# Back to fiscal consolidation in Europe and its dual tradeoff: now or later, through spending cuts or tax hikes

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Abstract

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## Introduction

Most governments in industrialized countries underwent expansionary fiscal policies in 2009 to dampen the macroeconomic consequences of the financial turmoil. This Keynesian revival, supported by the IMF (see Spilimbergo, Symansky, Blanchard and Cotarelli, IMF Staff Position Note, 2008), was yet short-lived, especially in the EMU. Two reasons were put forth. First, the requirement to reduce public deficit and comply with the 3%-of-GDP rule was enshrined in the Stability and Growth Pact. Second, the outbreak of the Greek crisis in late 2009 created fears of a possible sovereign default. European countries rapidly implemented fiscal consolidation, despite lower-than-pre-crisis level of economic activity. Governments in the periphery of the Euro area (Italy, Spain, Ireland, Portugal and Greece) were under rising financial market pressures and were urged to restore their credibility by implementing frontloaded fiscal consolidation. Meanwhile, fiscal rules were reinforced with the TSCG (Treaty on stability, coordination and governance, agreed by 25 out of 27 member states).

Thereafter, the on-going episode of fiscal consolidation has undoubtedly been stringent. Austerity measures have reached unprecedented levels in Greece. Furthermore, consolidation was synchronized among most European countries from 2011 on, hence amplifying the negative impact on growth (IMF, World Economic Outlook, 2010) and leading the Euro area to a double dip recession. Moreover, consolidation was implemented at a moment where the output gap had not recovered from the recession. National governments were then confronted with a dilemma: they had to guarantee long-term sustainability of public debt and had to avoid stifling the nascent recovery. This tradeoff between debt reduction and activity depends critically on the value of the fiscal multipliers. The former mainstream consensus – before the Great Recession – considered that fiscal multipliers were weak and that fiscal policy had very short-lived effects. The new consensus among the mainstream economists has now moved to the position that fiscal multipliers are high in time of crisis. [1] Then, not only fiscal consolidation would drag down growth more severely but it could even be self-defeating (Holland and Portes, National Institute Economic Review, 2012).

The consolidation process has thus raised a few questions. First, how large are the costs of consolidation? Second, do these costs depend on the composition (tax vs spending) of the consolidation process? Third, what has been the debt dynamics in the EMU after consolidations were performed? Fourth, is there an alternative strategy to reduce European public debts? The aim of the present paper is precisely to deal with these issues. It considers explicitly that the EMU member states have been facing a dual tradeoff, first a tradeoff between labour market outcomes of consolidation and public debt dynamics and, second, a tradeoff between reducing public expenditures and increasing taxes.

According to the first tradeoff, the gains from consolidation in terms of debt and interest rates have outweighed the costs in terms of activity losses and unemployment rises. The frontloaded strategy has therefore been preferred to the backloaded strategy. Nevertheless, the size of the impact of fiscal consolidation on long-term interest rates remains disputable. This point will be investigated in this paper.

According to the second tradeoff, the fiscal multiplier effect is usually assumed stronger after a shock on spending rather than taxes. Nevertheless, in the consolidation context, political economy arguments can help to explain why spending cuts are more frequent than tax hikes. Moreover, some public expenditures are less visible than some others (Balassone and Franco, Fiscal studies, 2000) and can be cut without short-run social costs. The most striking example is certainly public investment. The impact of the composition of the consolidation package will be investigated in this paper, on a country basis. Once all EMU countries will be included, and their composition effect characterized, it will be possible to compare the output outcomes of these consolidation plans with different compositions of the fiscal effort. The cost of spending-driven consolidation will thus be assessed.

[1] See Gechert and Rannenberg (2014) for a recent meta-analysis on the value of fiscal multipliers.

To judge the interactions between debt and unemployment reduction on the one hand, and between spending cuts and tax hikes, on the other hand, we develop a simple reduced-form model representing eleven countries of the euro area (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain). This model is sufficiently detailed to explicitly link all macro elements of debt sustainability and output dynamics, and the composition effect. The model also includes one important feature of the evidence on fiscal multiplier, its time-varying feature, since it is supposed that the size of fiscal multipliers depends on the business cycle. This is an attempt to consider a time-varying fiscal multiplier in a dynamic macroeconomic model and to consider the full consequences of such a feature on the dynamics of public debt and economic activity. But, as a strong debate still exists about the value of multipliers and about the evaluation of current output gaps, and also because there is of course strong uncertainty about future growth or hysteresis effect, we have chosen to parameterize the model in such a way that we can conduct a full sensitivity analysis. Finally, the model addresses the quest for an optimal fiscal stance, defined as a fiscal consolidation producing the smallest real costs and achieving public finance sustainability.

The international dimension of the model also permits to take into account the interdependencies between EMU member states and to investigate the consequences of fiscal consolidation, whether through spending cuts or tax hikes, or a mix of both, on competitiveness and current account (im)balances which have been at the core of the European sovereign-debt crisis.

We develop a simple macroeconomic model combining structural and reduced-form non-linear equations. Since the aim is to model numerous euro area countries, we use simple reduced-form equations to model supply and demand complex mechanisms that can be heterogeneous across countries. Hence the model does not derive from optimal behaviours: there are indeed multiple competing ways to obtain them though no consensus has emerged so far on the best modelling strategy. Dynamic Standard General Equilibrium (DSGE) models rely generally on strong hypotheses concerning the behaviour of agents. Households are notably often supposed to be Ricardian, limiting by definition the effectiveness of fiscal policy. These models also systematically suppose that expectations are rational whereas this hypothesis may be hard to reconcile with large strands of the literature that propose “rationalizable expectations” (Woodford, Columbia WP, 2013). Besides, DSGE models have performed poorly during the crisis, underestimating how deep the crisis was. Finally, to our knowledge, these models do not allow to introduce nonlinearities such as a variable fiscal multiplier over the business cycle, since these models are linearized around a single point (the steady state). We then give our preference to simplicity in modelling, which will allow us to calibrate the impact of fiscal policy shocks on output gaps and potential GDPs.

# 1. A simple reduced-form model to deal with consolidation, debt and growth

We extend the model developed in Blot et al. (2015) to account for a composition effect of the fiscal stance. The model is a simple macroeconomic framework combining structural and reduced-form non-linear equations. Since the aim is to model numerous euro area countries, we use simple reduced-form equations to model supply and demand complex mechanisms that can be heterogeneous across countries. Hence the model does not derive from optimal behaviours: there are indeed multiple competing ways to obtain them though no consensus has emerged so far on the best modelling strategy[2]. Dynamic Standard General Equilibrium (DSGE) models rely generally on strong hypotheses concerning the behaviour of agents. Households are notably often supposed to be Ricardian, limiting by definition the effectiveness of fiscal policy. These models also systematically suppose that expectations are rational whereas this hypothesis may be hard to reconcile with reality. Besides, DSGE models have performed poorly during the crisis[3], underestimating the deepness of the crisis. Finally, these models do not allow to model nonlinearities such as variable fiscal multipliers over the business cycle, since these models are linearized around a single point[4]. We then prefer simplicity in modelling, as it allows us to simply calibrate the impact of fiscal policy shocks on output gap and potential GDP. Yet, the calibration may be easily modified to embrace features of several class of models and notably DSGE models[5].

Before describing more precisely the equations of the model, some key features of our approach are worth mentioning:

- The model allows for an explicit representation of the main countries of the euro area: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain. An aggregated euro area is also computed in order to deal with global analysis and monetary policy.
- On the demand side, an open economy aggregate demand function is modelled which depends on fiscal and monetary policy, external demand (a channel for intra EU interdependencies) as well as exogenous shocks on the output gap.
- Hystereris effects are introduced but they only affect the level of output in the long run whereas the growth rate of the potential output reverts to baseline path.
- External demand is represented using a bilateral trade matrix taking into account interdependencies between countries.
- Prices are given by a generalized Phillips curve relating current inflation to expected inflation, economic activity, imported inflation and other exogenous shocks. Expectations

[2] See for example Wieland et al (2012) for a comparison of fiscal policy effects on output gap for a large set of DSGE models. These models make different assumptions on the share of liquidity-constrained households for example, a point that is critical to assess the fiscal multiplier.
[3] See Chatelain and Ralf (2012).
[4] A recent exception is the paper by in't Veld (2013).
[5] A comparison with QUEST III is available in the appendix.

are supposed to be backward-looking in the baseline scenario[6], but a simulation is realized with forward looking expectations.

- A Taylor rule is used to set the stance of monetary policy.
- Fiscal balance is the sum of interest payments, cyclically-adjusted balance and cyclical components. This simple definition may help to properly assess the fiscal stance, *i.e.* the part of fiscal policy, which is under the direct control (or discretion) of current governments. As composition of fiscal stance strongly matters[7] since the value of the fiscal multiplier may depend of the instrument of fiscal policy, we disentangle between fiscal impulses based on expenditures and taxes. The focus is also put on the time-varying dimension of the fiscal multiplier.[8] Then, we compute public debt projections for euro area countries, taking into account the impact of the market interest rate (government-bond yield), in order to assess fiscal sustainability issues.
- A risk-premium on long-term public interest rates is also introduced. It depends on public debt and on the structural primary balance.

