s = \frac{v_s}{u_s}. \tag{10.10}$$

Given the definition of the marginal productivity of labor, one can easily see that its value at the steady-state is equal to

$$mpl_s = z\alpha h_s^{(\alpha-1)}. \tag{10.11}$$

According to the wage channel defined by equation (4.8), the value of the firms' marginal cost at the steady-state is equal to

$$x_s = \frac{w_s}{mpl_s}. \tag{10.12}$$

Given the definition of the marginal rate of substitution, I obtain

$$mrs_s = \kappa_h \frac{h_s^{\phi}}{\lambda_s}. \tag{10.13}$$

Given equations (3.1), (3.2), (3.4) and (3.6), I obtain

$$FP_s = SP_s + T \tag{10.14}$$

$$SP_s = w_s^{\upsilon} \tag{10.15}$$

$$S_s = \rho_u (SP_s + \eta T) \tag{10.16}$$

$$F = \rho_a \rho_u (SP_s + \eta T) + (1 - \rho_a)\rho_u \beta FP_s. \tag{10.17}$$

Thanks to equations (4.12), (4.13), (4.15), (4.16), (4.17) and (4.18), one can easily obtain

$$\delta_s^w = \frac{h_s}{(1-\alpha)} \frac{mrs_s}{w_s - \alpha} \tag{10.18}$$

$$\delta_s^f = h_s \tag{10.19}$$

$$\chi_s = \frac{n_s \delta_s^w}{(\eta \delta_{w_s} + (1-\eta)\delta_s^f)} \tag{10.20}$$

$$\xi_s = \frac{\eta \delta_s^w}{(1-\eta)\delta_s^f} \tag{10.21}$$

$$A_s = \frac{1}{h}[\chi_s \rho + (1-s_s)(1-\rho)(1-\chi_s)\xi_s] \tag{10.22}$$

$$B_s = \frac{(1-\chi_s)(\rho + (1-s_s))(1-\rho)(1-\chi_s)}{h_s} \tag{10.23}$$

Finally, the marginal value of a job for a firm, defined by equation (4.1), at the steady-state is given by

$$J_s = \frac{x_s z h_s^{\alpha} - w_s h_s - \beta \rho F_s}{1-\beta(1-\rho)}. \tag{10.24}$$

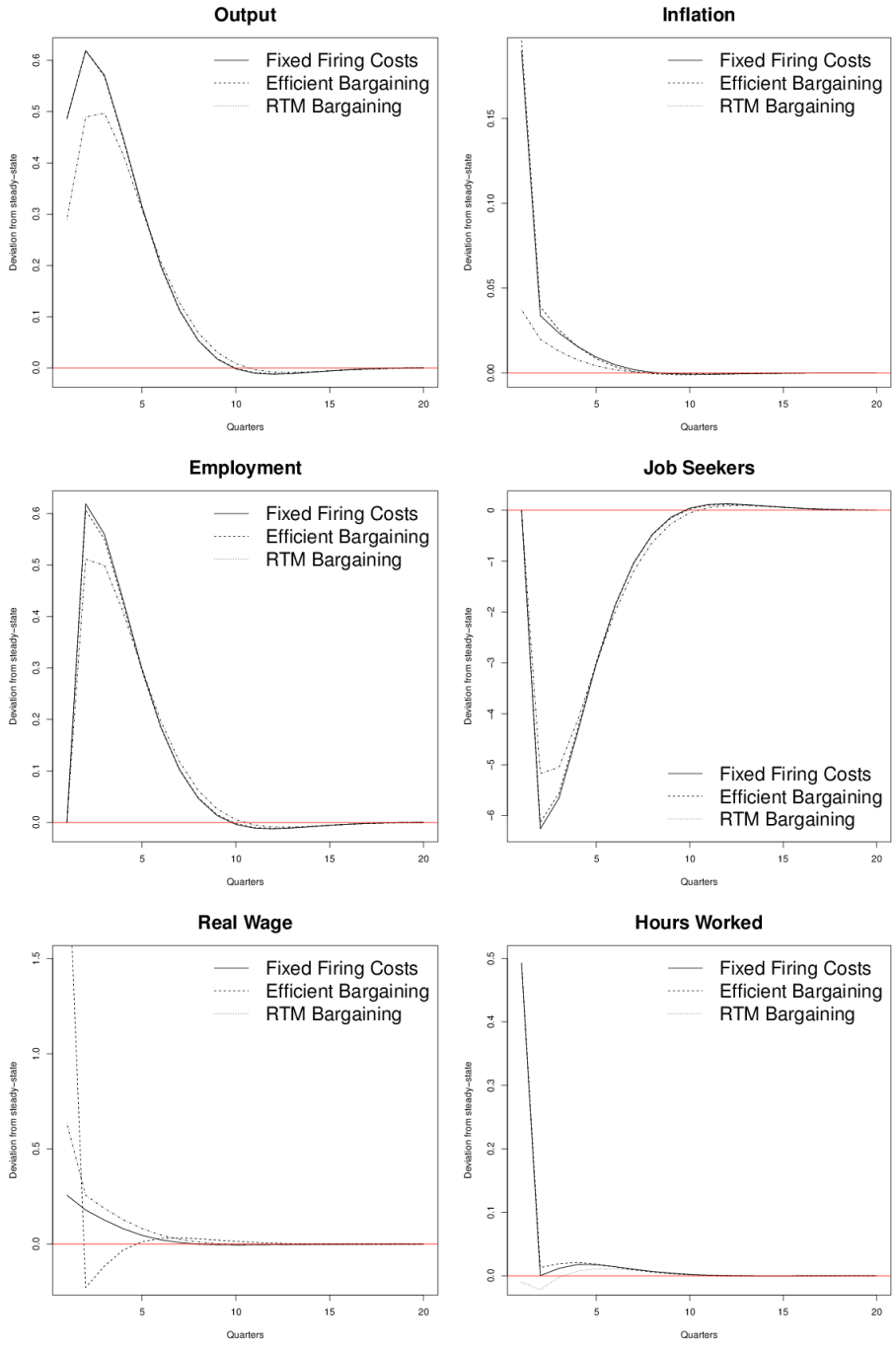
The marginal value of job, equation (4.5), and unemployment, equation (4.7), for a worker at the steady-state are given after some algebra by

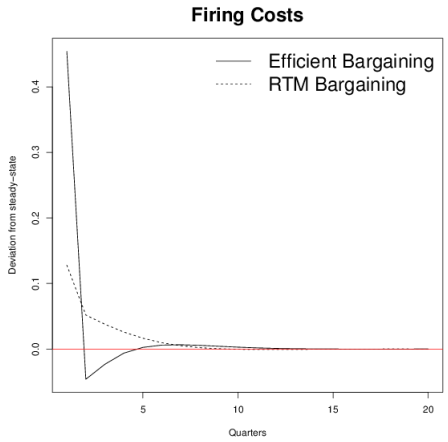
$$W_s = \frac{w_s h_s - \kappa_h \frac{h_s^{(1+\phi)}}{1+\phi} + \beta\rho\left(\frac{b}{1+\beta[s_s(1-\rho)-1]} + S_s\right)}{1-\beta(1-\rho)\left(1+\frac{\rho\beta s_s}{1+\beta[s_s(1-\rho)-1]}\right)} \tag{10.25}$$

$$U_s = \frac{b + \beta s_s (1-\rho) W_s}{1-\beta+\beta[s_s(1-\rho)]} \tag{10.26}$$

D Impulse Response Functions under the FFC, the EB and the RTMB frameworks

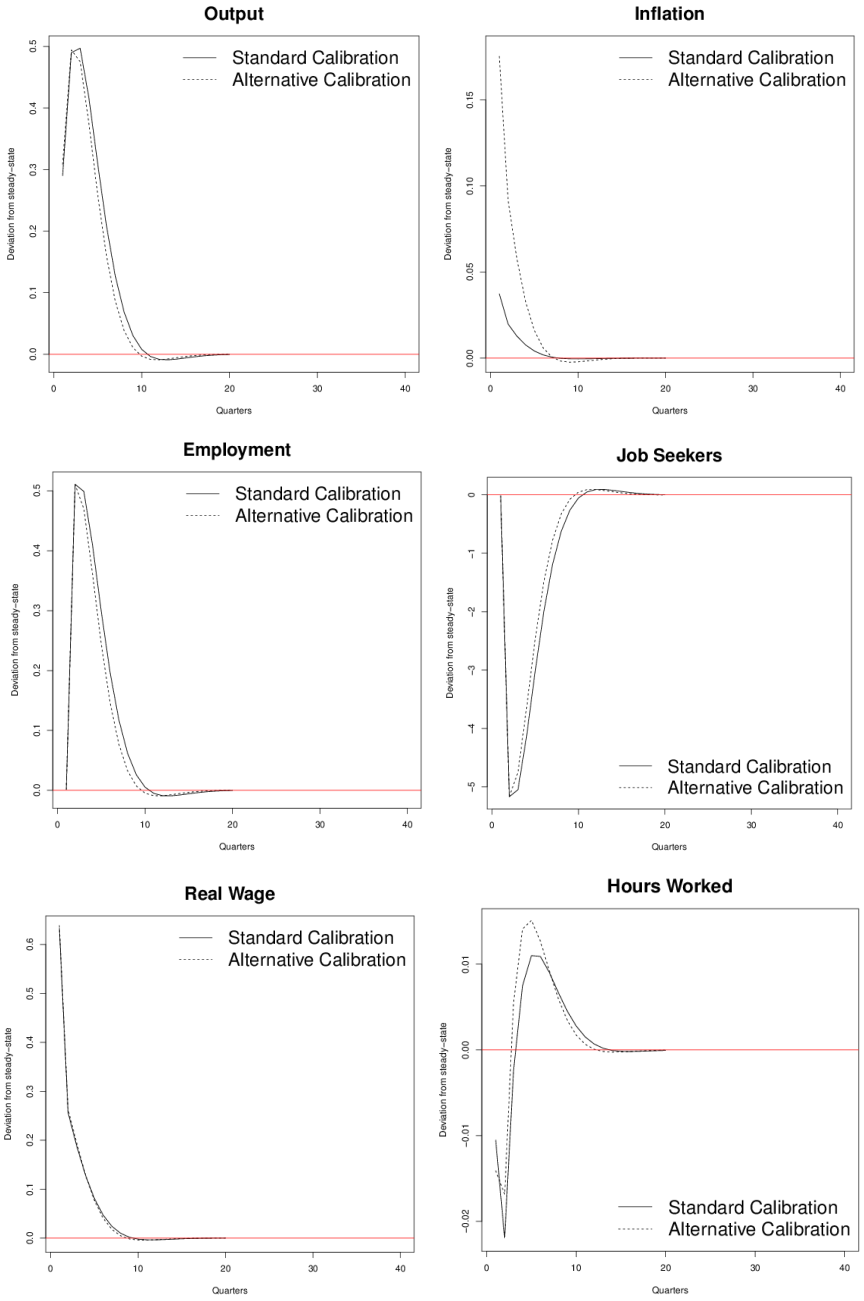
I present here the Impulse-Response Functions (IRF) to an unexpected monetary policies shock of 100 basis points.


Output
Inflation
Employment
Job Seekers
Real Wage
Hours Worked
Fixed Firing Costs
Efficient Bargaining
RTM Bargaining
Deviation from steady−state
Quarters


Firing Costs
Efficient Bargaining
RTM Bargaining
Deviation from steady−state
0.0
0.1
0.2
0.3
0.4
5
10
15
20
Quarters

E The IRF under the Baseline Calibration and the Alternative Calibration

I present here the IR functions in two different cases: the first case corresponds to the right-to-manage bargaining case where the Calvo coefficient is fixed to 0.85. The second case corresponds to the right-to-manage bargaining framework where the Calvo coefficient is fixed to 0.7.



Impact of government debt during financial stress on European bond spreads

Vivien Djiambou [i]

Tuesday, 20 August, 2019

Abstract

This paper investigates the non-linear impact of government debt on bond spread depending on the level of government debt ratio and the level of turmoil on the financial market. We apply a dynamic panel threshold regression to determine the impact of government debt when facing with high level of government debt and/or financial market stress on bond spreads. We find that high government debt ratios have positive and significant effects on bond spreads in periphery European countries. However, low government debt ratios with positive and significant impact on bond spreads in periphery EMU countries could rather indicate that considering the state of the financial system as threshold variable may better capture current development with the rise in importance of fiscal variables. Analyzing the impact of government debt ratios based on the state of the financial market shows in EMU, core EMU, periphery EMU, and periphery European countries that its impact is significant during adverse financial conditions. It is important to note that the shift in the coefficient of government debt from non-significant during low financial stress to positive and significant during high financial stress in periphery EMU countries could explain the sudden rise in bond spreads in periphery EMU countries. Also, the effects of government debts on bond spreads are generally non-significant for standalone and core European countries. A country with generally a high government debt ratio does not by itself means it would positively affect the bond spread when the financial markets are calm. Hence, considering the state of the financial market seems to be a crucial factor to explain the surge in bond spreads that pushed most periphery European economies into recessions and increased their government debt levels.

