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FISCAL CONSOLIDATION, PUBLIC DEBT AND OUTPUT DYNAMICS IN THE EURO AREA:
LESSONS FROM A SIMPLE MODEL WITH TIME-VARYING FISCAL MULTIPLIERS

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Lessons from a simple model with time-varying fiscal multipliers[1]

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Abstract

EMU countries have engaged in a consolidation of fiscal policies since 2011. This paper deals with the public debt and output dynamic consequences of this strategy. To this end, we develop a simple macroeconomic model of the Euro area, where fiscal multiplier is time-varying. Recent empirical evidence has indeed shown that fiscal multipliers were higher in time of crisis. We then analyze the ability of EMU countries to comply with the new fiscal rules on public debt. The path of public debt and output gap is simulated according to different hypothesis related to fiscal multiplier, monetary policy and hysteresis effects. Not all EMU countries would be able to reach a 60% debt-to-GDP ratio in 2032. An alternative strategy may be to spread austerity in order to report part of consolidation to periods where the fiscal multiplier will be weaker. The gain of spreading austerity may yet be partly offset by higher risk premium. There is then a need to find institutional arrangements to avoid panics in the sovereign debt markets. Finally, it is shown that it would not be very efficient to implement an expansionary fiscal policy in Germany in order to balance austerity in the Euro area. Since output gap is nearly closed in Germany, the multiplier effect of a positive fiscal stance would be low and spillover effects would not be significant.

Keywords: Fiscal consolidation, Fiscal multiplier, Public debt, Macroeconomic Performance

JEL Codes: E61, E62, E47

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Introduction

Public debt has rapidly become a major concern over the last few years. Most governments in industrialized had undertaken expansionary fiscal policies in 2009 to dampen the macroeconomic consequences of the financial turmoil. But this Keynesian revival, which was even supported by the IMF (see Spilimbergo, Symansky, Blanchard and Cotarelli, 2008), has been short-lived, especially in EMU. The need to reduce deficit in order to comply with the 3% rule for public deficit was indeed enshrined in the Stability and Growth Pact. Besides, the outbreak of the Greek crisis had renewed fears about a possible sovereign default. Even if the Eurozone crisis cannot boil down to a debt crisis (Shambaugh, 2012), it has rapidly been considered that European countries should rapidly engage in fiscal consolidation, economic activity was far from its pre-crisis level. Governments in the periphery of the Euro area (Italy, Spain, Ireland, Portugal and Greece) have been under rising financial market pressures and were urged to restore their credibility by implementing frontloaded fiscal consolidation. Besides, fiscal rules have been reinforced in the TSCG (Treaty on stability, coordination and governance, agreed by 25 out of 27 member states) to converge to a 60% debt-to-GDP ratio, achieving 1/20th of the adjustment yearly. As the Treaty was signed in 2012, it gives until 2032 to achieve the target.

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 amplifying the negative impact on growth (IMF, 2010) and leading the Euro area to a double dip recession. Moreover, consolidation was implemented at a moment the output gap had not yet been closed. National governments were then facing a dilemma: they sought to guarantee long-term sustainability of public debt and wished to avoid stifling the nascent recovery. This tradeoff between debt reduction and activity depends critically on the value of fiscal multiplier. The former mainstream consensus – before the Great Recession – considered that fiscal multipliers were weak and that fiscal policy had very short-lived effects[2]. Recent mainstream literature has emphasized that fiscal multipliers may notably be higher in time of crisis[3]. Then, not only fiscal consolidation would drag down growth more severely but it could even be self-defeating (Holland and Portes, 2012). The question is then, how large are the costs of consolidation, what will be the debt dynamics and is there an alternative strategy to reduce public debt? The aim of the paper is precisely to deal with these issues. It considers explicitly that the euro area is facing a tradeoff between unemployment and public debt, both of which are interlinked.

[2] The SVAR literature that followed the seminal paper by Blanchard and Perotti (2002) started to crack the mainstream consensus. In the Post-Keynesian literature, Arestis and Sawyer (2003) revived at the same moment the discussion on the usefulness of fiscal policy.

[3] Blot, Cochard, Creel, Ducoudré, Schweisguth and Timbeau (2014a) survey the new literature on fiscal multipliers.

To judge the interactions between debt and unemployment reduction, 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. 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 may be a first 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 the optimal fiscal stance, defined as an enhanced fiscal consolidation under some strong constraints.

The rest of the paper is organized as follows. The full model is presented in the first section. Macroeconomic dynamics is assessed in the second section according to different sets of hypothesis, regarding notably the size of fiscal multipliers, monetary policy, initial conditions or hysteresis. The third section seeks alternative strategy to reduce public debt or to enhance growth in the euro area. The opportunity to spread austerity and to implement a fiscal expansion in Germany is finally discussed.

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

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 strategies[4]. 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[5], underestimating the

[4] 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 crucial to assess the fiscal multiplier.

[5] See Chatelain and Ralf (2012).

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[6]. 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.

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. This equation also takes into account possible long run effects of macroeconomic policies such as long term fiscal policy, threshold effects or hysteresis on potential output. The parameterization allows simulating standard hypothesis as well as alternatives. Simulations may then help to deal with several scenarios regarding for example the effectiveness of monetary policy, the variability of fiscal multipliers, the sensitivity of interest rates to public debt…A large set of hypotheses may then be covered. In the central scenario, the size of fiscal multipliers changes with the state of the business cycle.
- 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 and expected inflation to economic activity, imported inflation and other exogenous shocks. Expectations are supposed to be backward-looking.
- 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. We then compute public debt projections for euro area countries. This module will help to assess fiscal sustainability issues, as it incorporates issues related to the impact of the market interest rate (government-bond yield).

[6] A recent exception is the paper by in't Veld (2013).

1.1. Aggregate demand and supply

Economic activity is described by the gap between the actual level of GDP and a baseline trajectory determined by a constant potential growth. However, this baseline is distinguished from the potential GDP, which can differ from the baseline due to possible hysteresis effects of recession or fiscal policy on potential GDP (see Figure 1 below). As a result, we model three gaps:

- $\tilde{y}_c$ is the gap between the log of real GDP Y of country *c*, and its baseline trajectory $\bar{Y}$ which is exogenous.
- y_c^* is the gap between log of potential GDP Y^* of country *c* and the baseline $\bar{Y}$.

Dropping country subscripts, the resulting output gap follows:

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

y is driven by aggregate demand in the short run:

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

where EFI is the cumulated sum of past and current *ex ante* effective fiscal impulses, summing up the fiscal policy effects on aggregate demand. The impact depends on the endogenous fiscal multiplier μ_t which is 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 $\delta_l.(R^{pri} - \bar{R}^{pri})$ describes 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. Combining equations (1) and (2) gives:

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

The dynamics of equation (3) is simply represented by the following error correction equation[7]:

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

where ε^d_t is an exogenous shock on aggregate demand.

Ad-hoc restriction is implemented in the dynamics of equation (4). 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 bounded during recoveries. The error

[7] t stands for time subscript and $\Delta(\tilde{y}_t) = \tilde{y}_t - \tilde{y}_{t-1}$.

correction effect is therefore limited and the final dynamics of the output gap results from this bounded effect plus the impact of monetary policy, fiscal policy and external trade:

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

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

Besides, the gap between potential GDP and the baseline depends on a hysteresis effect, a long run impact of fiscal policy and a negative public debt effect:

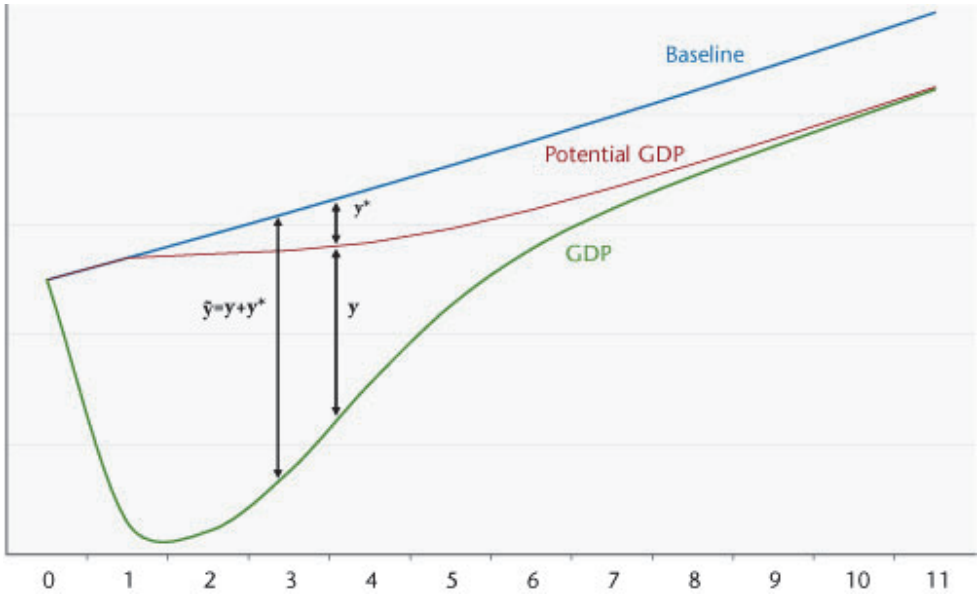
$$(5) \qquad y^*_t = y^*_{t-1} + H.y_t + \psi_\propto \Delta(\Sigma FI_t) + \zeta.(B_t - B^*) + \varepsilon^s_t$$

