THE RELEVANCE OF CYCLICALLY-ADJUSTED PUBLIC BALANCE INDICATORS - THE FRENCH CASE

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1. Introduction

Variations in the budget deficit can give a misleading picture of the fiscal stance. This is especially the case during upswings, when an improvement of fiscal balance may mask a deterioration in the underlying position of public finances (the traditional problem of «bad policies in good times»). This is why there is a need to adjust the budget balance for the position of the economy in the business cycle. Traditionally a highly sensitive issue, the evaluation of a cyclically-adjusted or so-called structural deficit is bound to become more important in the Euro zone, where budgetary positions have to be «close to balance or in surplus» under normal conditions.

Unfortunately, the estimation of the structural deficit is subject to wide margins of uncertainty. For example, evaluations of the French «structural» deficit for 1997 by international organizations range from 0.8% of GDP for the IMF to 1.7% for the OECD and 2.3% for the European Commission. Traditional methods cumulate uncertainties related to the evaluation of the size of the output gap (i.e. deviations of GDP from its potential level) and uncertainties related to the sensitivity of the budget balance to fluctuations in economic activity.

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[1] The views expressed are those of the authors. They do not necessarily reflect official positions of the Banque de France. The authors gratefully acknowledge Sophie Garcia's helpful comments.

In a first section, we highlight the ambiguities attached to the concept of «structural» deficit. In fact, the so-called structural deficit is usually no more than a budget deficit corrected for the impact of the output gap. It provides a rough evaluation of the current fiscal stance but is a relatively poor indicator of the medium-term sustainability of fiscal policy.

In the second section, we discuss the two-step methods used, among others, by international organisations: first an evaluation of potential GDP based on a Hodrick-Prescott filter or a production function; then an evaluation of the public balance which would prevail if GDP was at its potential level.

In the third section, we describe our own two-step methodology. An alternative estimate of structural balance given by a structural VAR model does not invalidate the results obtained by the two step methodology.

2. Relevance and ambiguities attached to a structural budget balance indicator

Contrary to Blanchard's assertions[2], the concept of a structural balance is neither as simple nor as unambiguous as it may seem. The so-called structural deficit is usually estimated by stripping out the influence of the position in the business cycle from the effective deficit. However, defining such a cyclically-adjusted balance as «structural» is somewhat misleading as it neglects the influence of other key macroeconomic variables such as inflation and interest rates and may incorporate one-off or temporary measures.

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[2] «The construction of such an indicator *(an indicator of discretionary fiscal policy)* presents no conceptual and few empirical difficulties. It requires a benchmark and a set of elasticites». In Blanchard O. (1990). «Suggestions for a new set of fiscal indicators», OECD Working Paper No. 79, April.

A) *A comprehensive cyclical adjustment should remove the influence of cyclical variations in interest rates and inflation as well as the deviations of effective GDP from its potential level*

Changes in interest rates affect the budget balance through different channels. For example, a transitory fall in interest rates in the downside of the business cycle results in: 1) an increase in GDP and tax revenues ; 2) a reduction in the cost of servicing the existing public debt ; 3) possibly, an increase in primary spending if the government takes advantage of lower interest payments to increase some expenditure items such as public investment.

Cyclically-adjusted balances remove the influence of interest rates changes on the output gap and the tax revenues, but they implicitly incorporate changes in interest payments (possibly offset by a discretionary increase in primary spending). This implies that the evaluation of structural deficit may be underestimated during a slowdown. During the following upswing, a less accommodative monetary stance will mechanically lead to a rise in interest payments and hence in the structural deficit.

Three different problems arise regarding inflation.

First, expenditures and revenues are not necessarily indexed on the same prices. Revenues are predominantly indexed on GDP prices, expenditures on consumer prices. As long as there is no import price shock, the net effect on the deficit is neutral. However, in the event of a favourable terms of trade shock, consumer prices will fall relatively to GDP prices and expenditures will rise by less than revenues. The deficit will improve.

Secondly, even if expenditures and revenues are indexed on the same deflator, a distortion can appear because expenditures are indexed on expected inflation while revenues depend on actual inflation. If an unexpected price shock occurs, revenues are mechanically affected while expenditures exhibit nominal rigidity, i.e. they cannot be easily modified within the year. The conclusion drawn earlier in the case of a favorable terms of trade shock may no longer be valid: if the shock was unexpected, the fall in consumer prices may not induce a parallel shift in nominal expenditures.

