Public Debt Sustainability: Some Results on the French Case

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The views expressed in this paper are our own and do not necessarily reflect those of INSEE. Any remaining errors or omissions are our responsibility.

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Abstract

In France, government debt steadily rose from just below 20% of GDP in 1980 to more than 60% today. This raises concerns about the sustainability of public finances i.e. whether the government's intertemporal budget constraint can be satisfied without a major change in fiscal policy practices and orientations.

Public finance developments in France between 1978 and 2002 are found to be weakly sustainable. Contrary to a situation of strong sustainability, where, in the long run, changes in government revenues and spending match, there has been a persistent gap between public spending and revenues developments. The dynamics of public debt is captured by breaking down the growth of government debt into different components within a cointegrated VAR model. This enables us to identify the trends that explain the strong persistence in the growth

Keywords: government debt, intertemporal budget constraint, sustainability, cointegrated VAR model

La soutenabilité de la dette publique : 
Quelques résultats pour la France

Résumé

Depuis 1980, la dette publique française est passée d’un peu moins de 20% du PIB à plus de 60% aujourd’hui. Hormis durant la dernière phase de bonne conjoncture entre 1999 et 2001, cette progression a été continue. On peut se demander si cette évolution est soutenable, c’est à dire si l’Etat peut respecter sa contrainte de budget intertemporelle sans changer l’orientation de la politique budgétaire et ses pratiques.

Entre 1978 et 2002, la politique budgétaire a été faiblement soutenable. On observe un écart persistant entre les évolutions des recettes et des dépenses, à la différence d’une situation de soutenabilité forte dans laquelle ces évolutions se compensent exactement. En modélisant la dynamique de la dette publique dans un VAR cointégré, on peut identifier les tendances à l’origine de cette dérive (principalement, la faiblesse de la réaction des recettes aux évolutions des dépenses et un « effet boule de neige »).

Mots-clés : dette publique, contrainte de budget intertemporelle, soutenabilité, modèle VAR cointégré

Classification JEL : E61, E62, H62, H63
1 Introduction

Over the past thirty years, OECD countries have exhibited a pattern of persistent public deficits along with a strong increase in public indebtedness. This episode raises concerns about the sustainability of fiscal policies. The debate took a new turn with the creation of the Economic Monetary Union (EMU) in Europe and the implementation of the Stability and Growth Pact (SGP) that strictly constrains the conduct of fiscal policy for EMU member states. Indeed, many European countries (including Germany since 2001 and France since 2002) have crossed the 3% ”reference value” set for the public deficit/GDP ratio. Government debt has kept increasing, sometimes going beyond the 60% limit set for the debt/GDP ratio by the SGP.

When facing downturns in economic activity, using public deficits boosts spending in the short run and therefore helps smooth fluctuations and limit slowdowns. However, when these deficits lead to an accumulation of debt in the long run, public indebtedness can reduce domestic investment, thereby weakening growth. Although increasing aggregate demand in the short run and evicting domestic investment in the long run are probably the main effects of an increase in government debt, other effects exist, mainly unfavorable. Particularly, a growing debt may exert an upward pressure on long term interest rates, exacerbating the eviction of domestic investment and reducing future latitude in government fiscal policy through an increase of the debt burden. Eventually, inflationary and default risks are likely to raise as debt monetization and default emerge as possible options to stop debt accumulation.

A fiscal policy is said to be sustainable if no drastic policy shift is needed to satisfy the government’s intertemporal budget constraint. This constraint requires that current debt can be covered by future primary surpluses. It raises the question of whether the different components of public finance can keep going indefinitely on the basis of past trends or whether a change in the orientation of fiscal policy will be necessary. Finally, this has some implications on the macroeconomic context. Indeed, a non-sustainable fiscal policy leads to an increase in public indebtedness whose effects on invest-
ment, interest rate, inflation and, in fine, on growth are not neutral.

Achieving fiscal sustainability and, in the case of EMU, satisfying the SGP requirements (in particular the public debt/GDP ratio criterion), could require adjustments in order to correct fiscal imbalances. Studying the joint evolution, interdependences and causal relationships between public spending and revenues and public debt can help grasp with more precision how the budget constraint is satisfied and, if it is not the case, why it is so. Analyzing the dynamics of public finance is thus necessary for a complete sustainability diagnosis. In this paper, we address two issues concerning the debate on fiscal policy sustainability: evaluating fiscal policy sustainability and analyzing the dynamics of public finance over the last 25 years.

First, as regards sustainability assessment, economic literature adopts two main approaches. Earlier tests, following the works of Hamilton and Flavin (1986) and Wilcox (1989), focus on the order of integration of the public debt and deficit processes and characterize the sustainability of fiscal policy by the stationarity of the first difference of public debt or deficit. The second approach, taken by Trehan and Walsh (1988, 1991) and Hakkio and Rush (1991), consists in analyzing cointegration between public revenues and spending. More recently, for instance in Quintos (1995) or in Martin (2000), particular attention has been given to detecting regime shifts in the conduct of fiscal policy. Our paper applies these tests to French data and analyzes the sustainability of public finance over the 1978-2003 period.

