The Legacy Debt and the Joint Path of Public Deficit and Debt in the Euro Area

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Abstract

This paper studies the joint dynamics of public debt and public deficit in the euro area for the period 1981-2013 and compute projections up to 2020. We show that, since 2009, public debt and public deficit have been negatively related. On the basis of a counter-factual simulation that conditions on past correlations with a large number of macroeconomic indicators and the observed GDP path since 2008 we find that the negative relation is anomalous with respect to previous historical experience. In contrast, private savings and private debt since 2008 have behaved in line with past experience. We define and estimate the "legacy debt" of the 2008 crisis and show that, if GDP and inflation will behave according to the International Monetary Fund (IMF) projection, by 2020 it will still account for 15% of total public debt.

JEL classification: C11, C32, C54, E52, E62, F45.
Keywords: euro area, government debt, recessions, financial crises, business cycles.

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Introduction

This paper analyses the joint dynamics of public debt and public deficit in the euro area in relation to the business cycle. The analysis exploits quarterly time series data since 1981 in order to establish empirical regularities and the particular features – possibly different from the past – of the adjustment since the 2008 crisis.

The relation between flows (deficit) and stock (debt) depends on the macroeconomic environment and it is endogenously determined through state-dependent general equilibrium mechanisms. For example, if the multiplier is large and if the real interest rate high (as it might be the case at the zero lower bound), we can envisage situations of perverse debt adjustments where a decline in the deficit to GDP ratio fails to achieve debt reduction even for a long time (see for example DeLong et al. (2012) for evidence and discussion of fiscal dynamics in large recessions).

Given those interdependences, the analysis of such relation must be conducted on the basis of an empirical framework including all relevant macroeconomic flow variables, as well as stock variables such as public and private debt. Indeed the problem of omitted variables biasing the estimated relation between public debt and primary surplus has long being recognised in the literature (see Bohn (1998)).

The focus of our paper is not on debt sustainability but on the adjustment between 2008 and 2013 as we have experienced it and as we forecast it up to 2020.[1] The analysis at medium term horizon is motivated by the fact that data are not very informative at low frequency and therefore present value relations implied by debt sustainability equations are poorly estimated.

We study this by mean of a large Vector Autoregressive Model (VAR) including stock and flow variables. The strength of this approach is that all variables are treated as endogenous. Previous papers have argued that disregarding non-linear effects in the debt accumulation equation may bias estimates of impulse response functions (see for example

[1] See Bohn (1998) as the classic reference.

Favero and Giavazzi (2007)). For this reason, we estimate the model from 1981q1 to 2008q1, a period where non-linearities are likely to be small and, rather than computing impulse response functions, we perform a counterfactual exercise based on conditional projections. Precisely, we compute counterfactual paths for all variables included in our model conditioning on the pre-2008 parameter estimates and the observed path of GDP from 2008 to 2013. We also compute projections for the period 2014-2020 conditional on the GDP and inflation paths as forecasted by the IMF.

Notice that, by conditioning on the realised path of GDP, we capture the effects of business cycle shocks that could have caused the recent recession if it were been generated by the same structural disturbances that have typically generated recessions in the euro area, in the observed sample. Any significant deviation from the conditional forecasts would imply that other factors, specific to the recent crisis, are at work (for a similar approach, see Giannone et al. (2014)). For what concerns the debt-deficit dynamics, possible examples of these factors are the financial frictions triggered by the financial crisis, non-linear effects due to the unprecedented size of the shock, or the rise of economic uncertainty impinging on interest rates. Indeed, some of these features are mentioned by DeLong et al. (2012) as characteristics of the adjustment in deep recessions.

We use the same framework to estimate the size of what is informally defined as the "legacy debt". For 2008-13, we define it as the difference between realised debt and its model-projected value, conditional on estimated VAR parameters up to 2008q1 and the observed path of GDP and inflation. For 2014-2020, we replace the observed data with forecasts from the IMF and define it as the part of forecast debt that results as the difference between the forecast conditional on the parameters estimated up to the end of 2013 and the forecast conditional on the parameters estimated before the 2008 crisis. This definition captures the notion that the legacy debt is that part of public debt that is above what could have been expected given GDP and inflation behaviour

and the historical correlations.

Understanding the dynamics of the legacy debt is important in the current policy debate. If the legacy debt resulted to be persistent even if associated with a fiscal contraction larger than in past experiences, a non-standard policy action dealing with the stock of the debt should be considered as relevant option (see, for example, what has recently been suggested by Corsetti et al. (2015)).

The paper is related to two papers that studied the effect of high public debt on growth. Reinhart et al. (2012), basing their analysis on a cross-section of countries, have suggested that high public debt overhang has a negative effect on growth. Jordá et al. (2013), focusing on a cross-section of recessions for different countries, show that this negative effect is only at work when recessions are associated to financial crises. Unlike these authors, we do not attempt at making any causal statements here. Rather we take GDP as exogenous and study departures from the "normal" path of adjustment. Since the 2008 recession is the only financial crisis in the sample, anomalous behaviour, if identified, would be in line with what found by Jordá et al. (2013).

The paper is organised as follows. In Section 1 we present some stylized facts. In Section 2 the results of the counterfactual analysis for 2008-13 and in Section 3 conditional projections for 2014-2020. Section 4 describes the results of our computation of the legacy debt and Section 5 concludes.

1 Some Facts about Fiscal Indicators

Before proposing a quantitative analysis, this section illustrates and discusses some facts about key fiscal indicators for the euro area as a whole.[2]

Let us start from the relation between fiscal deficit and public debt, which is the

[2]The data used in this section are taken from the updated version of the quarterly fiscal database for the euro area (Paredes et al. (2009)) and the Euro Area Wide Model database. A comprehensive descriptive table is in the Appendix A.

focus of our paper. Figure 1 shows the plot of the debt to GDP ratio (horizontal axis) and deficit to GDP ratio (vertical axis) for the period 2006q1-2013q4.