JEL *classification*: E44; E60; G15; H63
***Keywords*:** Financial stress; government debt; sovereign debt, dynamic panel threshold regression

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1. Introduction

The intensification of the euro area sovereign debt crisis with its epicenter in Greece, Ireland, and Portugal has been associated with the sudden surge in long-term government bond yields in European countries relative to the German bond yield after several years at low levels following the creation of the monetary union (see Figure 1). The subsequent severe deterioration of the financial and economic conditions in the affected euro area countries has been largely attributed to the increased in government debts, which has led to the revival of determining the impact of government debt on bond spread.

Figure 1. 10-year government bond spreads in European countries

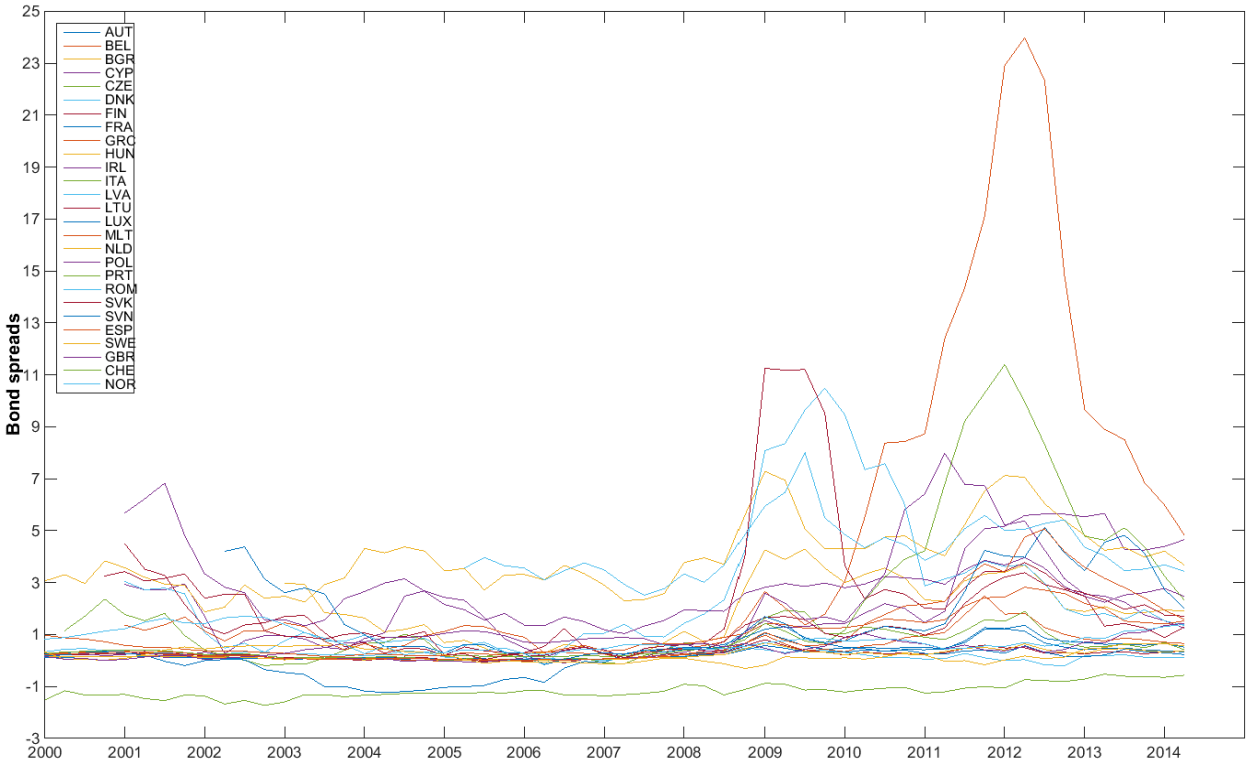
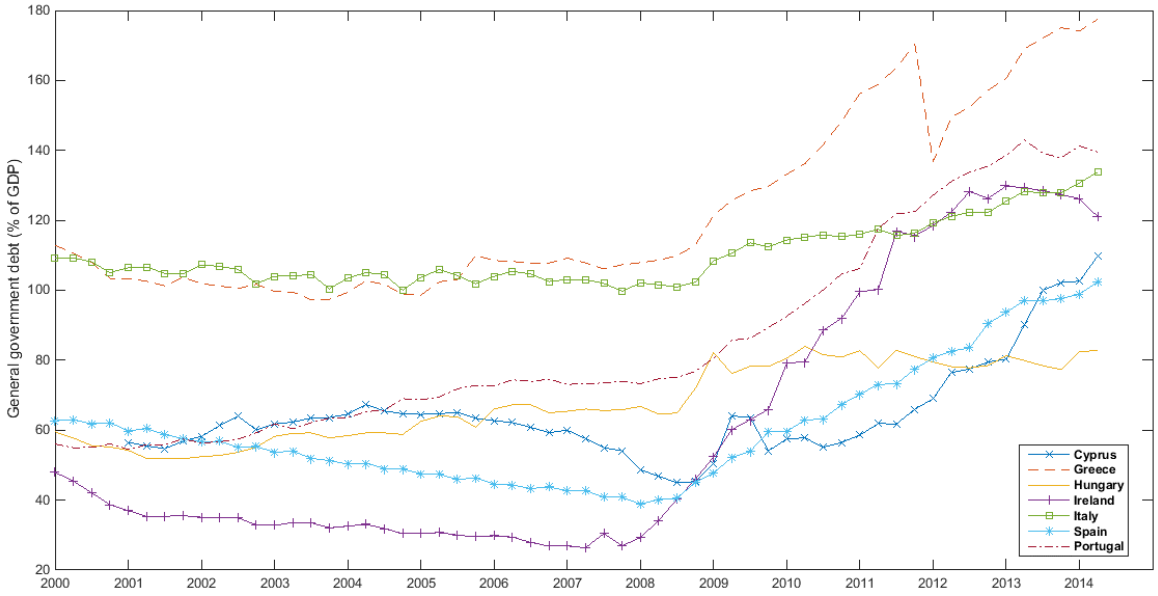


Figure 2 presents the development of general government debt as percentage of GDP in some affected European countries by the global crisis and subsequent euro crisis. Generally, we observe a rapid surge or continuously rising level of government debt ratios starting in 2008 in the heavily affected countries such as Cyprus, Greece, Ireland, Portugal, and Spain. Clearly, we observe in

Figure 1 and Figure 2 starting from 2008 the rapid surge in bond and government debt ratios. While prior to 2008, the relative calm and stable bond spreads generally match with stable and decreasing government debt ratios. This may suggest that correlation between bond spread and government debt ratio is positive and nonlinear.

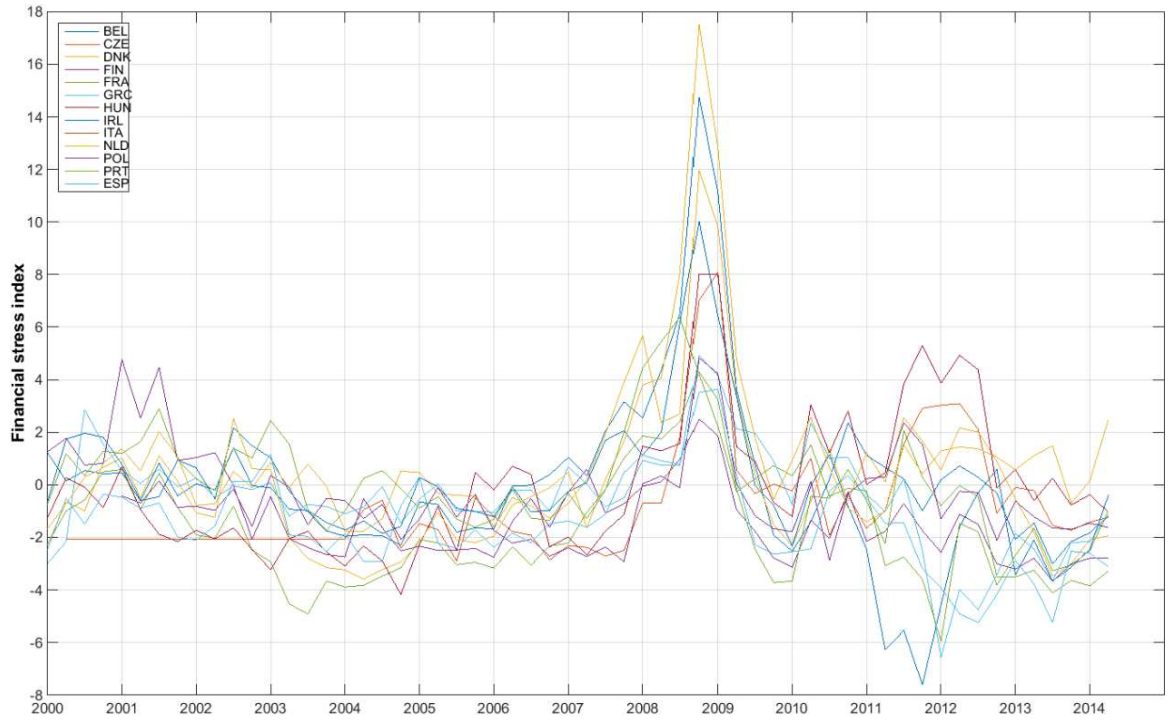
Figure 2. General government debt ratios in affected European countries



Typically, a government fiscal policy can have a greater impact on bond spread developments during periods of economic downturn or financial market stress compared to periods of good economic conditions. Given the scale of the euro crisis, it is crucial to adequately assess the effects of fiscal policies on bond spread developments particularly during periods of adverse financial stress. A country with a large government debt ratio may be exposed to significant amount of losses if investors' confidence about its ability to service the debt drops, especially when experiencing falling revenues and rising costs. However, the levels of government debts in countries such as Cyprus, Ireland, and Spain where relatively lower than 60% prior to the crisis in 2008, which could indicate low tolerance to high government debt ratios. In addition, this may suggest that the deterioration of the economic conditions due to higher financial markets stress seriously affected the economy (see Figure 3). We argue that the uncertainty surrounding financial institutions particularly in 2008 exacerbated the risks of potential governments defaults. Thus, there could exist

a possible non-linear relationship with bond spread after government debt ratio and/or financial market stress exceed certain threshold limits. In this study, we focus on the non-linearities that could be present due to various tolerance limits of European countries to high level of government debt ratios and/or high level of financial stress index. Then, it is important to assess whether the effects of government debt ratios and financial market stress after they reached certain thresholds are different from periods of favorable financial conditions. In addition, we analyze the interactions between government debt and financial stress within various states and their impact on bond spread developments.

Figure 3. Financial stress index in some European countries



The empirical literature that focuses on the non-linear impact of government debt on bond spread with the objective to determine the thresholds, is quite limited. Typically, the attempts in the literature are based on the determination of a single threshold variable that analyze the impact of sovereign debt (or inflation) on economic growth. In that order, the innovation in Proaño et al. (2014) concerns the investigation of the non-linear contributions of sovereign debt on economic

growth during financial stress using two threshold variables. Through empirical analyses using dynamic country-specific and dynamic panel threshold regressions for 16 OECD countries, they identified two thresholds variables (sovereign debt ratio and financial stress index) and the levels beyond which economic growth start to be impaired. This area in the literature emphasizes the impact of financial market stress as the source of non-linearity in the relationship between fiscal policy and economic growth. Afonso et al. (2011) argue that the state of financial markets represents an important factor in determining the effects of fiscal shocks on economic growth, and not just the level of government indebtedness itself. Nonetheless, another perspective in the empirical literature, such as in Reinhart and Rogoff (2010), employs a non-linear approach to determine the impact of government debt ratio on economic growth. They argue that government debt ratio beyond a certain threshold such as 90% of GDP starts to cause a negative impact on economic growth. However, Herndon et al. (2013) questioned the integrity of the Reinhart-Rogoff paper due to uncovered serious data omissions from certain countries, such as New Zealand and Belgium that have government debt ratios exceeded 90% and strong growth rates. After correcting for the omitted data, this seems to negate their main finding that government debts beyond a threshold at 90% significantly reduce economic growth. In addition, Minea and Parent (2012) discussed the results of Reinhart and Rogoff (2010) and demonstrated that additional evidence are required due to some complex nonlinearities present in the growth effects on fiscal policies in high government debt regimes. These complex nonlinearities indicate that on the one hand, high government debt above a certain threshold reduces economic growth, on the other hand, it still associated positively to the rise in economic growth.