Second, in order to analyze the dynamic evolution of public debt, we break down government debt and estimate the dynamics of public finance using a cointegrated VAR model with public revenue, primary spending, the interest burden and the "growth dividend"\(^1\). This aims to characterize the stochastic trends determining the dynamics of public finance and to analyze the interdependences between government spending and revenues. In this paper, we address these issues by identifying the VAR model’s response to public finance shocks.

The remaining of the paper is organized as follows. Section 2 describes...

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\(^1\)The "growth dividend" capture the effect of growth on the debt/GDP ratio, spontaneously reducing the ratio.
the history of government debt in France over the 1978-2003 period. The
evolution in France is then put in an European perspective. Section 3
presents the government’s intertemporal budget constraint, derives fiscal
sustainability conditions and discusses the different concepts used to char-
acterize the sustainability of public finance. Section 4 gives the results of
common sustainability tests applied to French data. In section 5, we model
the dynamics of public finance and analyze the main trends at work. Section
5 concludes.

2 Accounting for the Evolution of Public Debt

Throughout this paper, we use the concept of public debt as defined by
the Maastricht treaty. It corresponds to the public administrations’ financial
liabilities (public debt as defined by the French national accounts), to which
three main corrections are brought: the different public administrations are
consolidated, public debt is expressed in nominal terms and certain types
of indebtedness (e.g. commercial borrowing) are excluded. Appendix 1
provides a detailed presentation of the data used.

Public debt as defined by the Maastricht treaty is a gross debt, which
therefore does not include the government’s assets. Since these assets may
be sold in order to reimburse public debt, a net debt might have been a more
accurate definition. However, this latter definition requires calculating the
value of the assets, in particular that of public unlisted firms and properties.
Yet, between 1980 and 2003, the government debt/GDP ratio rose from 19% to 64%.
Over the same period, the value of financial and non-financial public
assets dropped slightly from 115% of GDP in 1980 to 95% of GDP in 2003,
reflecting the increase in public net indebtedness.

2.1 Public finance arithmetic

In order to understand the dynamics of public finances, one can start
from the government’s budget constraint for each period. The public deficit
is the difference between public revenues ($R_t$) and total public expenditures,
which consist of primary expenditures and debt service \((G_t + i_t B_{t-1})^2\).

Conceptually, the public deficit \((G_t + i_t B_{t-1} - R_t)\) is a flow equal to the variation of outstanding public debt \((\Delta B_t)\). Yet, in practice, there is sometimes a discrepancy between the change of public debt and the public deficit, which is due to some accounting adjustments (see Appendix 1). Setting this last term to zero, the accumulation identity of outstanding public debt is the following:

\[
B_t = B_{t-1} + G_t + i_t B_{t-1} - R_t \tag{1}
\]

As we focus on the debt/GDP ratio, we can rewrite this equation in the following way:

\[
\Delta b_t = (g_t - r_t) + \rho t b_{t-1} \tag{2}
\]

where lower case letters represent the corresponding variable as a ratio to GDP and where

\[
\rho_t = \frac{i_t - \gamma_t}{1 + \gamma_t} \approx i_t - \gamma_t \tag{3}
\]

can be understood as the addition to debt due to the excess of interest rate \((i_t)\) over the GDP growth rate \((\gamma_t)\), responsible for the snowball effect. Since equation (1) holds in nominal and in real terms, \(i_t\) and \(\gamma_t\) can either be both in real terms or in nominal terms. Inflation plays a role on debt dynamics only if there is a wedge between expected inflation and actual inflation\(^3\).

As is clear from equation (2) and (3), a high level of growth reduces the debt/GDP ratio by increasing the denominator of this ratio. The ratio decreases by \(-\gamma_t b_{t-1}\), the "growth dividend". This effect may be reinforced by an indirect channel of growth due to automatic stabilizers: higher growth brings more revenue and implies less public spending. This tends to improve

\(^2\)\(i_t\) corresponds to an average interest rate served on the debt as it accounts for different bonds of different maturities.

\(^3\)For example, economic agents underestimate the rate of inflation and ask for a lower real interest rate or on the contrary they ask for an inflation premium well above the actual level of inflation.
the primary deficit and further reduces the debt ratio. Changes in primary balance (due either to cyclical evolution or to structural changes) and in interest payment have straightforward effects.

2.2 An almost continuous increase in public debt

Figure 2 represents public debt variation over a given year and the contributions of the different elements that explain this growth. Note in this figure, the role of the “accounting adjustment” which tends to drive up debt. For instance, in 1982, the nationalization of a number of private banks and firms led to a public debt increase larger than the public deficit. As did the 1995 elimination of the one-month discrepancy for consumption tax reimbursements.