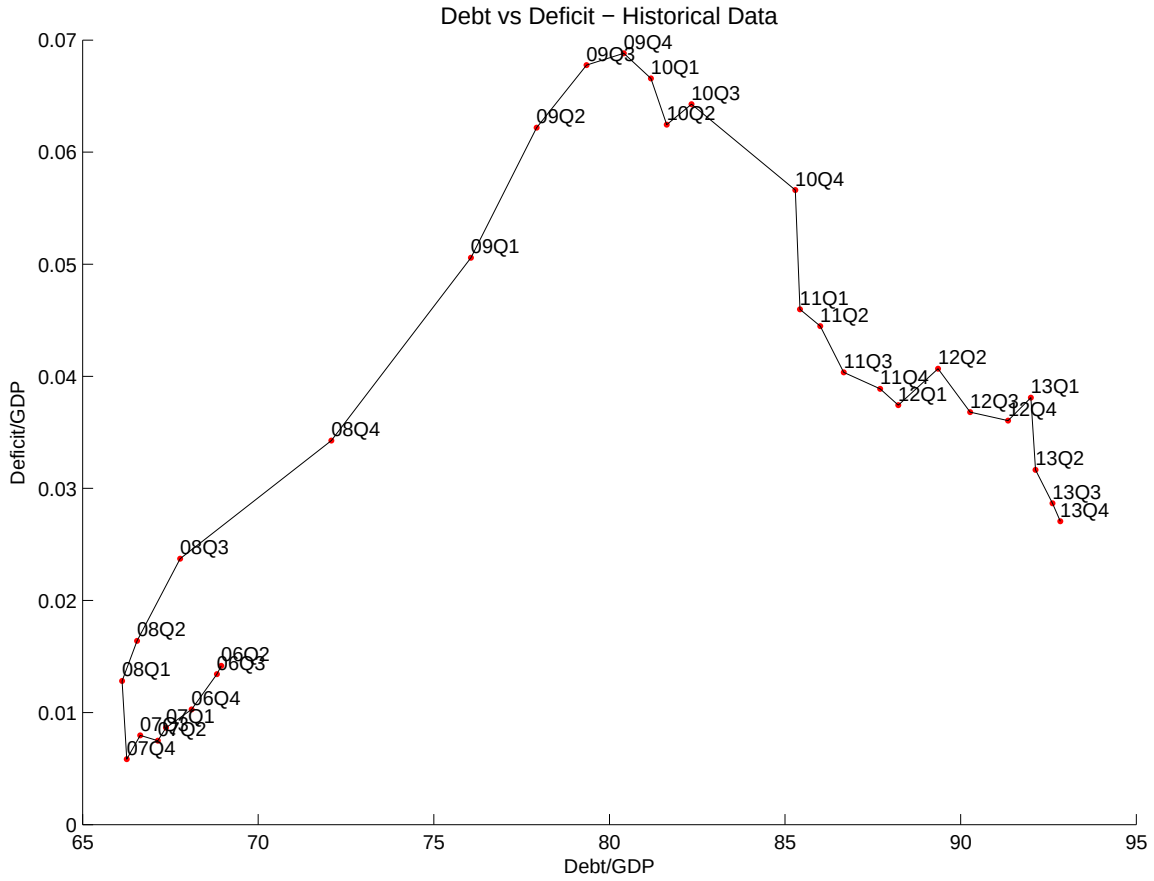

Figure 1: **Euro area government debt vs deficit, 2006-2013.**

Typically, the relation is such that an increase in deficit corresponds to an increase in debt (2007q4-2009q3) or vice versa (2006q2-2007q3). However, since 2009q4, the slope of the scatter plot changes sign: a decrease in the deficit to GDP ratio corresponds to an increase in the debt-to-GDP ratio.

The relation between debt and deficit ratios is a complex one which depends on the interaction between fiscal adjustment, output and the interest rate path. Whether a deficit reduction is associated to a debt reduction clearly depends on the effect that the

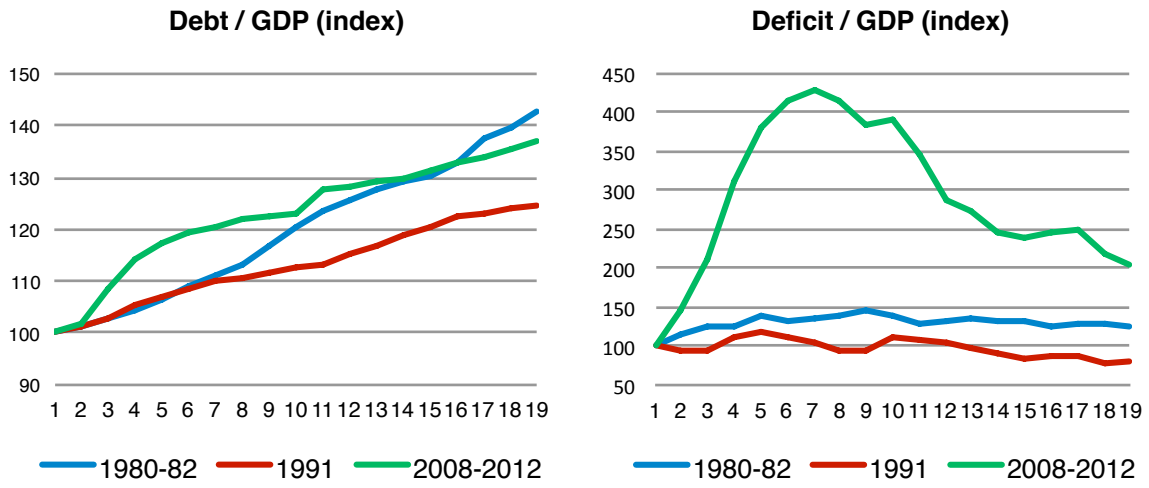

Figure 2: **Euro area government debt/GDP and deficit/GDP.** Indices based at 100 in the quarters in which each recession starts.

former has on output (the size of the multiplier) and may differ depending on the initial size of the stock. Although a non-explosive path implies that a deficit contraction will reduce debt at infinite horizon, at finite horizon there is no reason to expect a positive correlation. This is an entirely empirical question. In the next section we will study to what extent the negative correlation observed since the end of 2009 is historically unusual.

Next chart focuses on the three recessions in our sample: 1980-82, 1991, 2008-13 (see Figure 2). In the left panel we report public debt to GDP ratios and in the right the deficit to GDP ratios. For each episode the debt and deficit variables are set equal to 100 at the beginning of the recession. The horizontal axis indicates quarters after that date.

The charts show that both the increase in the deficit over GDP ratio and debt over GDP ratio in 2008 were unprecedented. In all recessions those ratios increase due to the decline of the denominator, the decline in tax income and the effect of fiscal stabilisers on public expenditure. The magnitude of the increase in 2008, however, is exceptionally large. The consolidation that followed (starting in 2009) was also unprecedented:

the deficit to GDP ratio more than halves in four years while in other recessions and recoveries has adjusted very little. Notwithstanding this effort, the debt to GDP ratio continued to increase and does not stabilise. In order to facilitate the interpretation of these facts we plot the public deficit and quarterly change of public debt since 1980 (Figure 3).

