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PUBLIC DEBT IN THE 21st CENTURY
Analyzing public debt dynamics with Debtwatch

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Summary

We propose a definition of public debt sustainability based on the possibility of conducting a fiscal effort or giving support to a macroeconomic path that makes it possible to reach a public debt target over a given horizon.

The concepts of a fiscal effort and a macroeconomic trajectory are both speculative, as they rely on the anticipation of unknown futures. By making the parameters of these futures explicit and using them in a parsimonious model, we can generate trajectories that are not forecasts but a means of assessing the effort required to reach a target that is conditional on explicit assumptions.

Debtwatch is a web application, freely accessible at **https://ofce.shinyapps.io/debtwatchr**, that can be used to carry out simulations, not only for France but also for other European countries and certain non-European countries such as the United States, including by modifying the parameters and exchanging assumptions with others. It is possible to carry out a calculation that is transparent (the assumptions are known and can be shared) and reproducible (the same assumptions lead to the same results) and which should help to further the debate on public debt targets and the associated efforts for a selection of developed countries.

The main results are:

- To stabilize public debt at its current level, most developed countries need to make an effort. In the case of France, this effort comes to between 1.4 and 2.6 points of GDP in the medium term. The upper limit is reached under the hypothesis of a rise in sovereign interest rates (see Table 1 and the section on *fiscal space* below);
- A more negative spread between the sovereign interest rate and growth makes it easier to stabilize the debt. In the case of France, this allows the fiscal effort to be eased by over one GDP point. Similarly, the inflation target, or still more, the response of public debt to interest rates, plays an important role. This points to the importance of monetary policy, but also of the path of interest rates in tomorrow's world (Table 1 and below on *the importance of* $r - g$);
- The magnitude of the multiplier effects is another key dimension of the analysis, as this influences in particular the sequencing of fiscal consolidation. This underlines the need to appreciate the way in which the structure of fiscal policies, the business cycle and the composition of household incomes influence the multipliers (below on the *multipliers*);

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- Stronger growth reduces the debt burden. In the medium term, the mechanisms for indexing expenditure and taxes limit the effects. In the case of France, one additional point of growth allows a reduction in the tax effort of 2.5 GDP points (Table 1 and below on *more growth, less tax effort*).

Table 1. **Medium-term fiscal effort to stabilize the debt**

In %	$r-g$ = -1,5 %		$r-g$ = 0 %	
$\Delta\ g^*$ =	+0.0	+1.0	+0.0	+1.0
Germany	-0.8	-2.9	-0.8	-2.9
France	1.4	-1.1	2.6	-0.2
Italy	0.9	-1.9	1.4	-1.5

Note: Using Debtwatch simulations for 3 countries, here are variations in medium-term tax rates (2028) calibrated such that public debt and public spending in GDP points return to their pre-pandemic ratio (2019), assuming a gap between the sovereign rate and growth for each country of -1.5% (its present value) and 0% on the one hand and potential growth (gpot) as defined in AMECO 5/2021 and increased by one point, per country, on the other. The simulations can be reproduced from the code on github.com/OFCE/dwr./pb

Ownership, neutrality, reproducibility

It is impossible to discuss the realism of a public debt target without specifying the means necessary to achieve it and the consequences that flow from it. For example, if the aim is to reduce the public debt, are we counting on more sustained growth, an increase in tax rates or a reduction in spending? Conversely, the effect of an increase in the public debt *ex ante* will depend on the government's use of the additional resources and their impact, for example, on the economy.

It is this reality that led to the development of Debtwatch. Debtwatch is a tool that aims to represent, as simply as possible, the short-term economic consequences of decisions and objectives, notably for the public debt, over several decades. Debtwatch seeks to be simple, accessible, neutral and agnostic with regard to the different representations of the functioning of the economy, and finally, to allow the reproducibility of the results and thus encourage a transparent debate.

Determining the debt target is not an easy task. The economic literature offers a number of works that seek to define a proper level of public debt. The complexity of the arguments – ranging from intergenerational effects to the functioning of financial markets and the risk structure of savings vehicles, to the interplay between creditors and borrowers – means that no simple conclusion emerges on what a good level of public debt is. The links between public debt and sovereign rates (or to be more precise, the spreads between sovereign rates and trend growth, Blanchard, 2019)[1] add an additional element of context. The 2008 financial crisis showed the importance of socializing private sector losses to prevent a recessionary spiral, which the health crisis illustrated even more clearly, as private losses were perfectly accidental and therefore did not involve any moral hazard or risk. The debt target is thus a focal point, fuelled by theoretical or empirical elements, moral considerations, but also circumstances.

1. Blanchard O., 2019, "Public Debt and Low Interest Rates", *American Economic Review*, vol. 109, no. 4, pp.1197-1229.

The originality of Debtwatch is that it lets users choose a debt target and then allows them to see the implications of the transition to that target, based on indicators such as unemployment, growth, taxes and inflation.[2] The implications depend of course on the underlying macroeconomic model. The application provides a simplified but realistic model. Moreover, the parameters of this model can be modified so that users can calibrate the model as they desire, in accordance with their understanding of the economy or the risk analysis.

The determination of the convergence path to the chosen debt target is based on the notion of the fiscal gap, *i.e.* the budgetary effort that is necessary to achieve the target conditional on the assumptions. This *fiscal effort* is calculated under the assumption of a rational and benevolent government. The rationality is that of an informed calculation: we assume that the government knows the model of the economy, that it anticipates the consequences of its actions, and that it measures uncertainty through a probabilistic assessment of future risks.[3] Benevolent means that it seeks to achieve the objective by minimizing the negative consequences for the economy. Box 1 describes the principles of the model in more detail and fleshes out these concepts. The approach followed is similar to that taken in macroeconomic models with microeconomic foundations (DSGE[4]-type models), except that in Debtwatch it is the behaviour of non-state agents that is assumed to be myopic, whereas this is "rational" in a DSGE model, and it is the state whose "behaviour" is (micro)-founded, whereas it is often represented by a fixed rule in DSGEs.[5] Because we are interested in the behaviour of non-state agents, we do not consider the behaviour of the state to be myopic. Because we are interested in the future trajectory of public debt, we find it difficult to assume that the main actor in the play is not behaving as rationally as possible, *i.e.* by projecting into a universe of uncertain futures to anticipate the consequences of its choices.

The objective of the Debtwatch application is to ensure a sweeping appropriation of the macroeconomic debate on the dynamics of public debt. The aim is to resolve the trade-off between complexity and transparency by using the simplest and most agnostic modelling possible to describe the hypothetical futures of the debt (and its ratio to GDP) and to allow everyone to explore the sensitivity of the assumptions needed for the speculative aspects. So there is a many-sided goal: that everyone can appreciate the consequences of one or another conjecture, that everyone can understand from someone else's conclusion what comes from a particular hypothesis, but also that everyone can re-evaluate in "real time" the hypotheses as information arrives and as once-possible futures become less likely.

Assuming that GDP growth is weak, we can tighten the line on public debt sustainability, thereby preparing for radical measures. There could be concern that rising interest rates will force us to make painful choices. These various intuitions cannot be countered by certainty on the evolution of either growth or interest rates. But we can quantify the consequences of one or the other with some degree of confidence.

Everyone should understand this as economists who are well versed in debt and sustainability issues, and we wanted the model to be sufficiently complete to inform those with a high level of knowledge about the subject. But simple citizens who are curious to understand an often tense debate and eager to anchor their intuitions should also be able to do this using this accessible, open approach. We also wanted to encourage dialogue by allowing the exchange of sets of hypotheticals and by promoting the reproducibility of simulations. This is key to a constructive debate marked by a wealth of complex, underlying notions.

2. The current account, an important indicator for the debate, is not represented in Debtwatch version 1. It will be in later versions. One might want to include things like inequality or CO_2 emissions. There is a risk of going beyond the parsimonious framework we have set for ourselves but an extension of the indicators to broader dimensions is also being studied.

3. In the first version of Debtwatch we consider the "easy" case of perturbations following a stationary law, l eaving more complex distributions for future work.

4. Dynamic Stochastic General Equilibrium.

5. In DSGEs, fiscal policy is often modelled by a fiscal rule: the primary surplus depends on the ratio of public debt to GDP and the output gap with fixed or time-varying coefficients. This type of rule was introduced in 1991 by Bohn. In 1998, Bohn tried to estimate this type of rule for the United States. In 2020, Aldama and Creel considered rules whose parameters can vary over time and proposed an application to the European states. Although the reaction function we calculate may be similar to this type of rule, our approach is different. We do not attempt to determine whether the government had a policy in the past that would stabilize the debt in the long run, provided that it was able and willing to maintain that policy in the future. Our objective is to determine whether the government will be able to implement a policy that will stabilize the debt at the desired level, in the sense that this stabilization would entail an acceptable economic and social cost, and to specify the economic assumptions under which this cost would be acceptable

A new approach to public debt sustainability

The approach to public debt dynamics proposed by Debtwatch sheds new light on the question of the stability or sustainability of public debt. The point is not to assert that current debt levels in developed countries are unsustainable but rather to assess the realism of proposed debt targets.