Using the decomposition presented in the previous section, we can distinguish five different phases in the rise of the public debt in the past twenty-five years.

Between 1978 and 1986, the debt ratio of French public administrations increased by 3.7% per year on average. Over this period, public spending increased strongly. In the early 80’s, the French government implemented a long-lasting expansionary fiscal stance.

The growth of public indebtedness slowed down between 1987 and 1991. Economic growth was stronger and interest rates were downward sloping, therefore reducing the interest burden of the public debt. Successive governments tried to control public spending and generate fiscal surpluses.

Between 1992 and 1997, the debt/GDP ratio started growing again at a particularly high rate (5.3% of the GDP per year). Facing a sharp recession (1993, a year of negative growth for the first time since 1945) and structural imbalances (particularly social security administrations’ deficits), the government reaction caused public spending to increase strongly. Public deficit peaked at a 6% of GDP high in 1993. Higher interest rates in the beginning of the period accentuated the burden of the public debt.

Since 1997 and until 2001, the debt/GDP ratio has stabilized just under the 60% threshold. Indeed, in order to satisfy the requirements for partic-
ipation in EMU from 1999 defined in the Maastricht treaty\textsuperscript{4}, the French government launched, in 1995, a public deficit reduction program, called "convergence program". In addition, the acceleration of economic growth, lower inflation and low interest rates also contributed to the alleviation of the public debt burden.

Over the most recent period, the public debt/GDP ratio increased by 1.8 points in 2002 and by 4.4 points the following year. French public debt now stands at almost 64% of GDP. Despite particularly low interest rates, the debt is increasing again as the government tried to cope with the global economic slowdown and since social spendings are increasingly high. The risk that the accelerating dynamics of debt turn out of control has become disturbing.

2.3 Where does France stand in Europe?

Optimism and benign neglect may lead to consider that the situation is, after all, not that worrying. Indeed, with a debt ratio of 63.7%, France is below the euro-zone average of 70% and well below the debt level of Italy, Belgium or Greece\textsuperscript{5} which are above 100%. However, after peaking between 110% and 140% of GDP in the early 1990’s, Italy and Belgium have managed to reduce their debt by more than 20 points. The debt ratio in France on the contrary has been almost continuously on the rise. The present position of France is all the more striking if considered in contrast to the situation in the early 1980s, when only the somewhat autarkic Spain and Greece had a smaller debt ratio.

\textsuperscript{4}In order to qualify for entry into EMU, the convergence criteria defined in the 1992 Maastricht treaty required member states to maintain public deficit below 3% of GDP and to significantly reduce the public debt/GDP ratio, bringing it under the 60% threshold. These criteria were made permanent in 1997 in the Stability and Growth Pact (SGP). The rationale for these criteria was founded in two main points. First, within a monetary union, the convergence criteria aim to prevent free-riding: one state’s public spending can have an individual direct positive effect, but can entail more diffuse costs (e.g. an increase in inflation) borne by the entire monetary union. Second, these criteria tend to encourage a healthy management of public finances, in particular in anticipation of spending to come due to the ageing of the European population.

\textsuperscript{5}This study used data available in September 2004. In November 2004, it appeared that the Greek data had been falsified since 1999.
Figure 3 represents the variation in public debt for some European countries over the past twenty five years.

Many countries have managed to contain or to reduce their debt ratio over the past 25 years. Austria and Portugal experienced a rapid rise in debt in the early 1980’s, but then have maintained their debt ratio around the 60% threshold. Spain and the United Kingdom engineered a substantial decline in their debt ratio, in the late 1990’s for the former and in the late 1980’s and then in the late 1990’s for the later. In 2003, all these countries have a debt ratio lower than that of France, except for Austria which is only a notch above France but on a downward path in the last three years.

The dynamics of French public debt is very close to that of Germany and especially so in the past ten years. France nonetheless experienced a more rapid rise of public debt in the 1980’s and did not suffer in the same way from the shock of German reunification - though the rise in interest rate in Germany did contribute to the slowdown in Europe around 1992-1993.

In the following sections, we analyze the dynamics of French public debt. Lack of appropriate data does not allow us to replicate the VAR methodology we use to analyze the French case on other European countries. However, using annual data and the simple accounting methodology presented in this section, we can provide some clues about the reasons for the rise in the debt ratio in France compared to the evolution in observed in other European countries. Table 1 presents the elements contributing to the evolution of the debt ratio.