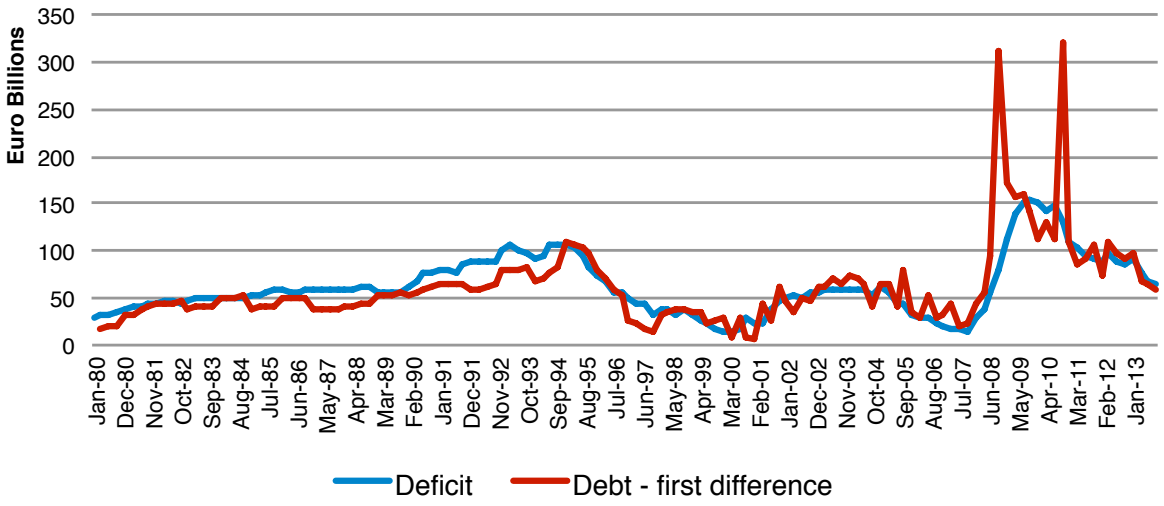

Figure 3: **Euro area government deficit and first differences of government debt.**

As expected, the two flow variables are highly correlated. However in 2008q4 and 2010q4 we can see two peaks in the rate of change of debt that are not generated by the deficit. Notice also that both the change in debt and in the deficit reach an historical peak and the largest contraction in the period. As we have seen in the previous chart, however, this fails to stabilise the debt-to-GDP ratio. The peaks are explained by special expenditures related to the support of the financial sector. The peaks in the rate of change of debt not generated by the deficit reflect discretional interventions related to banks' recapitalisations, the establishment of the European Financial Stability Fund

(EFSF) and ad hoc expenditures (see Appendix B for details).[3]

Figure 4 reports expenditures and revenues separately. We can see a large gap opening in 2008, mostly because of the decline in tax revenues. Since 2009 revenues start increase again but never returns to trend. Expenditures start declining in 2010, deviating from the pre-crisis trend.

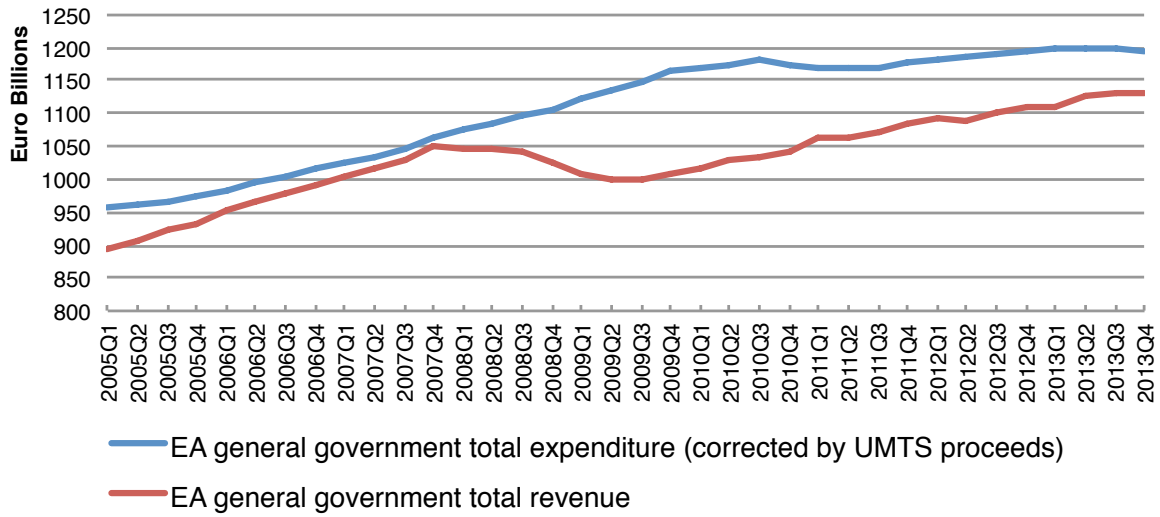

Figure 4: **Euro area government total expenditures and revenues.**

From Figure 5 – which reports the growth of different public expenditure items as percentage of the rate of growth of GDP – we can see that the decline in government expenditure is associated to a decline in the contribution to its growth of social payments and public investment. Notice also two spikes in the contribution of what is defined as a "residual", which can be explained by ad hoc capital transfers related to support of the financial sector.

[3]Information on the statistical treatment of bank recapitalisation operations can be found at: `http://ec.europa.eu/eurostat/statistics-explained/index.php/Bank_recapitalisations`. Estimates of the state aid in the context of the financial and economic crisis can be found at: `http://ec.europa.eu/competition/state_aid/scoreboard/financial_economic_crisis_aid_en.html`