The simplest definition of unsustainability is when the debt or debt service reaches such a level that restructuring is the only possible solution. A restructuring, which generally involves a partial reduction, is deeply political, but it can be compelled by a liquidity crisis when lenders, *i.e.* financial markets, national savers or partners that may or may not be represented by supra-national institutions, decide to stop lending.

Defining the sustainability of the public debt thus proceeds from two principles: (1) what is the long-term trajectory of the debt? (2) does this trajectory come up against a breaking condition at some point, making it unsustainable? The definition of public debt sustainability thus rests on a speculative pillar and a political pillar. Contrary to the situation of a private agent's default, there is no enforceable criterion that could be imposed on a company's managers or shareholders when it can no longer meet its debts.

Assessing sustainability is therefore a delicate exercise. Yet it is necessary both in relations with creditors – who want to assess the quality of a signature and the risk of not recovering their funds, and thus to know whether it is reasonable to lend, and under what conditions – and also so that citizens can assess whether the path being followed by their country's economy is sustainable or whether it will imply brutal and painful adjustments in the future. Judging sustainability is thus a fragile and uncertain construction in which subjective and arbitrary criteria are intermingled with assumptions that are either too simple or too obscure to be really useful. This is the conclusion of Charles Wyplosz in 2011[6] when he asserted that the exercise is impossible but then pleads for further clarification.

6. Charles Wyplosz, 2011, "Debt Sustainability Assessment: Mission Impossible", *Review of Economics and Institutions*, vol. 2, no. 3, October.

Second, beyond informed speculation, it is necessary to actually assess sustainability. We do not define this as the stability of the debt to GDP ratio. This condition is neither necessary nor sufficient. As Wyplosz (2011) notes, from 1700 to the present day, British public debt has been neither stable, nor continuously increasing, nor decreasing. It has gone through peaks (over 250% of GDP in the early 19th century and after the Second World War) and troughs, but for over 300 years successive British governments have never defaulted on Britain's debt. From this point of view, therefore, British public debt appears a posteriori to be perfectly sustainable (at least until now). For this reason, the analyses regularly carried out by the European Commission (the *Sustainability Debt Monitor for the EU Member States*) or by the International Monetary Fund (IMF) (for emerging countries) are insufficient: they approach the issue in an accounting manner. The scenarios are chosen by experts, and the criteria are properties of the trajectories of a divergent dynamic system that says nothing about what is actually at stake or about the reactions of the States or their creditors. The criterion we adopt is therefore based on determining, for a given debt ratio target and a given horizon, the *efforts* required to achieve the target. This is not a formal quantified criterion, but anyone can assess whether the *efforts* required are acceptable or not, given the target chosen, the reasons motivating the target, and the circumstances in which these choices are being made.

Sustainability is a matter of collective choices. A shared vision of the future and an understanding of the risks are only made possible through knowing the sensitivity to the parameters or the assumptions of the scenarios. In well-understood circumstances,

a target sets a course – and it is by measuring the costs that we can discuss the coherence of the whole. The purpose of Debtwatch is to enable all this.

More precisely, the fiscal effort constructed resembles the S2 indicator used by the European Commission in its sustainability analysis. This indicator builds on the *fiscal gap* concept used since the proposals of Auerbach, Kotlikoff and Gokhale (1994)[7] to define a coherent concept of the public deficit. In a simple version, *i.e.* stripped of any considerations of inter-generational transfers, it is the difference between the balance that would stabilize the public debt and the current balance in the long term. The elaboration of a *fiscal gap* requires many hypothetical assumptions, and the European Commission's use of S2 extends the spirit of this approach over the long term.

7. Auerbach A. J., Gokhale J., and Kotlikoff L. J., 1994, « Generational Accounting: A Meaningful Way to Evaluate Fiscal Policy », *Journal of Economic Perspectives*, vol. 8, no. 1, pp. 73-94.

The approach taken in Debtwatch is different:

(1) Unlike the S2 indicator, conditionality on the hypotheses is not a convention, or an expert opinion, but is built into the assessment of the *fiscal effort*. For example, instead of assuming an interest rate path, we ask that a monetary policy be made explicit;

(2) Unlike S2, which aims only at stabilization at some level, the target is also an element of the assessment;

(3) S2 is a very long-term indicator and therefore particularly sensitive to the assumptions that go into the long term, while ignoring what happens in the long interval between where we are today and the long term. The Debtwatch simulations allow us to appreciate the full trajectory from the first year to the end of the century. The *fiscal gap*, *i.e.* the rate of compulsory taxation or the reduction in public spending required to achieve the target, often passes through a maximum that results both from the dynamic constraints (hitting the target within a given time frame) and from taking into account the economic mechanisms that develop in the short and medium term. Depending on the value of the fiscal multipliers, the speed at which interest rates "normalize" and the speed at which inflation hits its target, reaching the target will be easier or harder, depending on the proposed metric of the fiscal effort. The immediate consequence is that sustainability is not assessed on its own but rather in combination with other policies. What is the influence of the monetary policy on changes in short-term inflation or on the longer-term inflation target? What kind of maneuvering room do we have on sovereign rates and their spread over the next five years? What is the maturity strategy for the public debt, and what credibility do we have to temporarily exceed the debt target? How might high multipliers affect the analysis?

(4) We do not limit the *effort* to a single metric, the *fiscal effort*. While it is useful for comparing different scenarios, it is not the only output of the simulations. The trajectory of the unemployment rate or of the growth gap are also indicators that can be used to assess the political, social and economic sustainability of a reduction in public debt.

Everything is not reducible just to fiscal policy but is embedded in an overall macroeconomic context and strategy. To ignore this is to resign oneself to respecting constraints that are not really constraints.

Box 1. **The Debtwatch model**

The model used in Debtwatch is constructed with a view to maximum parsimony while taking account of a sufficient wealth of economic channels. Parsimony allows both an easier understanding of the model, but also a resolution that helps to explore the impact of the assumptions. The viewpoint taken is that of the dynamics of the debt-to-GDP ratio, and therefore the core of the model is an (accounting) equation of public debt accumulation à la Blanchard *et al.* (1991). To represent the business cycle, a growth gap equation is added. This is based on a gravity model that postulates the spontaneous return of the growth gap to the trend path, also called the potential. This simple model makes it possible to introduce the fiscal multiplier by combining a direct short-term effect of fiscal policy on the output gap, an effect that persists due to the viscosity of the gravity equation, leading to a dynamic multiplier. The fiscal multiplier on expenditures may differ from the revenues multiplier. In this version of Debtwatch, the multiplier does not depend on the cycle (see iAGS 2012 to 2018).

Inflation follows a similar pattern, gravitating around the central bank's inflation target and diverging from this reference by the deviations of unemployment from equilibrium unemployment (Phillips equation). The determination of inflation and growth allows us to elaborate trends in the sovereign rates that determine the interest burden of the public debt. The sovereign interest rates converge towards a "neutral" rate, which is the sum of potential growth and inflation, offset by a premium that may represent a lasting fall in interest rates due, for example, to a shortage of safe financial assets. To represent debt crises, a parameter describes the short-term sensitivity of interest rates to the level of debt (a Reinhart-Rogoff effect of sorts or, more commonly, a crowding-out effect). By choosing this parameter appropriately, we can reproduce the rates paid by Italy until 2012 or, using an even higher value, those paid by Greece during the same period.

In Debtwatch, government expenditure is indexed to trend growth. A fall in growth therefore leads to a fall in government spending. This adjustment can be offset by explicitly changing the future rate of government spending in GDP.

However, without an explicit adjustment, the Debtwatch model assumes long-term neutrality: the output gap always tends towards 0, rates adjust to inflation, and real GDP growth is independent of inflation. Since expenditure and revenue are indexed, it is the expenditure and tax rates in GDP that determine the long-term fiscal balance. In the short term, numerous viscosities (those already mentioned, *i.e.* the output gap, inflation and interest rates as well as public spending) produce deviations from the long term that then accumulate in the debt trajectory.

The last important element in Debtwatch is the construction of fiscal policy. This is calculated using a fiscal rule in which the fiscal impulse (the discrete derivative of the structural balance, hence the second derivative of the debt) is determined by the deviation from the long-run value of the output gap, the primary government balance and the debt. Other state variables can be added to the fiscal reaction function. The parameters of the reaction function are estimated so as to minimize the expectation of a loss function over a set of simulations that share the same parameters but differ due to random perturbations to the output gap equation. The loss function is the discounted sum of the squared growth gaps plus the gap with the target debt based on the chosen horizon (with a weighting). This loss function makes it possible to choose the parameters that both respect the long-term constraint and minimize the loss of activity. This reaction function could evoke thoughts of a fiscal rule, but the sensitivity of the estimated parameters to the assumptions makes it impossible to speak of a rule, as the reaction function cannot be generalized. It is possible to estimate an optimal fiscal rule over a given set of parameters, but it will be far from the optimal fiscal policy. The Debtwatch reaction function is in fact an approximation of the optimal fiscal policy, and this approximation will be explained in a forthcoming working paper.