H is an hysteresis parameter, $\psi_\propto$ assesses the long run impact of fiscal policy on potential GDP (we discuss this point in the Fiscal policy section hereafter), ζ stands for a Barro-Laffer effect where debt exceeding a given threshold may have some negative impact on growth, B^* is a public debt target and ε^s_t an exogenous shock on aggregate supply. Though their results have been highly debated and questioned, Reinhart and Rogoff (2010) illustrated empirically this effect and identified the threshold around 90% of GDP. Yet, it must be recognized that causality is not clear as low growth may lead to higher public debt. A recent paper by Minea and Villieu (2011) provides theoretical foundations based on endogenous growth models.

The Barro-Laffer effect mixes the requirement to increase private savings to match lower public savings – the Barro-Ricardo effect – with the requirement to levy higher taxes in the future to repay debt and interests. The latter is associated with disincentives to produce according to the Laffer effect. Lower private savings and higher disincentives to produce would drag potential output[8].

[8] There may also be some non-linearities as regards the relationship between public debt and real economic growth. Some argue (Reinhart and Rogoff, 2010, Ceccheti *et al.*, 2011) that above a certain threshold of public debt, the latter reduces economic growth, though Panizza and Presbitero (2014) tend to reverse the causality. Panizza and Presbitero (2014) also highlight that high debt country may fear a loss of confidence from their creditors (the market) and may decide upon a fiscal contraction that drags economic growth, hence a negative causality between high debt and economic growth.

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



Source: iAGS model, OFCE.

Level and Growth rates of GDP

The growth rate of the baseline for real GDP is set exogenously:

(6) $\Delta\bar{Y}_t = \bar{Y}_t - \bar{Y}_{t-1}$

The growth rate of potential GDP is equal to the baseline if there is no long run impact of fiscal policy, no hysteresis and no Barro-Laffer effect:

(7) $\Delta Y_t^* = \Delta y_t^* + \Delta\bar{Y}_t + \varepsilon_t^S$

The growth rate of real GDP is given by that of potential GDP and the output gap, the growth rate of nominal GDP takes into account the inflation rate, and the level of nominal GDP follows:

(8) $\Delta Y_t = \Delta Y_t^* + y_t$

(9) $\Delta Q_t = \Delta Y_t + \pi_t$

(10) $Q_t = Q_{t-1}(1 + \Delta Q_t)$

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:

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

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

(13) $CS_t = \Phi.y_t$

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

(15) $\overline{\imath_t^B} = 1/MAT\,.R_t^{pub} + (1-1/MAT).\overline{\imath_{t-1}^B}$

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

The structural primary balance evolves according to the fiscal impulse and changes in taxes due to variations in the gap between potential production and the baseline (eq. (12)). 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 Φ, the overall sensitivity of revenues and expenditures to the business cycle (eq. (13)). 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. (14)).

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. (15)).

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. (16)).

Fiscal policy

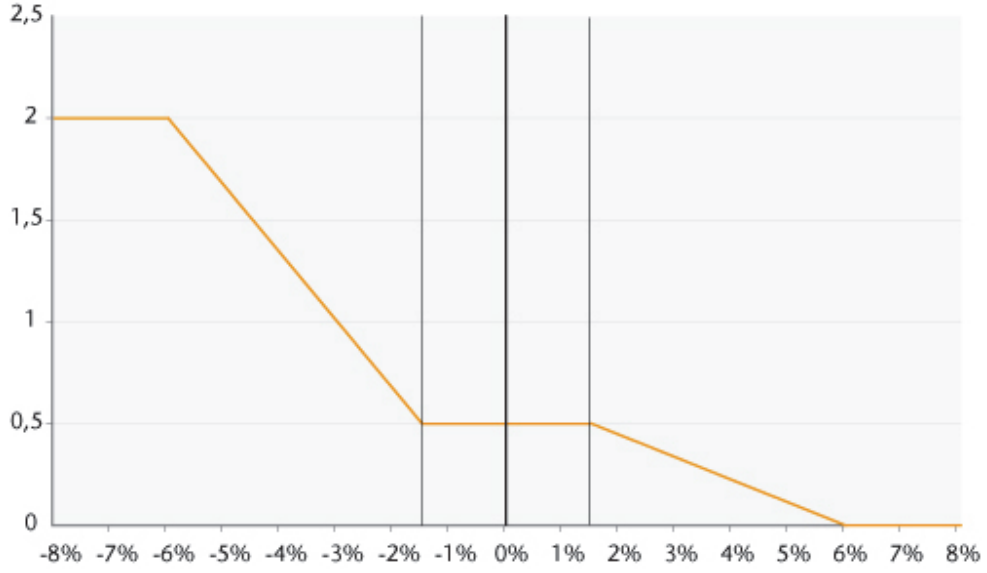
The impact of fiscal policy depends on the state of the economy. This modelling strategy has been growing recently in the literature (Parker, 2011), after empirical papers show that the fiscal multiplier differs according to the position of the economy in the cycle. For example, using regime-switching 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 than in expansions. 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[9]. Here, the fiscal multiplier μ_t is represented as follows:

$$
\begin{aligned}
&\textit{If } y_{t-1} < y_{min} \textit{ then } \mu_t = \mu_{max} \\
&\textit{if } y_{t-1} > y_{max} \textit{ then } \mu_t = \mu_{min} \\
&\textit{if } y_{inf} \leq y_{t-1} \leq y_{sup} \textit{ then } \mu_t = \mu_0 \\
&\textit{if } y_{min} \leq y_{t-1} \leq y_{inf} \textit{ then } \mu_t = \mu_{max} + (\mu_0 - \mu_{max})/(y_{inf} - y_{min}) * (y_{t-1} - y_{min}) \\
&\textit{if } y_{sup} \leq y_{t-1} \leq y_{max} \textit{ then } \mu_t = \mu_0 + (\mu_{min} - \mu_0)/(y_{max} - y_{sup}) * (y_{t-1} - y_{sup})
\end{aligned}
$$

The value of the multiplier is maximal in very bad times, whereas it is minimal in very good times (see Figure 1).

Figure 2. Example of the value of the multiplier according to the output gap



Note: $\mu_{max} = 2$, $\mu_0 = 0.5$, $\mu_{min} = 0$, $y_{min} = -6\%$, $y_{inf} = -1.5\%$, $y_{sup} = 1.5\%$, and $y_{max} = 6\%$. Values are taken as illustrative and may vary 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, that is the *ex ante* cumulative real effect of current and past fiscal

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

impulses at time t[10]. Thus, with $\psi_k.\mu_{t-k}.$ the fiscal multiplier at time t of a fiscal impulse that occurred k years ago, one has:

$$(17) \qquad \Delta EFI_t = \psi_0.\mu_t.FI_t + \psi_1.\mu_{t-1}.FI_{t-1} + \psi_2.\mu_{t-2}.FI_{t-2} + \psi_3.\mu_{t-3}.FI_{t-3} + \psi_4.\mu_{t-4}.FI_{t-4} + \psi_5.\mu_{t-5}.FI_{t-5} + \psi_6.\mu_{t-6}.FI_{t-6} + \psi_7.\mu_{t-7}.FI_{t-7}$$

$$(18) \qquad \Sigma FI_t = \Sigma FI_{t-1} + \mu_t.FI_t$$

Equation (17) ensures that the impact of a fiscal impulse depends on the fiscal multiplier that prevailed at the date the fiscal impulse occurred. We retain seven lags to account for the possibility of long lasting effects of fiscal impulses. We might also consider the case where fiscal policy has long run effect. This is the case when $\psi_\infty = \sum_{k=0}^{7} \psi_k \neq 0$, EFI is then not null in the long run[11]. The long run impact of a sequence of fiscal impulses is then computed using the accumulation of fiscal impulses times the multiplier (eq ((18)), and the long run impact on potential GDP is $\mu_\infty.\Sigma FI_t$.