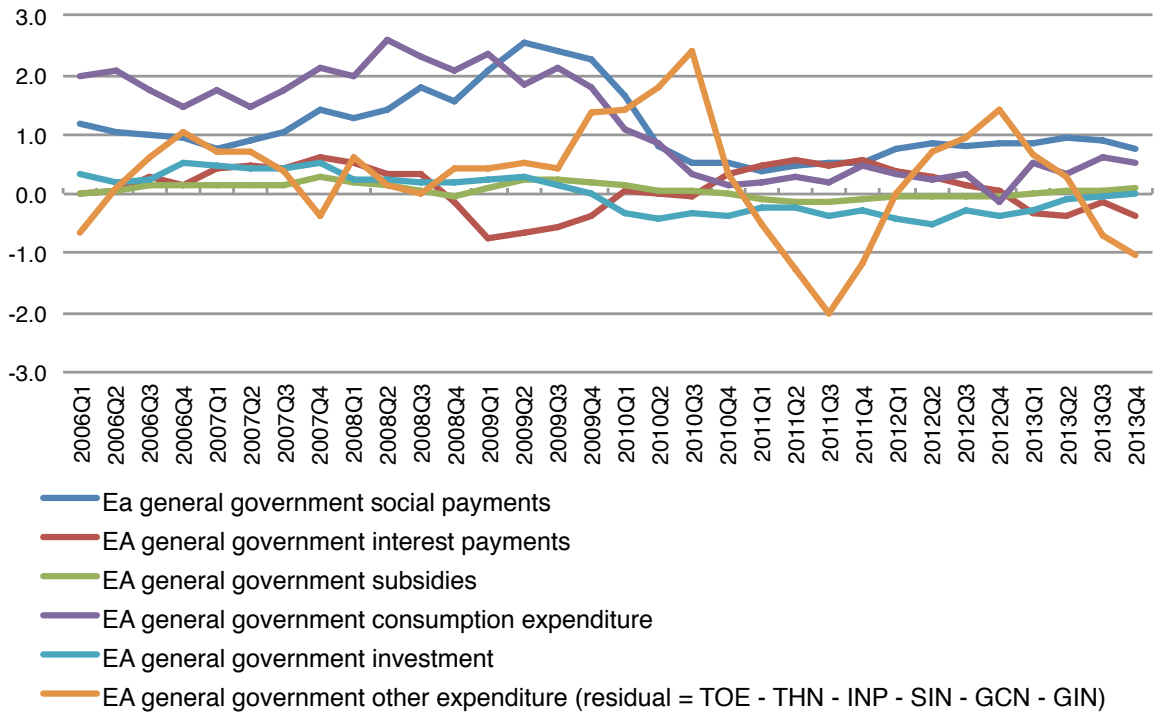

Figure 5: **Contributions to the year on year growth rate of euro area government expenditures.**

2 A Counterfactual Exercise

The stylised facts described in the previous section point to an exceptional behaviour of the public sector since 2008 and a perverse relation between public deficit and public debt since 2009. In order to shed some light into this, we estimate a large Vector Autoregressive Model (VAR) including stock and flows variables in different sectors (households, financial and non-financial corporations, external and public sector) and various macroeconomic variables including prices and interest rates. The data set is quarterly for the sample is 1981q1-2013q4. Table 1 describes the variables included in the model and the Appendix A provides more details on data sources and data treatment.

We estimate the VAR for the sample 1981q1-2008q1 including n=17 variables (as described in Table 1) and then compute conditional expectations of all variables based on the estimated parameters and the observed GDP path for 2008q2-2013q4.

Table 1: **List of Variables.** Variables included in the VAR model. See Appendix A for the details.

Variable	Description	Source
GDP	Real GDP	Euro Area Wide Model
Consumption	Personal consumption	Euro Area Wide Model
Investment	Unemployment rate	Euro Area Wide Model
Unemployment	Gross investment	Euro Area Wide Model
Gov Deficit	General government deficit	Euro Area Fiscal Database
Gov Debt	General government debt	Euro Area Fiscal Database
Gov Spending	General government total expenditure	Euro Area Fiscal Database
Social Payments	General government social payments	Euro Area Fiscal Database
HH Savings	Households saving ratio	Euro Area Wide Model
HH Debt	Households debt	Authors Calculations
NFC Debt	Non-financial corporations debt	Authors Calculations
FC Debt	Debt securities of MFI excl. ESCB	Authors Calculations
CA/GDP	Current account GDP	Euro Area Wide Model
House Prices	House prices	ECB
Long Term IR	Long term interest rate	Euro Area Wide Model
Short Term IR	Short term interest rate	Euro Area Wide Model
HCPI	Harmonized consumer price index	Euro Area Wide Model

Let us define the vector of our 17 variables as

$$X_t = [D_t \qquad S_t \qquad Z_t] \ ,$$

where D is the log of the public debt, S the log of the public deficit and Z the other sixteen variables capturing macroeconomic conditions and sectoral debt. Treating all variables as endogenous and allowing for a rich dynamic specification imply estimating the following VAR model:

$$X_{t+1} = A(L)X_t + e_{t+1} \ ,$$

where e_t is a normally distributed multivariate white noise with covariance matrix Σ and $A(L)$ is a polynomial of order $p = 4$ in the lag operator L.[4]

[4]All variables are in log-levels, except for variables expressed in rates or with negative levels, that are left in levels.

The model has a large number of parameters to estimate (precisely 17*(4+1)). Given the large dimension, we follow an approach that builds on econometric work of De Mol et al. (2008) and Bańbura et al. (2010) and that has recently been refined by Giannone et al. (2015). This consists in setting the tightness of the prior distribution in relation to the dimension of the model.

On the basis of the estimated parameters for the period 1981q1-2008q1 we compute, for all variables, the conditional expectations for the period 2008q2-2013q4. For any given draw of the model's parameters from their posterior density, the draws from the counterfactual exercise are computed as conditional forecasts in which the conditioning information is given by: (1) the pre-crisis history of all variables in the model; (2) their estimated parameters capturing historical correlations; (3) the observed GDP path for 2008q2-2013q4.[5] We report the median as well as 68% and 90% coverage intervals to provide a measure of uncertainty.

The question we are asking is whether the observed behaviour of the variables since 2008 could have been expected given their historical correlation with the macroeconomy and the observed path of GDP. A significant difference between the observed path and the median of the simulated path (conditional expectation) would suggest that the exceptional decline of GDP alone cannot explain what we have observed. Such deviation from the conditional expectation could be explained, for example, by non-linearities related to the support of the financial sector or the size of the initial shocks. Additional explanations are the associated exceptional decline in investment due to the uncertainty on policy action in the euro area and/or the tightness of monetary and financial conditions. Inspection of discrepancy between the counterfactual and actual paths of the other variables in our model can give insights on these questions. Results are illustrated

[5]The conditional forecasts are obtained using the algorithm used first in Giannone et al. (2010) and detailed in Bańbura et al. (2015). The procedure exploits the fact that the Vector Autoregressive model can be cast in a state-space form. Hence, the conditional forecasts can be computed using Kalman filtering techniques and the counterfactual simulations can be drawn using the simulation smoother of Carter and Kohn (1994).

in Figure 6.

The first observation is that both public debt and deficit are well outside the confidence bands and the variables for which "anomalous" behaviour as we have defined t is most obvious. However the deficit normalises somehow after 2009 and by 2012 reaches the upper limit of the 68% coverage. In other words, between 2009 and 2012 thee has been a huge consolidation effort that achieves deficit reduction to levels in line with historical experience but very little is achieved in terms of normalising public debt.