Third, there is no reason for revenues and expenditures to exhibit the same degree of price indexation. Presumably some expenditure items

can be de-indexed, at least for a while, whereas revenues are more mechanically linked to price inflation.

Overall, removing the influence of changes in inflation is particularly tricky, given that the impact of price shocks may differ considerably according to whether they are expected or unexpected (see box 1).

B) *The structural balance provides a very rough measure of the sustainability of fiscal policy over the medium term*

A cyclically adjusted balance is a mixture of very different items. Besides recurrent expenditures, it may include some temporary measures, aimed for example at recapitalizing the banking sector or activating labor market policies.

Moreover, cyclically-adjusted balances may mask the underlying trend increase or decrease of some permanent spending items. For example, a permanent shift in the average cost of debt (induced for example by a fall in the risk premium) may provide a structural improvement. If this is the case, the cyclically-adjusted deficit underestimates the sustainability of fiscal policy. By contrast, an improvement in the cyclically-adjusted deficit may be only temporary if social transfers are bound to increase because of aging population.

Therefore, a cyclically-adjusted balance calculated at any point of time is a relatively poor index of the trend in public finances and of the sustainability of fiscal policy. Ideally, a comprehensive structural balance should exclude one-off or temporary measures. However, it is very difficult to disentangle ex-ante permanent and transitory measure, insofar as a measure initially regarded as temporary can prove to be permanent.

3. Advantages and limitations of two-step approaches

Most economic institutes have developed a cyclically-adjusted budget balance indicator to remove the impact of automatic stabilizers and identify changes resulting from discretionary fiscal policy. This indicator gives an assessment of the current fiscal stance.

The indicator can be constructed using a wide variety of techniques, most of them based on a reference economic scenario,

Box 1. The impact of a variation in inflation on the French budget balance - an assessment

The effect of a fall in inflation on the budget balance differs considerably according to whether the inflation shock is anticipated or is the result of an unexpected event.

❶ An anticipated fall in inflation improves the budget balance because the average cost of the public debt diminishes.

On first approximation, public expenditures excluding interests are indexed, by law or *de facto*, on inflation. Tax revenues also vary in line with inflation. An anticipated fall in inflation thus has a neutral effect on the primary balance. Interest payments on the public debt are reduced as a result of lower nominal interest rates. A one percentage point decline in inflation is likely to reduce the amount of interest by 0.6% of GDP once the average cost of the debt has been entirely adjusted for the fall in inflation, i.e. after six years (a reduction of 100 basis points applied to a stock of debt close to 60% of GDP).

Anticipated lower inflation can improve the primary budget balance if it becomes negligible enough to attenuate demands for index-linking, meaning that it becomes possible for a certain number of benefits not to be increased each year. In contrast, it may cause a deterioration of the primary balance because of the nominal rigidity of certain items of public expenditures.

❷ A non-anticipated fall in inflation causes a deterioration in the budget balance because expenditures cannot be adjusted immediately.

Most expenditures are to all intents and purposes inert since they are budgeted according to anticipated inflation. By contrast, a substantial proportion of revenues are indexed downwards, although the extent to which revenues are indexed on contemporary inflation varies. Although VAT is entirely indexed on inflation, social security contributions are only partially indexed because wages are determined according to both past and anticipated inflation. Likewise, direct taxes are not indexed on contemporary inflation. If inflation is overestimated, the only consequence is an over-adjustment of personal income tax brackets. Corporate income tax, paid in advance on the basis of the previous year's profits and netted out at the end of the year, is not affected. Excise revenues rise in the event of a non-anticipated fall in inflation because tariffs are applied on a volume basis: an overestimation of inflation therefore leads to a rise in the real rate of taxation.

Overall, a one percentage point unexpected fall in inflation leads to a 0.2% GDP deterioration in the budget balance. This evaluation is given before taking macroeconomic factors into account. To be comprehensive, consideration should also be given to the nature of the shocks. Insofar as a non-anticipated fall in inflation is caused by a favourable supply shock, the negative impact of lower inflation is offset by the additional activity generated by improved terms of trade. If it is caused by an unfavourable demand shock, the decline in activity amplifies the effects of lower inflation.