Over the past twenty five years, the yearly increase in public debt in France was one of the highest in Europe, only behind that of Greece. Interest payment did not account for this ranking. The contribution of interest payment was one of the lowest and very close to the German one. A low initial level of debt in France and a relatively low interest rate, only 50 basis point on average over that of Germany, kept the burden of debt service under the European average. Neither should be blamed the adjustment term: the discrepancy between the debt increment and the deficit which

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6For simplicity, we do not distinguish between cyclical and structural elements as the cyclical effect is broadly neutral over the periods of interest.
tends to drive up the debt ratio stood in line with European average. Two factors contributed to the debt build-up: a lower contribution of growth and a primary balance that falls short from surpluses. The contribution of growth may reflect an initial lower debt ratio in the 1980’s and a relatively lower rate of growth in the 1990’s. At 1.8% on average since 1990, the annual rate of growth in above that of Germany and Italy. Nonetheless, the primary balance is probably the most relevant factor. As most European countries tended to have a small primary surplus, the primary deficit in France was the highest after that of Spain and Portugal.

If we focus on the 1990-2003 period, we find that the contribution of growth remained modest while that of interest payment was higher and that of the adjustment above the European average. Some smaller countries, such as Greece, Ireland or Portugal, benefited from the process of European integration with the convergence of interest rate, allowing them both to reduce debt service and to spur growth thanks to a lower cost of capital. These countries however have also adjusted their fiscal stance and have had a primary surplus on average since 1990. During this period, France is the only European country to have a primary deficit on average (albeit modest at 0.1% of GDP). Germany and the United Kingdom, which arrive next with a small primary surplus of 0.3 point of GDP, experienced however different economic situation, which the shock of reunification for Germany and a debt ratio some 10 points below for the United-Kingdom.

3 Public Debt Sustainability : Definition & Assessment Methodology

3.1 Defining sustainability

A sustainable fiscal policy is a policy that can be conducted forever without leading to “excessive” debt accumulation in the long run, i.e. to a level of debt that could not be covered by future surplus, thus ruling out “Ponzi games”, defaults and major shifts in the fiscal stance (tax increase and/or budgetary cuts). While sustainability primarily qualifies a given
fiscal policy and its future consequences, in a broader sense, we use this concept to qualify the observed fiscal developments over the last twenty-five years.

Sustainability should be distinguished from solvency. Solvency characterizes the ability of a state to meet its commitments, regardless of the way this is achieved. Concluding that a state is not immediately solvent leads to a public finances crisis, usually ending with a default on public debt and/or hyper inflation.

Sustainability characterizes a state which is solvent without requiring any fiscal adjustment. Concluding that public finances are not on a sustainable path does not mean that debt crisis is inevitable but rather that, sooner or later, fiscal shifts would be necessary to ensure solvency. Whereas solvency concerns government “financial health”, sustainability rather concerns the consistency of its current fiscal policy.

3.2 Sustainability criteria

The intuition of sustainability is rather clear, yet defining sustainability and deriving testable criteria is less straightforward. As stated in the introduction, the definition of sustainability used here refers to the fulfillment of government’s intertemporal budget constraint. At period $t$, the government budget constraint is:

$$\Delta b_t = (g_t - r_t) + \rho_t b_{t-1}$$  \hspace{1cm} (4)

Working with variables scaled by GDP allows us to focus on debt dynamics. Indeed, all these variables in real terms show an upward trend if the economy shows a similar pattern.

Assuming that $\rho_t$ is constant and positive\textsuperscript{7} and solving (4) forward, the intertemporal budget constraint can be written as:

\textsuperscript{7}This can be extended to the case where $\rho_t$ is stationary with positive expectation, see Quintos (1995) for further details. Note that if $\rho_t$ were negative, the deficit process would be sustainable and the analysis would not be of much relevance.
\[ b_t = \sum_{s=0}^{\infty} \frac{r_{t+s} - g_{t+s}}{(1 + \rho)^{t+s}} + \lim_{s \to \infty} \frac{b_{t+s+1}}{(1 + \rho)^{t+s}} \]  

Equations (4) and (5) cannot be subject to controversy for they only summarize an accounting identity. Following Hamilton and Flavin (1986), we focus on the expected behavior of the "bubble term" in (5). Taking expectation in this equation gives:

\[ b_t = E_t \sum_{s=0}^{\infty} \frac{r_{t+s} - g_{t+s}}{(1 + \rho)^{t+s}} + E_t \lim_{s \to \infty} \frac{b_{t+s+1}}{(1 + \rho)^{t+s}} \]  

Sustainability is satisfied if, and only if, current debt is expected to be covered by future primary surpluses, \( i.e. \)

\[ b_t = E_t \sum_{s=0}^{\infty} \frac{r_{t+s} - g_{t+s}}{(1 + \rho)^{t+s}} \]  

which is mathematically equivalent to the transversality condition:

\[ \lim_{s \to \infty} E_t \frac{b_{t+s+1}}{(1 + \rho)^{t+s}} = 0 \]  

From these sustainability criteria, relevant economic literature provides two main types of sustainability tests, unit root tests and cointegration tests.

From (8), it is clear that the stationnarity of the debt/GDP ratio is a sufficient condition for sustainability. Such a condition insures the respect of the transversality condition.