Box 2. **The Debtwatch application and reproducibility as a service**

Debtwatch responds to the need for transparency and consideration of complexity by providing a fast interactive web application that enables the model's simulations to be conducted at no cost to the user. It is possible to configure the desired parameters and in a matter of seconds to display the main graphs needed to assess the fiscal effort and the other elements of the macroeconomic trajectory necessary to reach a given debt target. Each simulation carried out is recorded anonymously with a unique identifier (a code with 5 or 6 lower case letters). This anonymous identification of the simulations ensures reproducibility, which the web application offers as a service (RaaS). Indeed, using this code anyone can access the parameters of the simulation, check its authenticity, and analyze its sensitivity by reproducing the simulation results. We would encourage you to use these codes as a source for your re-runs.

Some explanations are provided in the application, as are all the model's equations. A future working paper will provide a more thorough discussion of the model's equations and their main properties.

A "seed" for the random number generator is recorded for each simulation to ensure exact reproducibility, based on the unique identifier code. Each new simulation results in a new "seed" being drawn.

The graphics can be downloaded, and freely used, respecting the citation rules. It is also possible to download the data to produce custom illustrations. More advanced users can access the application's source code and use the underlying model in more complex configurations or by incorporating modifications to the modeling or the resolution algorithm. Although it is not a requirement, please respect the principles of reproducibility when modifying the model.

We suggest that Debtwatch be cited as follows:

Timbeau X., E. Aurissergues and É. Heyer, 2021, "Debtwatch, a public debt simulator for the 21st century", ofce.shinyapps.io/debtwatchr, github.com/OFCE/dwr

What Debtwatch says

A higher multiplier in the short term requires a greater fiscal effort

All developed countries have inherited higher public deficits and much higher public debts from the crisis (OFCE, 2021[8]). Reducing these would require a major fiscal effort. But an effort that is too brutal and too rapid would depress activity and prolong the crisis, which would not only jeopardize any fiscal recovery but also lock economies into a recessionary spiral.[9] The value of the fiscal multiplier (the link between fiscal policy and activity), both in the short and long term, is a critical parameter for the stabilization of public finances and a return to full employment.

Level and dynamics of multipliers in Debtwatch?

In the short term, there are several determinants that affect the value of the multiplier. In a small economy that is very open to international trade, if the fiscal shock is anticipated and isolated, it will have less impact than would a shock of the same magnitude in a large, closed economy, one that is unexpected and simultaneous with those in other partner countries. Other determinants of the sensitivity of the economy to fiscal policy have been discussed in the literature.

8. Creel J., Heyer É., Plane M., Poirier C., Ragot X. (dir), Saraceno F., Timbeau X., 2021, "Dette publique : un changement de paradigme, et après ?", *OFCE Policy brief* ,no. 92, 6 October.

9. During the years 2011-2013, the fiscal and budgetary policies in France and the rest of the euro area weighed heavily on European and French growth. The recessionary effects of these policies were exacerbated by the fact that they were applied while the economy was still showing the scars of the recession (high unemployment, for example), and because they were carried out systematically in all European countries, as a strategy of gradual and smooth fiscal consolidation was replaced by a strategy of rapid and aggressive reduction of public imbalances.

The nature and composition of the fiscal stimulus is particularly important: the multiplier is higher for expenditures than for taxes. The economic context is also important. The idea that the multiplier is countercyclical, *i.e.* that its size depends on the economy's position in the business cycle, which was already present in Keynes' work in 1936, has been the subject of a great deal of empirical work in the wake of the 2008 crisis (see in particular Creel, Heyer and Plane (2011)[10] and, more recently, Berge *et al.* (2021)).[11,12]

As a result, at least in the short term, the diagnosis today is that the fiscal multipliers are positive. The choice is therefore left to Debtwatch users to set the value they wish to give to the fiscal multipliers of government taxation (og_po) and expenditure (og_dep) within an interval varying from 0[13] – if they consider that agents who are perfectly anticipating that an increase in public expenditure today means an increase in future taxes will increase their savings and therefore reduce their consumption, which would cancel out the positive effect expected from the initial increase in public spending ("Ricardian equivalence theorem") – to 4, in line with the IMF analysis conducted in 2009, which evaluates the global fiscal multiplier with an accommodating monetary policy at 3.9 (Freedman *et al.*, 2009[14]).

In most macroeconomic models, including the dynamic stochastic general equilibrium (DSGE) models used by central banks and international institutions, the fiscal multipliers are positive in the short term (around 0.7 for a pure fiscal shock in "normal times", *i.e.* for a zero output gap). In the long term, the empirical analysis does not allow us to come to a decision. It therefore mainly reflects a theoretical *a priori*, which remains largely dominated by the idea that fiscal policy cannot have any long-term effect.[15]

The default value of the fiscal multiplier in Debtwatch is set at 0.7 in the short term for all countries.[16] The multiplier does not vary with the business cycle but may differ according to the instrument used. In the long run, the multiplier is zero, and its dynamics vary according to two parameters in the *output gap equation*,[17] namely the speed at which the business cycle is closing (og_mce) and the value of the autoregressive term (og_lag). As shown in Figure 1, the faster the cycle closes, the faster the multiplier effect will fade, while a large autoregressive coefficient will increase the short-term effect of the multiplier but accelerate its return to zero.

What are the implications of multipliers in Debtwatch?

Of course, the value of the multiplier chosen will be of great importance in the simulation results. In the following, we illustrate the impact of this choice by varying the short-run multiplier between 0 and 3 in the case of a fiscal policy that aims to erase in 20 years the debt surplus accumulated during the Covid-19 crisis (100% debt target).

The main lessons are:

- The lower the short-term multiplier, the faster the return to the public debt target. Regardless of the size of the short-term multiplier, a return to a 100% target will require a fiscal effort (Figure 2);
- When the value of the multiplier increases, the return to a 100% public debt target over a 20-year period will require a greater fiscal effort and will be accompanied by a higher level of unemployment (Figure 3);

10. Creel J., Heyer É., and Plane M., 2011, "Petit précis de politique budgétaire par tous les temps. Les multiplicateurs budgétaires au cours du cycle", *Revue de l'OFCE*, no. 116, pp. 61-88.

11. Berge T., De Ridder M., and Pfajfar D., 2021, "When is the fiscal multiplier high? A comparison of four business cycle phases", *European Economic Review*, 138, August.

12. According to this literature, the multiplier is higher in a low cycle, *i.e.* in a situation of high unemployment and a very large output gap. This is because during periods of recession economic agents (households and companies) not only anticipate a deflation ("liquidity trap") but also no longer base their spending on their anticipated income but on their current income. In a recession, however, as more and more agents are subject to a very short-term liquidity constraint, this prolongs the recessionary spiral and prevents monetary policy from working. This counter-cyclicality may also be due to the endogenous nature of the propensity to save or to import, particularly among the wealthiest. The optimal time frame for an expansionary policy might even be situated at the start of recessions as the unemployment rate rises (Berge *et al.*, 2021).