In practice, the cost of an anticipation error is reversible to only a very small extent and remains as in the series of future deficits, since there are very few automatic correction mechanisms for errors in inflation forecasts.

usually potential GDP or trend GDP. The two-step methodologies used by the OECD, the IMF, the European Commission and other institutes are well known. The first step consists in estimating the output gap, the second step in stripping out its influence on the public deficit. In this section, we briefly highlight the theoretical and empirical strengths and weaknesses of each of them.

A) *First step: estimating the output gap*

There are two types of methods for estimating the output gap: those based on smoothing or filtering techniques and those based on a production function. In practice however, the differences between them are relatively slight, except at the end of the sample.

This is hardly surprising, as in the first case, the HP filter is directly applied to GDP and in the second case the HP filter is used widely at various stages of the procedure to detrend the main inputs of the production function (unemployment rate, participation rate, total factor productivity gains, etc.).

A-1) The Hodrick-Prescott filter

There are several alternative methods for evaluating potential GDP and the output gap. Among the statistical methods that break down time series into a cyclical component, a trend and residuals, filtering methods are more widely used than the Beveridge-Nelson (1981) evaluation (using a VAR approach) or the unobservable components model (see Harvey, 1985).

The HP filter is both simple and transparent and does not require any subjective economic judgments[3]. Most of the time this filter,

[3] This filter arbitrates between the smoothness of the filtered series and its proximity with the initial series, according to the value of the parameter λ.

$$\underset{\{x_t^*\}_{t=1}^{N}}{Min} \sum_{t=1}^{N} \varepsilon_t^2 + \lambda \sum_{t=3}^{N} \left[\left(x_t^* - x_{t-1}^* \right) - \left(x_{t-1}^* - x_{t-2}^* \right) \right]^2$$

(continues)

operating almost like an infinite moving average, is a good approximation of a high-pass filter when applied to stationary time series. It extracts the relevant business-cycle frequencies of output (business cycle as defined by Burns and Mitchell (1946), i.e. cycles lasting no more than thirty-two quarters and no fewer than six). To be efficient, however, the HP filter must be applied to series dominated by high frequencies, with a spectrum presenting a peak located at usual business cycle frequencies, and these frequencies must account for an important part of the variance of the series.

The trend and the cycle, being driven by the same stochastic innovations, are not independent. Consequently, the trend estimated by a Hodrick-Prescott filter has no specific economic properties, in particular, it should not be regarded as an economic policy objective. The main assumption concerns the value assigned to the parameter λ which determines the extent to which the variability of the series is allocated to the trend or to the cycle. Obviously, there is no theoretical basis to justify the choice of a specific value of λ, which is a matter of judgment. As the deduced output gap fluctuates to a greater or lesser extent, the structural deficit will also be more or less variable.

Another limitation is that the HP filter behaves differently at the end of sample and at mid-sample. Acting like an infinite moving average, the filter cannot operate satisfactorily at the end of sample. By construction, the output gap is on average equal to zero. Therefore, the last available data are overweighed and the trend is very close to the last points of the actual series. For example, if the end of the sample is characterized by a recession, the estimated trend will be lower.

Lastly, the method is more robust for dating turning points than for determining the length of cycles. There is in particular a risk that the

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subject to $\varepsilon_t = x_t - x_t^*$ where x_t the actual series and x_t^* the filtered series.

When λ = 0, the smoothed series is equal to the actual series and all the volatility of the series is incorporated into the trend component. The larger the value of λ, the smoother the filtered series. As λ approaches infinity, the fitted series corresponds to a linear time trend.

filter may isolate spurious cycles with a length close to that of usual business cycles («the Slutsky-Yule effect»).

A-2) The production function approach

Some institutions use a production function[4] to calculate potential GDP. In that case, the reference is the level of GDP consistent with full employment of factors of production and stable wage or price inflation. This method is appealing because it is based on explicit economic assumptions concerning «equilibrium» unemployment and «normal» utilization of capacities. Therefore, this approach makes it possible to distinguish between supply shocks (with permanent effects on the level of GDP) and demand shocks (with only temporary effects on the level of GDP, except in the case of hysteresis).