## 1.1. Aggregate demand and supply

We first define $\tilde{y}_c$ as the gap between the log of real GDP $Y$ of country $c$, and a baseline (or initial) path for $\bar{Y}$ which is the level of output that would be observed if the economy were not hit by any shock. It is supposed that the growth rate of $\bar{Y}$ is exogenous. Then, we call $y_c^*$ the gap between log of potential GDP $Y^*$ of country $c$ and the baseline $\bar{Y}$. In the long-term, the growth rate of $Y^*$ reverts to the exogenous growth rate of $\bar{Y}$. Due to hysteresis effects, growth rates of $Y^*$ and $\bar{Y}$ may differ in the short-term so that the model may account for long-term effects of shocks on the level of output but not on the growth rate. Analysing long-term growth determinants goes indeed beyond the scope of this paper though we are aware that long term growth matters for the path of public debt. It results that the output gap – the difference between current and potential outputs – is defined as follows:

$$(1)\quad y = \tilde{y} - y^*$$

The output gap is driven by $EFI^G$ and $EFI^T$ (the effective fiscal impulses, cumulating past and current *ex ante* fiscal impulses on public expenditures and taxes), real interest rates and external demand:

$$(2)\qquad y = EFI^G + EFI^T + \delta_l.(R^{pri} - \bar{R}^{pri}) + \beta_l.ad$$

[6] More precisely, expected inflation depend on the gap between past inflation and the inflation target.
[7] See Coenen et al. (2012) for a recent analysis.
[8] See Creel et al. (2011) for a first analysis of the time-varying dimension of the fiscal multiplier, according to the instrument of fiscal policy, in a structural model for France.

The impact of fiscal policy depends on the endogenous fiscal multipliers on spending ($\mu_t^G$) and on taxes ($\mu_t^T$) which are discussed later. $R^{pri}$ is the long term real interest rate on private bonds and $\bar{R}^{pri}$ is the long run equilibrium value of interest rate. The term $\delta_l.(R^{pri} - \bar{R}^{pri})$ captures the effect of monetary policy on aggregate demand *via* its impact on financial markets and expectations of future inflation. The term ($\beta_l.ad$) stands for the impact of external demand by trade partners. By definition, the output gap will revert to zero in the long run, as shocks having permanent effect would equally affect current and potential output. Given the definition of the output gap, the current level of output depends on potential output, fiscal policy, real interest rates and external demand:

(3) $\tilde{y} = y^* + EFI^G + EFI^T + \delta_l.(R^{pri} - \bar{R}^{pri}) + \beta_l.ad$

The dynamics of equation (3) is represented by the following error correction equation[9]:

$$(4)\ \Delta(\tilde{y}_t) = -\lambda.\left[\tilde{y}_{t-1} - \left(y^*_{t-1} + EFI^G_{t-1} + EFI^T_{t-1} + \delta_l.\left(R^{pri}_{t-1} - \bar{R}^{pri}_{t-1}\right) + \beta_l.ad_{t-1}\right)\right] + \alpha.\Delta(\tilde{y}_{t-1}) + \Delta(EFI^G_t) + \Delta(EFI^T_t) + \delta_s.\Delta\left(R^{pri}_t - \bar{R}^{pri}_t\right) + \beta_s.\Delta(ad_t) + \varepsilon^d_t$$

where $\varepsilon^d_t$ is an exogenous shock on aggregate demand.

Yet, with a wide open output gap, the error correction model would imply growth rates that can be very large and unrealistic, whereas growth is certainly limited during recoveries. Therefore, *ad-hoc* restriction is implemented in the dynamics of equation (4). The error correction effect is limited at 2.5% and the final dynamics of the output gap results from this bounded effect plus the impact of monetary policy, fiscal policy and external trade[10]:

$$\Delta\left(\bar{\bar{\tilde{y}}}_t\right) = max[-\lambda.[\tilde{y}_{t-1} - (y^*_{t-1})] + \ \alpha.\Delta(\tilde{y}_{t-1}); 0.025]$$

$$\Delta(\tilde{y}_t) = \Delta\left(\bar{\bar{\tilde{y}}}_t\right) + \lambda.\left[EFI^G_{t-1} + EFI^T_{t-1} + \delta_l.\left(R^{pri}_{t-1} - \bar{R}^{pri}_{t-1}\right) + \beta_l.ad_{t-1}\right] + \Delta(EFI^G_t) + \Delta(EFI^T_t) + \delta_s.\Delta\left(R^{pri}_t - \bar{R}^{pri}_t\right) + \beta_s.\Delta(ad_t) + \varepsilon^d_t$$

The dynamic of the potential output is described by the following equation:

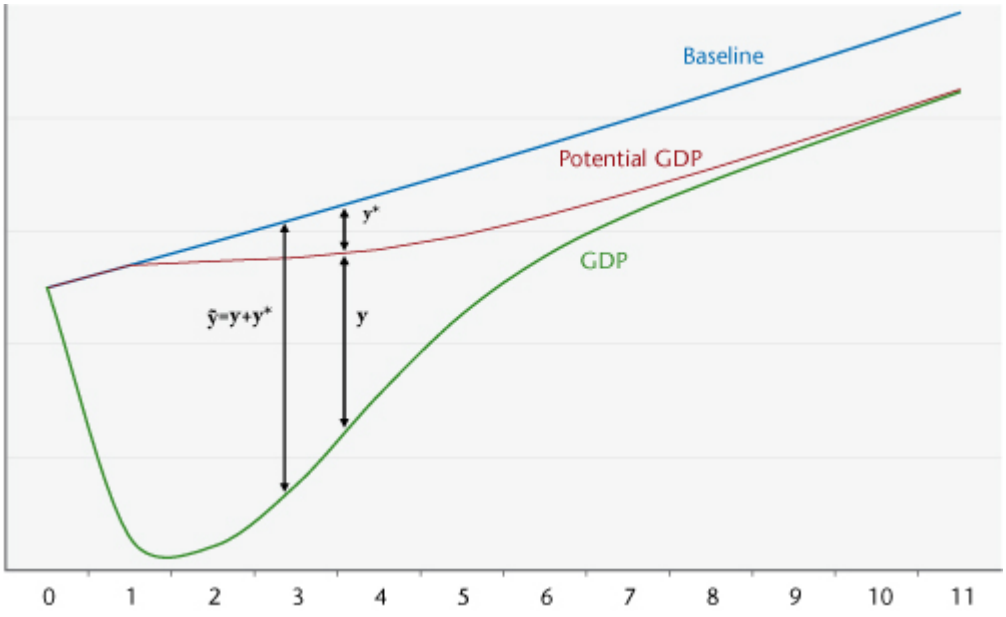
(5) $y^*_t = y^*_{t-1} + H.y_t + \varepsilon^s_t$

where $H$ is an hysteresis parameter, $\psi_\propto$ assesses the long run impact of fiscal policy on potential GDP (this point is developed in the Fiscal policy section hereafter) and $\varepsilon^s_t$ is an exogenous shock on aggregate supply.

[9] $t$ stands for time subscript and

The dynamics of the output and potential output in case of demand shock is represented in figure 1. Due to hysteresis effect, the long-term output may never revert to the initial output although the long term growth rate remains constant.

**Figure 1. Example: GDP path and potential GDP path with hysteresis**




*Source:* iAGS model, OFCE.

## 1.2. Public finances and fiscal policy

$FS$ is the fiscal balance in % of nominal GDP. We decompose it between a structural primary balance $SPS$ and a cyclical balance $CS$, minus government interest payments on public debt $GIP$:

(6) $FS_t = SPS_t + CS_t - GIP_t$

(7) $SPS_t = SPS_{t-1} - FI_t^G - FI_t^T + \Phi.\Delta y_t^*$

(8) $CS_t = \Phi.y_t$

(9) $GIP_t = \overline{i_t^B}.B_{t-1}/(1+\Delta Q_t)$

(10) $\overline{i_t^B} = 1/MAT\,.R_t^{pub} + (1-1/MAT).\overline{i_{t-1}^B}$

(11) $B_t = B_{t-1}/(1+\Delta Q_t) - FS_t + SFL_t$

The structural primary balance evolves according to the fiscal impulses decomposing between adjustment on public spending ($FI^G$), adjustment on taxes ($FI^T$) and changes in taxes due to variations in the gap between potential production and the baseline (eq.(7)). This latter point means

that a permanent downward shift of potential production relative to the baseline would entail a permanent fall in taxes, then a permanent fall in the structural primary balance.

The cyclical balance depends on $\Phi$, the overall sensitivity of revenues and expenditures to the business cycle (eq.(8)). Interest payments on debt (in % of GDP) depend on the stock of debt times its average interest rate, and deflated by the nominal GDP growth rate (eq. (9)).