This paper builds upon the above studies and contributes to the existing literature on financial crisis with the assessment of risks stemming from underlying macroeconomic fundamentals and financial market vulnerabilities. We argue about potential non-linearities effects of financial markets on the relationship between government debts and bond spreads. Brunnermeier and Oehmke (2012) argue that banks holding of sovereign debts can cause the banking system to be unstable and expose them to financial distress. Fearing their risk exposures to sovereign bonds, banks reduce or tighten conditions on loans to businesses and households to keep capitals. This behavior can lead to a climate of risk aversion with investors requiring higher risk premiums to fund even for viable profitable projects. In addition, this framework allow us to assess the aspect of the relationship between bond spread and government debt as part of a monetary union. De Grauwe and Ji (2013)

argue that bond spreads may be more sensitive in euro area countries that in countries with independent monetary policies (namely "standalone countries"). Also, they suggest that the impact of government debt ratios on bond spreads in euro area countries where initially disconnected and became significantly higher during difficult economic periods. In contrast, the relationship between government debt ratios and bond spreads in standalone countries is weak and remains independent of the state of financial markets even after the turmoil. In addition, Schoder (2014) argues that investor sentiment is even more volatile in peripheral euro area countries than in core euro area countries. Based on these papers, the non-linear effects of government debts on bond spreads should be more acute in euro area countries than in standalone countries (similarly, in peripheral euro area countries than in core euro area countries) when facing with financial stresses.

In this paper we contribute to that fiscal related literature by estimating the effects of the government debt ratios on bond spreads through two regime-dependent dynamic panel regression models in 27 European countries. We performed a principal component analysis on the bond spreads to obtain the various groups of European countries that have experienced similar variabilities. It is crucial to obtain groups that have experienced similar variabilities in their long-term government bond spreads such as those in the affected core and peripheral euro area countries. In addition, the financial stress index (see Cardarelli et al., (2009) and Danninger et al., (2009)) has been selected to represent a measure of the financial market unsustainability. In the dynamic panel regressions, we have two regime-dependent thresholds: one on the level of government debt ratio and the other on the level of financial stress index (FSI). According to our knowledge, there has been no attempt to analyze empirically the effects of government debt on bond spread based on the state of financial markets with measure such as the financial stress index. Also, collecting quarterly data starting from 2000 to 2014 can help us to make better inferences about the impact of the monetary union as taking longer series would result in including period where the monetary union was not yet created. With these specificities, we believe this paper can better address potential issues between euro area countries and standalone countries. In addition, we capture potential differences between core euro area and peripheral euro area countries since these groups have adopted quite similar reforms that strengthen economically and financially the relationship between them. Furthermore, we extend this analysis to the groups of core European and periphery European countries.

Our empirical analysis suggests several interesting results: (1) We find an empirical evidence suggesting that the impact of government debts on spreads are positive and significant in European countries, peripheral euro area countries, and periphery European countries. It is as expected that an increase in government debt ratio leads to an increase in bond spread when considering the government debt as the only threshold variable. Also, the magnitude of the coefficients that are positive and significant in high government debt regimes are generally greater than those in low government debt regimes. (2) Using the state of financial market as the only threshold is quite crucial to capture the source of non-linearities that government debt can exhibit during or after a financial turmoil. We observe a robust and positive significant coefficients of government debts on spreads in the groups of European countries, euro area countries, core euro area countries, peripheral euro area countries, and periphery European countries. This implies that a country may be impacted with surge in bond spread due to the state of the financial system whether the country present high or low government debt ratio. In particular, government debts in peripheral euro area countries are highly sensitives to the state of the financial markets. Hence, we identify the level of financial market stress as a crucial variable to capture non-linear effects of government debt on rising bond spread. (3) Using European countries with comparable economic characteristics, we found evidence that the combination of high financial stress and high government debt tends to increase bond spread in euro area countries and standalone countries. However, the impact is slightly lesser in standalone countries than in euro area countries with the latter appearing also to be more vulnerable to financial stress. The non-significance of the interaction between the level of government debt and financial market stress in core euro area countries may be an indication of investors confidences in the abilities of these economies to manage high government debt and high financial stress. Also, it may be an indication that political factors could represent an important driver of the bond spread. To conclude, our empirical results generally confirm that there is a significant and positive relationship between bond spread and government debt based on the levels of government debt and /or financial stress.

This paper is organized as follows: In section 2, we introduces the data and the control variables used in the empirical analysis. Section 3 explains the methodology of the dynamic panel threshold model relationship between government debt on bond spreads in European countries. Section 4 presents the estimation results. Section 5 concludes the paper.

2. Data description and variables

In this empirical analysis, we use a quarterly dataset ranging from 2000Q1 to 2014Q2 for 27 European countries: Austria, Belgium, Bulgaria, Cyprus, Czech republic, Denmark, Finland, France, Greece[1], Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United kingdom.[2]

The endogenous variable is the 10-year government bond spread which is computed using long-term government bond rates relative to the German government bond that we obtained from the OECD database and European Central Bank (ECB) database[3]. The general government debt ratio is defined based on the Maastricht treaty definition as the consolidated gross debt of the entire government sector outstanding debt at the end of the quarter. The financial stress index (FSI) has been obtained from the IMF dataset as discussed in Cardarelli et al. (2009) and Balakrishnan et al. (2009). FSI measures the level of strain in financial markets with high values indicating that the financial system in under stress. In addition, we consider the current account balance and real GDP growth rate as control variables to ensure that our results are robust. The current account balance and real GDP growth rate have been obtained from the OECD database. [4]

A relevant issue in the empirical analysis concerns the selection of variables that best describe fiscal developments. In order to capture the impact of fiscal policies on bond spread, we select government debt ratio as the single fiscal variable that covers past government actions and helps to ensure fiscal sustainability. In addition, government debt ratio captures fiscal development and extraordinary government interventions that have contributed over the years. The financial stress index is constructed to approximate the states of financial markets based on banking sector, securities, and exchange rate. It represents the sum of the normalized components with large positive values of FSI indicating high level of financial while values of FSI that are equal or lower

[1] We included Greece in the group of euro area countries despite joining the Eurozone a year later because we believe that this delay will not significantly affect the results.

[2] Due to missing data points, Bulgaria, Cyprus, Czech republic, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, and Slovenia cover the periods respectively from 2003Q1-2014Q2, 2001Q1-2014Q2, 2000Q2-2014Q2, 2001Q1-2014Q2, 2001Q2-2014Q2, 2001Q1-2014Q2, 2001Q1-2014Q2, 2005Q2-2014Q2, 2000Q4-2014Q2, 2and 002Q2-2014Q2. In addition, we excluded Croatia from the analysis due to lack of data.

[3] Long-term government bond yields obtained from the OECD database are in quarterly frequency. Also, we obtained some bond yields from the ECB in monthly frequency and subsequently average them to get quarterly observations.

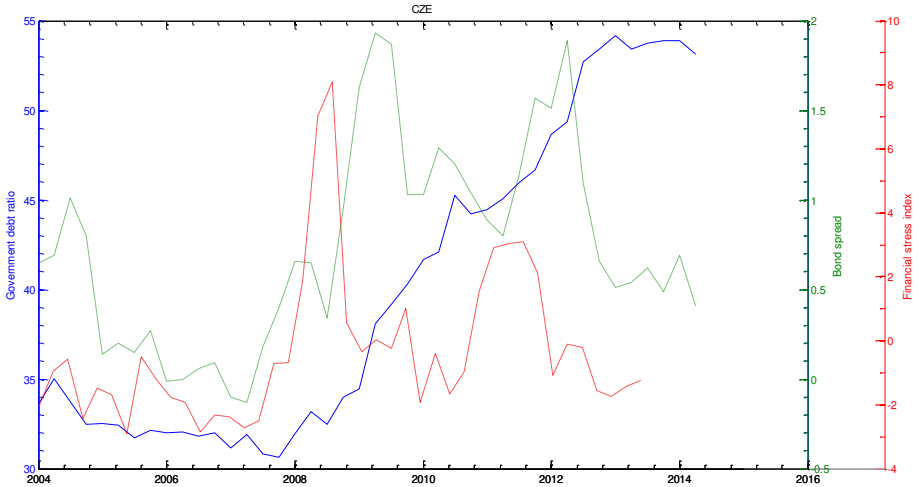
[4] We noted the potential non-stationarity of the variables such as bond spreads and government debt ratios. However, despite the fact that we may suspect the presence of unit root in these variables, we generally proceed as in the literature without taking the first difference since that would change the effects we are trying to analyze such as capturing the short term impact of government debt.

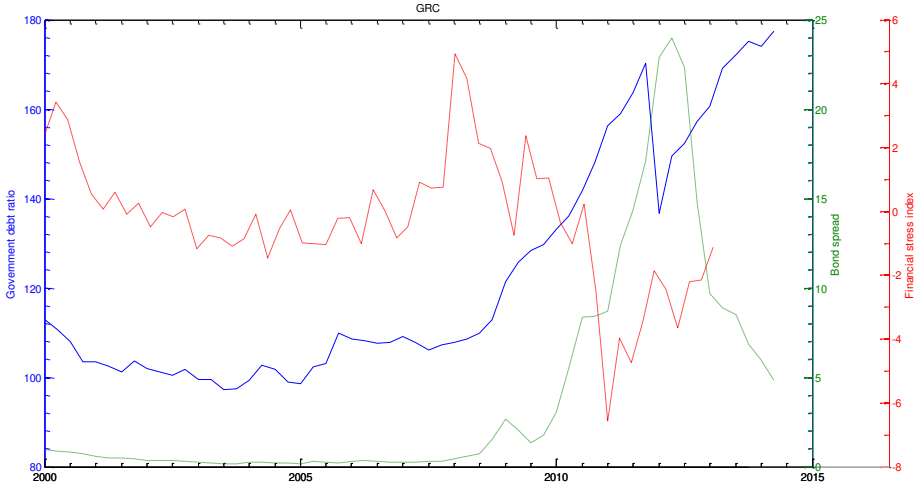
than zero generally indicate the absence of stress in financial markets. The current account balance reflects the performance of the country towards the rest of the world. European countries are highly generally dependent on trade with other European countries to generate strong economic growth. A significant contraction of their exports revenues can have major negative impact on the economic and sustainability risks of these countries. Similarly, we introduce the real GDP growth rate which reflects the state of the economy. A country can easily payback its debts during good economic condition because it can generate sufficient revenues or obtain cheaper funds through further indebtedness. However, during economic contraction, it faces with falling tax revenues, rising spending costs, and expensive borrowing costs.

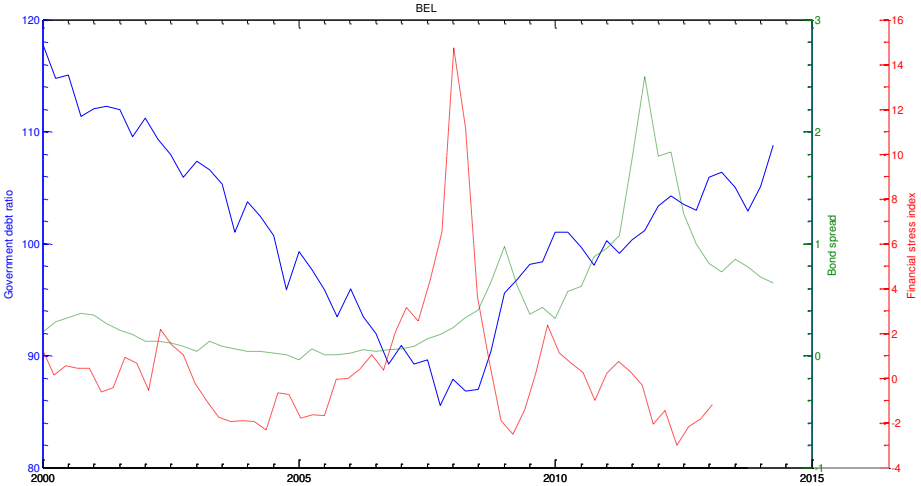
In Figure 4, bond spreads are expressed in percentage, government debt ratios are expressed in percentage of GDP, and financial stress indexes are not expressed in a unit. The government debt ratio differs considerably between euro area countries and standalone countries. In standalone countries such as Czech republic, Denmark, and Sweden, the government debt ratios are among the lowest for the sample considered. In contrast, euro area countries currently have among the highest levels of public debt ratios beyond 100% in Greece, Ireland, and Portugal. In addition, the steady increase in the level of government debt ratios over time in several European countries are of primary interest. However, we note a few exceptions in countries such as Belgium, Denmark, Finland, Ireland, and the Netherlands which managed to reduce significantly their government debt ratios until 2008 before the global financial crisis adversely affected those ratios causing them to rise. In particular, the haircuts in Greece provided in 2011 by the troika (European Union, International Monetary Fund, and European Central Bank) can clearly be seen in the data with the sudden fall in government debt. It is interesting to note the subsequent reductions in the risk of default of the Greek government despite further deteriorations of the government debt ratio. Also, we note that troubled peripheral euro area countries such as Ireland, Portugal, and Spain do not have considerably higher government debt ratios than core euro area countries such as Belgium.