1.3. Monetary policy, financial markets and prices

Monetary policy is described through a Taylor rule (Taylor, 1993) where the short term interest rate varies according to the gap between euro area inflation π_t^{EA} and the ECB target π^* on the one hand, and with the euro area output gap y_t^{EA} on the other hand (eq. (19)). r^* is the ECB long run target, hence the real equilibrium interest rate. We also account for a zero lower bound (0.5 %). The rate set by the ECB is the maximum of these two rates (eq. (20)).

According to the expectations theory, the long term interest rate for German public bonds is set equal to the expected sum of future short term interest rates (eq. (21); see Shiller, 1979).

The long term public rate for Germany is considered risk-free, and long term public rates of other countries include a risk premium $\varepsilon_t^{I_{pub}}$ that is set exogenously (eq. (22)). We also temporarily set exogenously the long rate for countries that entered the EFSF to account for a lower interest rate on debt refinancing. Finally, for each country the long term interest rate on private bonds is equal to the public one plus a risk premium that is set exogenously (eq. (23)). The long term real interest rate on private bonds is then equal to the private nominal long term rate minus long run expected inflation (eq. (24)).

$$(19) \qquad i_t^{Taylor} = r^* + \pi_t^{EA} + \Psi_1.(\pi_t^{EA} - \pi^*) + \Psi_2.y_t^{EA}$$

[10] 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.

[11] In that case we introduce a correction term in equation (4) to avoid counting twice the long run impact of fiscal policy on $\tilde{y}_t$ *via* y_t^* and EFI_t.

(20) $i_t^{ECB} = max\left(i_{min}; i_t^{Taylor}\right)$

(21) $I_t^{EA} = \tau . I_{t+1}^{EA} + (1 - \tau) . i_t^{ECB}$

(22) $I_t^{pub} = I_t^{EA} + \varepsilon_t^{I_{pub}}$

(23) $I_t^{pri} = I_t^{pub} + \varepsilon_t^{I_{pri}}$

(24) $R_t^{pri} = I_t^{pri} - \pi_t^{e,lr}$

Prices

GDP prices are set according to a new Keynesian hybrid Phillips curve approach (NKHPC hereafter). Inflation depends on past inflation, expected inflation one period ahead, output gap, and the variation of overseas inflation weighted by the share of imports coming from country *c* (eq. (25)).

Different possible formations of inflation expectations can be introduced. Expectations can be rational as in a standard NKHPC equation ($\pi_{t+1}^e = \pi_{t+1}$), or they can be adaptive (eq. (26)). In this latter case, we assume that inflation is expected to converge to the ECB target at a speed depending on the value of parameter κ.

For financial markets, long run expected inflation is modelled as the discounted sum of future inflation rates (eq. (27)), in the same way as nominal long term rates, in order to keep expectations consistent on both sides. This assumption could also be relaxed insofar as expectations may not be fully rational on financial markets.

(25) $\pi_t = \eta_1 . \pi_{t-1} + (1 - \eta_1) . \pi_{t+1}^e + \eta_2 . y_t + \eta_3 . \sum_j w_{m,j,c} (\Delta \pi_t^c) + \varepsilon_t^{\pi}$

(26) $\pi_{t+1}^e = \pi_{t-1} + \kappa . (\pi_{t-1} - \pi^*) + \varepsilon_t^{\pi^e}$ *with* $0 \geq \kappa \geq -1$

(27) $\pi_t^{e,lr} = \tau . \pi_{t+1}^{e,lr} + (1 - \tau) . \pi_t$

1.4. External trade

We model external trade using trade matrix between euro area countries. Imports of each country grow up relative to the baseline imports when output rises. The strength of the increase depends on sensitivity of imports to the output gap (eq. (28)).

Imports of one country divide into exports of the other countries. Each country faces an addressed demand composed of imports of trade partners. The addressed demand to country *c* is the sum of imports of other *j* countries times the share of imports of country *j* coming from country *c* (eq. (29)).

(28) $m_t = \Omega . y_t$

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

Finally, we build euro area aggregates for the main variables of the model. Euro area's GDP is the sum of countries' nominal GDP (eq. (30)). Country's weight is then derived from equation (30), in order to compute other aggregates such as euro area inflation, public debt, fiscal balance, fiscal impulse and output gap (eq. (31)-(33)).

$$(30) \qquad Q_t^{EA} = \sum_c Q_t^c$$

$$(31) \qquad w_{t,c}^{Q} = Q_t^c / Q_t^{EA}$$

$$(32) \qquad \pi_t^{EA} = \sum_c w_{t,c}^{Q} . \pi_t^c$$

$$(33) \qquad y_t^{EA} = \sum_c w_{t,c}^{Q} . y_t^c$$

Calibration of the model is described in the appendix.

2. Public Debt dynamic under alternative hypotheses

The aim of this part is to provide simulations on the paths of public debt and output gap of Euro area member states according to alternative hypotheses on the size of multiplier, the effect of monetary policy, hysteresis effects or by taking into account possible negative impact of public debt on potential growth. We first describe the central scenario where we consider a time-varying fiscal multiplier and hysteresis effects. Sensitivity of public debt and output gap is then assessed according to 10 different alternative hypotheses.

2.1. Debt dynamics under the current fiscal adjustment path when fiscal multiplier is time varying

Starting from this simple model, we analyze the dynamics of public debt as well as output losses resulting from the given path of fiscal path of consolidation, starting in 2013. The results of this baseline scenario are illustrated in Table 1 (see box 1 for a description of initial conditions and main hypotheses regarding sovereign spreads and fiscal impulses). In the baseline scenario, we simulate the path of public debt levels until 2032, which is the horizon of the 1/20th 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 2013 to 2015. We assume zero fiscal impulses beyond 2015. 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.

Columns 1-4 report public debt and structural balance respectively in 2020 and 2032 (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 2013-2015, reported in column 5, sums up the short term fiscal stance in the euro area. Growth performances (output gap and GDP growth rates) are reported in columns 6 to 8. For GDP growth, we reported the average growth rate over the austerity period (2013-2015). Beyond 2020, GDP growth is equal to the long-term growth rate.

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

	Public debt (% of GDP)		Structural balance (% of GDP)		Cumulated fiscal impulse	Output gap		GDP growth rate (%)
	2020	2032	2020	2032	2013-2015*	Maximum	2013-2020	2013-2015
Germany	59	26	0.9	1.8	-0.3	-0.7	-0.2	1.5
France	82	52	-0.5	0.2	-2.9	-6.8	-3.5	1.3
Italy	91	17	2.9	5.5	-2.1	-6.5	-2.4	1.3
Spain	97	83	-2.5	-2.2	-4.3	-9.7	-5.2	0.6
Netherlands	64	49	-1.0	-0.8	-2.9	-2.8	-1.6	1.6
Belgium	80	37	0.6	1.8	-2.2	-4.3	-2.3	1.9
Portugal	118	82	-1.1	0.1	-4.7	-10.1	-4.1	0.2
Ireland	133	105	-3.0	-2.3	-5.7	-10.9	-6.5	-0.3
Greece	178	93	0.7	3.0	-7.5	-17.1	-11.0	-1.5
Austria	62	40	-0.2	0.3	-1.9	-0.9	-0.3	1.7
Finland	36	7	1.1	1.9	-1.3	-1.9	-0.5	2.5
Euro area	78	43	0.3	1.2	-2.2	-4.8	-2.4	1.0

* Fiscal impulses are null beyond 2015.
Source: iAGS model.

Table 1 reports how tough austerity will be all over the euro area: between 2013 and 2015, all MS except Germany, Austria and Finland will implement fiscal consolidation measures above 2% of GDP. Spain, Portugal, Ireland and Greece will make the strongest efforts. This highly contractionary fiscal stance will make it ever harder to achieve an output gap at or above zero in our simulation: all MS will not close the output gap before 2019. The aggregate euro area GDP will plummet to a maximum negative output gap of almost -5%, with Portugal, Ireland and Greece reaching trough above 10 %. For those countries, the cumulated fiscal impulse is strongly negative despite negative output gaps. The size of fiscal multipliers should then be high leading to gloomy perspectives for the entire euro area. Germany and Austria will be exceptions, since they will face almost no further real cost with their forecast fiscal strategy thanks to milder consolidation plans and low fiscal multiplier. The average GDP growth rate of the auro area over 2013-2015

would reach 1 %, below the average potential growth. Real divergence across euro area member states under this scenario would thus widen as Greece would remain in recession whereas German GDP would grow at an average rate of 1.5% between 2013 and 2015.