The anomalous behaviour of public debt and deficit contrasts with that of consumption and public spending, suggesting that the adjustment post-2009 has been implemented by a counterfactually large increase in taxes. It contrasts also with the dynamics of debt of households, financial and non-financial corporations, all in line with past experience (although the liabilities of the financial sector start decreasing abnormally in 2012 due to the deleverage of banks in expectation of the asset quality review implemented by the ECB).[6] This suggests that the adjustment in the euro area does not corresponds to the narrative of the so-called "balance sheet recession" based on the increase of savings in the private sector (see Koo (2014)). Although this story may apply to some of the countries of the euro area, for the Union as a whole the key story is the massive public sector adjustment and the persistence of public debt. This contrasts with the US experience and it is likely to be explained by the fact that the decline in house prices was more muted in the euro area and, as a result, so was the negative shock on the net worth of households (see Buttiglione et al. (2014)).

Turning to macro-economic flow variables, we can see that consumption and government spending are in line with their conditional expectations but investment is particularly weak, at the lower bound of the bands. Unemployment is also exceptionally weak starting from 2010 while we observe exceptionally tight financial conditions. The overall tightness of financial conditions can be inferred looking at both short and long interest

[6]For a discussion on this point see Reichlin (2014) and Buttiglione et al. (2014).

rates. Between 2008 and 2009 the 3 month Euribor is in line with past experience, both because the large increase in unemployment dates only in 2010 and because inflation is quite persistent. In this period, unlike what has been observed by Stock and Watson, 2013 for the US, there is no zero lower bound constraint in the euro area (this result is in line with Giannone et al. (2014) which perform a similar exercise with a different model specification). However, the 10 year rate remains persistently (and anomalously) high, which results in a very steep yield curve. With the temporary recovery of 2009 the long-rate normalises for a while. The situation deteriorates again with the debt crisis and the second euro area recession, in correspondence of which we have both with an increase in long rates above its counterfactual path and a significant difference between the observed 3-month Euribor and its counterfactual path which reaches the zero lower bound in 2012.

Overall the results point to the following story. Since 2008 the euro area has experienced balance sheet effects via an increase in public and external savings but not via an increase in households and corporate savings. It also experienced a negative demand pressure via exceptionally tight monetary and fiscal conditions.

With this picture in mind we can now use the same tool to calculate he counterfactual scatter plot between public deficit and debt ratios. This would allow us to evaluate the quantitative importance of the inversion of the slope noted in Figure 1 of last Section. The results are illustrated in Figure 7. The yellow dots indicate the median of the counterfactual scatterplot in each date. Blue and cyan areas indicate respectively the 90% and the 68% posterior coverage areas. They show that, given the path of GDP that we have observed since 2008, the relation between the deficit ratio and the debt ratio was expected to be described by a positively sloped line from 2009 to 2010q4, then a horizontal line with constant deficit to GDP ratio and increasing debt until the end of 2012, and finally a vertical and mildly positively sloped line until the end of the sample. Instead, what we have observed is a positive relation from 2006 to 2009q4 and a negative

relation ever since. The difference between the observed and the counterfactual paths is statistically significant from 2008q4 until the end of the period.

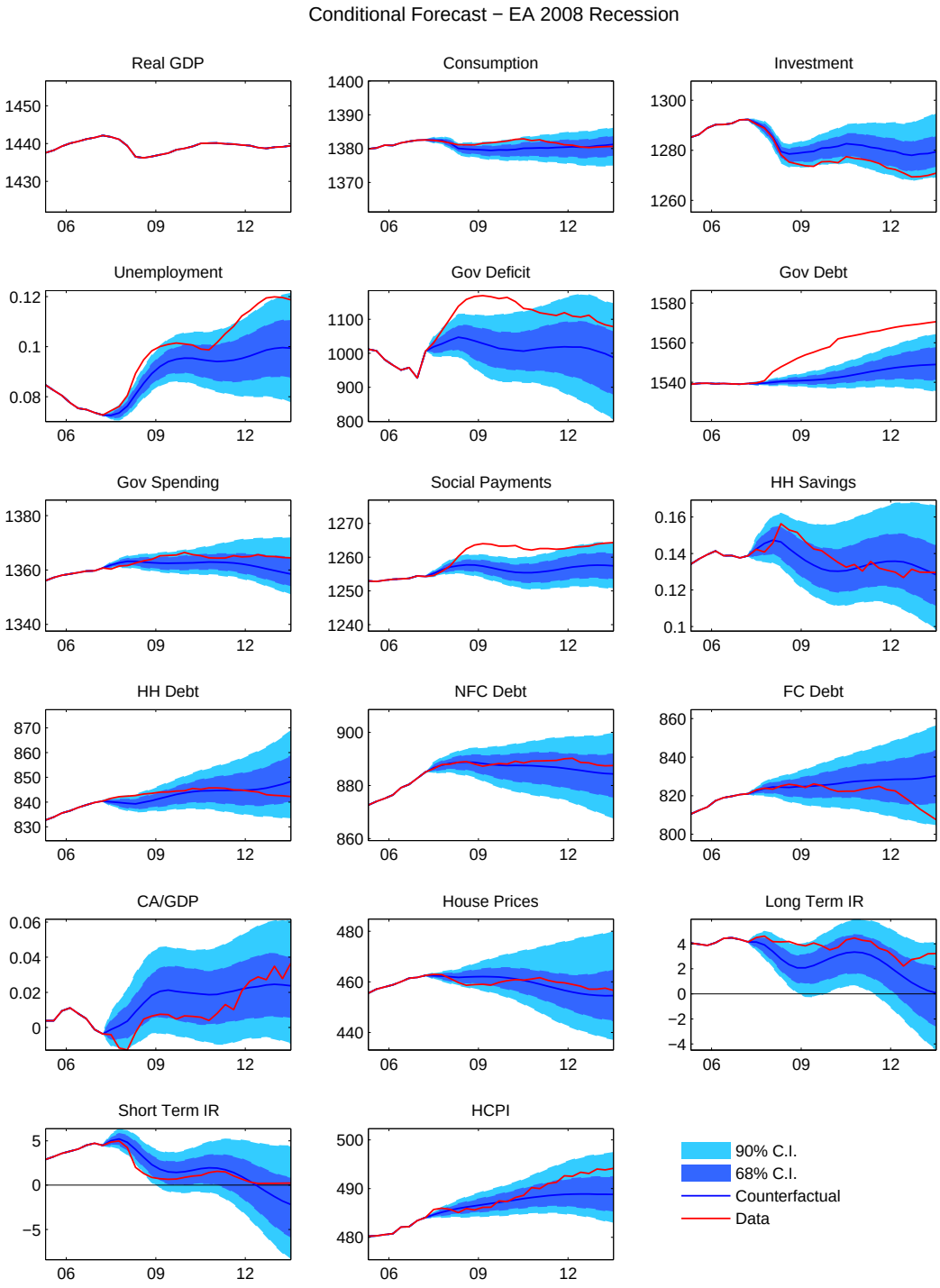

Figure 6: **Conditional forecast.** The figure shows the realised data and the counterfactual path of the variables. The blue lines are the medians of the forecasts conditional on the path of GDP, plotted with 68% and 90% coverage intervals.