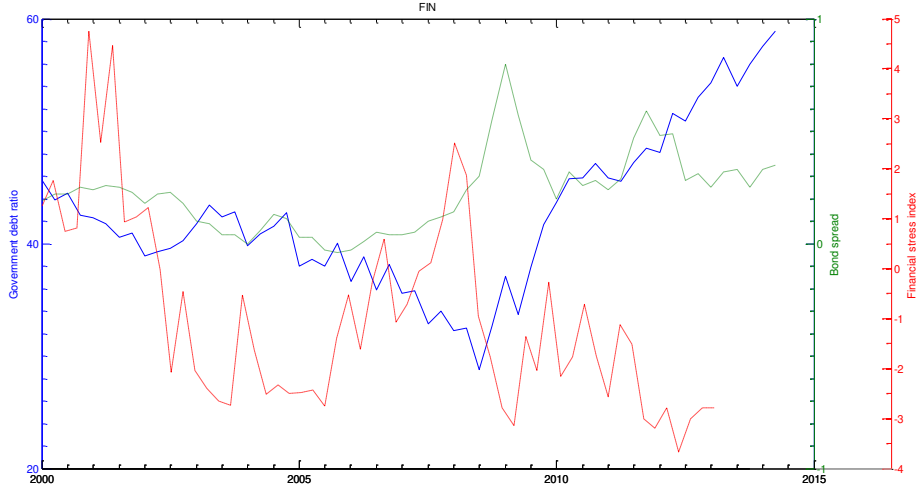
Concerning the interaction between the financial stress index and the bond spread, as Figure 4 clearly illustrates, there is a strong positive correlation between bond spread and FSI during certain periods. We observe the surge in bond spreads in the majority of considered countries with the rise in the FSI. In particular, during the recent financial crisis, both the FSI and bond spreads spiked to unprecedented levels in several European countries. This is not quite surprising considering that the FSI is constructed as a combination of factors (e.g. banking sector beta, stock market returns,

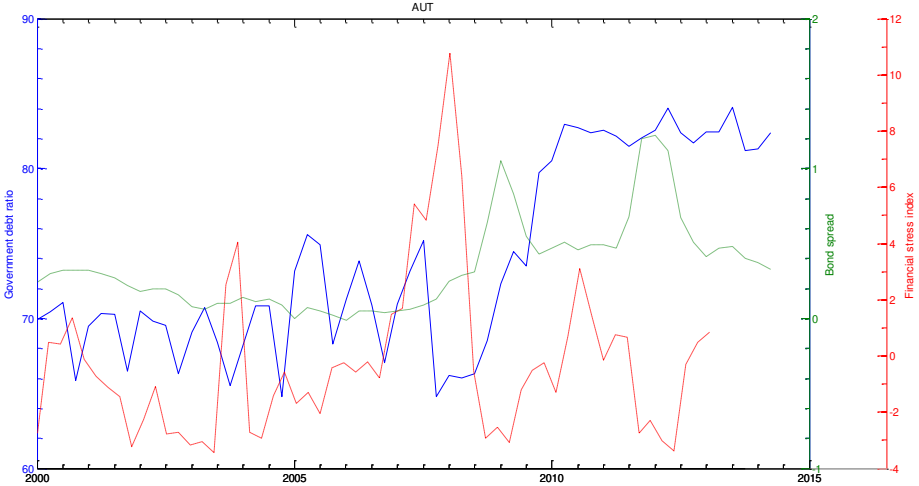
…) that are closely linked to the state of the market conditions. However, it is important to note that the construction of the FSI could be correlated to bond spread. In addition, government interventions through guarantees and bailouts added to central banks unconventional monetary policies helped to stabilize the financial system. This is indicated with the rapid fall of the FSIs while the bond spreads still have large values due to governments rising indebtedness. In this context, it is interesting to note that the surge in bond spreads during the recent financial crisis was observed across most European countries considered. However, the FSI reactions were quite differentiated and high in countries such as Belgium, Greece, Ireland, Hungary, and the Netherlands.

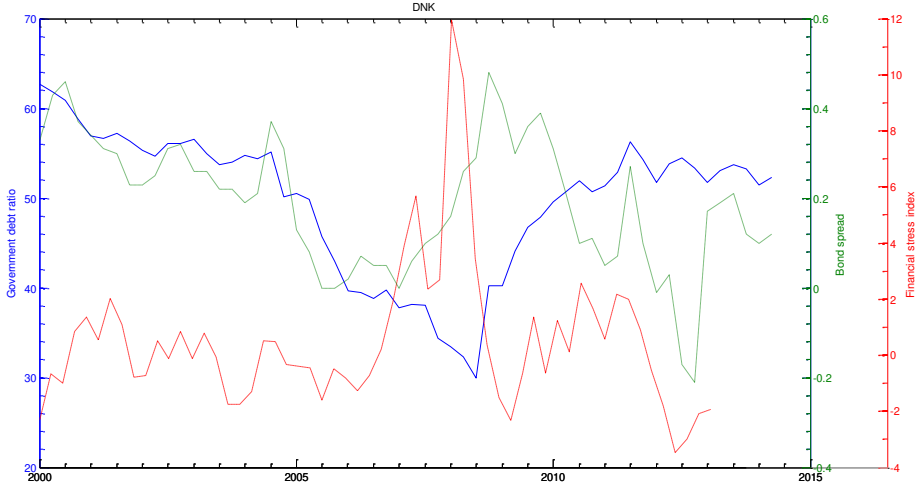

CZE
Government debt ratio
Bond spread
Financial stress index
2004
2006
2008
2010
2012
2014
2016