13. We do not consider the possibility of negative fiscal multipliers as put forward by Giavazzi and Pagano (1990).

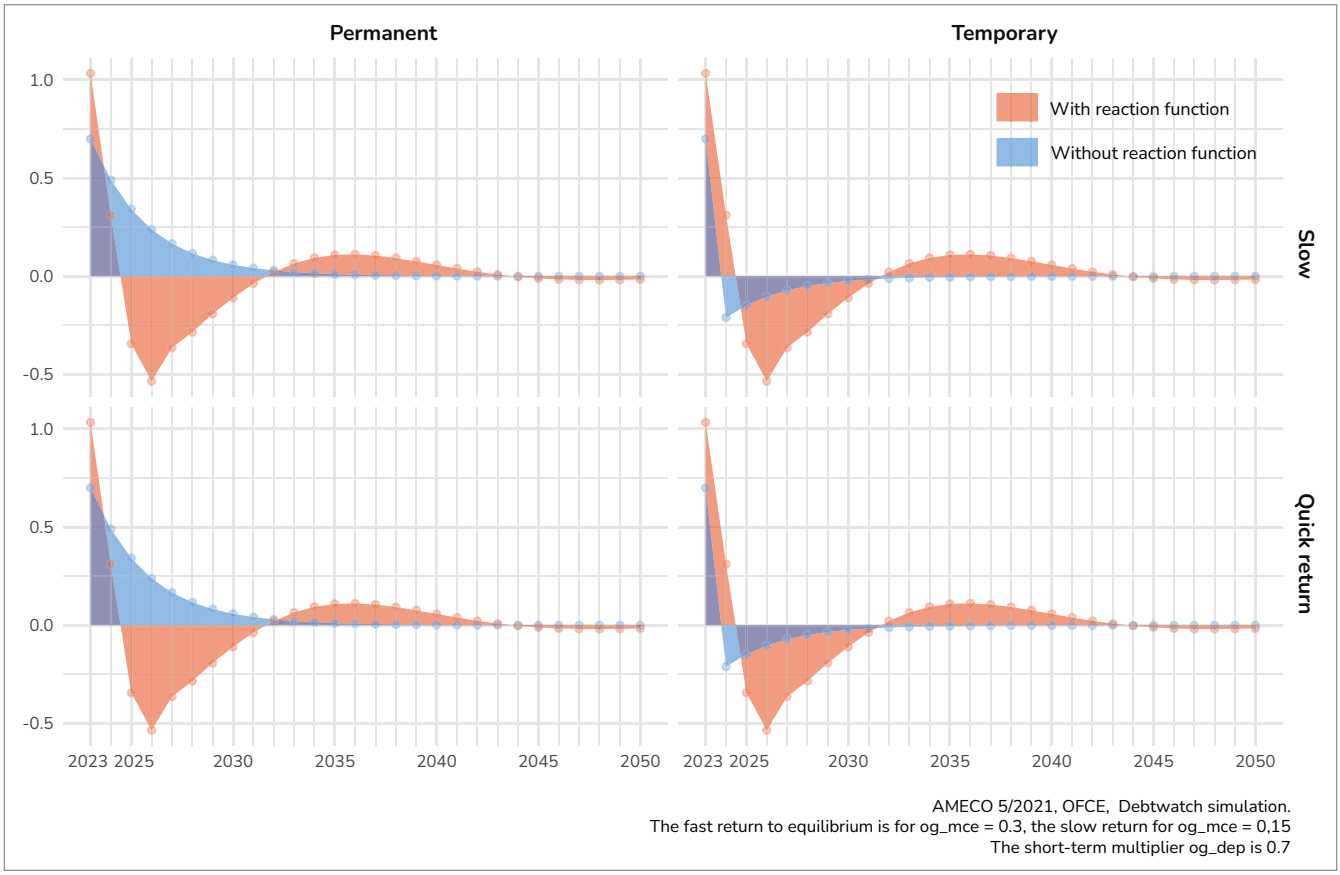
14. Freedman C., Kumhof M., Laxton D., and Lee J. , 2009, "The case for global fiscal stimulus", *IMF Staff Position Note*, March.

15. However, in the case of public investment, when hysteresis can occur, the assumption of long-term non-nullity seems more realistic.

16. Concerning the autoregressive term (og_lag), its default value is zero.

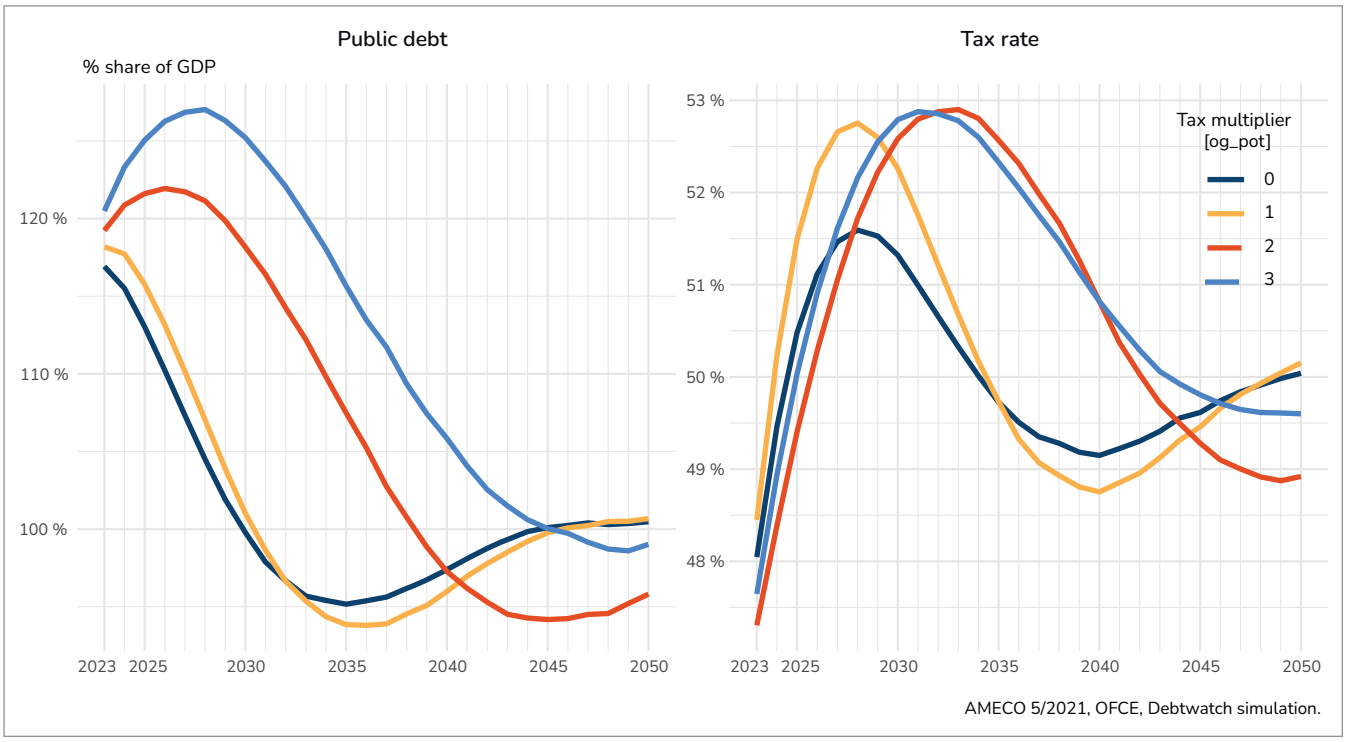
17. The value of these two parameters is set by default to the value estimated econometrically.

Figure 1. **Dynamic impact of the multiplier in Debtwatch**



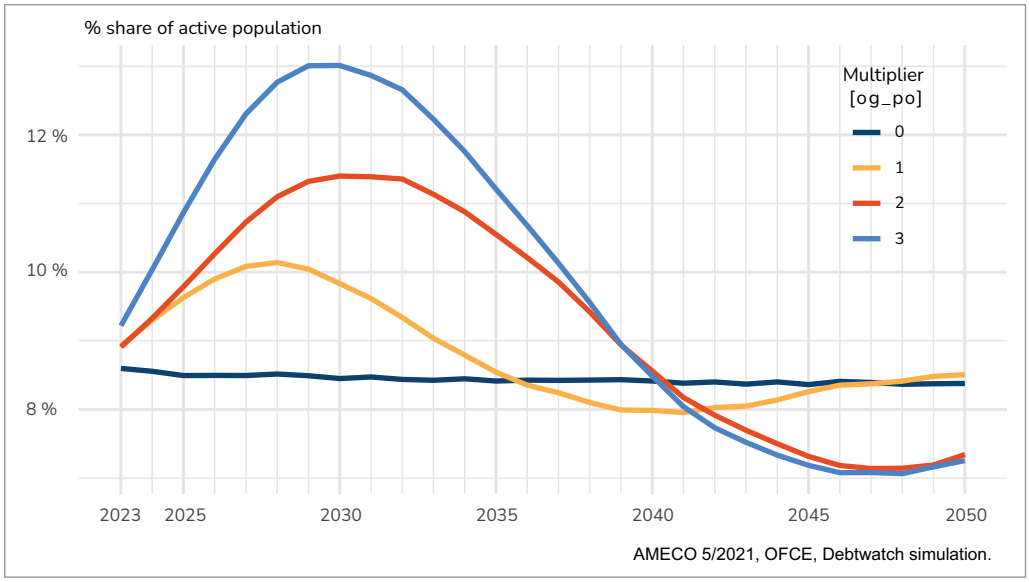
AMECO 5/2021, OFCE, Debtwatch simulation.
The fast return to equilibrium is for og_mce = 0.3, the slow return for og_mce = 0,15
The short-term multiplier og_dep is 0.7

Figure 2. **Trajectory for a 100 per cent public debt target in 20 years using the short-term multiplier**



AMECO 5/2021, OFCE, Debtwatch simulation.

Figure 3. **Unemployment rate for a 100% debt target according to the short-term multiplier**



- When the multiplier is greater than or equal to 2, the optimal fiscal policy changes: the fiscal effort is smaller in the short term but greater over the whole period. Over the period 2023-2050, the rate of compulsory levies would average 51 points of GDP for a multiplier of 3, compared with 50 points for a multiplier of zero. On the other hand, the peak of the compulsory levies rate (OP) would be reached in year six when the multiplier is less than 2, and in the twelfth year otherwise;
- Despite a more restrictive fiscal policy over the entire period, the public debt will be higher on average by 2050 when the multiplier is greater than or equal to 2 and continues to increase in the short term.