In 2020, despite substantial fiscal efforts, Spain, the Netherlands, Portugal and Ireland would not be able to bring their cyclically-adjusted deficit under 0.5% of GDP. Furthermore, 4 countries – Spain, Portugal, Greece and Ireland – would not comply with the new fiscal rule on public debt as it would still stand above the 60 % threshold despite strong efforts to bring back debt to this ratio. In the case of Greece, the threshold would not be reached, despite an extraordinary structural surplus of 3% of GDP and an outstanding negative fiscal impulse of 7.5% of GDP between 2013 and 2015. Fiscal efforts by this country will not be sufficient to achieve the debt target, due to a deflation between 2014 and 2018 which increases real interest rates. Due to wide open output gap, the cyclical deficit will remain very high. Public debt would then reach a peak in 2017. It must also be stressed that although the 60 % debt-to-GDP ratio is not reached in 2032, public debt would be halved from 2019 to 2032.

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[12].

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 2032. 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 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, 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. For other countries, debt will fall below 60 %. It is unsurprisingly the case for Germany, Netherlands and Finland, but it would also be true for France (52%), Italy (17%) or Belgium (37%)…The opportunity to pursue austerity in those countries is then raised 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

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

primary surplus would reach 2.6% by 2032 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 the 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

Simulations begin in 2013. To do so, we need to set some starting point values in 2012 for a set of determinant variables. Output gaps for 2012 come from ECLM-IMK-OFCE forecasts. Potential growth for the baseline potential GDP is based on OECD (2012) projections (see Table 2). Concerning fiscal policy and budget variables, the main hypotheses are as follows:

Table 2. Main hypotheses for 2012

in %

	Public debt	Fiscal balance	Structural primary balance	Interest expenditures	output gap	potential growth
Source	European Commission	ECLM-IMK-OFCE	ECLM-IMK-OFCE	European Commission	ECLM-IMK-OFCE	OECD
Germany	81.7	-0.2	2.7	2.4	-1.0	1.3
France	90.0	-4.4	1.2	2.6	-6.2	2.0
Italy	126.5	-2.5	5.8	5.5	-5.5	1.3
Spain	86.1	-7.4	-0.7	3.0	-8.5	2.0
Netherlands	68.8	-4.4	-0.9	2.0	-2.8	2.0
Belgium	99.9	-3.5	2.6	3.5	-4.8	2.0
Portugal	119.1	-5.5	1.7	4.5	-6.1	1.5
Ireland	117.6	-8.0	-1.0	4.0	-7.4	2.2
Greece	176.7	-6.7	4.8	5.4	-14.1	1.9
Finland	53.1	-0.9	1.3	1.1	-2.1	2.2
Austria	74.6	-3.0	0.1	2.6	-1.1	1.6

Sources: European Commission, ECLM-IMK-OFCE forecasts.

— The public debt in 2012 comes from the European Commission's autumn 2012 forecast[13];
— We use the ECLM-IMK-OFCE forecasts for fiscal balance in 2012;
— We use the European Commission's autumn 2012 forecast of interest expenditures for 2012; combined with ECLM-IMK-OFCE forecasts of output gaps in 2012, and model estimates of the cyclical part of the fiscal balance, it gives the structural primary balance for 2012;

[13] At the time simulations programmes were written and run, the final figure for debt was not known. There may then be differences with definitive public debt for 2012. Though it changes the starting point, errors are small and do not modify the dynamics and the conclusions of the paper.

— Fiscal impulses come from ECLM-IMK-OFCE forecasts for 2013 (see Table 3). For 2014-2015, we use fiscal impulses implied by the Stability and Growth Pact reported in the "Assessment of the 2012 national reform programme and stability programme" for each country.
— Sovereign spreads come from ECLM-IMK-OFCE forecasts for 2013-2015 (see Table 4). We made the hypothesis 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 direct access to financial markets as of 2014, Portugal as of 2015 and Greece as of 2016. We discuss a scenario with higher risk premium hereafter.

Table 3. Fiscal impulse

in % of GDP

	2013	2014	2015
Germany	0.0	-0.3	0.0
France	-1.8	-0.6	-0.5
Italy	-2.1	0.0	0.0
Spain	-2.5	-1.2	-0.6
Netherlands	-1.2	-1.2	-0.5
Belgium	-0.8	-0.6	-0.8
Portugal	-2.9	-0.6	-0.2
Ireland	-1.8	-2.1	-1.8
Greece	-3.9	-2.7	-0.9
Finland	-1.3	0.0	0.0
Austria	-0.9	-0.3	-0.6

Sources: ECLM-IMK-OFCE forecasts.

Table 4. Sovereign spreads relative to German interest rate on public debt

in %

	2013	2014	2015
Germany	0.0	0.0	0.0
France	0.1	0.0	0.0
Italy	1.3	0.8	0.0
Spain	1.5	0.8	0.0
Netherlands	0.1	0.0	0.0
Belgium	0.5	0.1	0.0
Portugal	1.4	1.2	1.0
Ireland	1.4	1.5	0.0
Greece	1.4	1.2	0.9
Finland	0.0	0.0	0.0
Austria	0.0	0.0	0.0

Sources: ECLM-IMK-OFCE forecasts.

2.2. Sensitivity of debt and output gap

The dynamics of public debt and output gap at such a distant maturity critically depends on the parameters of the model. However, there are clearly many uncertainties on several hypotheses. The impact of fiscal policy notably hinges on the size of multiplier, the efficiency of monetary policy, hysteresis effect or the initial conditions regarding notably the output gap. The sensitivity of debt dynamics and output gap is analyzed according to 10 alternative scenarios:

Scenario 1: the baseline scenario considers the situation where fiscal variables are time-varying and change according to the output gap. In the simulations presented above (table 1), the value of the multiplier ranges from 0 to 2. It has a value of 0.5 when the output gap is between -1.5% and 1.5%. In the first alternative scenario, we consider a fixed value (0.5) of the fiscal multiplier. We then expect the cost of consolidation to be weaker for most Euro area countries. Cyclical deficits should then be lower and debt would decrease more rapidly.

Scenario 2: Scenario 2 is equivalent to the 1st scenario but we suppose a higher multiplier, equal to the maximum value of fiscal multiplier (2).

Scenario 3: in the third alternative scenario, we consider a model with no hysteresis effect. It means that the decrease in short-run aggregate demand, resulting from austerity, does not decrease the level of potential output. In figure 1, it would correspond to a case where the red line is not different from the blue line. The output gap would then be wider since potential output is higher. GDP growth rate may then be higher during the adjustment period. Concerning public debt, two opposite effects may be observed. On the one hand, the cyclical component of the deficit would increase. But, on the other hand, structural balance would improve more rapidly. Equation (12) shows indeed that structural balance deteriorates when potential output is reduced.

Scenario 4: in scenario 4, we consider higher hysteresis than in the baseline. It would then reduce output gap and have theoretically ambiguous effect on public debt.

Scenario 5: we consider then a situation in which monetary policy is less effective. The monetary policy transmission may be impaired by several factors and notably by financial crises. In practice, it may result in tighter credit conditions or in higher retail banking or long term interest rates. The simple model developed here does not account for such transmission channels. We then opted for an *ad-hoc* and generalized reduction of parameters δ_l in equation (4).

Scenario 6: we change the parameter of the Taylor rule in equation (12) and suppose that the ECB focuses only on the output gap with a reaction coefficient equal to 1. On could expect a more expansionary monetary policy in the Eurozone than in the baseline scenario. But it must be stressed that monetary policy was already constrained by the zero lower bound in 2013 and 2014. Yet, with a stronger focus on the output gap, the zero lower bound period may last longer and then, it may take more time for ECB rate to get back to its long-term value.

Scenario 7: scenario 7 is similar to scenario 6 but with the ECB focusing only on the inflation target. It would then adopt be a pure inflation targeting strategy. Differences may yet be small as inflation, in the baseline, remains below the 2% target until 2021. Monetary policy should then be more expansionary than in the baseline, but it may be less than in scenario 6.