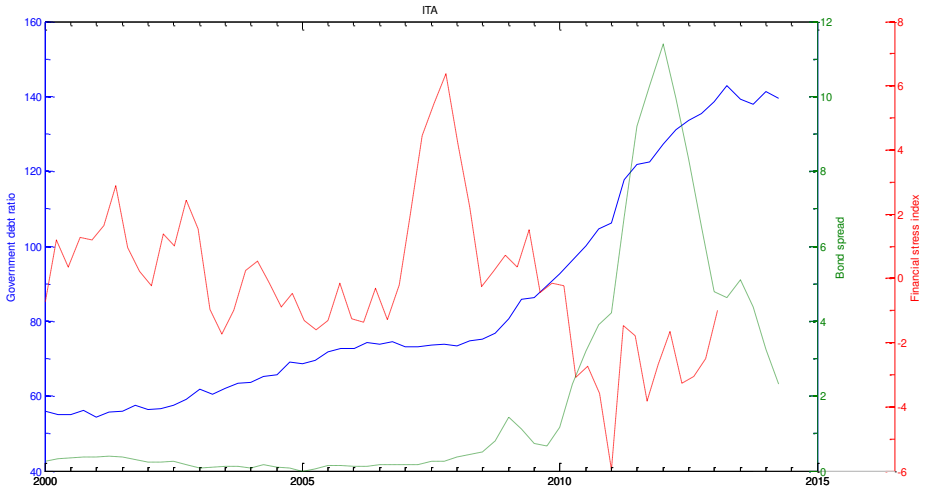

GRC
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015

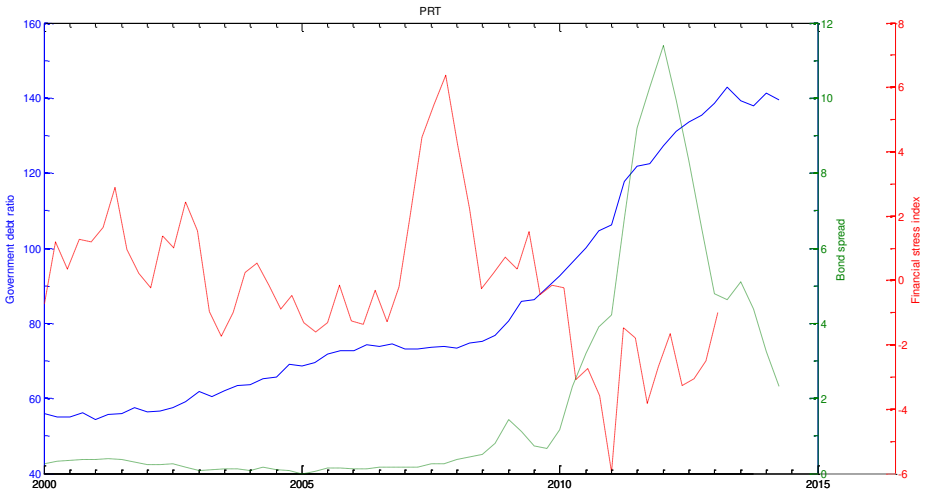

BEL
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015

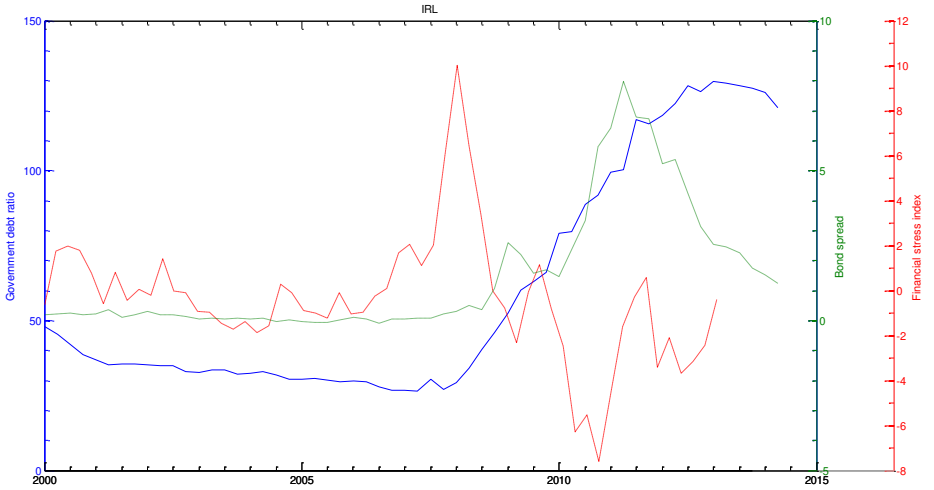

FIN
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015

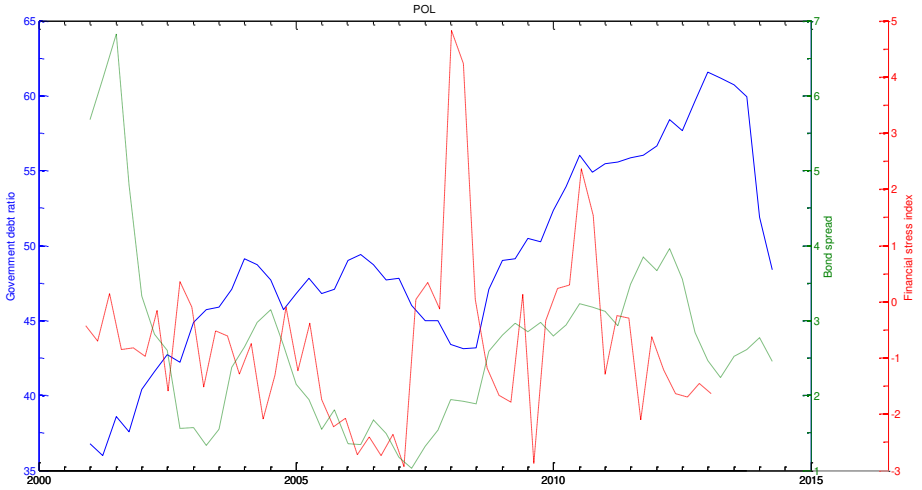

AUT
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015

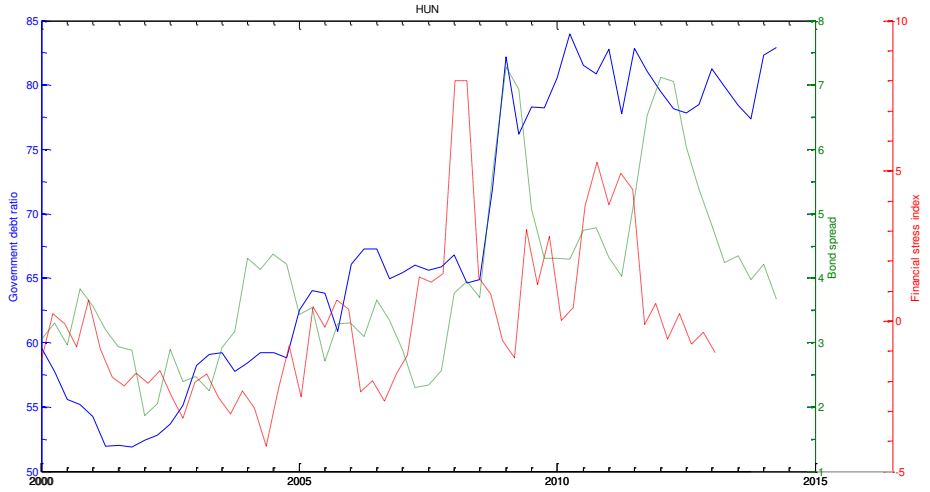

DNK
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015

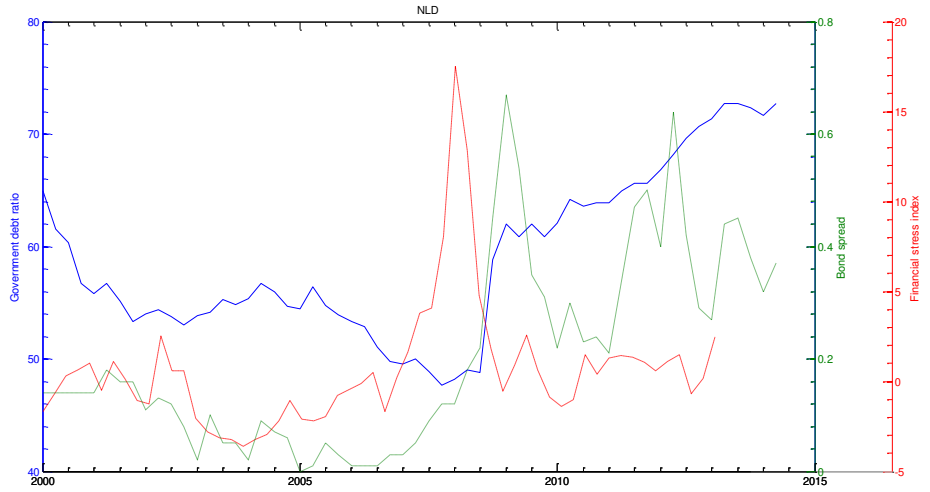

ITA
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015


PRT
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015


IRL
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015


POL
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015


HUN
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015


NLD
Government debt ratio
Bond spread
Financial stress index
2000
2005
2010
2015

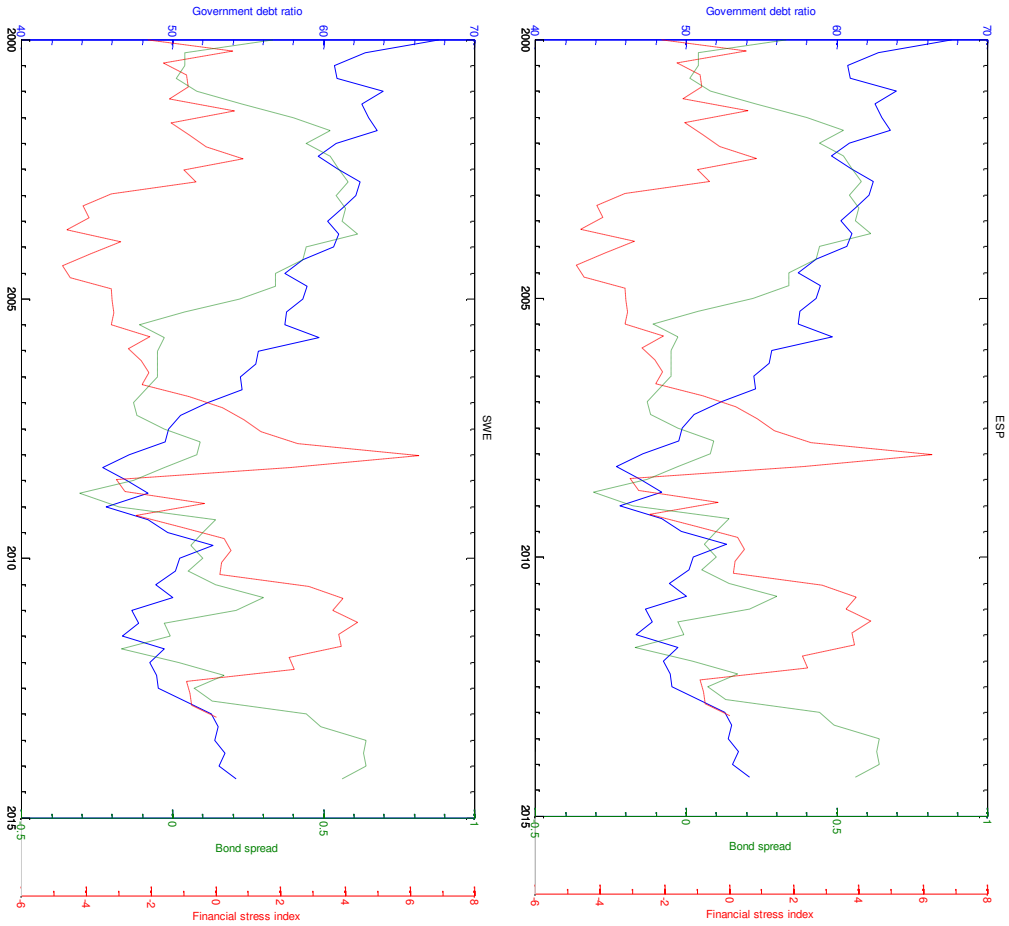


Figure 4. Bond spread, general government debt, and financial stress

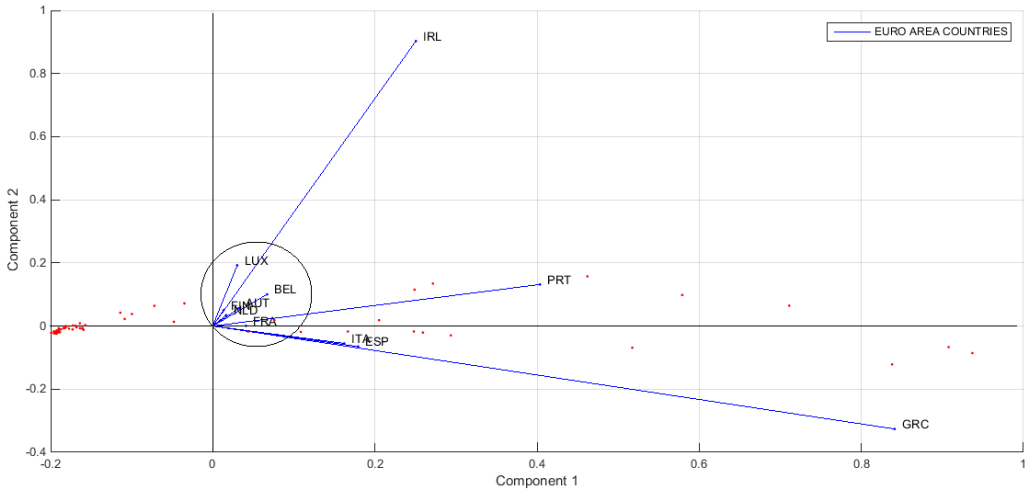
Note: General government debt ratio as percentage of GDP (blue line, left axis), bond spread in percentage (dotted green line, right axis), and financial stress index without unit (dash-dot red line, right axis) from 2000:1 to 2014:2.

Despite the relatively short time horizon, the dataset starts from the period where the monetary union was created. This offers several advantages in capturing the impact of the financial and economic policies conducted within the monetary union on the macroeconomic variables. Therefore, the result of the comparison between euro area countries and standalone countries can be fully differentiated. Also, this is quite important because data with longer horizon are not comparable with today's economic conditions. Thus, it would be difficult to compare euro area and standalone countries if we include the periods when euro area countries had independent monetary policies. In addition, short term period reduces the likelihood of finding several structural changes in the dataset. Therefore, the results of dynamic panel threshold regressions can estimate adequate threshold values that better fit the development in today's market conditions.

To determine the different groups of countries that will be used in the dynamic panel threshold method, we put together the countries with independent monetary policies and denoted the group as "*standalone countries*". In this group of standalone countries, we did not consider European countries that later joined the euro area in 2014 and 2015. That is because we believe that efforts to meet the pre-conditions to join the euro area could already have important consequences on the development of bond yields. Thus, we selected only countries with no formal agreement to join the monetary union. In the composition of the remaining groups, we applied a principal component analysis on the 10-year government bond spreads relative to Germany to distinguish between periphery and core countries in euro area and European levels. The biplots in Figure 5 and Figure 6 represent respectively the bond spreads in euro area countries and in European countries. The biplots reveal how strongly bond spreads in these countries are correlated with each other such that they can be grouped together. Also, they provide the amount of variabilities accounted for by the first two principal components.

In Figure 5, the two principal components in euro area countries account for at least 98% of the total variance, which means the biplot provides a very good approximation. We observed that the 10-year government bond spreads from Austria, Belgium, Finland, France, Luxembourg, and the Netherlands are generally clustered together (grouped as core EMU countries). Also, this group substantially differ from those in Greece, Ireland, Italy, Portugal, and Spain (grouped as peripheral

Figure 5. Biplot of bond spreads in euro area countries

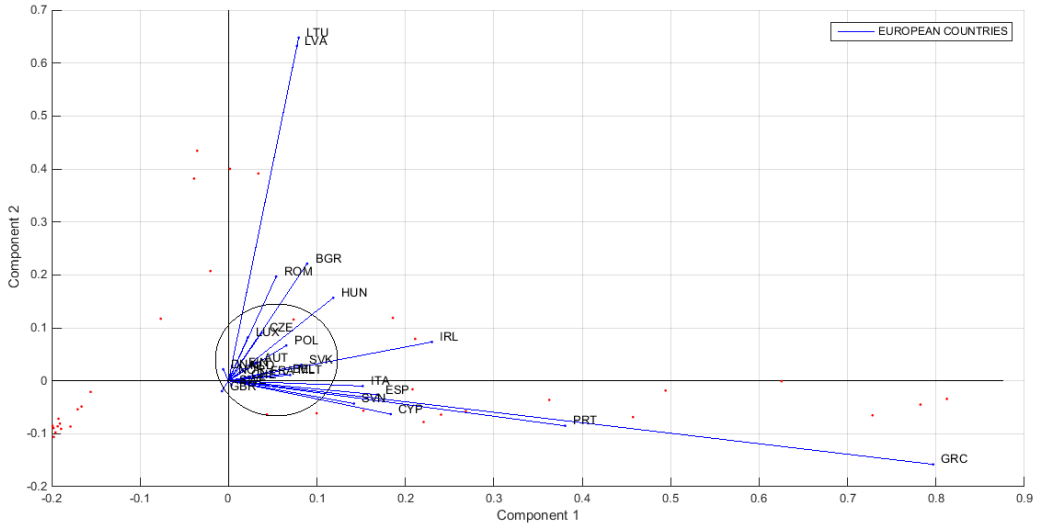


Note: We applied the principal component analysis to obtain the biplot of the 10-year government bond spreads in euro area countries. The result shows that bond spreads in euro area countries substantially differ and can be grouped into two main groups such as core euro area countries (circle with an elliptic curve) and peripheral euro area countries. We circle together countries that are clustered near each other due to similar amount of variabilities in bond spreads.

EMU countries). We grouped various EMU countries into two main groups based on the fact that countries with similar amounts of variabilities will be clustered together or near each other's on the graph. This method allows us to identify core EMU countries since we expect fewer divergences in bond spreads. In contrast, we expect greater divergences in bond spreads for peripheral EMU countries.

Similarly in Figure 6, the two principal components in European countries account for at least 93% of the total variance in the data. Thus, using the first two principal components provide a good approximation. The result shows that Austria, Belgium, Czech republic, Denmark, France, the Netherlands, Norway, Poland, Slovakia, Sweden, Switzerland, and United Kingdom can be grouped together and denoted as core European countries. This is due to the fact that these countries are clustered together or near each other's on the graph. Meanwhile, the group of countries made of Bulgaria, Cyprus, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Portugal, Romania, Slovenia, and Spain are also grouped and denoted as periphery European countries due to high divergence on the graph.

Figure 6. Biplot of bond spreads in European countries



Note: We applied the principal component analysis to obtain the biplot of the 10-year government bond spreads in European countries. The result shows that bond spreads in European countries substantially differ and can be grouped into 2 main groups such as core European countries (circle with an elliptic curve) and periphery European countries.