More growth, less fiscal effort

Irrespective of the value of the multipliers, the potential growth rate of the economy in the coming years is a key variable for public finances, with a long-term influence. Accelerating it would help to improve the path of public finances by increasing revenues and reducing deficits. Moreover, if we choose to reduce the general government debt by cutting public expenditures, this means keeping actual growth below potential growth: the lower the potential growth, the greater is the effort to control public spending.

For several decades now, we have been observing a fall in potential growth in the major developed countries. There are many reasons for this, ranging from an ageing population to the slowdown in total factor productivity, and this has revived a debate on a possible "secular stagnation" (Summers, 2013[18] following Hansen, 1939[19]). However, it is possible to boost potential growth by raising the employment rate, by increasing the level of education of the working population or by upgrading capital (R&D, innovation, etc.).

The Debtwatch simulator makes it possible to study the link between potential growth and the fiscal effort required to achieve the public debt target. The simulator assumes by default that this potential growth rate is stabilized at the last value provided by

18. Summers L.H., 2013, *Speech at the IMF 14th Annual Research Conference in Honor Of Stanley Fisher,* International Monetary Fund, 8, November.

19. Hansen A. H., 1939, « Economic progress and declining population growth », *American Economic Review,* vol. 29, no. 1, pp. 1-15.

AMECO for the year 2022. It is of course possible to modify this value and to analyze the consequences, for example in terms of the public finances or the unemployment rate.

To illustrate this sensitivity, three cases were studied, always under the assumption that the debt target for general government that gets back to 100% of GDP in 20 years:[20]

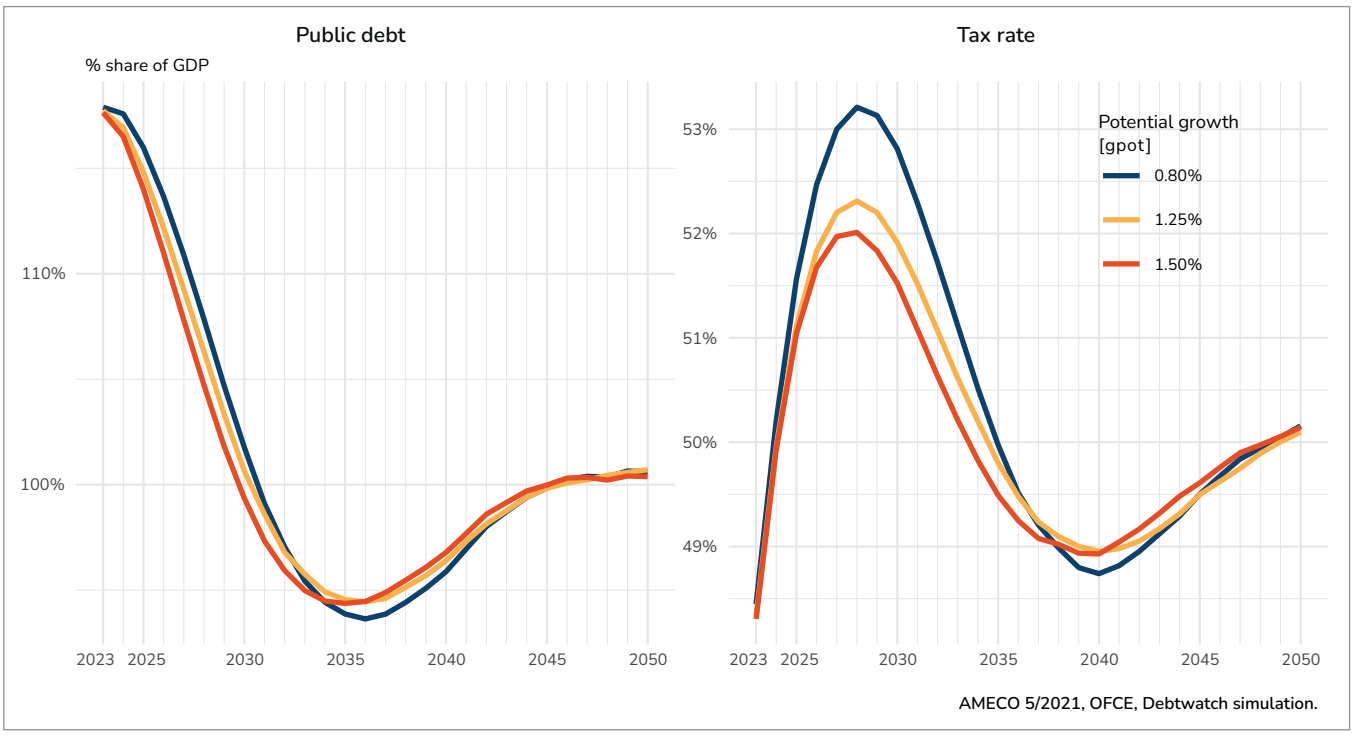
1. The first case corresponds to a scenario of "secular stagnation" with a prolongation of the slowdown in potential output, which could be accentuated in the wake of the Covid-19 crisis (rising inequality, business failures, falling labour productivity). In this scenario, potential growth would be 0.8% per year over the next few decades;
2. The second scenario is the "status quo" scenario, which assumes that potential growth stabilizes at the value observed before the crisis. For France, we use the value transmitted by the government to the European Commission in its last Stability programme, *i.e.* 1.25% per year;
3. The third scenario posits an increase in potential growth over the next few years (1.5% per year).

The results of these simulations are in line with intuition: the reduction of public debt is both faster and requires less fiscal effort when the potential growth rate increases[21] (Figure 4). The peak of the OP tax rate would be reached in year six and would be above 53 GDP points in the "secular stagnation" scenario, compared to 52 GDP points in the scenario with annual potential growth of 1.5%.

20. In these scenarios, the value of the short-term multiplier is set at 0.7

21. This intuitive result, however, is contrary to many analyses, most recently the Arthuis Report in 2021, which suggest that in a situation of secular stagnation, the deficit would deteriorate rapidly and continuously and that the debt-to-GDP ratio would continue to rise ad infinitum, placing it on an unsustainable path. The reason is that in Debtwatch, government spending adjusts to long-term activity. In many analyses, the growth rate of government spending does not change when long-term growth changes.

Figure 4. **Trajectory for a 100 per cent public debt target in 20 years according to the economy's potential growth rate**



A smaller short-term fiscal effort due to economic reserves: The role of the output gap

As mentioned earlier, in Debtwatch the size of the multipliers does not depend on the economic cycle and hence on the output gap (OG). However, the level of the output gap has an impact on the path of public finances via the greater or lesser extent to which activity catches up in the short term.

The initial value of the output gap taken by default is the one forecast in AMECO. In the case of France, the OG would be zero in 2022 (0.1 point of GDP), suggesting that the catching up of activity following the health crisis will be completed next year, that the unemployment rate will have reached its structural level by then (NAIRU[22] = 8.7% of the active population) and that this crisis, under the assumption of annual growth of 1.25%, will have definitively reduced the level of output by 2.4 GDP points.[23] This assumption naturally influences the future dynamics of the public finances and can be modified in Debtwatch. If we assume, as the government indicates in the PLF 2022 budget bill, that the cost of the crisis for potential growth amounts to 1.75 points, it is sufficient to lower the level of the NAIRU, set by default at 8.7%, by 0.65 points.

Here again, three cases were studied to investigate the simulator's sensitivity to the assumptions made for the OG in 2022, the last year before the simulation:[24]

1. The first scenario corresponds to a "staircase" scenario, *i.e.* a significant final loss in the level of potential output following the health crisis. In this scenario, which is the default scenario in Debtwatch, the output gap is zero in 2022 and the NAIRU is 8.7% of the labour force;
2. The second, more favourable scenario assumes that the crisis has no impact on the economy's potential output. All other things being equal, the OG would be – 2.5 GDP points in 2022 and the NAIRU close to 6% of the labour force;
3. The third scenario would be the least favourable and would suggest that the Covid-19 crisis would have more significant and persistent effects on the French economy's productive capacity. In this scenario, the NAIRU would be 11%.

As shown in Figure 5, the debt path is influenced only in the short run by the initial hypothesis of the OG. Given the default values of the other parameters, the debt paths converge 7 to 8 years after the start of the simulation.

Unsurprisingly, in the short term, when the initial OG is negative, implying a larger growth reserve, the public debt falls more rapidly, even though compulsory levies (PO) do not increase as much (Figure 5).