An other sufficient condition for sustainability is the stationnarity of the first difference of the debt/GDP ratio. Among others, Hamilton and Flavin (1986) and Wilcox (1986) assess sustainability by testing the stationarity of \( \Delta b_t \). Similarly, one can test the order of integration of public debt (which must be at most I(1)), or of public deficit (which must be stationary).

The stationarity conditions used above are only sufficient conditions for sustainability, but not necessary ones. Hakkio and Rush (1991) and Quin-
tos (1995) give less restrictive testable conditions for sustainability. Following Quintos (1995), we can define two concepts, "strong sustainability" and "weak sustainability", based on the relationship between public revenues and total public expenditures.

For both strong and weak sustainability, public revenues and total expenditures must be cointegrated. Consider the following relationship between revenues and expenditures:

$$ r_t = \alpha + \beta g_t^T + \varepsilon_t $$  \hspace{1cm} (9)

where $g_t^T$ represents total public expenditures, i.e. the sum of both primary expenditures and debt service ($y_t + \rho_t b_t$), and where $\varepsilon_t$ is a random term of expectation zero presenting no persistence. Three situations are then possible:

- **strong sustainability**: revenues and expenditures are cointegrated with cointegrating vector $(1, -\beta) = (1, -1)$. This is a sufficient condition for sustainability, which corresponds to the condition on the order of integration of debt or deficit proposed by Hamilton and Flavin (1986).

- **weak sustainability**: revenues and expenditures are cointegrated, but the cointegrating vector is $(1, -\beta)$, with $0 < \beta < 1$. Public spending increases faster than revenues but since $\Delta b_t$ is $I(1)$, its variance grows as $\sqrt{T}$ and

$$ \lim_{s \to \infty} E_t \frac{b_{t+s+1}}{(1 + \rho)^{t+s}} = 0 $$

The transversality condition is thus verified since the discounting term decreases faster than the increase in $b_t$.

- **no sustainability**: if revenues and expenditures are not cointegrated and if the growth rate of the debt is higher than $\rho_t$, public debt is not sustainable.

It is noteworthy to stress that these notions remain theoretical. For instance, "weak sustainability" supposes that the debt/GDP ratio does not influence the macroeconomic context. However, strong indebtedness can put
upward pressure on interest rates and have unfavorable effects on growth. Therefore, it can be more prudent to use the more restrictive stability constraint when assessing fiscal sustainability. Or at least to keep in mind the underlying assumptions used to defined these concepts.

4 Assessing Public Debt Sustainability: Preliminary Tests

Definitions of the data and descriptions of the data manipulations used in the following sections are detailed in Appendix 1.

4.1 Unit root tests

We give here a preliminary assessment of the "strong sustainability" of fiscal policy in France over the 1978-2002 period using unit root tests (see Appendix 2).

According to these tests, the deficit serie is I(1), which leads us to reject the strong sustainability hypothesis. Identical tests carried out on $\Delta b_t$ generally also lead to the rejection of the same hypothesis. Note that these two tests, although conceptually equivalent, correspond, in practice, to two different series (due to the presence of the accounting adjustment term). Conclusions based on the behavior of $\Delta b_t$ do not characterize fiscal policy \textit{stricto sensu}, but the movements in public debt, including purely financial ones.

Therefore, although the tests allow us to conclude without doubt that the debt series is non stationary, conclusions concerning sustainability are less accurate. These results still tend to reject the strong sustainability constraint. Indeed, even if financial flows can have an influence on outstanding public debt, the main cause for non-sustainability seems to be the non-stationarity of public deficit.
4.2 Cointegration test

Cointegration tests are also carried out on the same data. A simple VAR bivariate model using "public revenues" ($r_t$) and "total public expenditures" ($g_T^T$) is estimated following Johansen method. On the basis of common tests, we estimate a cointegrated VAR with three lags and a linear intercept which reflects the increase in public revenues and expenditures over the past twenty-five years.

The analysis shows that fiscal policy in France has been, at best "weakly sustainable": the two variables are cointegrated and the value for the cointegrating coefficient $\beta = 0.24$ while the test of the constraint $\beta = 1$ always rejects strong sustainability.

Moreover, used as a quick way to detect a possible stability break, a recursive estimation of the cointegrating vector over successively longer periods shows a decrease in the coefficient $\beta$ starting in 1992, and then a rise from 1995. Efforts made to increase public revenues only start to pay in 1996.

Fiscal policy in France over the past twenty-five years was therefore not consistent with strong sustainability. The value for $\beta$ is particularly low, compared to that obtained for the United States\(^9\) or for other European countries\(^10\). However the estimation period seems to matter for these results\(^11\). During our estimation period (1978-2002) in France, public deficits increased, whereas previously it was common to periodically release public surpluses. The long-run relationship between public revenues and expenditures has plausibly deteriorated in the recent past.

5 Understanding Public Debt Dynamics

The tests of the previous section lead to conclude that the dynamics of French public debt in France is not consistent with strong sustainability. However, they do not allow us to understand why the debt ratio deviates

\(^9\)0.6-0.8, see Quintos (1995) and Crowder (1997).