Therefore, we summarized the composition of the various panel groups[5] in Table 1 that would be used during the dynamic panel threshold analysis.

Table 1. List of countries within each panel group

PANEL GROUPS	**LIST OF COUNTRIES**	**Nr.**
EUROPEAN	Austria (AUT), Belgium (BEL), Bulgaria (BGR), Cyprus (CYP), Czech republic (CZE), Denmark (DNK), Finland (FIN), France (FRA), Greece (GRC), Hungary (HUN), Ireland (IRL), Italy (ITA), Latvia (LVA), Lithuania (LTU), Luxembourg (LUX), Malta (MLT), the Netherlands (NLD), Norway (NOR), Poland (POL), Portugal (PRT), Romania (ROM), Slovakia (SVK), Slovenia (SVN), Spain (ESP), Sweden (SWE), Switzerland (CHE), United kingdom (GBR)	27
STANDALONE	Bulgaria (BGR), Czech republic (CZE), Denmark (DNK), Hungary (HUN), Norway (NOR), Poland (POL), Romania (ROM), Sweden (SWE), Switzerland (CHE), United kingdom (GBR)	10

[5] The composition of the panel groups are quite robust since we obtained similar results when performing the biplots with respect to 10-year government bond spreads relative to the United States rather than Germany.

EMU	Austria (AUT), Belgium (BEL), Finland (FIN), France (FRA), Greece (GRC), Ireland (IRL), Italy (ITA), Luxembourg (LUX), the Netherlands (NLD), Portugal (PRT), Spain (ESP)	11
CORE EMU	Austria (AUT), Belgium (BEL), Finland (FIN), France (FRA), Luxembourg (LUX), the Netherlands (NLD)	6
PERIPHERY EMU	Greece (GRC), Ireland (IRL), Italy (ITA), Portugal (PRT), Spain (ESP)	5
CORE EUROPEAN	Austria (AUT), Belgium (BEL), (DNK), Finland (FIN), France (FRA), Luxembourg (LUX), Malta (MLT), the Netherlands (NLD), Norway (NOR), Poland (POL), Slovakia (SVK), Sweden (SWE), Switzerland (CHE), United kingdom (GBR)	14
PERIPHERY EUROPEAN	Bulgaria (BGR), Cyprus (CYP), Czech republic (CZE), Greece (GRC), Hungary (HUN), Ireland (IRL), Italy (ITA), Latvia (LVA), Lithuania (LTU), Portugal (PRT), Romania (ROM), Slovenia (SVN), Spain (ESP),	13

Note: Estonia is excluded in the analysis due to the absence of a 10-year government bond yield.

3. Econometric methodology

Let us now apply the dynamic panel estimation techniques in the analysis of the impact on long-term government bond spread. The regressions that are applied throughout this study follow the approach developed by Proano, Schoder, and Semmler (2014) and Kremer et al. (2013). To this aim, we consider the following three panel threshold models in order to account for the level of government debt ratio as well as the level of financial stress that can affect the impact of government debt ratio on bond spread. These threshold regressions allow us to distinguish between countries within the low or high government debt regime and also countries with low or high financial stress regime, respectively. More specifically, we first study the potential non-linear impact of government debt ratio on bond spread depending on the level of government debt ratio itself; second, we study how the impact of government debt ratio on bond spread depending on the level of financial market stress; and finally, how the effect of government debt ratio on bond spread is dependent on both the level of government debt ratio and the level of financial market stress.

Following the approach in Proano, Schoder, and Semmler (2014) and Kremer et al. (2013), we first consider the dynamic panel threshold regression with the specification that a threshold level is based on government debt ratio beyond which a rise in government debt ratio leads to an increase in bond spread. Hence, the government debt ratio is assumed to be the only threshold variable.

This model can be written as:

$$sprdde_{it} = \mu_i + \varphi.z_{it} + \beta_{gdbt}^{L}.gdbt_{i,t-1}.I(gdbt_{i,t-1} \leq \gamma_{gdbt}) + \beta_{gdbt}^{H}.gdbt_{i,t-1}.I\,(gdbt_{i,t-1} > \gamma_{gdbt}) + \varepsilon_{it} \qquad (1)$$

where $sprdde_{it}$ refers to the 10-year government bond spread relative to Germany in year t for country i. γ_{gdbt} is the threshold level of the government debt ratio and is assumed to be exogenous. I(.) is an indicator function which takes on the value of 1 if the condition in its argument holds and otherwise takes on a value of 0. β_{gdbt}^{L} and β_{gdbt}^{H} are coefficients of the government debt ratio respectively representing the effects during low and high government debt regimes. z_{it} is a vector which could contain the endogenous lagged dependent variables $sprdde_{i,t-1}$ and the control variables such as real GDP growth ($rgdp_{i,t}$) and current account balance ($cab_{i,t}$) that are exogenous explanatory regime-independent variables. μ_i is a country-specific fixed effect, ε_{it} an *i.i.d.* country-specific random disturbance with zero mean and a variance $\sigma_{\varepsilon i}^2$.

We estimated the dynamic panel threshold model following the approach by Caner and Hansen (2004). However, given that the Caner and Hansen (2004) procedure does not apply to panel data, we first had to make their framework suitable enough to deal with the country-specific fixed effects μ_i from the model we used. Thus, country-specific fixed effects μ_i are eliminated from the model to ensure that the regression results are not biased using the transformation method called "forward orthogonal deviation". Arellano et al. (1995) proposed this transformation which eliminates individual country-specific fixed effects while leaving the lagged dependent endogenous variables as valid instruments. To analyze the threshold effect of government debt ratio on bond spreads, we applied the methodology suggested by Kremer et al. (2013) that extends the threshold estimation for the case of panel data and uses forward orthogonal deviations to eliminate individual fixed effects. Thus, for the error term, the forward orthogonal deviations transformation required is given by:

$$\epsilon^*_{it} = (T-t/T-t+1)^{1/2}[\epsilon_{it}-(1/(T-t))*(\epsilon_{i(t-1)}+\ldots+\epsilon_{iT})]$$

and $Var(\varepsilon_{it}) = \sigma^2 I_T$ is not serially correlated and $Var(\epsilon_{it}^*)=\sigma^2 I_{T-1}$ with also has no serial correlation.

This estimation procedure ensure that cross-sectional model can be applied to the dynamic panel model. Applying the transformation procedure to Eq. (1) leads it to be rewritten as:

$$sprdde^{*}_{it} = \delta^{H} + \varphi.z^{*}_{it} + \beta_{gdbt}{}^{L}.gdbt^{*}_{i,t-1}.I(gdbt_{i,t-1} \leq \gamma_{gdbt}) + \beta_{gdbt}{}^{H}.\ gdbt^{*}_{i,t-1}.I(gdbt_{i,t-1} > \gamma_{gdbt}) + \varepsilon_{it} \quad (2)$$

where the superscript * denotes the data after the transformation and δ^{H} is the coefficient of the intercept in high government debt regime such that $\delta^{H} = \delta.I(gdbt_{i,t-1} > \gamma_{gdbt})$ with δ as coefficient of the constant term.

In addition, we assumed the lag of the endogenous variable is 1 due to the small sample periods and large number of variables after we subdivided the dataset into several groups (e.g. standalone, core, and periphery countries). Thus, we restricted the number of control variables to avoid potential overfitting of the endogenous variable that can lead to bias in the estimated coefficients. In order to estimate robust threshold values, we specified that a change of regime in the estimation of the thresholds should exclude the lowest and highest 5% of all the observations. This is to minimize the impact of potential breaks, mostly indicated by sudden shifts or extreme values such as outliers within the data on the estimated results. However, while the decision to reject the lowest and highest 5% of all observations during the threshold estimation was quite arbitrary, such a simple rule allowed us to reduce the likelihood that the threshold estimation would tilt toward those extremes values. This procedure is also applied in Proaño et al. (2014) to minimize the effects of these few extreme values on the results. Therefore, the estimated threshold values would be more robust if we take that into account across each panel group.

Similarly, we analyze the non-linear impact of government debt ratio on bond spread using the FSI as the threshold variable. As argued in the theoretical section, the impact of government debt on bond spread may be positive and significant during times of high financial stress to compensate investors for the additional risk exposures causing the surge in bond spreads. With high levels of government debts, bond spreads in euro area countries could be even more sensitive to the state of financial market stress as the financial stress index rise to new record level. We specify the panel regression as follow:

$$sprdde^{*}_{it} = \delta^{H} + \varphi.z^{*}_{it} + \beta_{gdbt}{}^{L}.gdbt^{*}_{i,t-1}.I(fsi_{i,t-1} \leq \gamma_{fsi}) + \beta_{gdbt}{}^{H}.\ gdbt^{*}_{i,t-1}.I(fsi_{i,t-1} > \gamma_{fsi}) + \varepsilon_{it} \quad (3)$$

where fsi_{it} is the financial stress index, δ^{H} is the coefficient of the intercept in high financial stress regime such that $\delta^{H} = \delta.I(fsi_{i,t-1} > \gamma_{fsi})$, and the other parameters and variables are as previously stated.

Finally, we analyze the impact of government debt on bond spread depending on the level of the government debt ratio itself as well as the level of the FSI. In this case, we consider two threshold variables in the regression model, which give rise to up to four regimes. These four regimes are as follows: low government debt ratio and low financial stress index (LL), high government debt ratio and low financial stress index (HL), low government debt ratio and high financial stress index (LH), and high government debt ratio and high financial stress index (HH).

Thus, we consider the following panel threshold model:

$$\begin{aligned} sprdde^{*}_{it} = \delta^{HH} + \varphi.z^{*}_{it} + \beta_{gdbt}{}^{LL}.gdbt^{*}_{i,t-1}.I(gdbt_{i,t-1} \le \gamma_{gdbt}, fsi_{i,t-1} \le \gamma_{fsi}) + \\ \beta_{gdbt}{}^{HL}.gdbt^{*}_{i,t-1}.I(gdbt_{i,t-1} > \gamma_{gdbt}, fsi_{i,t-1} \le \gamma_{fsi}) + \\ \beta_{gdbt}{}^{LH}.gdbt^{*}_{i,t-1}.I(gdbt_{i,t-1} \le \gamma_{gdbt}, fsi_{i,t-1} > \gamma_{fsi}) + \\ \beta_{gdbt}{}^{HH}.\ gdbt^{*}_{i,t-1}.I(gdbt_{i,t-1} > \gamma_{gdbt}, fsi_{i,t-1} > \gamma_{fsi}) + \varepsilon_{it} \end{aligned} \quad (4)$$

where the variables and parameters are expressed as before.

4. Estimation results

The results of the empirical relation between bond spread, government debt ratio, and financial stress are estimated using dynamic panel threshold regressions previously stated. In the next part, we analyze how the level of government debt ratio after reaching a certain threshold could affect the impact of government debt on bond spread.

4.1. Government debt ratio as threshold variable

In the following panel threshold analysis, we assume that government debt ratio is the only threshold variable. Table 2 reports the results of the panel threshold regressions. The second column present the estimated government debt thresholds and the interval where the thresholds are significant at 5% level. The third and four columns respectively present the number of observations in which government debt ratios are below and above the thresholds. The fifth, six, and seven columns respectively present the lagged bond spread, real GDP growth rate, and current account

balance. The eight and nine columns are our primary interest since it allows us to determine the impact of the changes of government debt ratio in low and high government debt regimes respectively.

The plots of the likelihood ratios in Figure 7 (see Appendix) suggest that the threshold of the government debt ratio that have been endogenously estimated by the model are significant at 5% level in all panel groups. Column 1 contains the estimated thresholds and feasible set with the true threshold values of the government debt ratios.

Table 2. Panel results of government debt ratio thresholds impact on spreads.

	γ_{gdbt}	L	H	$sprd_{t-1}$	$rgdp_t$	cab_t	β^L_{gdbt}	β^H_{gdbt}	δ^H	R_2 R_2 adj
EUROPEAN	106.45 [106.24, 108.12]	1355	118	0.878***	-0.049***	-0.001	0.002*	0.020**	-2.033**	87.89 87.85
STANDALONE	23.20 [15.50, 69.16]	79	506	0.843***	-0.030**	-0.001	-0.077***	0.001	-1.355***	75.96 75.75
EMU	106.44 [106.24, 121.40]	527	100	0.942***	-0.045***	-0.016***	0.002	0.009*	-0.788	91.63 91.56
CORE EMU	97.71 [6.53, 98.36]	294	48	0.906***	-0.003	0.000	0.002*	-0.003	0.518	83.53 83.28
PERIPHERY EMU	122.48 [117.71, 133.20]	244	41	0.969***	-0.074***	-0.069***	0.007***	0.009	-0.441	91.72 91.57
CORE EUROPEAN	100.19 [97.71, 101.03]	776	67	0.925***	-0.001	-0.003*	0.001	0.001	-0.047	81.11 81.00
PERIPHERY EUROPEAN	121.16 [106.24, 121.16]	583	47	0.884***	-0.059***	-0.019***	0.007***	0.034**	-3.634**	87.64 87.54

Notes: Standard errors are in parenthesis. ***, ** and * denote the level of significance at 1%, 5% and 10%, respectively. The interval of feasible threshold values is in brackets. Panel threshold regression model presented in equation (2).