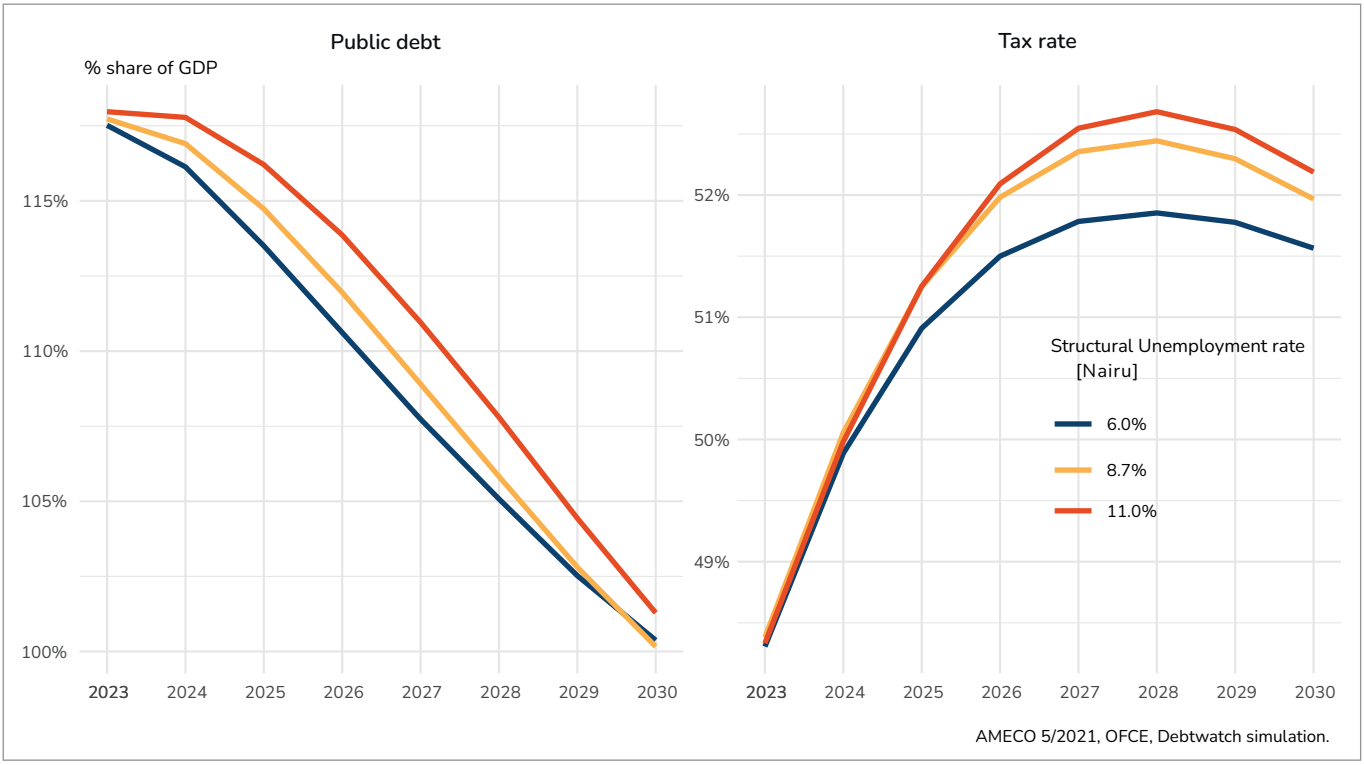
The real divergence here is mainly on the level of unemployment. In the scenario of an NAIRU close to 6%, the increase in the compulsory levies rate necessary to return to a 100% public debt would be accompanied by a very limited and transitory rise in the unemployment rate: after having risen to 9.1% in the second year of the simulation, it would then begin to fall to 7.8% in 2030, compared to 9.5% and 10.9% in the same year in the other scenarios.

22. The NAIRU (Non-Accelerating Inflation Rate on Unemployment) is the equilibrium unemployment rate towards which unemployment converges, in the absence of temporary supply shocks, once the dynamic adjustment of inflation has been completed.

23. Given the growth forecasts in AMECO (5.7% in 2021 and 4.2% in 2022 after -8% in 2020). It should be noted, however, that in 2019, AMECO estimated the OG at 1.8 GDP points, which would suggest a smaller loss of potential due to the health crisis (0.6 GDP points).

24. In these scenarios, the value of the short-term multiplier is set at 0.7.

Figure 5. **NAIRU trajectory for a 100% public debt target in 20 years**



Fiscal efforts partially lifted by inflation

While, as we have seen in past decades, it is not always easy for a central bank to increase inflation and anchor expectations to their target, it is generally accepted that higher inflation could help to reduce the ratio of public debt to GDP and thus improve the sustainability of the public purse, all else being equal. By increasing the base on which taxes are levied, this could facilitate the repayment of capital as well as the payment of interest on loans.

Note here that Debtwatch does not include a competitiveness effect related to a change in the inflation target. This is equivalent to assuming that the change in target would be common to all a country's partner countries or regions. Furthermore, we assume that changing the target does not lead to greater price volatility and therefore does not affect employment or investment.

Three cases are presented to observe the sensitivity of Debtwatch to the inflation target adopted.[25]

1. The first case is a "status quo" scenario, *i.e.* maintaining the annual inflation target at 2%;
2. The second scenario assumes an increase in the target to 3%;
3. The third scenario suggests a downward revision of the target to 1%.

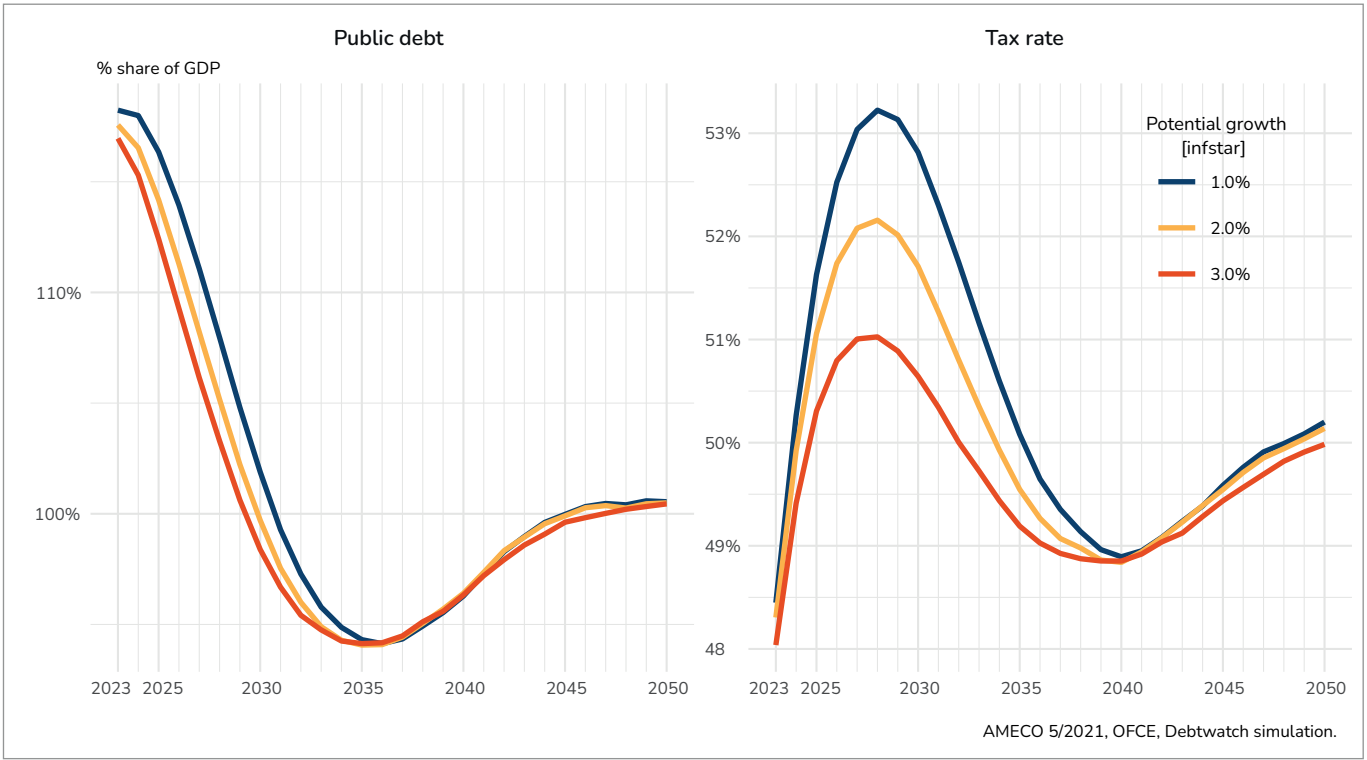
Under these conditions, for the same public debt target of 100% in 20 years, raising the inflation target would allow a faster reduction of the public debt, which could be achieved with a smaller increase in the taxation rate and less deterioration in the unemployment rate (Figure 6).

25. In these scenarios, the value of the short-term multiplier is set at 0.7.

The peak rate of taxation would, in all the cases studied, be reached in year six but would exceed 53 GDP points in the 1% inflation scenario compared to 51 points in the 3% scenario. This difference of more than 2 GDP points in the rate of compulsory levies would gradually disappear by 18 years later.

The smaller fiscal effort due to a higher inflation target would have less impact on economic activity, resulting in a lower unemployment rate over the analysis period.