While the statistical methods impose a long-term identity between effective and trend output, the production function approach makes it possible to test it. At the end of the sample, the HP trend is very close to the last points of the actual GDP. The production function by contrast provides an opportunity to assume the occurrence of a supply shock in recent years.

Rising and persistently high levels of unemployment in continental Europe complicates the use of production functions. The equilibrium unemployment rate is defined as the unemployment rate[5] which guarantees the same medium-term real wage and labour productivity trends, i.e. stable inflation and constant income shares. It is assumed to be stationary so that GDP does not deviate from the potential output in the medium term. In France, however, as in other European countries,

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4 The OECD and the IMF estimate the potential GDP by using an aggregate Cobb-Douglas constant return-to-scale production function.

5 The equilibrium unemployment rate is usually evaluated by a Phillips curve estimation. Evaluations of NAIRU or NAWRU given by international organisations for 1988 run from 11.2 for the IMF and 9.0 for the OECD to 7.7 for the European Commission. The effective unemployment rate was about 10% in 1988.

See: LeBihan, Sterdiniak and Cour (1998).

both the unemployment rate and the equilibrium unemployment rate have risen continuously since 1973, causing a lasting divergence between effective and potential GDP growth based on labour efficiency gains and increase in the working age population (see box 2).

A production function approach also requires an hypothesis concerning the exogeneity of the stock of capital. Indeed, the question arises as to whether the evaluation of potential GDP growth should depend solely on the working age population growth and labour efficiency gains or whether capital should be included as a factor that potentially constrains potential growth. In a Solow-type model, the capital/output ratio is constant as capital adjusts to GDP growth. In the short run, however potential growth may be held back by the accumulation of capital. If capital stock is assumed to be rigid in the short term, potential GDP growth depends on the investment cycle and may stand below long term potential GDP growth.

Box 2

Short term and long term potential GDP growth

Assuming a constant return to scale Cobb-Douglas production function, GDP growth depends on total factor productivity gains (γ) and increases in the volumes of production factors (k and l): $y = \gamma + \alpha k + (1-\alpha)l$. In the long term, the capital/output ratio and the equilibrium unemployment rates are constant, potential GDP growth only depends on labour efficiency gains and increase in the labour force $y = \gamma / 1-\alpha + l$.

In the short run, however, potential GDP growth may stand somewhat below its long term trend for three reasons:

1) a rise in the equilibrium unemployment rate or a fall in the participation rate due to a wage shock an hysteresis effects,

2) a fall in the capital/output ratio due to a rise in the user cost of capital,

3) adjustment costs of the capital stock to changes in GDP.

B) *Second step: removing the influence of the output gap*

The second step consists in estimating budget elasticities (revenues and expenditures) with respect to GDP (see table 1). These elasticities are either calculated as a mean value for the period considered or estimated through a simple regression. However, small changes to their values have a limited impact on the structural deficit estimation compared to the output gap.

Table 1

Elasticities of French taxes and unemployment benefits vis-à-vis GDP

	OECD	IMF	European Commission
Personal income taxes	1.4	1.7	
Corporate taxes	3	3	
Social security contributions	0.7	0.8	
Indirect taxes	1	1	
Aggregate revenue elasticity		1.1	1.1
Expenditures	-0.1		-0.05

The main difficulty with these evaluations is that elasticities are assumed to be constant over the cycle. However, there is widespread evidence that revenue elasticities are sensitive to the business cycle, with tax revenues falling more rapidly than GDP during a downturn and increasing more rapidly during an upswing. These variations may be due to changes in the composition of GDP, in income shares, in the Household saving ratio and in the profitability of firms.

4. Estimations of the French cyclically-adjusted budget balance

A) *The two-step approach*

Although the production function approach is more appealing as it is based on explicit macroeconomic assumptions, the degree of uncertainty involved in its implementation is too high. This is why we prefer to base our own evaluation of the output gap on a statistical approach. A parsimonious, albeit reliable, way of estimating trend GDP is to adjust the log of GDP on a linear temporal trend.

However, as the trend in French GDP growth has changed direction on various occasions in the last 30 years, structural breaks need to be inserted. GDP is therefore stationary around a time trend, with the trend subject to occasional changes in its slope. Two major breaks have been identified, the first in the middle of the 1970s (fourth quarter of 1974) and the second in the beginning of the 1980 (third quarter of 1983)[6]. A third break (first quarter of 1993) appears but its statistical significance is too recent and fragile to be incorporated in the estimation. Once again, this method suffers from the end of sample problem. It cannot reliably identify current structural change in the trend insofar as it cannot discriminate between higher business fluctuations around a constant trend and usual fluctuations around a lower trend.