Scenario 8: in this scenario, we deal with the adjustment of expected inflation. We suppose that expected inflation converges less rapidly to the 2% target. In practice, parameter κ in equation (26) is smaller in absolute terms (-0.5 instead of -0.8). It would then imply a slowest adjustment of inflation and lower inflation. Monetary policy would be then more expansionary but the real interest rate may also be higher than in the baseline.

Scenario 9: we introduce a negative impact of debt on potential output. We consider that for public debt above 90% of GDP, potential output is reduced. The effect is supposed to be small and the parameter ζ in equation (5) is calibrated at -0.001. It means that for debt-to-GDP ratio at 100%, the percentage reduction in potential growth is -0.1. The effect is not permanent and once debt has decreased below 90%, the potential growth gets back to the baseline. Given the levels of public debt in the baseline, France, Italy, Spain, Belgium, Ireland, Portugal and Greece would be concerned by the negative effect. The stability properties of the model are very sensitive to the value of (ζ). For high value of this parameter and given the level of debt, notably in Greece, the model does not always converge to long-term equilibrium.

Scenario 10: we consider that initial output gaps are lower. There is a huge debate on the level of output gap and statistical methods do not allow estimating it precisely. The European Commission estimates of the output gap are for example significantly lower than in our baseline scenario. This also means that potential output has decreased with the financial crisis, a hypothesis that is currently questioned. This assumption is crucial as it has consequences on the structural deficit. At given public balance, a lower output gap implies that the cyclical deficit is lower and the structural deficit higher. It may have strong implications in terms of public dynamics and the needed adjustment to bring back public debt below 60% of GDP.

The results concerning public debt in 2032 for the 10 scenarios are reported in table 5. It must first be noted that scenarios 1 and 3 display the strongest difference with the baseline. The time-varying fiscal multiplier is a very important feature of the dynamics of public debt. Considering a low and constant value for the fiscal multiplier would imply a significant reduction in public debt in 2032. For the euro area as a whole, public debt would reach 25% instead of 43%. It must also be stressed that the gap would already be significant in 2020 (see table B.1 in appendix) since public debt would be 10 points lower. It is also important to stress that Spain, Ireland, Portugal and Greece would now satisfy the debt criterion, with an output cost significantly lower (table 6). The average output gap over 2013-2020 would stand at -2.5% in Spain instead of -5.2. In Ireland and Greece, the difference with the baseline in terms of output gap would exceed 4 points.

These results may certainly help to explain why national governments and the European Commission have supported the frontloaded strategy. They may have considered that fiscal multipliers were certainly low. It was thought consequently that austerity measures would only have a small negative impact. Empirical evidence and macroeconomic performances of European countries should yet have alarmed them that this hypothesis would be misleading. Under the alternative assumption of a high and constant fiscal multiplier, public debt would not change significantly in countries where the initial output gap is strongly negative (France, Italy, Spain, Ireland, Portugal and Greece). But when the output gap is smaller, the negative impact of fiscal consolidation is amplified. This is the case for the Netherlands, Belgium, Austria and Finland. For Germany, the difference is weak as austerity measures only amount to -0.3% over 2013-2015.

Table 5. Public debt in 2032 in different scenarios

	DEU	FRA	ITA	ESP	NLD	BEL	IRL	PRT	GRC	AUT	FIN	EA
Baseline	26	52	17	83	49	37	105	82	93	40	7	43
S.1	29	27	1	46	41	22	46	38	-46	43	8	25
S.2	30	52	19	82	74	48	104	81	93	61	20	47
S.3	20	19	-12	49	33	15	75	47	126	34	0	22
S.4	29	70	34	105	56	46	126	102	100	43	12	55
S.5	29	54	17	81	52	39	101	77	56	43	10	44
S.6	25	51	15	81	48	36	103	80	91	39	6	41
S.7	25	51	16	82	48	36	103	81	92	39	7	42
S.8	24	55	18	89	49	38	118	89	139	38	5	44
S.9	27	55	23	88	50	40	110	89	97	41	8	46
S.10	32	59	28	102	51	44	104	74	99	46	15	51

Source: iAGS model.

Hysteresis effects also imply significant differences with the baseline. Public debt is indeed lower for all countries in Scenario 3 despite higher negative output gaps (table 6). The impact of higher potential output on the structural balance is therefore more important. It may not be surprising since the effect of structural balance is long-lasting, for a given and constant fiscal impulse, whereas the negative impact of higher cyclical deficits resulting from the output gap are only transitory. Table B.2 in the appendix shows the average primary structural fiscal balance. For the euro area, it would be 1.2 point higher if there were no hysteresis effect in the model. In Greece, the structural primary surplus would reach 12.1%, 5 points higher than in the baseline. This would imply a very fast reduction in public debt as illustrated in table 5 where the Greek public debt would become negative[14].

[14] All simulations are realized considering gross public debt figures. A negative public debt would then correspond to a situation where the net debt becomes positive.

In scenarios 5 to 7, the differences with the baseline do not appear to be very substantial. A more reactive central bank would help to reach a slightly higher output gap (see scenario 6 in table 6). Debt in 2032 would also be smaller. But, these differences may not be significant. Monetary policy is indeed already expansionary in the baseline and constrained by the zero lower bound. It would be needed to take into account the possibility of non-conventional measures to amplify the effects of monetary policy beyond the standard transmission of monetary policy, notably if purchases of sovereign bonds contribute to reducing long-term interest rates.

In scenario 8, we consider a situation where the adjustment of expected inflation takes longer. For most countries, this would not change dramatically the debt dynamics. The only changes would be observed in countries threatened by deflation, Ireland and Greece notably. For both countries, real interest rates are higher and public debts increase relatively to the baseline. Scenario 9, where we take into account a possible negative impact of public debt on potential growth has no significant effect on debt dynamics.

Finally, if potential output levels are seriously revised downward as illustrated in scenario 10, debt would be higher in 2032: 51% instead of 43% for the euro area. With a debt-to-GDP ratio of 59%, France would still comply with the debt objective but the objective would be harder to reach for Spain. Considering a weaker output gap would indeed imply that structural deficits are higher and in some countries, there may be a need to amplify consolidation.

Table 6. Average output gap (2013-2020) in different scenarios

	DEU	FRA	ITA	ESP	NLD	BEL	IRL	PRT	GRC	AUT	FIN	EA
Baseline	-0,2	-3,5	-2,4	-5,2	-1,6	-2,3	-6,5	-4,1	-11,0	-0,3	-0,5	-2,4
S.1	-0,3	-1,7	-1,4	-2,5	-1,0	-1,3	-2,1	-1,4	-3,0	-0,4	-0,5	-1,2
S.2	-0,5	-3,5	-2,5	-5,2	-3,1	-3,0	-6,5	-4,1	-11,0	-1,7	-1,4	-2,7
S.3	-0,3	-4,8	-3,2	-9,1	-2,5	-3,7	-11,8	-6,4	-23,0	-0,3	-0,6	-3,7
S.4	-0,2	-2,6	-1,9	-3,9	-1,1	-1,6	-4,8	-3,1	-7,1	-0,3	-0,4	-1,8
S.5	-0,4	-3,6	-2,4	-5,1	-1,8	-2,4	-6,3	-3,8	-9,1	-0,5	-0,7	-2,5
S.6	-0,2	-3,4	-2,3	-5,1	-1,5	-2,2	-6,4	-4,0	-10,9	-0,3	-0,5	-2,3
S.7	-0,2	-3,4	-2,3	-5,2	-1,6	-2,3	-6,4	-4,0	-11,0	-0,3	-0,5	-2,4
S.8	-0,2	-3,5	-2,4	-5,4	-1,6	-2,3	-6,7	-4,2	-11,9	-0,2	-0,5	-2,4
S.9	-0,3	-3,3	-2,2	-5,0	-1,6	-2,1	-6,2	-3,8	-10,4	-0,3	-0,5	-2,3
S.10	-0,2	-1,8	-1,2	-3,7	-0,7	-1,0	-4,1	-1,7	-7,4	-0,3	-0,3	-1,4

Source: iAGS model.