Figure 6. **Trajectory for a 100 per cent public debt target in 20 years under the inflation target**



Stabilizing the debt vs. reducing it

In this section, we compare a policy of stabilizing the debt at its current level with two debt reduction policies. In the first, the authorities aim to return to a public debt equal to 100% of GDP. In the second, they comply with the European treaties to return to a debt-to-GDP ratio of 60%. The horizon is 20 years in both scenarios. Stabilizing the debt requires a moderate increase in the long-term primary surplus, which is reflected in a permanent increase of about one percentage point in the compulsory rate of taxation (PO).[26] The model suggests a strong increase in compulsory levies from 2023 onwards at the cost of a slightly negative output gap and rising unemployment.[27]

The need for fiscal consolidation to stabilize the debt is directly implied by the assumption on the long-run spread between interest rates and growth rates. By default, the long-run spread is assumed to be zero, which may appear to be a conservative assumption given the evolution of interest rates since the 2008 financial crisis.[28]

The policies needed to reduce the public debt to 100% or 60% of GDP would imply more substantial increases in taxation rates, i.e. hikes on the order of 3 or 6 points respectively by 2030. Taxation would return to the same level as in the scenario for stabilizing the debt at its current level by 2035 in the case of a target of 100% of GDP,

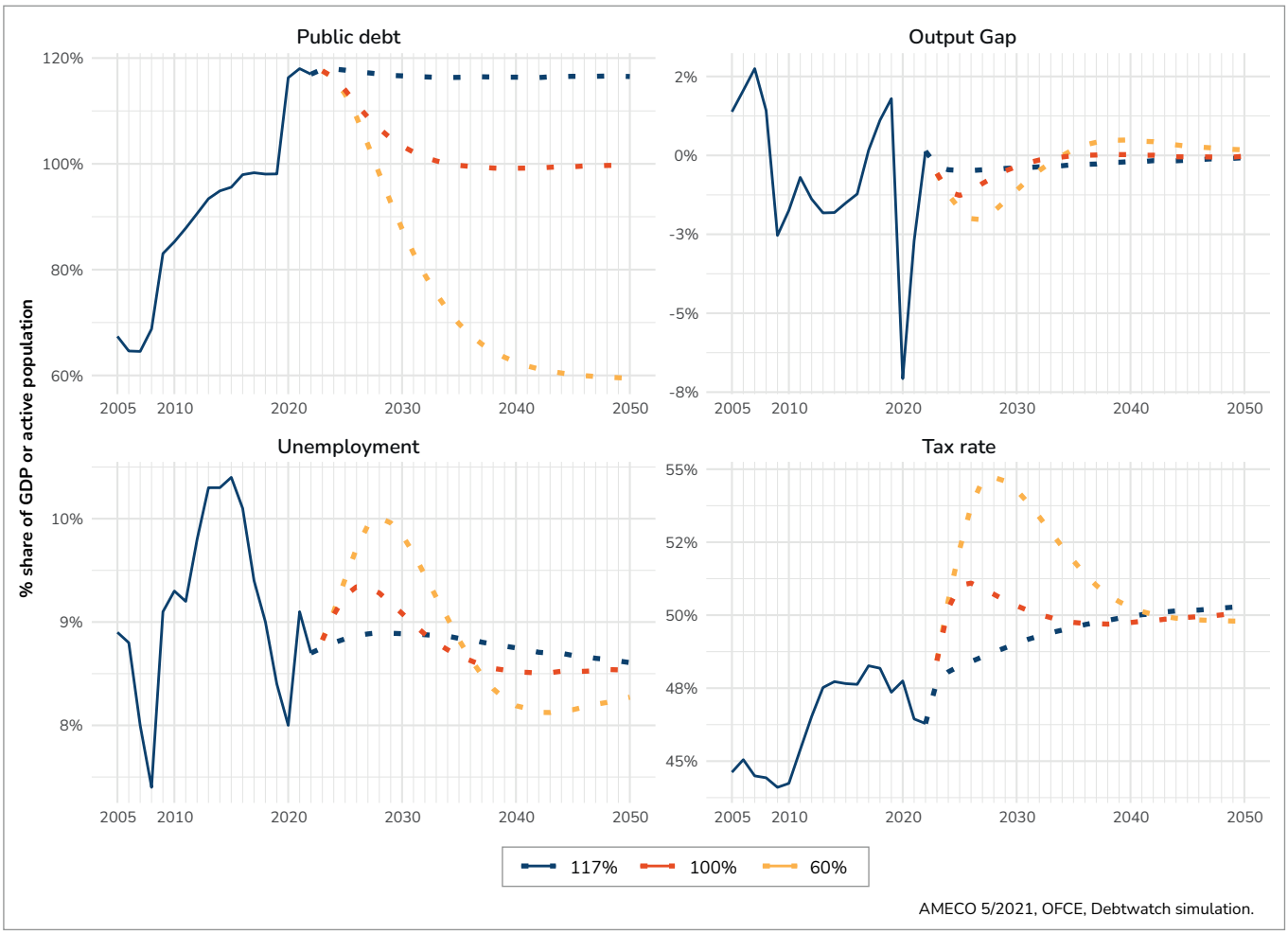
26. Recall that fiscal consolidation is assumed by default to take place entirely through taxes, an assumption that can obviously be modified in Debtwatch. A similar fiscal consolidation through spending would imply a decrease of about 1 point of public spending in the long term.

27. It should be stressed here that the Debtwatch application is mainly interested in the long-term evolution of public debt and that it is advisable to remain cautious about its short-term recommendations, a fortiori in a period as exceptional as the Covid-19 crisis.

28. This assumption can also be modified by the user; see the next section for an exploration of the sensitivity of the model to this parameter

but only in the mid-2040s in the case of a return to 60% of GDP. The impact on the unemployment rate and the output gap would be massive, implying another deep and lasting recession. In the event of a return to 60% of GDP, the effects would be similar in magnitude and duration to the effects of the eurozone crisis on the French economy in the early 2010s.

Figure 7. **Changes in key macroeconomic variables for different debt targets**



The importance of the critical gap ($r - g$)

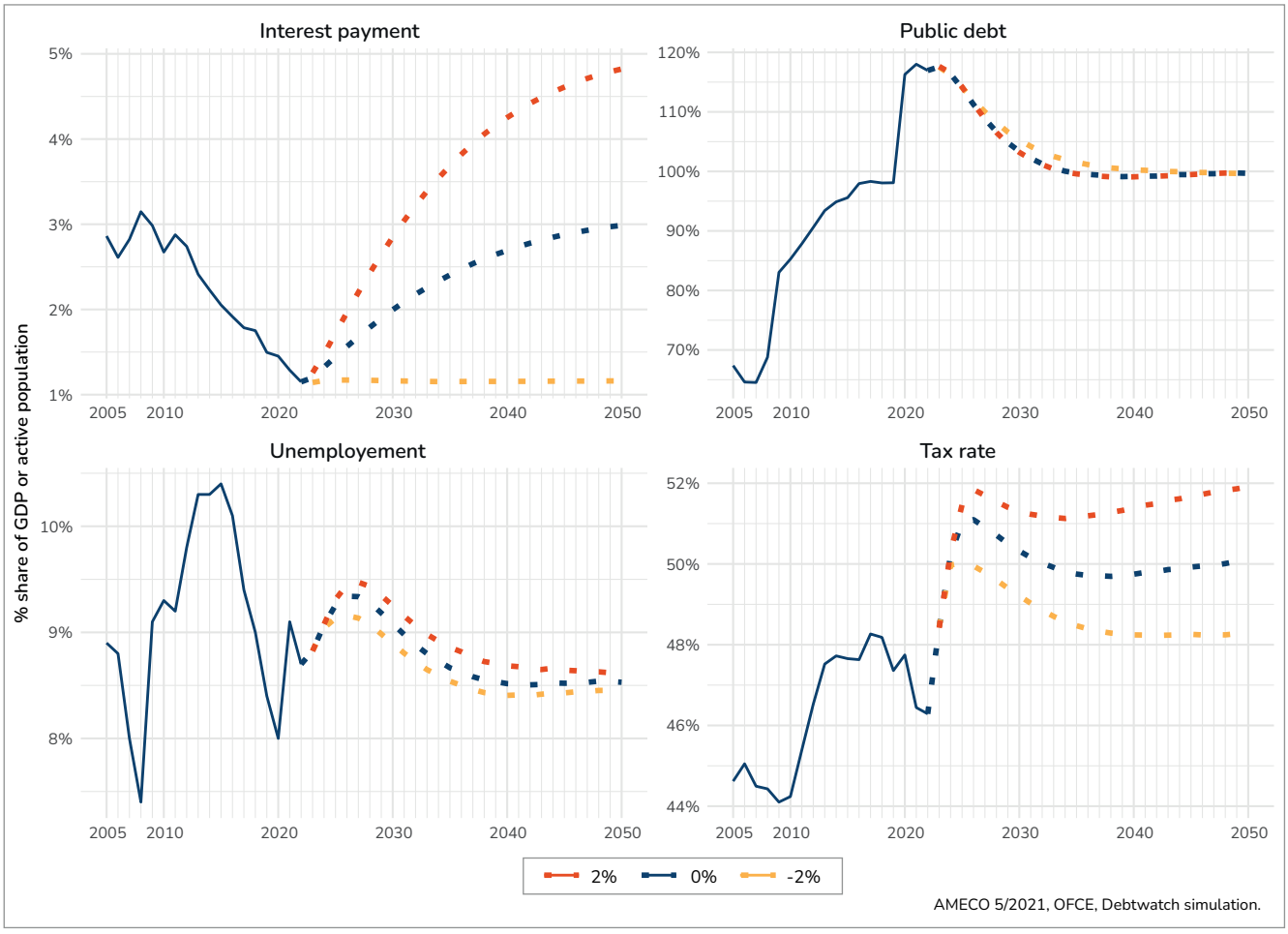
The difference between the long-term interest rate (r) and the economy's potential growth rate (g) is crucial for debt dynamics. If $r > g$, then the government will necessarily have to run a primary surplus to stabilize the debt. On the other hand, if $r < g$, then the debt can be stabilized even in the presence of a moderate primary deficit. In Debtwatch, the interest rate is modelled as the sum of the potential growth rate, the central bank's inflation target, and the critical gap between the long-term interest rate and the potential growth rate. This critical gap term is itself an endogenous variable of the model. The model is modelled by an error correction equation and converges to a long-run value, which is one of the fundamental parameters of the model.