\(^10\)0.7 in Spain, see De Castro, Gonzà les-Parmo and Hernandès De Cos (2001).

\(^11\)For instance, De Castro et al. carry out their estimation on the 1964-1998 period.
from the sustainable path. To provide some answers, we use a more comprehensive model of public debt dynamics. This model helps us to identify the trends that led the drift of public finance.

5.1 Model specification

Six variables are considered: $b_t$, the government debt, $r_t$, the total revenues of the government, $g_t$, the primary expenditures of the government, $id_t$, the debt service, $res_t$, the "growth dividend" (capturing the effect of growth on the debt ratio) and $adj_t$, the adjustment term due to changes in the financial account of the government. As in the preliminary assessment, all these variables are expressed as a ratio to GDP. We specify a VAR model which allows to take into account the order of integration of the variables as well as any possible long-run relation between them.

The variables are linked by the following identity equation:

$$\Delta b_t = g_t + id_t - r_t - res_t + adj_t$$

(10)

According to univariate tests the debt ratio is presumably a I(2) process. This hypothesis is confirmed by multivariate tests, when all variables (except the adjustment term) are encompassed in a VAR model. For these reasons, we choose to focus on variables which are presumably I(1), from which the variation of debt is deduced using the relation (10). The full model is thus given by the following vector:

$$(g_t, id_t, r_t, res_t, adj_t)$$

The long-run cointegrating relationships are estimated following Johansen (1991, 1994). We subject our VAR model to a number of specification tests. The regression features an intercept in the long-run relations but no linear trend. The intercept is restricted to belong to the cointegration space and has no influence on the growth of the variables. Indeed, such a specification would imply an exogenous deterministic drift of the level of all variables, which would hamper our understanding of the very trends that lead to the
drift of public finances.

The lag length used to whiten the residuals is chosen on the basis of a battery of information criteria\(^\text{12}\). These tests, however, offer conflicting results on the optimal lag length. Eventually, based on other properties of the VAR model (e.g. normality of the residuals), we choose a lag-length of six (hence five lags for the VAR in difference). This reflects the quarterly nature of our series and is consistent with the expected dynamics of public finances (in particular yearly budgeting).

Eventually, the residuals obtained by this model are checked for autocorrelation (Box-Pierce test) and for white noise (Bera-Jarque test). Both tests are satisfied when adding a single dummy for the third quarter of 1983 (see Appendix 3).

5.2 Cointegrating relations and stochastic trends

The next step consists in identifying the number of cointegrating relations. The results of the trace and eigenvalue tests are reported in Appendix 4. These tests suggest the existence of two cointegrating relations in the system. This result is particularly robust to changes in the lag length of the VAR as the tests return the same number of long-run relations when restricting the number of lags down to three or expanding it up to seven. The VAR model presents two cointegrating relations and three stochastic trends. The cointegrating relations correspond to a vectorial basis of the cointegrating space and cannot be interpreted directly in terms of economic significance unless further restrictions are imposed on the model.

The direct interpretation of the long-run relations turn out to be challenging. We found that none of the variables can be excluded from the long-run cointegration space and none could be considered stationary over the sample period. These results are in line with those of univariate tests. However, we could not impose further restriction on the model.

To interpret the nature of the three stochastic trends driving the model, we study the impulse response functions. To identify the shocks, we assume

\(^\text{12}\)The Schwarz Bayesian information criterion (BIC) as well as the criteria of Akaike (AIC) and Hannan-Quinn (AH) (see Appendix 3).
a recursive structure for these shocks. The order in which an unexpected shock on one variable influences the other is assumed to be the following:

\[ res_t \Rightarrow g_t \Rightarrow r_t \Rightarrow id_t \Rightarrow adj_t \]

Let us consider for example a negative unexpected output shock. We assume that this shock on output (measured indirectly by the term \( res_t \) which combines the level of the debt and the growth of GDP) is not influenced contemporaneously by any other variables but influence all the other variables in the model. In addition to the effect of automatic stabilizers, the government can decide to raise public expenditures to provide a buffer against the recession. Besides, the government will decide whether or not to finance this increase in public expenditures. This decision, along with the effect of automatic stabilizers on the revenues side, will determine the evolution of public revenues. The increase in expenditures and the decrease in revenues then feed into fiscal deficit and public debt and may raise debt service if the interest rate is constant. A countercyclical monetary policy (leading to a decline in the interest rate) should have a more limited impact. Eventually, we decide to assign the last position in our structural interpretation of the VAR to the adjustment term.

Figure 5 provides figures of the effect of a shock of one standard deviation in the recursive VAR. To make the interpretation of the impulse response clearer, we reconstructed a debt series using the debt accumulation identity of equation (10). This series helps us to analyze a shock on \( res_t \) as a shock on the rate of growth of GDP and a shock on \( id_t \) as a shock on the interest rate.