The average interest rate on debt evolves according to the long term nominal interest rate on newly issued public bonds. $MAT$ stands for the average maturity of public debt, and is assumed to be constant. $1/_{MAT}$ then gives the share of debt refinanced every year (eq.(10)).

Public debt (in % of nominal GDP) increases with past debt deflated by the nominal growth rate of GDP, fiscal deficits and with an exogenous stock-flow adjustment variable (eq.(11)).

The impact of fiscal policy depends on the state of the economy as emphasized by a growing literature (Parker, 2011), showing that the fiscal multiplier differs according to the position of the economy in the cycle[11] (Corsetti, Meier and Müller, 2012), the stance of monetary policy (Hall, 2009), the situation of the financial system or the growth of public debt (Corsetti et al, 2013). For example, using regime-switching models, Auerbach and Gorodnichenko (2010) estimate effects of tax and spending policies that can vary over the business cycle. They find large differences in the size of fiscal multipliers in recessions and expansions: fiscal policy is considerably more effective in recessions. Assuming that the economy can endogenously switch between regimes, they find that historical multipliers can vary between 0 and 0.5 during expansions and between 1 and 1.5 during recessions[12]. Based on the conclusion of Auerbach and Gorodnichenko (2010), we build a time-varying fiscal multipliers $\mu_t$ which depends on the output gap and on the composition of the adjustment.

For $i = G, T$ where *G* stands for government spending and *T* for taxes, we consider the following form for the fiscal multiplier:

$$\text{If } y_{t-1} < y_{inf} \text{ then } \mu_t^i = \mu_{max}^i$$
$$\text{if } y_{t-1} > y_{sup} \text{ then } \mu_t^i = \mu_{min}^i$$
$$\text{if } y_{t-1} = 0 \text{ then } \mu_t^i = \mu_0^i$$
$$\text{if } y_{inf} \leq y_{t-1} \leq y_0 \text{ then } \mu_t^i = \mu_{max}^i + \left(\mu_0^i - \mu_{max}^i\right)/\left(y_0 - y_{inf}\right) * \left(y_{t-1} - y_{inf}\right)$$
$$\text{if } y_0 \leq y_{t-1} \leq y_{sup} \text{ then } \mu_t^i = \mu_0^i + \left(\mu_{inf}^i - \mu_0^i\right)/\left(y_{sup} - y_0\right) * \left(y_{t-1} - y_0\right)$$

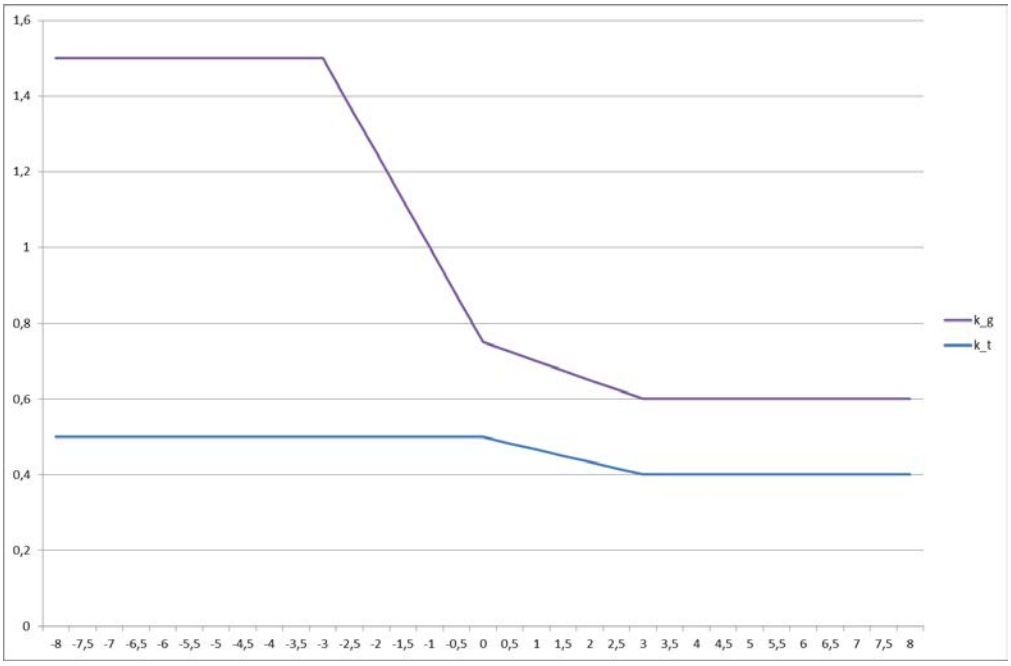
[11] See Blot et al. (2014a) for a literature review .

[12] See Baum and Koester (2011) for empirical estimates for Germany and Creel *et al.* (2011) for France; see Michaillat (2012) for a theoretical approach.

The values of fiscal (tax and spending) multipliers are maximal in very bad times, whereas they are minimal in very good times. Such a representation of the fiscal multiplier does not directly account for all the possibilities highlighted in the empirical literature. Yet, as monetary policy is endogenous and constrained by the zero lower bound (see details below), the effect of fiscal policy becomes stronger when the output gap is negative and monetary policy constrained by the ZLB as there is no increase in the interest rate that would mitigate the impact of fiscal policy. Since the banking sector is not represented in the model, the state of the financial system has no incidence on the fiscal multiplier but we may suppose that a situation of distressed banking system would be accompanied by a negative output gap and would then be implicitly taken into account by the representation sketched above. Besides, fiscal multipliers are higher when unemployment rate (output gap) is low as liquidity constraints become more stringent for firms and households. In such a case, the hypothesis or Ricardian equivalence would not surely hold. Finally, there is one situation that seems to be more controversial if public debt is high or increases quickly: Corsetti et al. (2013) argue that the fiscal multiplier would be low. The analyses will yet also include a situation where a risk premium in the interest rate increases with public debt. Though it may not strictly correspond to the effect illustrated by Corsetti et al. (2013), it will mitigate our conclusion on the cost of consolidation when public debt is high. We consider the same shape for the two fiscal multipliers. Yet $\mu^T_{max}$ (respectively $\mu^T_{min}$ and $\mu^T_0$ ) may differ from $\mu^G_{max}$ (respectively $\mu^G_{min}$ and $\mu^G_0$ ).

The calibrated values for the fiscal multipliers are based on the meta-regressions analysis presented by Gechert and Rannenberg (2014) where it is shown that the fiscal multiplier on spending is very sensitive to the state of the economy whereas the fiscal multiplier on taxes seems to be more flat (see figure 2).

**Figure 2. Example of the value of the multiplier for public spending and taxes according to the output gap**




Note: $\mu^G_{max} = 1.5$, $\mu^G_{min} = 0.6, \mu^G_o = 0.75$, $\mu^T_{max} = 0.5$, $\mu^T_{min} = 0.4$, $\mu^T_o = 0.5$. $y_{inf} = -3\%$, and $y_{sup} = 3\%$. Values are supposed to be identical across countries.

Source: OFCE.

Fiscal impulse represents discretionary decisions (in % of GDP) on government spending and taxes. It drives the structural primary surplus. We then compute the effective fiscal impulse (based on public expenditures or taxes), that is the *ex ante* cumulative real effect of current and past fiscal impulses at time $t$[13]. Thus, with $\psi_k . \mu^j_{t-k}$ (for $j = G, T$) the fiscal multiplier at time $t$ of a fiscal impulse that occurred $k$ years ago, one has:

$$\Delta EFI^j_t = \psi_0 . \mu^j_t . FI^j_t + \psi_1 . \mu^j_{t-1} . FI^j_{t-1} + \psi_2 . \mu^j_{t-2} . FI^j_{t-2} + \psi_3 . \mu^j_{t-3} . FI^j_{t-3} + \psi_4 . \mu^j_{t-4} . FI^j_{t-4} + \psi_5 . \mu^j_{t-5} . FI^j_{t-5} + \psi_6 . \mu^j_{t-6} . FI^j_{t-6} + \psi_7 . \mu^j_{t-7} . FI^j_{t-7} \quad (12)$$

$$\Sigma FI^j_t = \Sigma FI^j_{t-1} + \mu^j_t . FI^j_t \quad (13)$$

Equation (12) ensures that the impact of a fiscal impulse depends on the fiscal multiplier that prevailed when the fiscal impulse occurred. Seven lags are retained to account for the possibility of long lasting effects of fiscal impulses. The total impact of a sequence of fiscal impulses is then

[13] It is an *ex ante* multiplier in the sense that it does not take into account monetary policy effects and feedback effects of external trade on GDP following a fiscal impulse.

computed using the accumulation of fiscal impulses times the multiplier (eq. (13)), and the long run impact on potential GDP is $\mu_{\propto}$.