The HP filter gives similar results in the 1970s (see chart 1 and table 2). The mid-80s structural break we identified is smoothed by the

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[6] The output trend is defined by:

$LogPIB = (C_1 * T_1) + (C_2 * T_{74-4}) + (C_3 * T_{83-3}) + C_4$, where T1 is a temporal trend from 1970-1 to 1997-4.

	Coefficient	T-statistic
C_1	0.0105	21.5
C_2	-0.0047	-7.9
C_3	-0.00078	-3.5
C_4	13.114	1853

HP method. Part of the variability of GDP is included progressively in the trend, causing a less volatile cyclical component. At the end of the sample, we assumed that there is no new structural break and made implicitly the assumption of a stable trend. Using the HP filter, on the contrary, the slowdown of the beginning of the 1990s is partly included in the trend. The output gap is therefore smaller.

Chart 1

Output gap

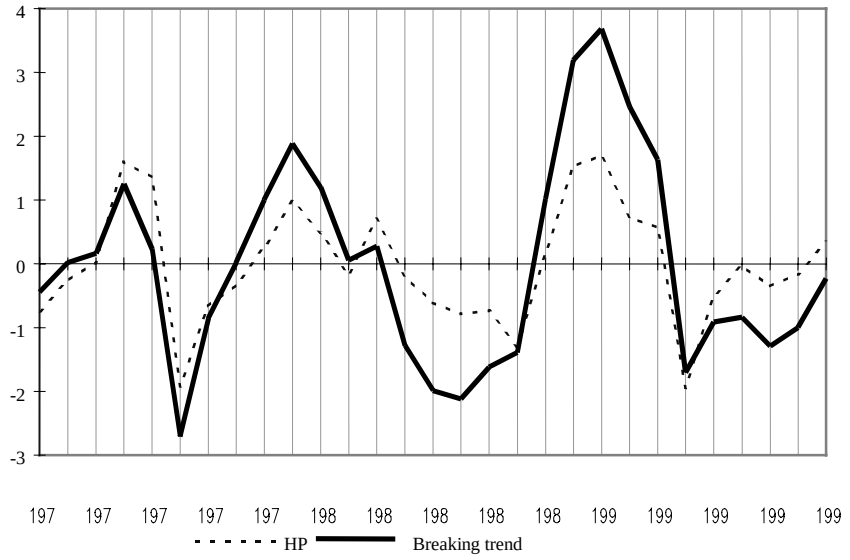


Table 2

Output gaps

	1992	1993	1994	1995	1996	1997
HP filter	0.6	-1.9	-0.5	-0.0	-0.4	-0.2
Breaking trend	1.6	-1.7	-0.9	-0.8	-1.3	-1.0

Budget elasticities have been estimated by two methods. First we have calculated apparent elasticities for each tax for different sub-periods. The most relevant period is 1980-1995, which avoids taking into account the 1970s (too old) and the recent years which experienced numerous changes in the tax legislation. Secondly, we have calculated the same elasticities by regressing taxes on GDP and a temporal trend (the complete results are given in the annex 1). Results are significant, except for the corporate income tax. The aggregate revenue elasticity (obtained by computing the relative share of components in total revenue with the associated elasticity) stands at 1.1.

Table 3

French apparent and estimated budget elasticities

	TIND Indirect taxes	TY Total direct taxes	TYH Direct taxes on Households	TYB Direct taxes on business	SSRG Social security contri-butions	Total receipts
Apparent elasticities						
71-97	1.0	1.2	1.3	1.2	1.2	1.1
75-85	1.1	1.2	1.4	1.0	1.3	1.2
85-92	0.7	1	1.1	0.7	1.0	0.9
80-95	1.0	1.2	1.2	1.1	1.1	1.1
Estimated elasticities						
80-95	1.1	1.2	0.9	1.9	1.0	1.1
Student	*2.9*	*1.8*	*1.1*	*0.7*	*3.4*	*3.9*

Source: Banque de France

The cyclical component of budget spending has been obtained by the EC method (see annex 2). First we have estimated the Okun coefficient, by regressing the output gap on the deviations of unemployment from its equilibrium rate estimated with the HP filter. The inverse of this coefficient gives an approximation of the elasticity of the unemployment vis-à-vis GDP. Secondly, we have estimated the marginal cost in social security benefits with respect to the unemployment rate. The social transfers elasticity is -0.1 (see table 4).