This analysis allows us to distinguish three main trends that drive the increase in French public debt.

- The model presents a bias towards fiscal deficit, as a shock on expenditure does not lead to an offsetting rise of revenues of the same amplitude. Indeed, a 1 point of GDP shock of primary expenditures leads, after five years, to a rise of 3 points of GDP. This may be explained by the gradual nature of the implementation of a particular
measure. The effect on revenues is not significant during the first three years. Moreover, after five years, the rise in revenues only offsets half of the effect of the expenditure shock: the deviation of revenues is only of 1.5 point of GDP. This persistent imbalance leads to increasing fiscal deficit and rising debt services. All in all, the overall effect on the debt level is of 12 points over a five year horizon. When comparing a standard expenditure shock to a revenue shock, the results are strikingly dissimilar. The impacts of revenue shocks have a more limited time span and seem to give rise to a small albeit less significant decline in debt service. The dynamics of debt is partly driven by this bias towards persistent fiscal deficits.

- Shocks on the interest rate (measured by a shock on debt service) also seems to be persistent and self-sustained. A 100 basis point rise in interest rate leads to a 7 points increase in the debt to GDP ratio over five years. This effect is however less significant than the autonomous drift in expenditures presented above. Furthermore, this effect is present in the model even though the interest rate has declined substantially over the past two decades.

- Eventually the debt ratio is also influenced by specific one-off operations on the financial account of the government. One should note however that the accounting adjustment term tends to be positive on average over the period and is sometimes reasonably high. Hence, it provides a further cause of the drift of public debt. A rise of 1 point of GDP in the adjustment term leads, after five years, to a rise in the debt level of 10 point of GDP.

6 Concluding Remarks

In this paper, we address two issues, the sustainability of public finances over the past twenty-five years in France and the underlying causes of the drift of public debt. Our findings can be summarized as follows.
Since 1980, the dynamics of public debt has been at best weakly sustainable. Three main reasons stand out to explain this result. First, expenditure shocks only give rise to a smaller offsetting rise in revenues in the long run. This result is confirmed by both impulse response functions of the VAR model and by the bivariate analysis of the cointegration between revenues and primary expenditures. Second, any rise in the debt level tends to be persistent, in particular because of a snowball effect through the debt interest burden. Third, the discrepancy between the first difference of the debt and the fiscal deficit tends to be persistent and sometimes quite large.

This situation of weak sustainability can become worrying as the debt level can affect the macroeconomic environment. Weak sustainability assumes that this very environment is not affected by the level of debt, a somehow heroic hypothesis for very high levels of debt. In particular, a rising debt level may depress growth or may feed up into a rising cost of borrowing. Interest rate hikes would have a further downward effect on growth.

This situation may become all the more problematic given the current constraints on policymaking. In particular, the SGP restricts fiscal policy while the devolution of monetary policy to the ECB forbids debt monetization, the previously favored solution to get rid of the debt overhang. With this in mind, the only way to solve the debt problem is the "virtuous" path of fiscal consolidation. This requires scaling down expenditures or matching them with offsetting revenues.

Any conclusions derived from these results should bear in mind the limitation of the analysis. The model reflects the average behavior of the data considered over the past 25 years although this behavior may have changed during the period. Besides, the evolution of some structural factors such as demographic trends and their impact on public finances are not taken into account. However, these added pressures on public finances should make fiscal consolidation all the more probable in the near future.
References


Table 1: Contributions to debt evolution in European countries (average annual growth rate)

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Source: Eurostat, author’s calculations.
Figure 1: Public finances (% GDP)

Figure 2: Contribution to public debt evolution
Figure 3: Public debt in European countries (% GDP)

Figure 4: β recursive estimate
Figure 5: VAR model, impulse response functions
Appendix 1: Definition and Description of the Data

Definitions

Fiscal deficit is (theoretically) equal to the first difference of outstanding public debt. It is also equal to the difference between public revenues $R_t$ and total public expenditures (equal to primary expenditures $G_t$ and debt service $i_t B_{t-1}$. The debt accumulation equation can thus be written as follows:

$$\Delta B_t = (G_t + i_t B_{t-1}) - R_t = (G_t - R_t) + i_t B_{t-1}$$

Government debt as defined in the notification to the European Commission consists in gross government debt. In particular, government assets such as the assets of the Treasury deposits at the Central Bank, public ownership of corporate firms and other equity items are not included. As these assets can be sold in order to reimburse the debt, a net measurement of public debt may reflect more accurately the situation of public finances. However, it is also difficult properly evaluate the value of these assets (see in particular the case of corporate firms which shares are not present on stock markets or of public buildings belonging to the national heritage).

Government debt notified to the European Commission is distinct from government debt as published in the National Accounts for three reasons:

- the debt is netted out between different sections of the general government, such as the central government, the central bank or local government.