GDP prices are set according to a new Keynesian hybrid Phillips curve approach (NKHPC hereafter). Inflation depends on past inflation, expected inflation, output gap, and imported inflation (eq.(21)). Actually, a distinction is made between short term (or one-period ahead forecast) and long term forecasts. For one-period ahead forecasts (eq.(22), we rely on backward expectations, which seems in line with what is usually observed (see Fuhrer and Moore, 1995). Here we assume that inflation is expected to converge to the ECB target at a speed depending on the value of parameter $\kappa$.

For financial markets, long run expected inflation is modelled as the discounted sum of future inflation rates (eq.(23)), in the same way as nominal long term rates, in order to keep expectations consistent on both sides. Here expectations are forward-looking.

(21) $$\pi_t = \eta_1 . \pi_{t-1} + (1-\eta_1) . \pi^e_{t+1} + \eta_2 . y_t + \eta_3 . \sum_j w_{m,j,c} (\Delta \pi^c_t) + \varepsilon^\pi_t$$

(22) $$\pi^e_{t+1} = \pi_{t-1} + \kappa . (\pi_{t-1} - \pi^*) + \varepsilon^{\pi^e}_t \ with \ 0 \geq \kappa \geq -1$$

(23) $$\pi^{e,lr}_t = \tau . \pi^{e,lr}_{t+1} + (1-\tau) . \pi_t$$

### 1.4. External trade

Imports of each country increase with the output gap (eq.(24)). Then, as imports in each country are exports for other countries, we define external demand to country *c* as the weighted sum of imports of the other EMU countries (eq.(25). As the model considers only EMU countries, the external demand only accounts for intra-EMU trade[15].

(24) $$m_t = \Omega . y_t$$

(25) $$ad_t = \sum_j w_{m,j,c} m_t$$

Calibration of the model is described in the appendix.

## 2. Public Debt and output gap dynamics under alternative composition of fiscal adjustment

The aim here is to provide simulations on the paths of public debt and output gap of Euro area member states according to the path of consolidation and the composition of the adjustment. We first describe the central scenario where we consider a time-varying fiscal multiplier and hysteresis effects. In this baseline, there is no risk premium on long-term interest rates. Parameter $\kappa$ of equation (20) is set to zero. The impact of the endogenous risk premium is taken into account in a second step. First, we take into account the observed composition of the fiscal consolidation from 2011, which is the starting point for all simulations. The public debt dynamic until 2034 is then derived under the

[15] It is supposed implicitly that the output gap of the rest of the world is zero.

first set of hypotheses regarding the national fiscal impulses. We notably wonder whether euro area countries may achieve the 60% debt-to-GDP target under this baseline scenario. Then, we analyze different path of consolidation considering three alternative instruments: purely expenditure-based adjustment, purely tax-based adjustment and a mixed-adjustment.

## 2.1. Public debt in 2034 under the current adjustment

We first present a baseline scenario where the asses the public finance and macroeconomic dynamics under the adjustment path implemented from 2011 and taking into account the composition of this adjustment. The results of this baseline scenario are illustrated in Table 1 and hypotheses regarding the set of initial conditions are described in box 1. In the baseline scenario, we simulate the path of public debt levels until 2034, which is the horizon of the 1/20$^{th}$ debt rule incorporated in the revised SGP and in the Fiscal Compact. The simulated path of public debt levels depends on the fiscal impulses which have been forecast in the euro area from 2011 to 2016[16]. We then assume zero fiscal impulses beyond 2016. Under the baseline scenario, fiscal multiplier is supposed to be time-varying as described in figure 2. Hysteresis effect is also introduced in the model so that a negative (respectively positive) demand shock will have negative (respectively positive) long-term effect on the GDP level. Growth rates are indeed supposed to converge to a fixed and constant value in the long-term. We also suppose that sovereign spreads will vanish after 2015.

Table 1. Public finance and output performances under the baseline scenario

| | Public debt (% of GDP) | | Structural balance (% of GDP) | | Cumulated fiscal impulse | GDP growth rate (%) | | Sovereign Spread to Germany |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2034 | 2020 | 2034 | 2011-2016* | 2011-2014 | 2015-2034 | 2012-2018 |
| Germany | 51 | 6 | 1,9 | 3,0 | -1.8 | 1,5 | 1,1 | 0,0 |
| France | 93 | 99 | -3,1 | -3,9 | -2.5 | 0,8 | 1,6 | 0,4 |
| Italy | 112 | 57 | 1,1 | 2,9 | -2.1 | -0,8 | 0,5 | 1,5 |
| Spain | 92 | 71 | -1,4 | -1,0 | -5.7 | -0,4 | 1,7 | 1,4 |
| Netherlands | 71 | 66 | -1,6 | -1,8 | -2.3 | 0,0 | 1,5 | 0,2 |
| Belgium | 86 | 52 | -0,3 | 0,5 | -1.1 | 0,8 | 1,7 | 0,5 |
| Portugal | 115 | 83 | -1,0 | -0,2 | -7.4 | -1,4 | 1,4 | 1,3 |
| Ireland | 82 | 8 | 2,4 | 4,6 | -6.3 | 1,5 | 2,2 | 0,9 |
| Greece | 148 | 58 | 1,7 | 4,9 | -11.1 | -4,8 | 1,7 | 1,5 |
| Finland | 65 | 74 | -2,3 | -3,3 | -1.8 | 0,1 | 1,9 | 0,2 |
| Austria | 69 | 56 | -1,1 | -1,0 | 0.3 | 1,3 | 1,5 | 0,2 |
| Euro area | 82 | 54 | -0,3 | 0,2 | -2.8 | 0,4 | 1,3 | 0,7 |

Source: iAGS model

[16] For 2015 and 2016, we consider expected fiscal impulses.

*: Fiscal impulses are null beyond 2016.

Columns 1-4 report public debt and structural balance respectively in 2020 and 2034 (20-year horizon). 2020 is the year for which the output gap has returned to zero for almost all countries. The cumulated fiscal impulse for 2011-2016, is reported in column 5 and sums up the short term fiscal stance for all euro area countries. Growth performances (GDP growth rates) are reported in columns 6 and 7. For GDP growth, we report the average growth rate over the period for which we have information on realized fiscal stance (2011-2014). Beyond 2020, GDP growth converges to the long-term growth rate.

Given the initial conditions and the realized and expected fiscal impulses, table 1 shows that public debt would significantly decrease between 2020 and 2034 for all countries but France and Finland. Germany, Italy, Belgium, Ireland, Greece and Austria would meet the 60% target by 2034. It must be yet that those projections may be sensitive to alternative hypotheses. Blot and al. (2015) notably shows that the value of fiscal multipliers and the hysteresis effect play a significant role to gauge the dynamics of public debt. Initial output gap and long-term growth are also critical hypotheses. Fiscal impulses have been high for most of euro area countries sometimes exceeding 5% as in Spain, Portugal, Ireland and Greece. They may be even larger if years 2015 and 2016 are excluded as fiscal stance would turn positive for some countries according to AMECO forecasts (see table 2). For most countries average growth rates has been low in the 2011-2014 period. It must be stressed that for those years, the model has been adjusted to mimic the observed growth, public debt, public balance and interest rates. Thereafter, due to less contractionary or even expansionary fiscal impulses in 2015 and 2016, GDP would recover implying higher growth rates: 1.3% and 2.9% respectively for the euro area as a whole. This also result from expansionary monetary policy and to the error correction effect introduced in the model (see eq.(4)).

In 2020, despite substantial fiscal efforts, France, Spain, the Netherlands, Portugal, Finland and Austria would not be able to bring their cyclically-adjusted deficit under 0.5% of GDP. Among those countries, France, Spain, the Netherlands, Portugal and Finland would not comply with the new fiscal rule on public debt as it would still stand above the 60 % threshold in 2034 despite strong efforts to bring back debt to this ratio.

Finally, this baseline scenario questions the issue of public debt sustainability in the euro area. Consistently with the new fiscal framework, it seems relevant to fix a 20-year horizon for assessing debt sustainability. The simulations are then carried out over this horizon. Sustainability refers to the ability of the general government to pay back the domestic public debt. This ability depends on the future available scope for spending cuts and tax hikes, but also on future economic growth[17]. In our simulations, the public debt sustainability is assessed regarding the ability of countries to meet the objective of bringing back the debt ratio to 60 % of GDP by 2034. Though some countries in our baseline simulations do not reach this 60% threshold, it is noticeable that they achieve substantial reductions in public debt-to-GDP ratios. This downward trend in public debt implies enhanced debt

[17] The issue of EU debt sustainability and the requirement to limit deficits in this respect are discussed, e.g. by Pollin (2011).

sustainability *stricto sensu*. However the social costs as well as the cost in terms of fiscal balance could make this adjustment unrealistic (see Buiter and Rahbari, 2014). For Greece, Italy and Ireland, it would require structural primary surpluses close or above 3% of GDP for many years. This will obviously question the ability of those countries to maintain such a high primary surplus, a situation which has rarely been observed in the history of fiscal consolidations.