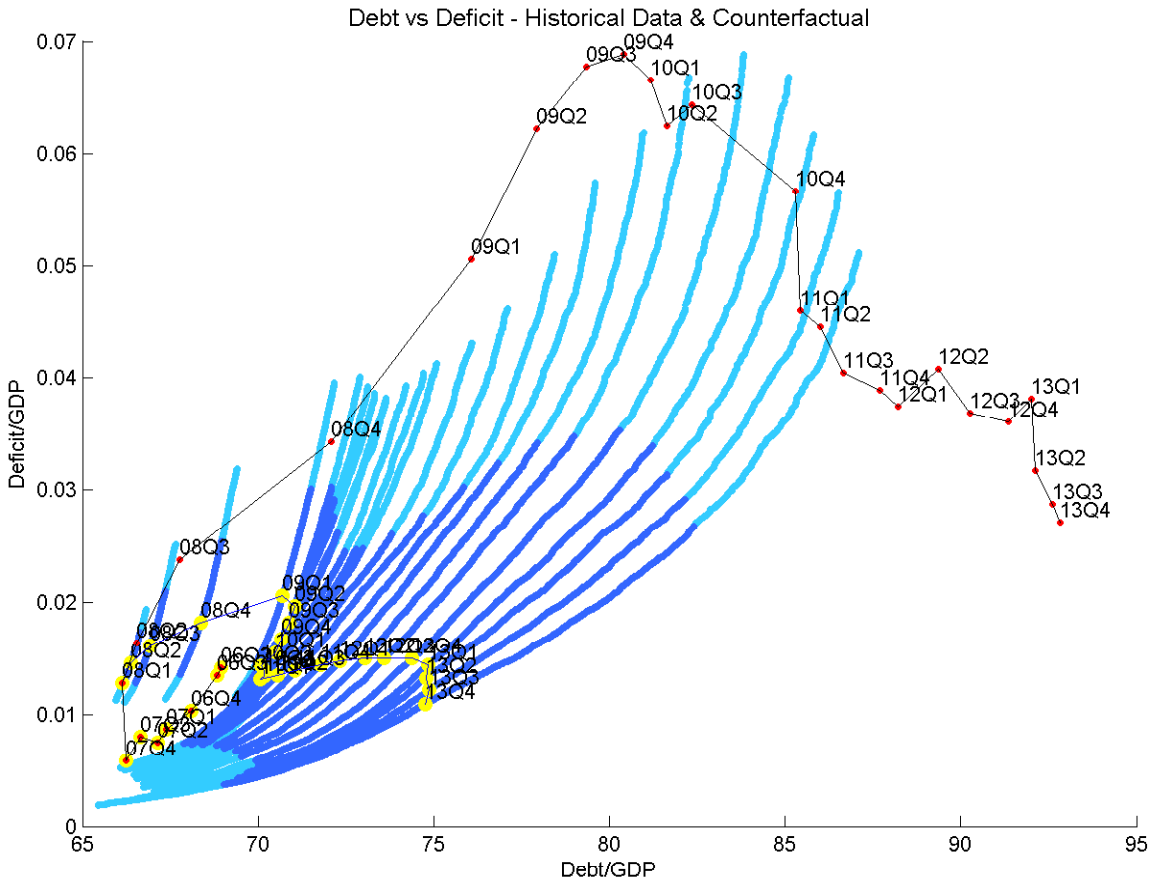

Figure 7: **Scatter plot: Debt and deficit counterfactual.**

3 Conditional and Unconditional Forecast: 2014-2020

In this section we evaluate the model implications in term of medium term projections. We propose a hybrid exercise where conditional expectations for the 2014-2020 period (for which we have no observations) are computed interpolating the annual IMF projections on real GDP and inflation. In other words, we treat the institutional forecast 2014-2020 on GDP and inflation as observations. Table 2 reports IMF projections while Figure 8 the results from our model.

In order to interpret these results, one must be aware that the model, by construction, forces variables to go back to their historical trend and therefore conveys a relatively optimistic picture of future adjustment. With that in mind, notice that investment and consumption go up to their historical association with GDP while public debt stabilises but in 2020 is not yet at its pre-crisis level. At the same time private debt goes up and so does unemployment, which in 2020 is projected to be around 10%.

In sum, the model projects that by 2020 all debt variables – public and private – will not be back to their pre-crisis levels. Notice however that the three-month Euribor counterfactual path is below zero for the all period, violates the zero lower bound constraint. This implies that our projections are excessively optimistic. Notice also that both short and long term interest rates are forecast to remain very low even under the assumption that GDP and inflation will return to their steady state values.

Table 2: **IMF Projections.** Euro area annual projected values for GDP and Inflation (source: IMF).

IMF projections	2014	2015	2016	2017	2018	2019	2020
Gross Domestic Product	0,9	1,5	1,7	1,6	1,6	1,6	1,5
Inflation	0,4	0,1	1,0	1,2	1,4	1,5	1,7