Based on the results in Table 2, we find that coefficients of the lagged bond spreads are positive and significant at 1% confidence level for all panel groups. In addition, the coefficients of the real GDP growth are negatives and mostly significant at 5% level as expected. Clearly, the increase in real GDP growth rate should lift up the economy and reduces bond spread. Also, the coefficients of current account balance are negative and generally significant at 1% level. The negative sign is generally expected because improvement in current account balance should reduce the government borrowing needs leading to reduction in bond spread.

However, we are primarily interested by the coefficients government debt in high and low government debt regimes. The coefficients of government debt ratio appear to be positive and significant in the groups of European and periphery European countries in both government debt regimes. It is interesting to note that the coefficients of government debt are positive and significant in low government debt regime while be non-significant in high regime in core EMU and periphery EMU countries. In addition, the negative and significant coefficient of government debt in low regime in standalone countries is quite unexpected. Clearly, these unexpected results suggest that using the government debt ratio as threshold variable maybe inadequate to fully capture the impact of government debt. This shows that the argument that most periphery euro area countries have been affected because of high government debt ratio may not be entirely correct.

Overall, our results suggest that the impact of government debt on bond spread is mostly positive and quantify the level at which government debt contributes to the significant rise in bond spread. However, countries with large government debts such as in core euro area countries do not necessarily undergo an increase in bond spread such as experienced in peripheral euro area countries. In general, the significant contributions of government debts in standalone countries to the increase of bond spreads at both low and high government debt regimes indicate that government debt is a major economic driver. However, the non-significance in core euro area countries seems to indicate that government debt is not particularly the most relevant driver. In the next section, we will introduce the financial stress index as regime dependent threshold.

4.2. Financial stress index as threshold variable

In this section, we analyze the non-linear effects of government debt on bond spread using the FSI as threshold variable. We argue that when FSI values are above threshold, a rise of government debt leads to an increase in bond spread. A country with FSI values above a certain threshold undergoes financial stress that can lead to economic contraction. This transmission is possible through the banking sector which holds significant portions of short and long-term government debt securities. High financial stress causes banks to require higher bond yields due to the higher risk exposures. As the government has to pay higher interest rate to fund its activities, this further deteriorate the fiscal position causing the bond spread to rise. As the financial stress causes the

economy to be more sensitively to changes in government debt, non-linear effects can also be experienced in a country with relatively lower level of government debt ratio.

Table 3. Panel results of financial stress index thresholds impact on spreads.

	γ_{fsi}	L	H	$sprd_{t-1}$	$rgdp_t$	cab_t	$\beta^L{}_{gdbt}$	$\beta^H{}_{gdbt}$	δ^H	R_2 R_2 adj
EUROPEAN	-2.15 [-2.42, -2.12]	307	897	0.898***	-0.028**	-0.006	0.007**	0.003	0.190**	89.52 89.47
STANDALONE	3.78 [-1.76, 4.83]	472	60	0.800***	-0.038***	-0.006	0.001	0.001	0.079	76.01 75.78
EMU	-1.65 [-2.50, -1.01]	196	374	0.965***	-0.041***	-0.024***	0.003*	0.003**	-0.038	91.76 91.69
CORE EMU	0.15 [-0.80, 2.05]	183	102	0.860***	0.005	-0.010***	0.002***	0.003***	0.003	79.11 78.72
PERIPHERY EMU	-4.09 -4.29, -3.10 []	20	265	0.973***	-0.065***	-0.072***	-0.004	0.006***	-1.043	92.00 91.85
CORE EUROPEAN	0.75 [-3.53, 2.92]	569	164	0.907***	0.007	-0.007***	0.001	0.000	0.109**	80.71 80.58
PERIPHERY EUROPEAN	-1.85 [-2.15, -1.61]	126	345	0.950***	-0.035**	-0.036***	0.004	0.005*	-0.046	90.02 89.91

Notes: Standard errors are in parenthesis. ***, ** and * denote the level of significance at 1%, 05% and 10%, respectively. The interval of feasible threshold values is in brackets. Panel threshold regression model presented in equation (3). RGDP and CAB are exogenous variables

Table 3 reports the estimation results of the regression model described in equation (3) with the government debt ratio as the only regime dependent variable using the financial stress index as threshold variable. The threshold estimates of the FSI are all significant at 5% level in all panel groups (Figure 8 plots the likelihood ratios of the FSI as single threshold variable). The signs of the significant coefficients of lagged bond spread, real GDP growth, and current account balance are expected as previously indicated. Also, we find strong evidence suggesting that government debt in high FSI regime are positive and significant in periphery EMU and periphery European

countries while being non-significant in low regime. This could indicate the severe consequences that these countries experienced following the global financial crisis. In addition, we observe that the impact of government debt are positive and significant in both regimes in core EMU countries. Clearly, the positive and significant coefficient in high FSI regime in EMU countries indicates that impact in periphery EMU countries are mostly driving EMU countries compared to core EMU countries. It is interesting to note that coefficients of government debt in standalone and core European countries are non-significant in low and high financial stress regimes.

These results suggest that the regime of the financial system (low or high FSI state) can cause the government debts to have strong positive effects on bond spreads in core EMU countries and periphery EMU countries. These results are further validated in Table 4 when we assumed using the definition of the financial stress index that indicates potential market stress when the FSI is greater than zero. Assuming that the financial stress threshold is equal or greater than 0.05[6], we obtain the results presented in Table 4. Assuming exogenously a financial stress that is higher than the estimated thresholds endogenously clearly shows that the impact of government debt are positive and significant in low and high financial stress regimes in European, EMU, core EMU, periphery EMU, and periphery European countries. In contrast, the impact in standalone and core European countries remain non-significant.

Table 4. Panel results with a predetermined financial stress index thresholds impact on spreads.

	L	**H**	$sprd_{t-1}$	$rgdp_t$	cab_t	β^L_{gdbt}	β^H_{gdbt}	δ^H	R_2 R_2 *adj*
EUROPEAN	796	408	0.852***	-0.039***	-0.001	0.008***	0.006**	0.165**	89.22 89.18
STANDALONE	349	183	0.802***	-0.039**	-0.007	0.001	0.000	0.106	75.89 75.66
EMU	376	194	0.944***	-0.041***	-0.021***	0.005***	0.006***	-0.062	91.76 91.69
CORE EMU	179	106	0.859***	0.005	-0.011***	0.002***	0.003***	0.009	79.20 78.82
PERIPHERY EMU	197	88	0.937***	-0.093***	-0.085***	0.008***	0.012***	-0.249**	91.94 91.79
CORE EUROPEAN	494	239	0.899***	0.003	-0.006***	0.001	0.000	0.055	80.68 80.54
PERIPHERY EUROPEAN	302	169	0.909***	-0.048***	-0.035***	0.008**	0.007**	0.083	89.90 89.79

[6] We obtained similar results when we estimated the regressions with financial stress threshold equal to 1.

Notes: Standard errors are in parenthesis. ***, ** and * denote the level of significance at 1%, 05% and 10%, respectively. The interval of feasible threshold values is in brackets. Panel threshold regression model presented in equation (3). RGDP and CAB are exogenous variables.

4.3. Government debt ratio and financial stress index as threshold variables

In the previous two sections, we first studied how the level of government debt beyond a single threshold variable affected the impact of government debt on bond spread. In order to obtain a robust panel estimation results, we need to have a large number of observations in each of the four regimes due to increase in the number of independent variables. Following the approach in Proaño et al. (2014), we reduce the amount of computational power required to identify the two threshold values by rounding the government debt ratio to full integers and the FSI to one decimal digit.
Table 5 reports the estimation results of the four regime threshold model described in equation (4). The coefficients of the lagged bond spread are positive and significant at 1% level for all panel groups. In addition, the various negative and significant coefficients of current account balance and real GDP growth are as expected. We note that the coefficients of government debt in European and core EMU countries display quite interesting results. In both groups, countries experiencing high financial stress and high government debt beyond the threshold limits are facing with significant high impact. This contrast with the remaining regimes where the impact is almost similar. However, two negative and significant coefficients in the coefficient of government debt may indicate that considering the level of government debt in standalone and EMU countries may be inadequate. Figure 9 plots the likelihood ratios of the government debt ratio and of the FSI for different threshold values (see Appendix). The estimated government debt and financial stress thresholds are significant at 5% level in EMU. core EMU, core European, and periphery EMU countries. However, these estimated government debt and financial stress thresholds are non-significant European, standalone, and periphery European countries. It is important to note that the transparent surface indicates the critical values that represent the minimum 5% confidence level of the likelihood ratios.

In addition, this suggests that government debt threshold may not be relevant in combination with financial stress threshold in all countries. Also, we observed that there are usually fewer number

of observations in the state with high government debt ratio and low financial stress regime for the groups of core and periphery EMU countries.

Table 5. Panel results with government debt and financial stress as threshold variables.

	γ_{gdbt}	γ_{fsi}	LL	HL	LH	HH	$sprd_{t-1}$	cab_t	$rgdp_t$	$\beta^{LL}{}_{gdbt}$	$\beta^{HL}{}_{gdbt}$	$\beta^{LH}{}_{gdbt}$	$\beta^{HH}{}_{gdbt}$	δ^{HH}	R_2 $R_2 adj$
EUROPEAN	111	0.4	786	69	333	16	0.843***	-0.037**	0.000	0.003**	0.007***	0.004**	0.036**	-3.674**	89.28 89.21
STANDALONE	67	1.6	348	81	84	19	0.761***	-0.042***	-0.008*	-0.002	0.001	-0.002	-0.015**	1.653**	76.53 76.21
EMU	117	-3.1	42	22	475	31	0.975***	-0.026*	-0.014***	0.000	-0.003*	0.001	0.025**	-2.900**	92.58 92.49
CORE EMU	104	-1.1	113	5	151	16	0.845***	0.001	-0.006***	0.003***	0.003***	0.003***	0.014***	-1.280***	78.82 78.28
PERIPHERY EMU	133	-3.3	26	6	151	16	1.062***	-0.062***	-0.051***	-0.001	-0.025***	0.000	0.028	-3.870	93.61 93.45
CORE EUROPEAN	43	-3.0	8	70	170	485	0.911***	0.000	-0.005**	0.002	-0.001	-0.002	0.000	-0.020	80.51 80.32
PERIPHERY EUROPEAN	127	-2.4	56	20	378	17	0.947***	-0.031**	-0.030***	0.004*	0.002	0.003	0.022	-2.214	90.27 90.12

Notes: Standard errors are in parenthesis. ***, ** and * denote the level of significance at 1%, 5% and 10%, respectively. The interval of feasible threshold values is in brackets. Panel threshold regression model presented in eq.(3).

5. Concluding remarks

We have shown empirically that the effects of government debt ratio on bond spread does not depends exclusively on the level of government debt ratio but rather on the state of financial market. We selected a large set of European countries that we believe share similar economic characteristics such as strong trade relationships.

We based our econometric analysis on the dynamic panel threshold regression techniques to investigate non-linearities in the relationship between bond spread, government debt ratio, and financial stress that can be relevant to the affected euro area countries. To sum up, we found the following empirical results: First, we found evidence in periphery European countries for a positive and significant impact of government debt when the government debt reach level beyond the threshold. In addition, a rise in government debt ratio increases bond spread particularly during adverse financial market conditions. Hence, neglecting the state of the financial market for instance in periphery EMU countries could lead us to underestimate the impact of government debt ratio despite non-significant impact during normal economic conditions. In the case we consider two thresholds, we observed that while the approach is adequate to in core EMU countries, it mostly fail in standalone countries. Just because a country has a high level of government debt ratio does not automatically mean that it would cause bond spread to rise. Therefore, we identified that financial market stress is a crucial source of non-linearity between of government debt on bond spread. At high levels of financial market stress, government debt ratio such as in peripheral EMU economies contributed to the rise of bond spread, regardless of the level of government debt. The level of government debt ratio may not be always important compared to the level of financial stress that is crucial to explain the increase of bond spread in serious European countries. In particular, this is quite visible in EMU countries, core EMU countries, periphery EMU countries, periphery European countries where increased uncertainty about financial market clearly contributed to the rise of bond spreads. However, the large coefficients in EMU countries in high government debt and high financial stress regimes confirmed the vulnerability of these countries. In future research, we would like to study the impact of political risk factors on bond spreads during adverse economic conditions such as experienced in several European countries. It would be interesting to study such effects particularly in a country with high government debt and subjected to political uncertainty.