For countries, where public debt would fall significantly below 60 %, it raises the opportunity to pursue austerity as existing fiscal rules only state that debt must be below 60 % leaving leeway to expand in the near future. We may consider that the baseline scenario goes too far: beyond the requirements of fiscal sustainability, beyond the requirements of EU fiscal rules and beyond the social resilience of European citizens. For Germany, the primary surplus would reach 3.0% by 2034 under the current scenario. As the optimal level of public debt is unknown *a priori*, there is no reason to consider that this situation will correspond to a long term equilibrium. The German government may decide to expand fiscal policy in the coming years and our simulation would then show that it might not threaten public debt sustainability.

### Box 1: Main hypotheses for the baseline simulations

All simulations begin in 2011. To do so, we need to set some starting point values in 2010 for a set of determinant variables. Output gaps for 2010 come from OECD database. We have considered EO88 database as output gaps levels are frequently revised. An alternative might be to consider most recent OECD estimates of the output gaps, taking EO96 for example[18]. Long-term projections for growth rates are OFCE hypotheses which may be considered as prudent hypothesis. An alternative scenario with higher long-term growth rates from OECD (2012) estimates may be analyzed to consider the sensitivity of the results to these hypotheses[19]. for the baseline potential GDP are based on OECD (2012) projections (see Table 2) where long term growth is decomposed between the growth of labour force and productivity of labour. These hypotheses are necessarily open to debate but they may only be seen as exogenous projections since the model does not properly account for a long term analysis of the growth rate equilibrium. Concerning fiscal policy and budget variables, the main hypotheses are as follows:

— Public debts and fiscal balances for 2010 comes from Eurostat;

— Fiscal impulses and the composition of the adjustment are taken from AMECO database for (see Table 3). For 2015-2016, these fiscal impulses are expected. Fiscal impulses take into account the one-off measures and correspond then to the underlying primary cyclically adjusted fiscal balance.

— Sovereign spreads for 2015-2016 are supposed to vanish progressively in the baseline scenario. It is indeed considered that the ECB program of unlimited debt buying on the secondary market (Outright Monetary Transactions) is effective and achieves its goal to bring down interest rates for Italy and Spain. Regarding countries relying on the ESM for debt financing, we assume that Ireland will get full access to financial markets in 2014, Portugal in 2015 and Greece in 2016. We discuss a scenario with endogenous risk premium hereafter.

[18] This has not been done yet but might integrated in future draft of the paper.

[19] This has not been done yet but might integrated in future draft of the paper.

## Table 2. Main hypotheses for 2010

in %

| | Public debt | Fiscal balance | output gap | potential growth |
|---|---|---|---|---|
| **Source** | **Eurostat** | **Eurostat** | **OECD** | **OFCE** |
| **Germany** | 82.5 | -4.2 | -3.7 | 1.0 |
| **France** | 82.8 | -6.8 | -3.3 | 1.4 |
| **Italy** | 115.3 | -4.5 | -4.4 | 0.2 |
| **Spain** | 61.7 | -9.4 | -6.5 | 1.4 |
| **Netherlands** | 63.4 | -5.1 | -2.4 | 1.3 |
| **Belgium** | 96.6 | -3.8 | -3.8 | 1.5 |
| **Portugal** | 94.0 | -11.2 | -2.3 | 1.0 |
| **Ireland** | 91.2 | -9.1 | -11.7 | 1.8 |
| **Greece** | 148.3 | -10.9 | -7.3 | 1.5 |
| **Finland** | 48.8 | -2.5 | -6.0 | 1.6 |
| **Austria** | 72.5 | -4.5 | -2.5 | 1.4 |

## Table 3. Fiscal impulses – 2011-2016

in % of GDP

| | 2011 – 2014 | | 2015-2016 | |
|---|---|---|---|---|
| | Expenditures | Taxes | Expenditures | Taxes |
| **Germany** | -1.5 | -0.7 | 0.1 | 0.3 |
| **France** | -3.9 | 1.1 | 0.4 | -0.1 |
| **Italy** | -2.2 | -0.5 | 0.5 | 0.2 |
| **Spain** | -1.9 | -4.1 | -0.1 | 0.4 |
| **Netherlands** | -1.7 | -1.3 | 0.5 | 0.2 |
| **Belgium** | -2.9 | 1.4 | 0.6 | -0.3 |
| **Portugal** | -3.9 | -4.4 | 0.3 | 0.6 |
| **Ireland** | -1.3 | -4.8 | 1.7 | -1.9 |
| **Greece** | -7.0 | -5.5 | 1.3 | 0.1 |
| **Finland** | -3.9 | 4.0 | -0.4 | 0.6 |
| **Austria** | -1.6 | 0.0 | -0.2 | 0.0 |

*Sources:* OECD, Eurostat and AMECO.

## 2.2. Does composition matter?

In a second step, we compute simulations that aim at gauging if countries can attain the public debt target in 2034 by resorting to alternative instrument of consolidation. For sake of simplicity and regarding literature on fiscal multipliers, we consider an instrument for which the fiscal multiplier is higher, called here expenditure-based adjustment and the other for which the fiscal multiplier is lower, called tax-based adjustment as emphasized in figure 2. [20]

For each instrument, we calculate a sequence of fiscal impulses over 2011-2034 and we assess whether or not the country achieves the target and what is the output dynamics under the adjustment. For simplicity, we set fiscal impulses at - / + 0.5 from years from 2011. Next section will consider higher absolute values for the consolidation path to compare backloading versus frontloading strategy. Austerity is ended when public debt reaches 60%. For example, Spanish public debt stands at 71% of GDP in 2034 in the baseline scenario, we consider an additional negative fiscal impulse of -0.5 and look whether debt-to-GDP ratio reaches 60%. If yes, consolidation is ended. If not, additional impulses are added years after …

The baseline scenario also makes clear that some other countries would reach a debt-to-GDP ratio below 60% in 2034. Too much austerity would then have been implemented regarding the debt criteria. For those countries, possibility was left to expand fiscal policy. But, as the equilibrium is unknown *a priori*, we consider that a 60% debt-to-GDP ratio is also the target for 2034. There is no theoretical reason behind that choice. It may serve as a comparison point for simulating alternative scenarios (see next section). Then, we implement positive fiscal impulses of +0.5 (expenditure-based or tax-based) from 2011 and until public debt is equal to 60%. The ability to comply with the debt objective is analyzed in the two alternative scenarios (without and with the endogenous risk premium) and with three instruments (expenditure-based, tax-based and mix-adjustment). In the mix-adjustment case, we consider that countries for which consolidation is needed resort to the instrument with the lowest fiscal multiplier (here taxes) whereas countries where an expansionary fiscal policy can be implemented resort to the instrument with the higher instrument (here expenditures). In the first scenario (table 4a), we consider the pure expenditure-based consolidation (or expansion) and in table (4b), we consider the pure tax-based consolidation (or expansion). Finally, table (4c) represents the situation of a mix-adjustment. In all the cases, it is first supposed that interest rates converge among euro area countries. Credibility or sustainability of public finances is not an issue so that there is no risk-premium on sovereigns. The case with endogenous risk-premium is analyzed in the second step.

First, with maximum yearly consolidation of -0.5 GDP based only on expenditures point from 2011 (table 4a), only three countries (Spain, Portugal and Greece) would not be able to reach the 60% target for public debt in 2034. For those countries the fiscal impulse would amount to 11.5%.

[20] It may be relevant to consider alternative shapes for the multiplier effect. This issue is left for further research.

For France, the Netherlands and Austria, a significant additional amount of consolidation is needed when compared to table 1. In the case of Italy, reaching 60% with -0.5 point of consolidation per year would involve 3.1 points of consolidation which is close to the -2.1 that was realized between 2011 and 2016.[21] For Germany, fiscal stance would now turn to a positive figure reflecting the rooms of maneuver of the country. With a neutral fiscal stance, Belgium would also be able to reach the 60% debt-to-GDP ratio. Finally, it must be stressed that average growth between would be significantly higher between 2011 and 2014 due to less consolidation. For the euro area as a whole average growth would have been 0.6 point higher. The most striking difference would concern Greece, with an averaged recession of -0.9 instead of -4.8. But it must also be reminded that with this path of adjustment Greece would still not be able to reach a 60% debt. The reduction of debt would yet be significant.

Such a result raises the issue of debt sustainability. Though some countries would not meet the 60% threshold, it is noticeable that they achieve substantial reductions in public debt-to-GDP ratios. This downward trend in public debt implies enhanced debt sustainability stricto sensu. The 60% debt-to-GDP target may be seen as an institutional definition of sustainability. Yet, the issue of public debt sustainability is theoretically and empirically unsettled, between promoters of investigating the statistical properties of public finances' variables on the one hand, and, on the other hand, promoters of a "return to economic thinking" (Bohn, 2007). However the social costs as well as the cost in terms of fiscal balance could make this adjustment unrealistic (see Buiter and Rahbari, 2014). For Greece, Italy, Portugal and Belgium, it would indeed require structural primary surpluses close or above 3% of GDP for many years. This will obviously question the ability of those countries to maintain such a high primary surplus, a situation which has rarely been observed in the history of fiscal consolidations.