2.3. Is it possible to reach 60% for all EMU countries in 2032?

In the baseline scenario described by table 1, not all countries reach the 60% target for debt-to-GDP; they require additional fiscal consolidation to comply with fiscal rules. Therefore, we compute simulations that aim at gauging if all countries can attain the public debt target in 2032. We calculate a sequence of fiscal impulses over 2015-2032 that achieve the target, assuming that fiscal impulses for the years 2013 to 2015 are left unchanged. For simplicity, we set fiscal impulses at -0.5 for years beyond 2015. Austerity is then ended when public debt reaches 60% or is below this threshold. For example, public debt stands at 83% of GDP in 2032 in Spain. We consider then an alternative scenario where we first add a -0.5 fiscal impulse in 2016 and simulate the debt dynamics. If public debt is still above 60% of GDP in 2032, we implement additional negative impulse in 2017, etc. We have also emphasized that other countries would reach a debt-to-GDP ratio below 60% in 2032. But yet, it is not clear whether this level of debt will correspond to an economic and social long-term equilibrium. For those countries, possibility is 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 2032. There is no theoretical reason behind that choice. It may yet serve as a comparison point for simulating alternative scenarios (see next section). Then, we implement +0.5 positive fiscal impulses beyond 2015 such as public debt is equal to or below 60%. For instance, if adding positive fiscal impulses in Germany from 2016 to 2020 leads to a 64% debt ratio, we consider shorter expansionary period (2016-2019 if public debt is then equal to 57%). The ability to comply with the debt objective is analyzed in the 2 opposite scenarios: one in which fiscal multiplier is time-varying and the other where fiscal multiplier is constant and equal to 0.5 (see table 7).

Reaching a debt-to-GDP ratio equal to 60% would not be feasible in Greece and Ireland despite continuous consolidation measures between 2016 and 2032. The cumulated fiscal impulses would amount to respectively -14.2% and -16% of GDP. Besides, GDP growth rates would be lowered by 1.2% on average between 2013 and 2020 in Greece, in comparison to the baseline scenario. The 60% target would be achieved in Spain and Portugal but under substantially more restrictive fiscal stances. Fiscal adjustment under such conditions may appear unrealistic and unreasonable: between 2013 and 2017, both countries would experience slower economic growth than in the baseline, hence postponing until 2025 (Portugal) and 2027 (Spain) the return to a zero output gap. The average growth would respectively be 0.6, 0.4 and 0.5 lower than in the baseline, for Spain, Ireland and Portugal. Yet, for the euro area as a whole, there would be no difference in terms of growth, as some countries (notably Germany) would implement more expansionary fiscal policy. The average growth in France and Germany would be 0.2 point higher.

When the fiscal multiplier is constant and equal to 0.5, all countries succeed in reaching the 60% target. It may be noticed that Greek public debt may stand at 22% despite fiscal stimulus beyond 2015. In the Greek case, the primary structural balance

would indeed improve with potential output. It indicates that in Greece, there has been clearly too much austerity. The main problem comes from the output gap and public debt would certainly decrease more rapidly once the output gap is closed. For all countries, the cumulated need for consolidation would be softened if fiscal multiplier is supposed to be constant and low. A great attention should have been paid to the estimates of the fiscal multiplier when macroeconomic policy is decided, as was already put forward by Creel, Heyer and Plane (2011). Yet, Blanchard and Leigh (2013) warned that previous forecast models of the IMF had probably underestimated the multiplier effect. Taking these early signals into account, should have led the European Commission and European national governments to mitigate austerity in the euro area.

Table 7. Is it possible to get to 60% in 2032?

	When fiscal multiplier is time-varying			When fiscal multiplier is low and constant		
	Public debt in 2032	Average GDP growth (2013-2020)*	Cumulated fiscal impulse	Public debt in 2032	Average GDP growth (2013-2020)*	Cumulated fiscal impulse
Germany	58	0,2	2,2	58	0,1	1,7
France	60	0,2	-1,9	59	0,4	-0,4
Italy	58	0,2	1,9	57	0,3	3,4
Spain	55	-0,6	-9,3	56	0,4	-3,8
Netherlands	55	0,0	-2,4	57	0,1	-1,9
Belgium	55	0,1	-0,7	56	0,3	0,3
Greece	85	-1,2	-14,2	22	1,1	1,0
Portugal	57	-0,5	-7,7	56	0,4	-2,7
Ireland	71	-0,4	-16,0	56	1,0	-5,2
Austria	55	0,0	-0,9	60	0,0	-0,9
Finland	58	0,1	3,2	61	0,1	3,2
Euro area	58	0,0	-1,2	57	0,3	0,3

*: in difference with central scenario summarized in table 1.
Source: iAGS model

3. Alternatives to austerity

In this section, we first address the issue of the opportunity to spread austerity to take advantage of the time-varying multiplier[15]. Then, we also consider a scenario where a more expansionary fiscal policy is implemented in Germany. It has indeed been claimed that countries where public debt sustainability is not threatened should expand their

[15] This scenario is also detailed and presented in Blot, Cochard, Creel, Ducoudré, Schweisguth and Timbeau (2014b). Yet, we present here additional simulations where we account for the possibility that sovereign spreads may increase, due to credibility effects, when fiscal adjustment is softened.

fiscal policy in order to balance the negative effect of austerity in countries where there is an urgent need to reduce public debt. Interdependencies among EMU members would then boost external demand in crisis countries (Spain, Ireland…) and mitigate the effect of austerity.

3.1. The case for spreading austerity

The scope of alternative scenarios is inevitably infinite and any scenario reducing the strength of fiscal consolidation would improve growth but it may also undermine the sustainability of public debt. The identification of an alternative strategy is then fundamentally based on a trade-off between growth and debt. The stronger the consolidation, the costlier it is in terms of output losses and the more debt is reduced unless the size of the fiscal multiplier exceeds 2. Conversely, a more cautious path of consolidation may delay the reduction of debt but it would improve growth. Taking into account the objective of the TSCG, we maintain the objective for public debt at 60% of GDP in 2032. Yet, we consider the possibility of spreading austerity over time from 2013. Current fiscal impulses are then replaced by maximum negative fiscal impulses of -0.5% of GDP. Fiscal impulse may also be positive when past consolidation would have led public debt below 60% of GDP. This is notably the case for Germany and Italy. We first run these simulations with constant sovereign debt spreads. Yet, fiscal consolidation has also been urged because governments had lost credibility. Sovereign spreads started to increase in 2008 and were then pushed up by the outbreak of the Greek crisis (Arghyrou and Tsoukals, 2011). In those circumstances, one should also take into account the fact that spreading austerity may reduce credibility of government, if doubts are raised by financial markets about the commitment to postpone part of the consolidation in the future. Hence, we introduce a risk premium in the long-term public interest rate equation (22) as long as public debt exceeds 60% of GDP. The risk premium is calibrated such that for a public debt equal to 100% of GDP, sovereign yields are increased by 1 point. It must be noted that the risk premium effect is calibrated for all countries and not only crises countries such as Spain, Italy, Portugal, Ireland or Greece. But as German public debt is lower than public debt in those countries, it will imply higher interest rates for crises countries than for Germany, increasing the spreads. It must be stressed that this effect will not hold as long as countries are in the European Stability Mechanism (ESM), which is supposed to be the case until 2015 for Greece, 2014 for Portugal and 2013 for Ireland.

The results for these two scenarios are reported in table 8. Average GDP growth over 2013-2020, cumulated fiscal impulse and long-term interest rate for the period 2013-2020 are computed in comparisons with the same variables in the scenario where austerity is not spread and where the objective is to bring back public debt to the 60% debt-to-GDP ratio by 2032. It must first be stressed that even without the risk premium effect, interest rate are higher in the scenario where austerity is spread. This may result from improved output gap. Monetary policy is then less expansionary. Actually, ECB is

not constrained by the zero lower bound from 2013 to 2015. The short term interest rate would increase from 0.8% in 2012 to 2.5% in 2016. Otherwise, average growth would on average increase by 0.1. But, from 2013 to 2017, the GDP growth rate for the euro area as a whole would be 0.6 point higher. During this period, there would be less austerity than in the baseline. The most favorable effect would be observed in Spain, Portugal, Greece and Ireland. The main reason is that when consolidation is spread, it implies that less consolidation is implemented when the fiscal multiplier is high. The corollary is that a larger share of the consolidation is implemented after the output gap has recovered. The negative impact on growth is then reduced. There is less consolidation when it hurts the most and more when it hurts the least. The most striking difference is identified for Greece where the average growth between 2013 and 2017 is 3.6 points higher than if the current expected consolidation path is implemented. Besides, this strategy would enable Greece to reduce debt in 2032 more significantly even though the cumulated fiscal stance would be increased by 12.5 points of GDP. For the euro area as whole, fiscal policy would be less restrictive or more expansionary by 0.4 point of GDP than in the scenario where austerity is not spread. The situation of France would be close to the euro area average. Fiscal policy would also be significantly less restrictive in Spain, Portugal and Ireland. On the contrary, it would be more restrictive in Germany and Finland.