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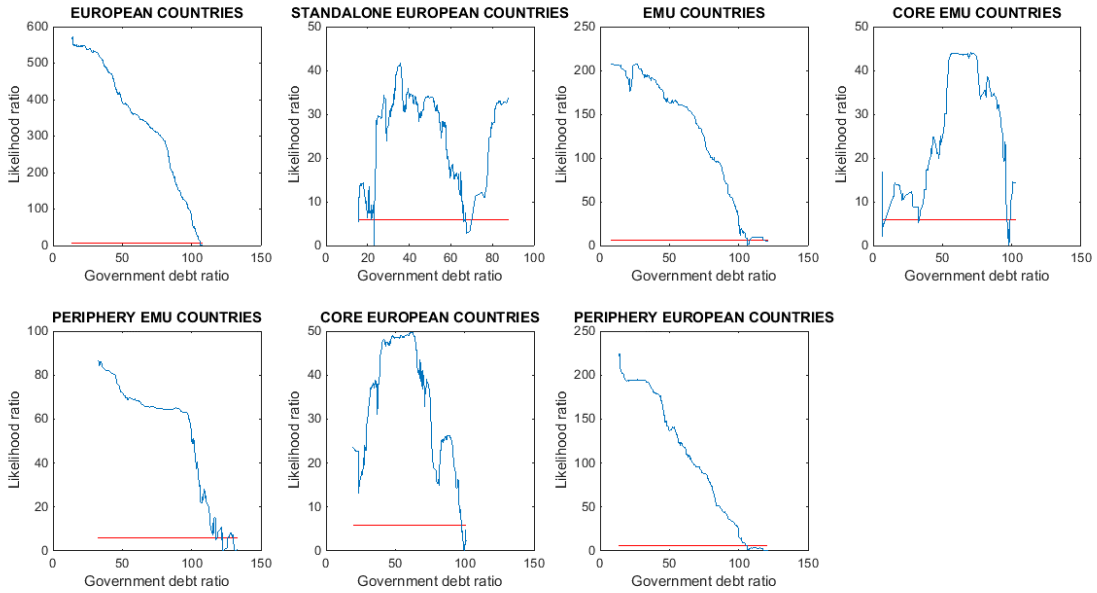
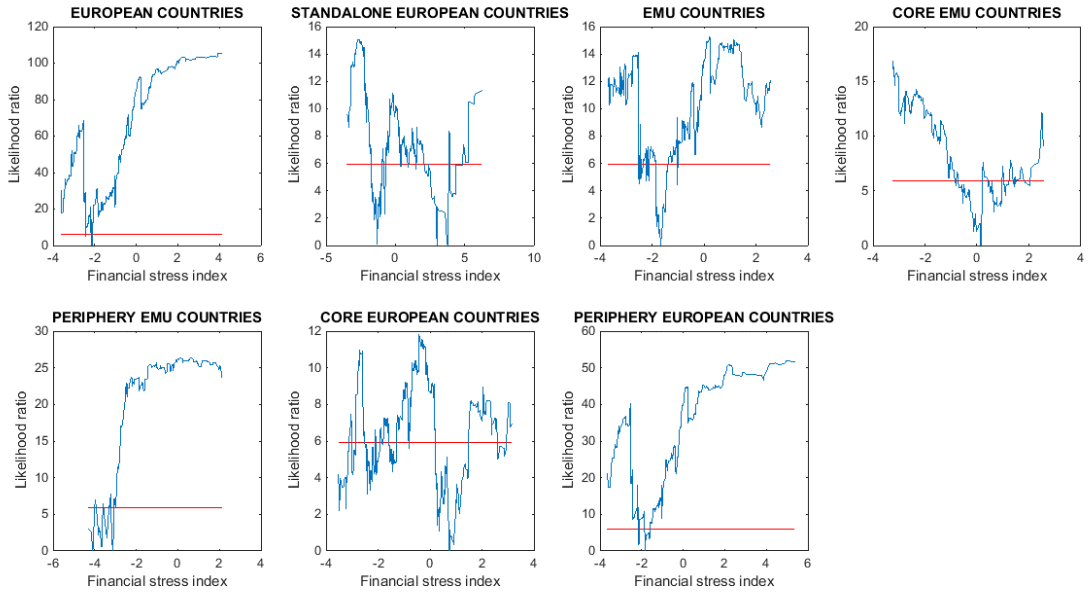
Appendix

Figure 7. The likelihood ratio with government debt ratio as threshold variable.



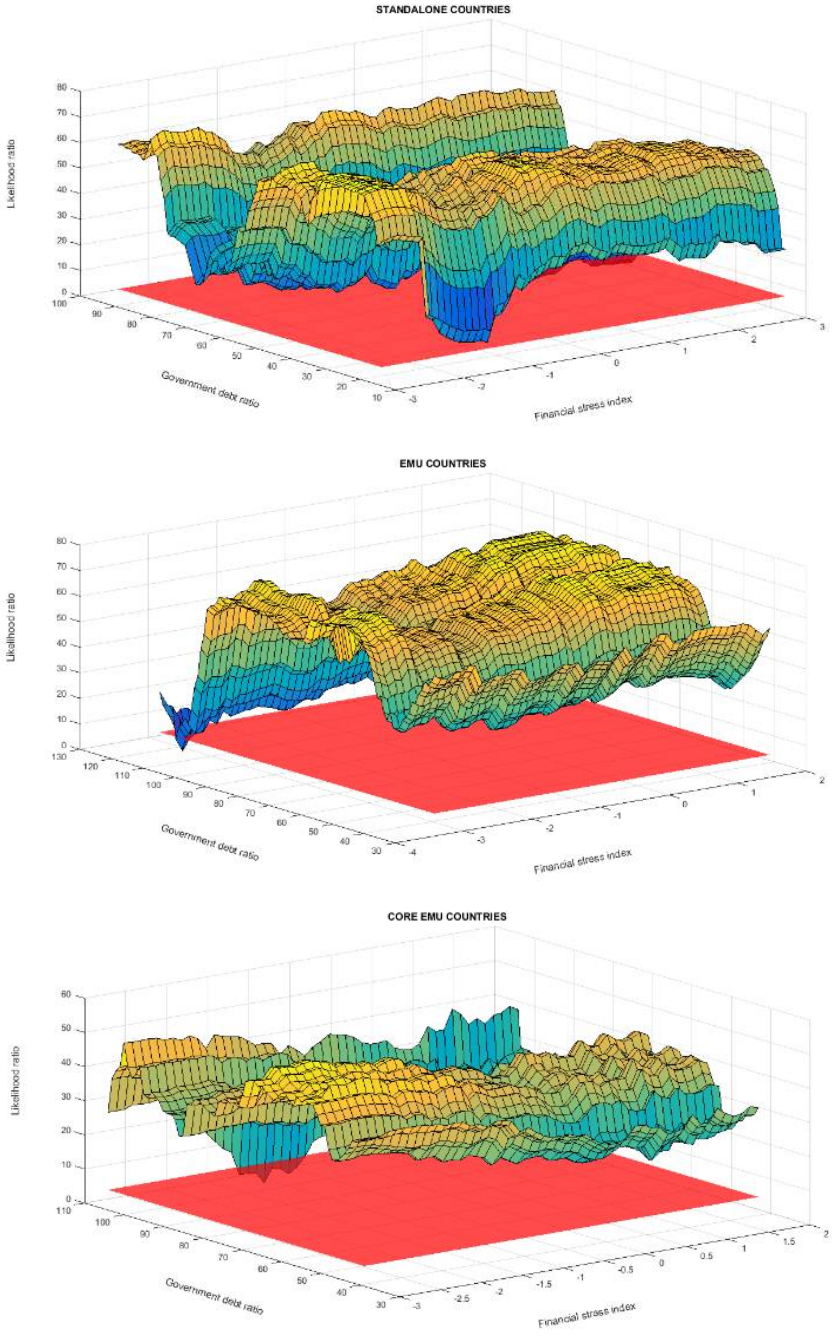
Note: To test the null hypothesis that the true threshold value is equal to γ_{gdbt}, given the estimate $\bar{\gamma}_{gdbt}$, as well as the critical value for the 95% confidence level. The set of γ_{gdbt}'s for which the null cannot be rejected is the domain with likelihood ratios below the red line indicating the critical value.

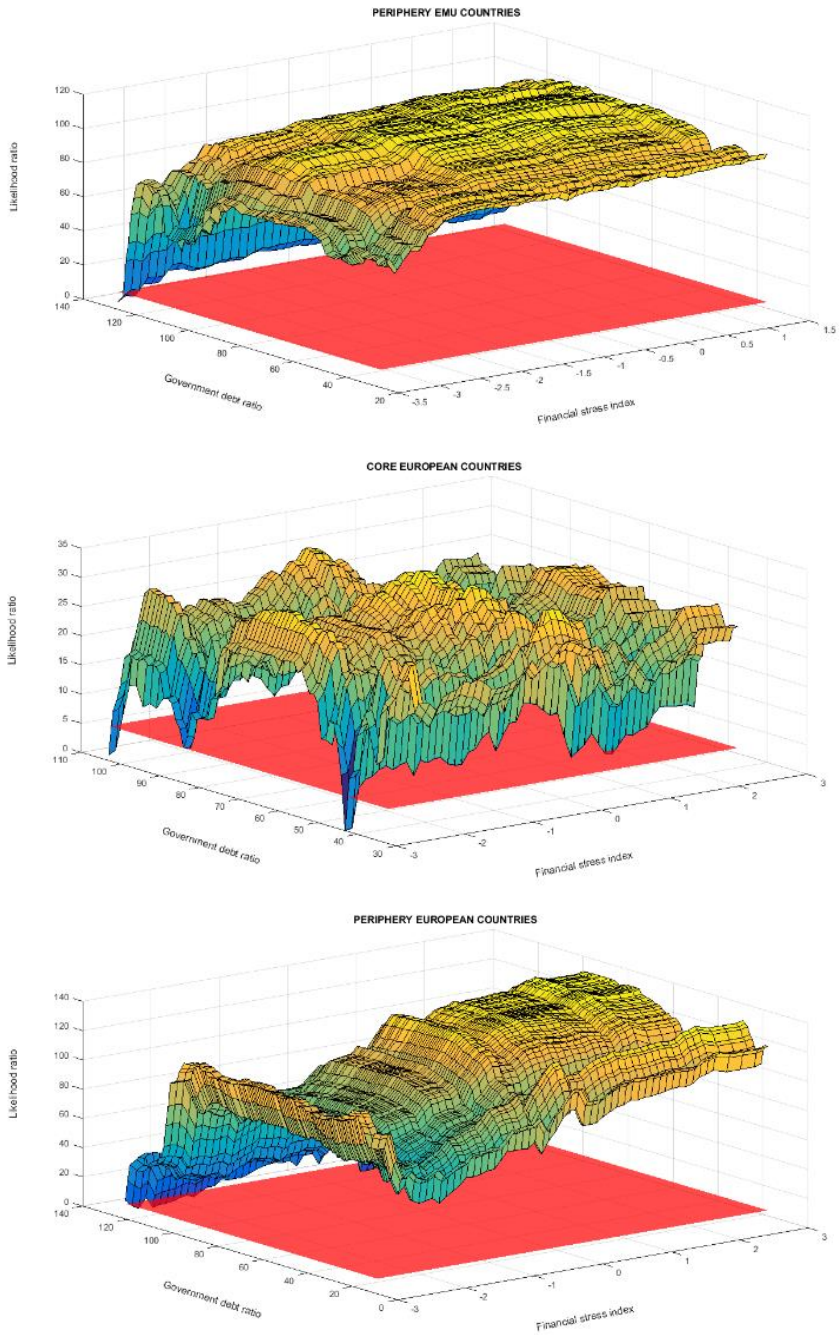
Figure 8. The likelihood ratio with the financial stress index as threshold variable.



Note: To test the null hypothesis that the true threshold value is equal to γ_{fsi}, given the estimate $\bar{\gamma}_{fsi}$, as well as the critical value for the 95% confidence level. The set of γ_{fsi}'s for which the null cannot be rejected is the domain with likelihood ratios below the red line indicating the critical value.

Figure 9 . The likelihood ratio with government debt and financial stress as threshold variables





Note: To test the null hypothesis that the true threshold values are respectively equal to γ_{gdbt} and γ_{fsi}, given the estimates $\bar{\gamma}_{gdbt}$ and $\bar{\gamma}_{fsi}$, as well as the critical value for the 95% confidence level. The set of γ_{gdbt} and γ_{fsi}'s for which the null cannot be rejected are the domain with likelihood ratios below the red area indicating the critical values.