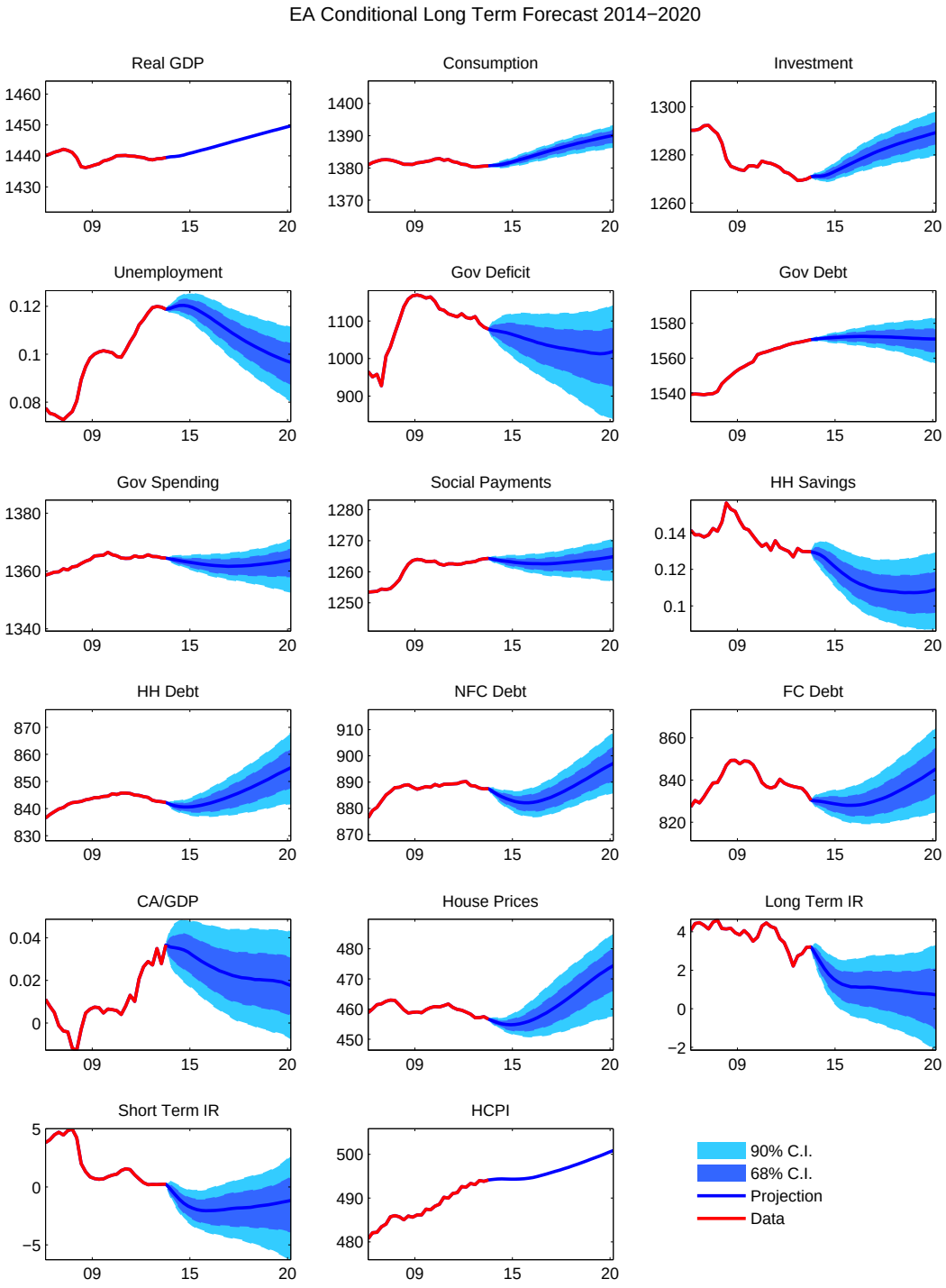

Figure 8: **Conditional medium term forecast.** The blue lines are the medians of the forecasts conditional on the path of GDP and inflation, plotted with 68% and 90% coverage intervals.

4 Legacy Debt

On the basis of the exercise presented in the last section we can provide a quantitative assessment of the so-called "legacy debt". We define it as that part of the debt that, since 2008, could not have predicted on the basis of pre-crisis correlations. For 2008-13 the legacy debt is computed as the difference between observed public debt and its VAR based expectation conditional on real GDP and inflation. For 2014-2020 we compute it as the difference between the forecast conditional on the parameters estimated in the end of 2013 and on GDP and inflation projections by the IMF, and the forecast conditional on the parameters estimated before the 2008 crisis . Figure 9 shows the estimated legacy debt as a percentage of the observed (2008-2013) and forecast (2014-2020) debt.

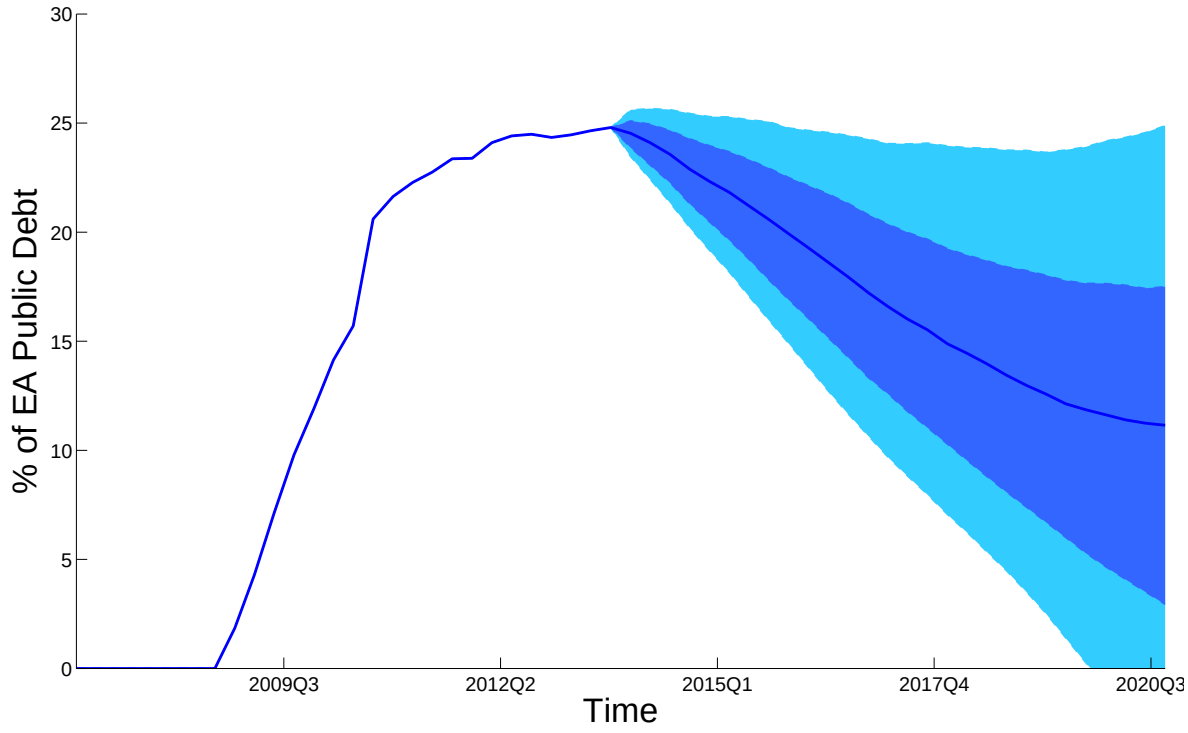

Figure 9: **Legacy Debt.** The figure shows the "Legacy Debt" as a percentage of the observed (2008-2013) and forecast (2014-2020) debt, plotted with 68% and 90% coverage intervals.