Turning to the case of pure tax-based adjustment (table 4b), only Portugal would not comply with fiscal rule on debt. Public debt would reach 92%, which is significantly lower than in the expenditure-based adjustment, where it stood at 150%. This scenario is certainly and not surprisingly better for all euro area countries since, needed adjustment is lower and consolidation is less costly. Average growth in the euro area would now have reached 1.2 between 2011 and 2014. This conclusion strongly hinges on the hypotheses of the model where the size of the tax multiplier is always lower than the size of expenditure multiplier. It is then always better to resort to the instrument associated to the lower multiplier to implement consolidation. The reverse is yet true when considering an expansion. This is why, we have considered a third scenario which is called mixed-adjustment (see table 4c). Here, countries which have fiscal space may resort to expenditure-based expansion whereas countries implementing consolidation resort to tax-based adjustment. The differences with the pure tax-based adjustment is rather small. Public debt for Portugal is only reduced by 1 point. Average growth for the euro area is 0.1 point higher between 2011 and 2014. It must be stressed that the main country for which there is fiscal space is Germany. Though it is the biggest euro area countries, the spillover effects from an fiscal expansion based on public expenditures are small (see also Blot et al., 2015 for a discussion on that point).

[21] Here we also take into account expected consolidation or expansion for 2015 and 2016.

Table 4a. + / - 0.5 adjustment - the case of expenditure-based adjustment

| | Public debt (% of GDP) | | Structural balance (% of GDP) | | Cumulated fiscal impulse | GDP growth rate (%) | |
|---|---|---|---|---|---|---|---|
| | 2020 | 2034 | 2020 | 2034 | 2011-2034 | 2011-2014 | 2015-2034 |
| Germany | 70 | 60 | -1,1 | -1,1 | 1,2 | 2,2 | 1,0 |
| France | 95 | 60 | -1,1 | 0,8 | -6,8 | 1,4 | 1,4 |
| Italy | 122 | 60 | 1,1 | 3,4 | -3,1 | -0,7 | 0,4 |
| Spain | 127 | **100** | -3,6 | 2,0 | -11,5 | 0,1 | 1,4 |
| Netherlands | 85 | 60 | -0,6 | -0,3 | -5,0 | 0,1 | 1,4 |
| Belgium | 87 | 60 | -1,0 | -0,2 | 0,0 | 1,7 | 1,6 |
| Portugal | 160 | **150** | -4,6 | 0,1 | -11,5 | -0,1 | 0,9 |
| Ireland | 122 | 60 | -0,8 | 2,4 | -7,0 | 1,9 | 1,9 |
| Greece | 163 | **110** | -2,2 | 4,4 | -11,5 | -0,9 | 1,0 |
| Finland | 58 | 60 | -1,8 | -2,4 | 0,9 | 1,3 | 1,7 |
| Austria | 74 | 60 | -1,4 | -1,2 | -2,1 | 1,1 | 1,5 |
| Euro area | 96 | 67 | -1,1 | 0,5 | -3,8 | 1,0 | 1,1 |

Source: iAGS model

Table 4b. + / - 0.5 adjustment - the case of tax-based adjustment

| | Public debt (% of GDP) | | Structural balance (% of GDP) | | Cumulated fiscal impulse | GDP growth rate (%) | |
|---|---|---|---|---|---|---|---|
| | 2020 | 2034 | 2020 | 2034 | 2011-2034 | 2011-2014 | 2015-2034 |
| Germany | 72 | 61 | -1,1 | -1,1 | 1,0 | 2,1 | 1,0 |
| France | 84 | 60 | -0,9 | -0,5 | -4,2 | 1,8 | 1,4 |
| Italy | 114 | 60 | 0,7 | 2,8 | -1,7 | -0,2 | 0,4 |
| Spain | 111 | 60 | -2,4 | 2,8 | -9,2 | 0,6 | 1,6 |
| Netherlands | 72 | 60 | -1,3 | -1,2 | -2,6 | 0,6 | 1,4 |
| Belgium | 88 | 63 | -1,1 | -0,5 | 0,2 | 1,7 | 1,6 |
| Portugal | 142 | **92** | -3,2 | 3,8 | -11,5 | 0,4 | 1,0 |
| Ireland | 105 | 60 | -0,6 | 0,7 | -3,8 | 2,6 | 2,0 |
| Greece | 139 | 60 | -0,4 | 4,6 | -7,6 | -0,2 | 1,1 |
| Finland | 59 | 61 | -1,8 | -2,4 | 0,7 | 1,1 | 1,8 |
| Austria | 71 | 60 | -1,4 | -1,3 | -1,5 | 1,5 | 1,4 |
| Euro area | 89 | 61 | -1,0 | 0,3 | -2,6 | 1,2 | 1,2 |

Source: iAGS model

Table 4c. + / - 0.5 adjustment - the case of mix-adjustment (expenditure-based expansion and fiscal-based consolidation)

| | Public debt (% of GDP) | | Structural balance (% of GDP) | | Cumulated fiscal impulse | GDP growth rate (%) | |
|---|---|---|---|---|---|---|---|
| | 2020 | 2034 | 2020 | 2034 | 2011-2034 | 2011-2015 | 2016-2034 |
| Germany | 70 | 60 | -1,1 | -1,1 | 1,2 | 2,2 | 1,0 |
| France | 84 | 60 | -0,9 | -0,5 | -4,2 | 1,8 | 1,4 |
| Italy | 114 | 60 | 0,7 | 2,8 | -1,7 | -0,2 | 0,4 |
| Spain | 111 | 60 | -2,4 | 2,8 | -9,2 | 0,6 | 1,6 |
| Netherlands | 72 | 60 | -1,3 | -1,2 | -2,6 | 0,6 | 1,4 |
| Belgium | 87 | 62 | -1,1 | -0,4 | 0,2 | 1,8 | 1,6 |
| Portugal | 142 | 92 | -3,2 | 3,8 | -11,5 | 0,4 | 1,0 |
| Ireland | 105 | 60 | -0,6 | 0,7 | -3,8 | 2,6 | 2,0 |
| Greece | 139 | 60 | -0,4 | 4,6 | -7,6 | -0,2 | 1,1 |
| Finland | 58 | 61 | -1,8 | -2,5 | 1,0 | 1,3 | 1,7 |
| Austria | 71 | 60 | -1,4 | -1,3 | -1,5 | 1,5 | 1,4 |
| Euro area | 89 | 61 | -1,0 | 0,3 | -2,5 | 1,3 | 1,2 |

Source: iAGS model

## 2.3. Does credibility matter?

All the previous scenarios are based on the assumption that interest rates will converge. Yet, recent experience have shown that countries with high public debt had lost credibility. The sovereign debt crisis has illustrated that risk premia may appear. It may then force countries to implement harder consolidation to convince financial markets that public finance are under control. This why we consider now scenarios with an endogenous risk premium on sovereign debt. As show in eq. (20), risk premium increases linearly with public debt. We have yet supposed that there thresholds effect introducing non linearity. A risk premium would appear as long as public debt exceeds 60% and if structural primary balance is not high enough to stabilize debt.

From there, we run the same simulations and assess the possibility to reach a 60% debt-to-GDP ratio when there is an endogenous risk premium. Such a goal is harder to achieve as, positive risk-premium will increase debt burden and increase public debt. Besides, it will also weigh down on growth, reducing the advantage of smoother path of consolidation and increasing debt due to lower cyclical balance. Here the focus is made only on pure expenditure or pure tax-based scenarios. Results are presented in tables 5a and 5b, which may be compared to 4a and 4b. The sovereign spread relative to German interest rate are shown in the last column.

Main results are:

-There are still only three countries (Spain, Portugal and Greece) which are not able to reach the 60% target,

-For those countries, public debt in 2034 is significantly higher than in the case without risk premium. Except for Greece, public debt does not decrease from 2020 to 2034. The issue of sustainability is then clearly raised (notably for Portugal) as the path of debt may even not satisfy weak definitions of debt sustainability,

- Average growth is lower between 2011 and 2014 but the difference with table 4a is rather small for the euro area as a whole (0.9% instead of 1.0),

-Sovereign spreads are above 1 point for Italy, Spain and Portugal,

-tax-based adjustment is still better suited since fiscal multiplier is lower.

We may then conclude that it is not only important to make the fiscal adjustment through the instrument associated with the lower fiscal multiplier and that it is important to neutralize the risk premium through appropriate monetary policy. Fiscal consolidation has not proved to be very efficient to improve credibility. Though, Spain or Greece implemented strong measures to reduce public balance, risk-premium kept rising in 2011 and 2012 and went down only after Mario Draghi declared that the ECB would do "whatever it takes" to save the euro.