We compare three scenarios for reducing the government debt to 100% of GDP in 20 years using three hypothetical values for the long-run critical gap: -2%, 0% and +2%. The first scenario corresponds roughly to the current level of real interest rates

and the growth rate. The second is the application's default scenario, while the third corresponds to a rise in interest rates to high levels. In scenarios 2 and 3, the adjustment to higher interest rates is gradual. Unsurprisingly, the interest burden in GDP points rises gradually to its 2010 level in the second scenario, and very quickly above this level in the third, while it remains stable at a low level in the first. The model suggests a rapid decrease in public debt when the critical gap is positive or zero in the long run and a slower decrease when the gap is negative. It is possible that in the first case, the model suggests taking advantage of the low interest rates in the first years of the simulation to consolidate before the rates rise again. However, complex phenomena are at play, notably because the conditions for the model's long-term convergence are not at all the same depending on whether $r - g$ is positive or negative. Further work is needed to better understand this. What is certain, however, is that a negative critical gap implies a much smaller increase in tax rates by 2030 in order to return to a public debt of 100% of GDP within 20 years.

This fiscal consolidation would have much more limited effects on the unemployment rate in the scenario when rates remain low, with the rate remaining between 8% and 9% of the active population, whereas it would peak above 9.5% in the other two scenarios. Conversely, while a critical long-term gap of 2% would only marginally alter the trajectory of public debt compared to a zero gap, it would imply significantly higher tax and social security contributions (on the order of 2 GDP points) on a permanent basis.

Figure 8. **Impact of the long-run critical gap ($r - g$)**



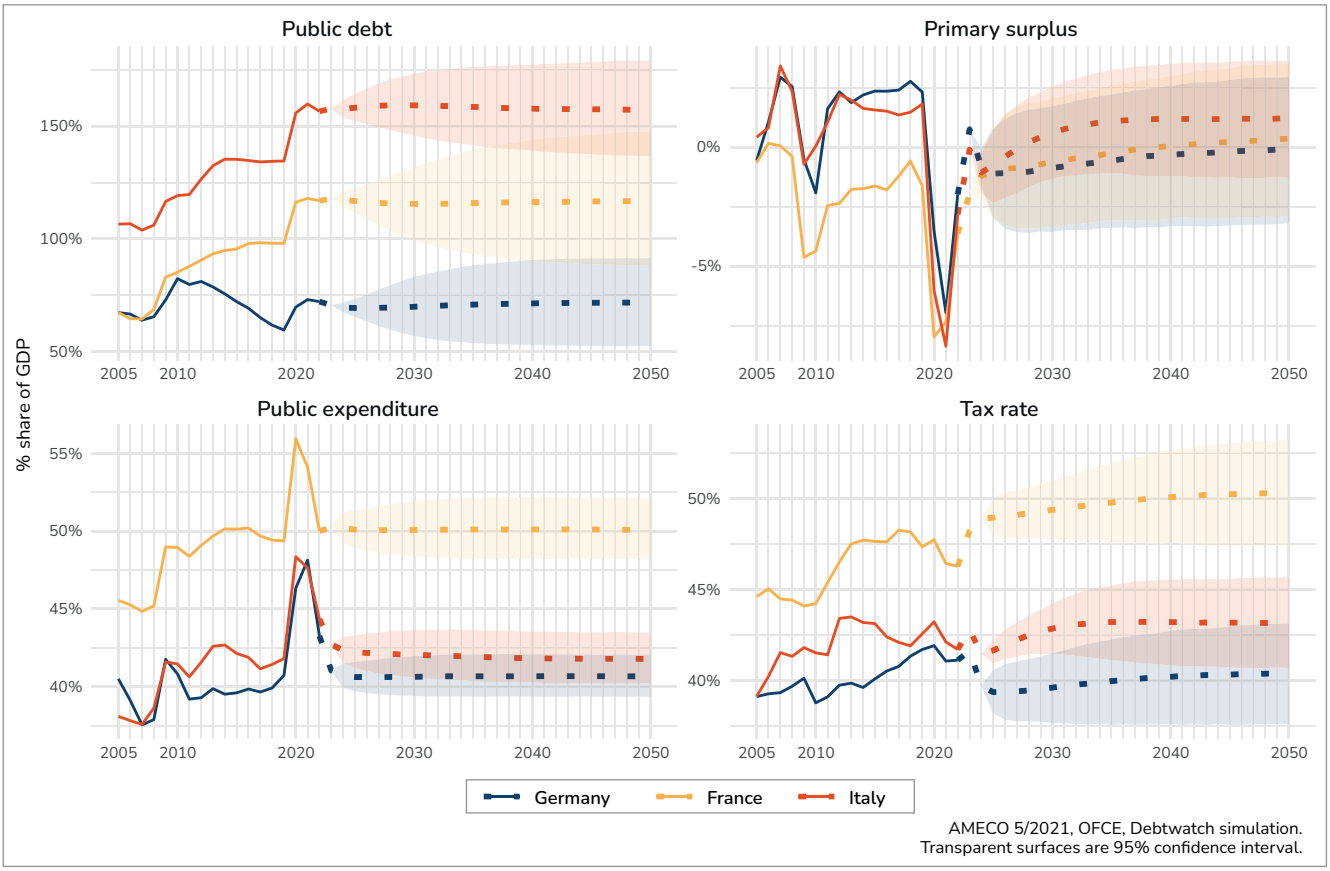
The role of debt maturity

Lengthening the average maturity of the public debt would have only a limited impact on macroeconomic dynamics for the "standard" set of assumptions. We compared the evolution of public debt when the average maturity is equal to the current level (8 years) with a variant where it increases to 12 years.[29] Here again, we use the default scenario with a real interest rate equal to the economy's potential growth rate in the long term and a fairly rapid rise in rates towards their long-term value. The increase in the maturity makes it possible to delay the rise of the interest burden but only marginally modifies the trajectory of the public debt and the unemployment rate.

29. In this "analytical" simulation, we consider that maturity is higher from 2023 without defining the details.

Figure 9. **Impact of the average maturity of public debt on economic dynamics**

Figure 10. **Differences in the fiscal space between France, Germany and Italy**



Greater or lesser fiscal spaces in European countries

We can also compare the fiscal policies of France, Germany and Italy by assuming that all three countries wish to stabilize their public debt/GDP ratio at the 2022 level, under our usual default assumptions. As we have seen, for France accomplishing this would imply an increase in the primary surplus and in the tax rate compared to their pre-Covid level. Conversely, Germany would be able to stabilize its debt with a zero primary surplus, well below its pre-Covid level, as the latter was particularly high there at 2.3% of GDP compared to 1.8% of GDP in Italy and -1.6% of GDP in France. In our simulation, this would result in a long-term reduction in compulsory taxes in Germany of about 1.5 GDP points. This illustrates the large fiscal space available to Germany. In order to stabilize its debt, Italy would have to return to a primary surplus of over 1% of GDP, slightly lower than its level before the Covid-19 crisis. Note that our default scenario remains quite optimistic about Italy's potential growth (0.9% according to AMECO's 2022 forecast), given the country's demographic outlook and the trend productivity growth observed over the past two decades. ■

Xavier Timbeau, Elliot Aurissergues, Éric Heyer, 2021, "Public debt in the 21st century: *An analysis of public debt dynamics with Debtwatch*", *OFCE Policy brief* 96, 22 October.

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