Table 8. The advantage of spreading austerity*

	When fiscal multiplier is time-varying			When sovereign spreads increase with debt		
	Average GDP growth (2013-2020)	Cumulated fiscal impulse	Long-term interest rate (2013-2020)	Average GDP growth (2013-2020)	Cumulated fiscal impulse	Long-term interest rate (2013-2020)
Germany	-0,1	-0,7	0,3	-0,2	-1,2	0,3
France	0,0	0,4	0,3	-0,2	-1,1	0,5
Italy	0,1	0,1	0,3	-0,1	-1,9	0,7
Spain	0,6	2,3	0,3	0,4	-0,7	0,6
Netherlands	0,0	0,4	0,3	0,0	-0,6	0,3
Belgium	0,1	0,7	0,3	-0,1	-0,8	0,5
Greece	1,9	12,5	0,1	1,6	8,5	0,7
Portugal	0,6	3,7	0,1	0,4	-0,8	0,6
Ireland	1,1	4,2	0,2	0,9	4,2	0,8
Austria	0,0	-0,1	0,3	-0,1	-0,6	0,3
Finland	0,0	-1,7	0,3	0,0	-1,2	-0,4
Euro area	0,1	0,4	0,3	0,0	-1,0	0,5

*: in difference with central scenario summarized in table 7.
Source: iAGS model

With higher risk premium, results are partly modified. The average fiscal impulse would be more restrictive for the euro area as a whole. It is the case for all countries but Greece and Ireland. Despite, higher interest rates, Spain, Ireland, Portugal and Greece would still benefit from a scenario where austerity is spread. But, for the euro area as whole, growth performance between 2013 and 2020 would not be improved. This result may partly explain why European countries have chosen to engage in frontloaded consolidation despite the output costs. It has often been claimed that there was no alternative to austerity since spreading or postponing the needed fiscal effort would have triggered new speculative attacks and higher interest rates. In our scenario, the spread with the German interest rate would increase by 0.5 point in Ireland, 0.4 point for Italy and Greece, 0.3 point for Spain and Portugal. It may yet be argued that risk premium are non linear and partly driven by contagion and self-fulling prophecies (de Grauwe and Yi, 2013). It should be reminded that spreads were still rising in 2011 and 2012 for Italy and Spain despite several fiscal adjustment plans. Even if it is impossible to assess what would have been the development of spreads if countries had considered an alternative fiscal strategy, it remains that consolidation has not been a sufficient condition to ensure credibility. Institutions may also matter and spreads have actually receded after countries adopted the TSCG and mainly after Mario Drahi, President of the ECB, has pledged to do "whatever it takes" to protect the euro area from a collapse. Credible announcements of a central banker to intervene in the sovereign debt market may be more efficient than those made by government to cut back public deficit.

3.2. The case for a German expansion

Finally, we simulate the impact of a German expansion. It has indeed been often claimed that austerity in crises countries should be balanced by more expansionary fiscal policy in the Northern countries and notably in Germany where the government has more fiscal leeway. To this end, we consider an alternative scenario where fiscal impulse is increased by 1 point of GDP, compared to the current expected fiscal impulse, from 2013 to 2015. Fiscal policy stance is unchanged in all other Euro area members. This expansionary fiscal policy is reversed from 2017 to 2019, with a reduction of the fiscal impulse by 1 point. There is then no change in the cumulated German fiscal impulse. The aim here is twofold: first, assessing the spillover effects from core to periphery countries (here, we take the case of Spain). Second, this scenario is compared to a similar one where an equivalent fiscal stimulus is implemented in the periphery, namely Spain here. Thus, the question is raised about where it would be more efficient to "spend" a given amount of money (equivalent to 1 point of German GDP, which corresponds to a 2.6 point of Spanish GDP).

Results of table 9 unambiguously show that a German fiscal expansion would mainly stimulate German growth. The spillover effects for Spain would be negligible. Growth would be automatically increased in the euro area due to the large weight of Germany in total GDP. Weak spillover effects result from the low value of fiscal multiplier in Germany.

As the output gap is nearly closed in Germany, fiscal multiplier is roughly equal to 0.5. Domestic demand is boosted but less so than with a higher fiscal multiplier (close to or above unity). The spillover effects resulting from an increased external demand in Spain are then weak and may even be partly offset by the increase in the interest rate. German expansion would mechanically increase euro area growth and may lead the ECB to tighten monetary policy according to the Taylor rule.

Conversely, the same amount of money spent in Spain would boost Spanish growth directly and with a higher multiplier effect since the output gap is more deteriorated than in Germany. The global impact for growth in the euro area is also amplified: +0.7 point in 2014 against 0.2 if expansion is implemented in Germany. When the size of the fiscal multiplier is linked to the business cycle, money should be spent where it is mostly needed, that is in the periphery rather than in core of the Euro area. What is needed is thus a change in the geographical composition of the fiscal adjustment within the euro area. There are only small advantages with letting countries with higher fiscal leeway to adjust more slowly. On the contrary, it would be efficient to soften consolidation when countries are already concerned with mass unemployment and banking troubles. The issue of credible arrangements to ease consolidation in the periphery needs to be raised again.

Table 9. German or Spanish fiscal expansion?*

	German fiscal impulse			Spanish fiscal impulse		
	German GDP growth	Spanish GDP growth	Euro area GDP growth	German GDP growth	Spanish GDP growth	Euro area GDP growth
2013	0,5	0,0	0,2	0,0	4,9	0,5
2014	0,6	0,0	0,2	0,0	5,8	0,7
2015	0,5	0,0	0,2	0,0	2,8	0,4
2016	0,0	0,0	0,0	0,0	-0,7	-0,1
2017	-0,6	0,0	-0,2	0,0	-2,6	-0,3
2018	-0,8	0,0	-0,2	0,0	-3,0	-0,3
2019	-0,7	0,0	-0,2	0,0	-2,9	-0,3

*: in difference with scenario described in table 7
Source: iAGS model.

Conclusion

In this paper, we have presented a simplified macroeconomic model representing 11 EMU countries. The aim was to analyse public debt and output dynamics regarding fiscal rules and notably the 60% target for public debt. To this end, we develop a very tractable model able to integrate features emphasized by recent empirical literature on the fiscal multiplier. Besides, the model is supposed to be tractable to account for other several theoretical backgrounds. Based on this model, we present several simulations to assess the impact of the expected fiscal stance. We show that current fiscal adjustment is unambiguously costly confirming what has been observed in the euro area in 2011 and 2012. Yet, the costs of consolidation and the public debt dynamics critically hinge on the size of fiscal multipliers. Economic policy decisions made by national governments or recommendations formulated by the European Commission should be based on reliable estimates of the fiscal multiplier. We also show that it would have been better to spread consolidation. Output costs would have been lessened without challenging the ability to achieve the 60% debt-to-GDP ratio. Such a scenario may have given rise to doubts on the credibility of a partly postponed fiscal adjustment. Though increasing risk premia would have reduced the gain resulting from a spreading strategy, we consider that frontloaded fiscal consolidation was not the appropriate answer to enhance credibility. Active monetary policy and increased fiscal and political integration, permitting a substantial change in the geographical composition of the fiscal adjustment within the euro area, would be a better solution to avoid panic-driven austerity and its consecutive increase in interest rates.

APPENDIX

Calibration

A. Aggregate demand and supply

We calibrate equation (4) by distinguishing short run and long run effects of monetary policy and external trade on GDP. Long run effect of long term yields is higher than the short run one, to take into account delays in monetary policy effects on output.

We set β_l equal to the share of exports in country's GDP, and β_s equal to half β_l.

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

	δ_s	δ_l	β_s	β_l
Austria	-0.20	-0.50	0.29	0.58
Belgium	-0.20	-0.40	0.40	0.81
Finland	-0.20	-0.45	0.23	0.46
France	-0.20	-0.50	0.13	0.27
Germany	-0.30	-0.50	0.25	0.50
Greece	-0.40	-0.80	0.13	0.25
Ireland	-0.30	-0.70	0.50	1.00
Italy	-0.40	-0.75	0.14	0.28
Netherlands	-0.20	-0.45	0.40	0.79
Portugal	-0.40	-0.80	0.17	0.34
Spain	-0.30	-0.70	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 λ and α, that are the same across countries. We fix α to 0.1 and λ 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 can come from hysteresis effects, a Barro-Laffer effect of debt on potential GDP and a long run effect of fiscal policy.