- the level of debt is measured at its book value and not at its market value. The accounting principle is justified inasmuch as it allows to match the level of debt to its value at time of repayment. It also simplifies the comparison between stocks and flows as it does not require to account for a change in prices from one year to another.

- some form of borrowing such as commercial borrowing are excluding. All countries do not have reliable data on such items.

Fiscal deficit is the balance of the non-financial account of the government sector.
Debt service includes interest payments on negotiable debt, which accounts for 90% of French public debt, interest payments on non-negotiable debt, as well as administrative costs related to the management of public debt. Debt service and the level of debt outstanding enable the calculation of the average level of interest rate served on the debt.

Accounting adjustments are to be made. In practice, the fiscal deficit is not absolutely equal to the first difference of the outstanding public debt. This discrepancy, which can be quite large, can be explained by some changes in the size of the government sector (such as the nationalization of a number of French banks in 1982), by some one-offadjustments (such as the end of the delay of one month for repaying VAT to the retail and wholesale sector in 1995) or more frequently, though on a smaller scale, by public transactions in financial assets (for example, the government can issue more debt than needed to finance its fiscal deficit, which would lead to an increase of the stock of debt). This adjustment is integrated of order 1 and on average positive. Its impact on the evolution of the debt may not be negligible.

Data

Most data have been derived from the National Accounts either on an annual or on a quarterly basis. The period covered ranges from 1978Q1 to 2002Q4.

All variables used in the VAR model are measured as a ratio to GDP. This enables the canceling out of the effect of the growth of GDP. We also consider that a debt/GDP ratio makes more sense for assessing the sustainability of public finances as the level of debt is scaled by the capacity of the nation to produce wealth. The variables of interest are the followings:

- $b_t$ the government debt as defined in the notification to the European Commission,

- $r_t$ the total revenues of the government,

- $g_t$ the primary expenditures of the government,

- $id_t$ the debt service,
- $res_t$ the effect of growth on debt outstanding,

- $adj_t$ the adjustment term due to changes in the financial account of the government.

Total revenues and primary expenditures are constructed by aggregating quarterly data from the national accounts. Our aggregates are consistent with those published on an annual basis by the European Commission.

The outstanding public debt is only available on an annual basis. Furthermore, the debt service is available on a quarterly basis but this time series reflects more national accountants construction hypothesis than the real impact of economic variables. Indeed it linearly increases from the first to the last quarter of the year. For this reasons, both series have been reconstructed using an iterative procedure.

In a first step, new data for debt service are constructed using the method proposed by Chow and Lin (1976). The indicator we consider is the long run (10 year) interest rate, itself a weighted average. The new time series then allow us to construct new data for the fiscal balance and eventually a first estimate of outstanding debt. In a second step, a second series for debt service is constructed, using as indicator the long run interest rate times outstanding debt. A second estimate of the fiscal balance and of the debt outstanding can finally be deduced from these new data.

Finally, $res_t$ and $adj_t$ are deduced from the above variables.
Appendix 2: Stationarity & Cointegration Tests
<table>
<thead>
<tr>
<th>variable</th>
<th>order of int.</th>
<th>level</th>
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<td></td>
<td>ADF</td>
<td>SP</td>
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<td>-9.76</td>
<td>0.89</td>
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<td>-8.75</td>
<td>1.75</td>
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<td>1.73</td>
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<td>$adj_t$</td>
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<td>-9.30</td>
<td>1.06</td>
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Upper case letters denote nominal variables, lower case letters denote the corresponding variable as a ratio to GDP.

* (**) denotes the rejection of the null hypothesis (non stationarity) at the 5% level (1%).

ADF test: the critical value at 1% is -3.49 (it is -2.89 at 5%).

SP test: the critical value at 1% is -25.2 (-18.1 at 5%).

†(††) denotes the rejection of the null hypothesis (stationarity) at the 5% level (1%).

KPSS test: the critical value at 1% is 0.74 (0.46 at 5%).
### Table 3: Number of cointegration relations in the VAR model \((r_t, G_t^T)\)

<table>
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<tr>
<th></th>
<th>Eigenvalue test</th>
<th>Test stat. (5%)</th>
<th>Trace test</th>
<th>Test stat. (5%)</th>
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<td>(d \leq 0)</td>
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\(d\): number of cointegration relations.

### Table 4: Restriction testing in the VAR model \((r_t, G_t^T)\)

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<td>11.871</td>
<td>0.001</td>
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A restriction is accepted if the probability is above 5%.
Appendix 3: VAR Model
Figure 6: Time series (level & 1st difference, % GDP)
Table 5: Specification tests in the VAR model \((g_t, id_t, r_t, res_t, adj_t)\)

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<td>(adj_t)</td>
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Table 6: Information criteria

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Table 7: Number of cointegration relations

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\(d\): number of cointegration relations.

Table 8: Cointegration relations

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Note: the cointegrating vectors are scaled by the coefficient on \(r_t\).