Table 5a. +/- 0.5 fiscal impulses - endogenous risk-premium - the case of expenditure-based adjustment (can be compared to 2a)

| | Public debt (% of GDP) | | Structural balance (% of GDP) | | Cumulated fiscal impulse | GDP growth rate (%) | | Sovereign Spread to Germany |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2034 | 2020 | 2034 | 2011-2034 | 2011-2014 | 2015-2034 | 2012-2018 |
| Germany | 72 | 60 | -1,2 | -1,0 | 1,3 | 2,2 | 1,0 | 0,0 |
| France | 101 | 61 | -2,1 | 4,0 | -11,5 | 1,5 | 1,2 | 0,5 |
| Italy | 127 | 60 | 1,2 | 3,8 | -4,0 | -0,9 | 0,4 | 1,4 |
| Spain | 134 | **132** | -5,0 | 0,1 | -11,5 | 0,0 | 1,3 | 1,9 |
| Netherlands | 87 | 60 | -0,8 | 0,1 | -5,3 | 0,0 | 1,4 | 0,5 |
| Belgium | 86 | 60 | -1,0 | -0,3 | 0,5 | 1,8 | 1,6 | 0,3 |
| Portugal | 173 | **252** | -7,0 | -9,6 | -11,5 | -0,2 | 0,7 | 1,4 |
| Ireland | 124 | 60 | -1,0 | 2,7 | -7,4 | 2,0 | 1,9 | 0,7 |
| Greece | 163 | **108** | -2,3 | 4,6 | -11,5 | -0,9 | 1,0 | 0,9 |
| Finland | 58 | 60 | -1,9 | -2,4 | 1,0 | 1,4 | 1,7 | 0,0 |
| Austria | 74 | 60 | -1,5 | -1,1 | -1,7 | 1,1 | 1,5 | 0,1 |
| Euro area | 99 | 72 | -1,6 | 1,0 | -4,9 | 0,9 | 1,1 | |

Source: iAGS model

Table 5b. +/- 0.5 fiscal impulses - endogenous risk-premium - the case of tax-based adjustment (can be compared to 2b)

| | Public debt (% of GDP) | | Structural balance (% of GDP) | | Cumulated fiscal impulse | GDP growth rate (%) | | Sovereign Spread to Germany |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2034 | 2020 | 2034 | 2011-2034 | 2011-2014 | 2015-2034 | 2012-2018 |
| Germany | 73 | 63 | -1,3 | -1,1 | 1,2 | 2,1 | 1,0 | 0,0 |
| France | 87 | 60 | -0,9 | -0,2 | -4,8 | 1,8 | 1,4 | 0,5 |
| Italy | 114 | 60 | 0,7 | 2,8 | -1,9 | -0,3 | 0,4 | 1,4 |
| Spain | 117 | **67** | -3,5 | 4,5 | -11,5 | 0,5 | 1,5 | 2,0 |
| Netherlands | 72 | 60 | -1,4 | -1,2 | -2,4 | 0,6 | 1,4 | 0,2 |
| Belgium | 87 | 59 | -1,0 | -0,2 | 0,2 | 1,7 | 1,6 | 0,4 |
| Portugal | 152 | **134** | -5,2 | 1,4 | -11,5 | 0,2 | 1,0 | 1,4 |
| Ireland | 106 | 60 | -0,7 | 0,7 | -3,8 | 2,6 | 2,0 | 0,6 |
| Greece | 139 | 60 | -0,6 | 4,6 | -7,7 | -0,2 | 1,2 | 0,9 |
| Finland | 59 | 61 | -1,8 | -2,5 | 0,7 | 1,1 | 1,8 | 0,0 |
| Austria | 72 | 60 | -1,5 | -1,3 | -1,2 | 1,5 | 1,5 | 0,1 |
| Euro area | 91 | 63 | -1,2 | 0,5 | -2,9 | 1,2 | 1,2 | |

Source: iAGS model

## 3. Backloading versus frontloading

In this section, we address the issue of the opportunity to frontload fiscal consolidation according to the choice of instruments (expenditures or taxes). In the case of a frontloaded adjustment, countries implement the bulk of the fiscal consolidation as soon as possible. This is clearly the choice that has been made in the euro area since 2011. Despite negative output gaps, euro area countries have engaged massive consolidation plan as emphasized in table 3 where it appears that for some countries fiscal consolidation between 2011 and 2014 exceeded 10 GDP points. Considering that fiscal multiplier may be higher in time of crisis, as stressed here for expenditure-based adjustment, this strategy may be ill-designed (see also Blot et al., 2014b for more details), implying high output losses. It may even be counterproductive for very high value of fiscal multiplier since, public debt is then hardly reduced (due to the feedback effect stemming from bad growth performance). But, spreading (or postponing) the adjustment may undermine the credibility of government and trigger speculative attacks on sovereign debt markets. Interest rates then would go up. There is then clearly a trade-off since less consolidation would imply more growth but less credibility about public finance sustainability would drive up interest rate weighing down private investment and growth. We illustrate here this trade-off by comparing the +/- 0.5 GDP (backloaded) point adjustment path

developed in the previous section with scenarios where the adjustment would now amount to +/- 1 GDP point (frontloaded). As for the previous scenarios, all adjustment (positive or negative) start in 2011 and are pursued until debt-to-GDP ratios reach 60%.

Table 6a. +/- 1 fiscal impulses - endogenous risk-premium - the case of expenditure-based adjustment (to compare to Table 3a)

| | Public debt (% of GDP) | | Structural balance (% of GDP) | | Cumulated fiscal impulse | GDP growth rate (%) | | Sovereign Spread to Germany |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2034 | 2020 | 2034 | 2011-2034 | 2011-2016 | 2017-2034 | 2012-2018 |
| Germany | 71 | 60 | -1,2 | -1,0 | 1,3 | 2,2 | 1,0 | 0,0 |
| France | 90 | 60 | -0,8 | -0,1 | -6,1 | 0,7 | 1,5 | -0,1 |
| Italy | 120 | 60 | 0,9 | 3,2 | -3,1 | -1,2 | 0,5 | 1,3 |
| Spain | 130 | 60 | -0,7 | 4,0 | -13,4 | -0,8 | 1,5 | 1,8 |
| Netherlands | 77 | 60 | -1,3 | -0,8 | -3,7 | -0,5 | 1,5 | 0,1 |
| Belgium | 86 | 60 | -1,0 | -0,3 | 0,5 | 1,8 | 1,6 | 0,3 |
| Portugal | 183 | **84** | 0,2 | 16,9 | -34,5 | -1,8 | 0,2 | 1,4 |
| Ireland | 117 | 60 | -0,4 | 1,5 | -6,0 | 1,0 | 2,1 | 0,5 |
| Greece | 181 | **87** | 0,1 | 12,4 | -23,0 | -1,9 | 0,6 | 0,9 |
| Finland | 58 | 60 | -1,9 | -2,3 | 0,9 | 1,4 | 1,7 | 0,0 |
| Austria | 73 | 60 | -1,4 | -1,1 | -1,7 | 1,1 | 1,5 | 0,1 |
| Euro area | 94 | 61 | -0,7 | 0,7 | -4,1 | 0,5 | 1,2 | |

Source: iAGS model

Main findings are:

-Sovereign spreads are not significantly reduced notably in countries where they were high (Italy, Spain and Portugal)

-Average growth is significantly lower over the period 2011-2014. For the euro area as a whole, the difference amounts to -0.4 point,

-In the pure expenditure-based consolidation, Portugal and Greece still do not reach the 60% target whereas all countries reach the target in the pure tax-based adjustment.

Table 6b. +/- 1 fiscal impulses - endogenous risk-premium - the case of tax-based adjustment (to compare to Table 3b)

| | Public debt (% of GDP) | | Structural balance (% of GDP) | | Cumulated fiscal impulse | GDP growth rate (%) | | Sovereign Spread to Germany |
|---|---|---|---|---|---|---|---|---|
| | 2020 | 2034 | 2020 | 2034 | 2011-2034 | 2011-2016 | 2017-2034 | 2012-2018 |
| Germany | 73 | 63 | -1,3 | -1,1 | 1,2 | 2,1 | 1,0 | 0,0 |
| France | 77 | 60 | -1,2 | -1,0 | -3,8 | 1,7 | 1,5 | -0,2 |
| Italy | 113 | 60 | 0,6 | 2,7 | -1,8 | -0,3 | 0,4 | 1,4 |
| Spain | 96 | 60 | -0,8 | 0,4 | -6,5 | 0,2 | 1,7 | 1,4 |
| Netherlands | 69 | 60 | -1,4 | -1,3 | -2,3 | 0,6 | 1,4 | 0,0 |
| Belgium | 87 | 59 | -1,0 | -0,2 | 0,2 | 1,7 | 1,6 | 0,4 |
| Portugal | 125 | 60 | 0,8 | 2,8 | -9,4 | 0,0 | 1,1 | 0,8 |
| Ireland | 101 | 60 | -0,8 | 0,4 | -3,5 | 2,4 | 2,1 | 0,6 |
| Greece | 126 | 60 | 0,5 | 3,0 | -5,9 | -0,5 | 1,2 | 0,9 |
| Finland | 59 | 61 | -1,8 | -2,5 | 0,7 | 1,1 | 1,8 | 0,0 |
| Austria | 71 | 60 | -1,5 | -1,3 | -1,2 | 1,5 | 1,5 | 0,1 |
| Euro area | 85 | 61 | -0,8 | -0,2 | -2,0 | 1,1 | 1,2 | |