Notice that, immediately post-crisis the percentage jumps to 25% while, by the end

of 2020, it still accounts for 15%.[7]

5 Conclusions and Discussion

This paper studies the relation between public debt and public deficit in the euro area in the context of the broader macroeconomic adjustment. Our analysis is based on the 1981-2013 sample but we focus in particular on special features of the adjustment since 2008. Moreover, we study medium term adjustment rather than infinite horizon sustainability of public finances and look at the euro area as a single economy. The choice of the medium term focus is motivated by the unreliability of empirical estimates of the very low frequency components of the data generating process. Indeed, even our 5 years horizon projections are subject to large uncertainty. The choice on focusing on the euro area as a single economy, on the other hand, is justified by the notion that any statement on overall fiscal capacity for the Union needs to be based on the analysis of the adjustment of the euro area seen as a whole. This is indeed crucial for understanding the interaction between monetary policy and fiscal policy.

The paper presents many results. The key ones are the following. First, the association between a decline in fiscal deficit and an increase in public debt experienced since 2009 is unique in our sample and could not have been predicted just on the basis of low GDP growth. We conjecture that such perverse adjustment is the consequence of the large size of the initial shock on the debt and the deficit partly related to financial sector support. Second, the crisis has produced an increase in public debt that could not have been anticipated based on past macroeconomic behaviour and the observed GDP and inflation paths since then. That unanticipated increase – which we define as "the legacy debt" – has proved to be very persistent and we project that will have not disappeared by 2020. Third, debt and savings of the private sector do not present the

[7]Our conditional projections on public debt are in line with the IMF forecast in IMF, 2015, and point to a public debt/GDP ratio of about 85% in 2020.

same anomalies of the public sector. Fourth, monetary conditions as revealed by the behaviour of both the short and long-run rates, have been unusually tight since 2008: initially because of a persistently high long-term rate and later because of the zero lower bound constraint reached by the short term rate.

Overall the results suggest the following story. Since 2008 the euro area has experienced balance sheet effects via an increase in public and external savings but not via an increase in households and corporate savings. It also experienced a negative demand pressure via exceptionally tight monetary and fiscal conditions.

The results on the public debt-deficit adjustment point to the difficulty of dealing with the legacy debt via fiscal consolidation and suggest putting on the table of the policy discussion, policies which propose a federal approach to reduce the stock of the public debt (see Corsetti et al. (2015)).

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Variable	Source	Name	ID / Details
GDP	Euro Area Wide Model	GDP (Real)	YER
Consumption	Euro Area Wide Model	Private Consumption	PCR
Investment	Euro Area Wide Model	Gross Investment	ITR
Unemployment	Euro Area Wide Model	Unemployment rate (as a percentage of labour force)	URX
Gov Deficit	Euro Area Fiscal Database	EA general government deficit (computed= TOE-TOR)	DEF, deflated by GDP deflator (ID: YED of EAWM)
Gov Debt	Euro Area Fiscal Database	EA general government debt	MAL, deflated by GDP deflator (ID: YED of EAWM)
Gov Spending	Euro Area Fiscal Database	EA general government total expenditure (corrected by UMTS proceeds)	TOE, deflated by Gov. Consumption Deflator (ID: GCD of EAWM)
Social Payments	Euro Area Fiscal Database	EA general government social payments (social transfers other than in kind, D62)	THN, deflated by Consumption Deflator (ID: PCD of EAWM)
HH Savings	Euro Area Wide Model	Household's savings ratio	SAX
HH Debt	Authors Calculations	Constructed from BIS data (Long series on total credit and domestic bank credit to the private non-financial sector, Households and NPISHs)	Data for the Euro Area are available since 1999. To reconstruct data prior to 1999, we used the quarterly growth rates of the sum of the correspondent data for Belgium, Finland, France, Germany, Italy, Spain and Portugal.

Table 3: Variables included in the VAR model [1/2].

Variable	Source	Name	ID / Details
NFC Debt	Authors Calculations	Constructed from BIS data (Long series on total credit and domestic bank credit to the private non-financial sector, Non-financial corporations)	Data for the Euro Area are available since 1999. To reconstruct data prior to 1999, we used the quarterly growth rates of the sum of the correspondent data for Belgium, Finland, France, Germany, Italy, Spain and Portugal.
FC Debt	Authors Calculations	Constructed from IMF and ECB data	Data for the Euro Area are available since 1997 Q3. To reconstruct data prior to 1997 Q3, we used the quarterly growth rates of the sum of the Debt securities for Other Depository Corporations in Austria, France, Germany, Italy, Netherland, Portugal, Spain.
CA/GDP	Euro Area Wide Model	Current Account Balance/GDP	CAN YEN
House Prices	ECB	Residential property prices, New and existing dwellings	RPP.Q.I7.N.TD.00.3.00
Long Term IR	Euro Area Wide Model	Long-Term Interest Rate	LTN
Short Term IR	Euro Area Wide Model	Short-Term Interest Rate	STN
HCPI	Euro Area Wide Model	Overall HICP (Non-seasonally adjusted)	HICP

Table 4: Variables included in the VAR model [2/2].

B Public Interventions in Support of the Financial Sector During the Crisis

We can distinguish between two types of intervention for the financial sectors: those that affect both debt and deficit and those that affect debt only. According to the budget rules a capital injection can be considered as a capital transfer (increasing the government deficit) or as an acquisition of equity (a financial transaction, which does not impact on the government deficit).

Between 2008 and 2013 in the European Union there have been recapitalisation measures for 448.16 billions of euros accounting for 3.43% of GDP and asset relief interventions for 188.24 billions accounting for 1.44% of GDP. Overall these measures accounted for 5.06% of GDP. This however is a small fraction of what was approved. We provide a list of approved measures by categories below.

Guarantees on liabilities (bulk of the intervention):

- The EC authorised a total aid of EUR 3 892.6 billion (29.8% of EU GDP in 2013) for guarantees on liabilities.
- The outstanding amount peaked in 2009 at EUR 835.8 billion (6.39% of EU 2013 GDP), and has decreased since.
- In 2013, outstanding guarantees amounted to EUR 352.3 billion (2.7% of EU 2013 GDP). However only EUR 3.13 billion of the total guarantees provided have been called.

Recapitalisation

The EC authorised aid for EUR 821.1 billion (6.3% of EU 2013 GDP) in the last six years. In 2008-2013, EUR 448 billion (3.4% of EU 2013 GDP) granted in recapitalisation measures. This was mostly for the UK, Germany, Ireland and Spain.

Direct Short Term Liquidity Support

The EC approved EUR 379.9 billion (2.9% of EU 2013 GDP) for liquidity measures. However, Member States have practically used only a very small amount. Spain and the Netherlands account for more than a half of the outstanding amounts in the peak year 2009.

Asset Relief Measures

In 2008-2013, Member States provided asset relief measures reaching EUR 188.2 billion (1.4% of EU 2013 GDP) while the total aid approved was EUR 669.1 billion (5.1% of EU 2013 GDP).