Table A2. Calibration of hysteresis, Barro-Laffer and long run effect of fiscal policy

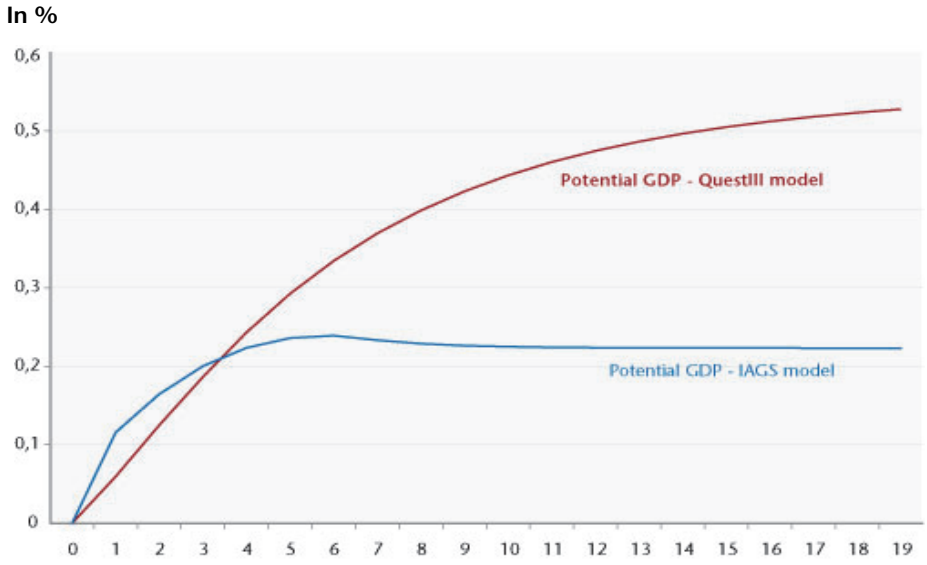
Hysteresis	Barro-Laffer	Barro-Laffer
H	ζ	μ_{α}
0.15	0	0

Source: iAGS Model, OFCE.

Barro-Laffer and fiscal policy effects on potential GDP are set to 0 for standard simulations. The impact of non-zero values will be discussed in future work. We calibrate the hysteresis effect to 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 Φ, 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

	Φ	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

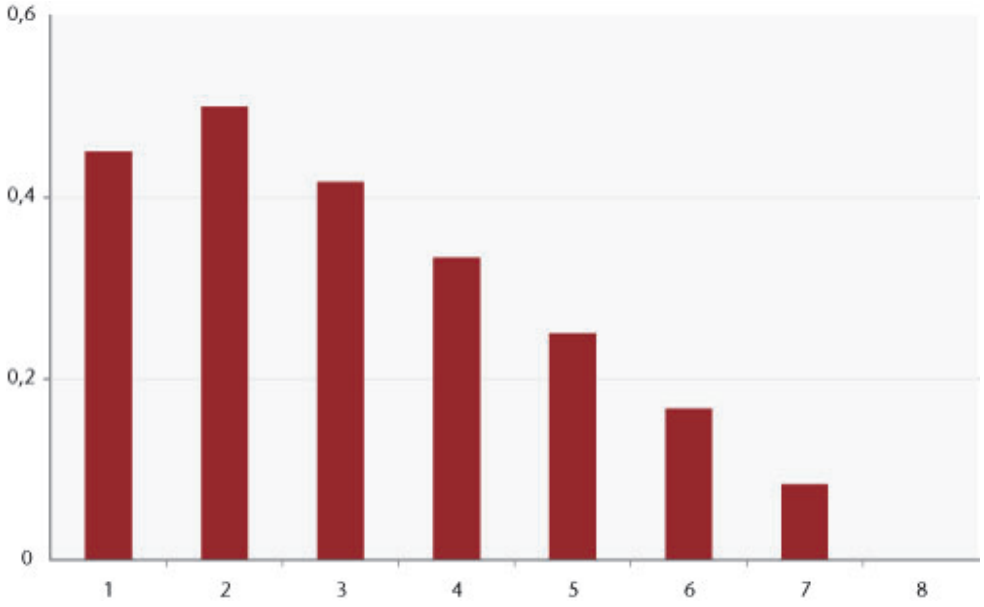
Sources: European Commission (2005), OFCE.

Fiscal policy

Calibration of fiscal policy parameters determines the duration impact of fiscal policy on GDP. We calibrate the effective fiscal impulse to return to 0 in seven years in normal times, *i.e.* when the output gap is close to 0 (see Figure A.2). Indeed the effective fiscal impulse also depends on the value of the *ex ante* instantaneous fiscal multiplier μ_t, which can vary over time according to the output gap. More precisely, we define normal times as economic states in which output gap is greater than -1.5% and lesser than 1.5%. In that case, we fix the *ex ante* instantaneous fiscal multiplier to 0.5 for big countries (Germany, France, Italy and Spain), and to 0.3 for other countries, accounting for the fact that fiscal multipliers are generally smaller for small countries (see the recent estimates by Ilzetsky *et al.*, 2011). When output gap is over 1.5%, the *ex ante* instantaneous fiscal multiplier linearly decreases to 0, until output gap reaches 6%.

In bad times, the *ex ante* instantaneous fiscal multiplier increases as output gap deteriorates. We set its maximum value to 2 when output gap reaches -6%.

Figure A.2. Effective fiscal impulse in normal times with $\mu_t = 0.5$ following a positive fiscal impulse (1% of GDP)



Source: 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

	Ω
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

Ψ_1	Ψ_2	π^*	i_{min}
0.5	0.5	2%	0.05%

Source: iAGS Model, OFCE.

Prices

Values for η_1 and η_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

η_1	η_2	η_3	κ
0.5	0.1	0.1	-0.8

Source: iAGS Model, OFCE.

B. Additional tables

Table B.1. Public debt in 2020 in different scenarios

	DEU	FRA	ITA	ESP	NLD	BEL	IRL	PRT	GRC	AUT	FIN	EA
Baseline	59	82	91	97	64	80	133	118	178	62	36	78
S.1	61	67	81	75	59	71	93	91	85	64	37	68
S.2	60	82	92	97	78	86	133	118	178	74	43	81
S.3	56	73	81	95	60	76	139	111	237	59	33	74
S.4	60	87	96	103	65	82	138	124	169	63	38	82
S.5	60	83	91	96	65	81	130	115	153	63	37	79
S.6	58	81	89	96	63	79	131	117	177	61	35	77
S.7	58	81	90	96	63	79	132	117	177	61	36	78
S.8	58	85	92	102	64	81	143	125	212	61	35	80
S.9	59	83	92	98	64	80	133	119	176	62	36	79
S.10	61	81	92	103	62	79	127	108	171	64	39	80

Source: iAGS model.

Table B.2. Average primary structural balance

	DEU	FRA	ITA	ESP	NLD	BEL	IRL	PRT	GRC	AUT	FIN	EA
Baseline	2,9	2,3	6,5	1,0	1,0	3,4	1,7	3,4	7,1	1,8	2,3	3,0
S.1	2,8	3,2	7,0	2,3	1,3	3,9	3,5	4,7	10,6	1,7	2,3	3,6
S.2	2,7	2,3	6,4	1,1	0,2	3,0	1,7	3,4	7,1	1,1	1,9	2,9
S.3	3,0	4,1	7,8	3,4	1,9	4,7	4,4	5,4	12,1	1,9	2,6	4,2
S.4	2,8	1,3	5,7	-0,2	0,6	2,8	0,5	2,4	5,6	1,7	2,1	2,4
S.5	2,8	2,2	6,5	1,1	0,9	3,3	1,8	3,6	8,0	1,7	2,2	3,0
S.6	2,9	2,3	6,5	1,1	1,0	3,4	1,8	3,5	7,1	1,8	2,3	3,1
S.7	2,9	2,3	6,5	1,1	1,0	3,4	1,8	3,4	7,1	1,8	2,3	3,1
S.8	2,9	2,3	6,5	1,0	1,0	3,4	1,6	3,4	6,7	1,8	2,3	3,0
S.9	2,8	2,1	6,2	0,8	1,0	3,2	1,4	3,0	6,7	1,8	2,3	2,9
S.10	2,6	1,6	5,8	-0,1	0,8	2,8	1,3	3,2	5,7	1,6	1,9	2,5

Source: iAGS model.

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