Source: iAGS model

# Conclusion

# Appendix

# Calibration

## A1. Aggregate demand and supply

We calibrate equation (4) by distinguishing short run and long run effects of monetary policy and external demand on GDP. Long run effect of long term yields is higher than the short run one, to take into account delays in the transmission of monetary policy. Empirical literature on the heterogeneity has not provided very conclusive results on the asymmetry of the transmission of interest rate shocks. Peersman (2004) reports diverging results so that any calibration remains hazardous. The choice is

then made to avoid a strong discrepancy between the different pass-through, which may also be consistent with convergence in the transmission process – at least before the crisis – as emphasized by Boivin, Giannoni and Mojon (2008) or Barigozzi, Conti and Luciani (2014). Boivin et al (2008) notably suggest that the effect of an increase in the interest rate is higher for Spain and Italy than for France and Germany. Besides, the transmission channel of monetary policy also hinge on the exchange rate channel that is not explicitly taken into account in the model. Yet, the price-elasticity of exports may be also higher for Spain and Italy (Blot and Cochard, 2008) and for more open economies. The value of parameters $\delta_s$ and $\delta_l$ is then fixed regarding these different arguments. The effect of interest rate shocks is then supposed to be lower for "Northern countries".

We set $\beta_l$ equal to the share of exports in country's GDP, and $\beta_s$ equal to half $\beta_l$.

**Table A1. Calibration of monetary policy and external demand effects on output**

| | $\delta_s$ | $\delta_l$ | $\beta_s$ | $\beta_l$ |
|---|---|---|---|---|
| Austria | -0.40 | -0.60 | 0.29 | 0.58 |
| Belgium | -0.40 | -0.60 | 0.40 | 0.81 |
| Finland | -0.40 | -0.60 | 0.23 | 0.46 |
| France | -0.30 | -0.50 | 0.13 | 0.27 |
| Germany | -0.30 | -0.50 | 0.25 | 0.50 |
| Greece | -0.40 | -0.60 | 0.13 | 0.25 |
| Ireland | -0.40 | -0.60 | 0.50 | 1.00 |
| Italy | -0.30 | -0.40 | 0.14 | 0.28 |
| Netherlands | -0.40 | -0.60 | 0.40 | 0.79 |
| Portugal | -0.40 | -0.60 | 0.17 | 0.34 |
| Spain | -0.30 | -0.40 | 0.15 | 0.30 |

*Source:* iAGS Model, OFCE.

The critical point in calibrating equation (4) is to set the speed of convergence of output to its long run equilibrium. This speed depends on values of $\lambda$ and $\alpha$, that are the same across countries. We fix $\alpha$ to 0.1 and $\lambda$ to -0.3. These values ensure that the speed of convergence of output to its long run value is comparable in normal times to that of standard DSGE models. With these values, the output gap is closed about 5 years after a shock.

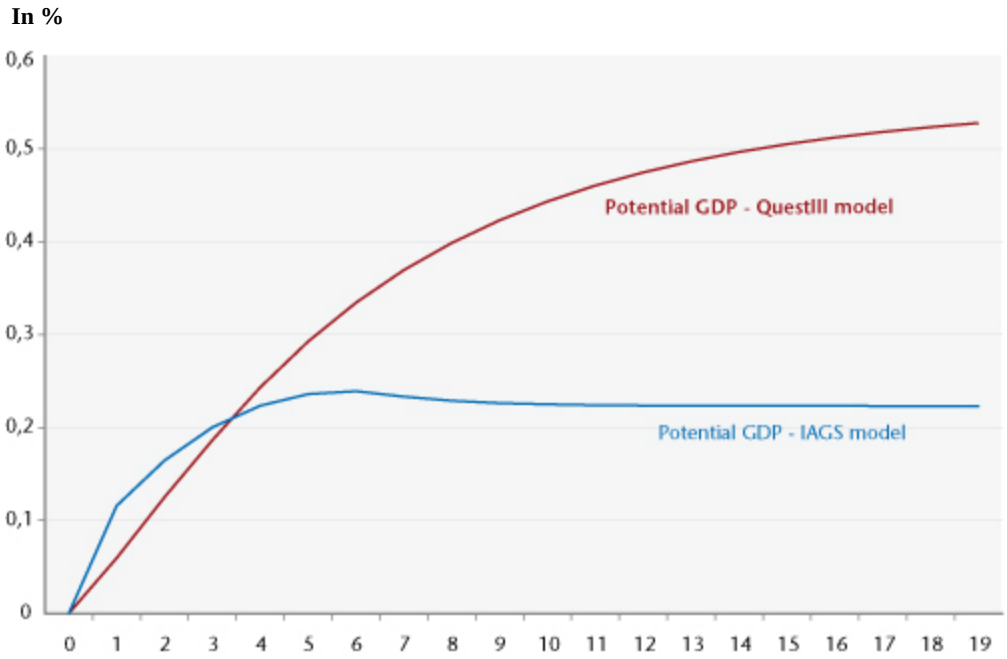
Concerning equation (5), long run effects on potential GDP come from hysteresis effects. The risk-premium effect depends on the sensitivity of the sovereign yield on public debt as described in eq. (20).

| Hysteresis | Risk-premium |
|---|---|
| $H$ | $\kappa$ |
| 0.15 | 0.01 |

iAGS Model, OFCE

The hysteresis effect parameter is fixed at 0.15 in order to obtain qualitatively similar impacts of transitory and permanent fiscal impulses on potential growth, as those obtained with QUEST III (see Figure A.1). We used the Macroeconomic Model Database to perform deterministic simulations of the QUEST III model. For the simulation, fiscal policy rules are disconnected and shocks are done on the share of government consumption to GDP ratio.

**Figure A.1. Calibration of hysteresis effects of fiscal policy on potential GDP**




*Notes*: results are in difference from baseline.

*Sources: Macroeconomic Model Database - Wieland et al. (2012), iAGS Model, OFCE.*

## Public finances

The most important parameter to set for public finances is $\Phi$, the overall sensitivity of revenues and expenditures to the business cycle. To do so we use the European Commission estimates. To compute the average interest rate on public debt, we compute an average maturity of public debts using national sources on public debt maturity structures in 2011.

**Table A.3. Calibration of public finances parameters**

| | $\Phi$ | *MAT* |
|---|---|---|
| Austria | 0,47 | 8,1 |
| Belgium | 0,54 | 6,8 |
| Finland | 0,50 | 5,0 |
| France | 0,49 | 6,9 |
| Germany | 0,51 | 6,1 |
| Greece | 0,43 | 11,3 |
| Ireland | 0,40 | 6,9 |
| Italy | 0,50 | 6,6 |
| Netherlands | 0,55 | 7,0 |
| Portugal | 0,45 | 6,1 |
| Spain | 0,43 | 6,8 |

*Sources:* European Commission (2005), OFCE.

## External trade

We set the sensitivity of imports to output gap equal to the share of imports in country's GDP. The matrix of trade exchanges between countries comes from the Chelem Database for year 2003.

**Table A.4. Calibration of the sensitivity of imports to output gap**

| | $\Omega$ |
|---|---|
| Austria | 0.5 |
| Belgium | 0.8 |
| Finland | 0.4 |
| France | 0.3 |
| Germany | 0.4 |
| Greece | 0.3 |
| Ireland | 0.8 |
| Italy | 0.3 |
| Netherlands | 0.7 |
| Portugal | 0.4 |
| Spain | 0.3 |

*Source:* OECD Economic outlook 91.

## Monetary policy and financial markets

We choose standard values for the Taylor rule. The short term interest rate is bound at 0.05% to account for the zero lower bound on monetary policy. We fix $\tau = 0.82$, a value compatible with a long run nominal interest rate of 4% (see Shiller, 1979, or Fuhrer and Moore, 1995).

**Table A.5. Calibration of monetary policy parameters**

| $\Psi_1$ | $\Psi_2$ | $\pi^*$ | $i_{min}$ |
|---|---|---|---|
| 0.5 | 0.5 | 2% | 0.05% |

*Source:* iAGS Model, OFCE.

## Prices

Values for $\eta_1$ and $\eta_2$ are standard in empirical literature on New Keynesian Hybrid Phillips curve estimates (Rudd and Whelan, 2006; Paloviita, 2008).

**Table A.6. Calibration of Phillips curve and expected inflation parameters**

| $\eta_1$ | $\eta_2$ | $\eta_3$ | $\kappa$ |
|---|---|---|---|
| 0.5 | 0.1 | 0.1 | -0.8 |

*Source:* iAGS Model, OFCE.

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