Table 4

Social transfers elasticity vis-à-vis GDP

	Okun coefficient (1)	Marginal cost in social security benefits with respect to unemployment rate (2)	Social transfers elasticity -1/(1) * (2)
Banque de France	2.1	0.14	-0.1
		Marginal cost in unemployment benefits with respect to unemployment rate	
European Commission	2.5	0.13	-0.05
OECD	3.3	0.3	-0.1

According to our two-step method, the deterioration of the actual deficit at the beginning of the 1990s is partly due to the business cycle and partly due to the cyclically-adjusted component of the deficit. By contrast, the reduction in the actual deficit in the recent years (1994-1997) is mostly structural with the cyclical part of the deficit remaining almost stable (see chart 2).

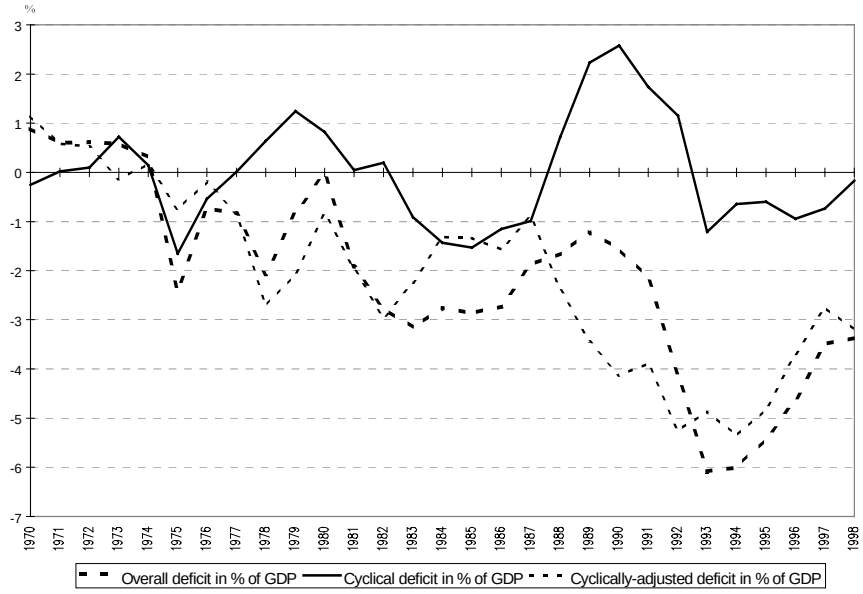
B) *An alternative method for assessing the structural budget balance: a structural VAR approach*

The traditional methods suffer from a conceptual drawback: they consider only one relation between GDP and the budget balance. They assume that the balance is influenced *ex-post* by deviation of output from potential or trend GDP, but neglect the fact that the output gap can be modified by fiscal policy. For example, a stimulus package increases the public deficit *ex-ante* but narrows, via the multiplier effect on GDP, the output gap. *Ex-post*, the deterioration in the deficit is less pronounced.

Chart 2

French cyclical and cyclically-adjusted balances

(two-step method, National accounts[7])



7 National accounts differ from Maastricht definitions, for which no long term series are available. In 1997, the public deficit in Maastricht definition was 0.5% GDP below the National accounts definition.

Traditional methods would overestimate the deterioration of the structural part of the deficit, with the observed output gap being reduced by the smoothing impact of fiscal policy. With a structural VAR approach, the budget deficit and output changes can be co-determined (see boxes 3 et 4).

Box 3

Budget balance and output gap

Traditional two-step methods consider one relation, with the overall budget balance (Def) depending on the output gap (Gap) and discretionary fiscal policy (Res1). *a* is the sensitivity of the deficit to the GDP.

$$Def = -a\,Gap + Res1$$

However, a second relation needs to be considered as the output gap is partly determined by fiscal policy and partly by other shocks (Res2). *m* is the keynesian multiplier.

$$Gap = mDef + Res2$$

Combining the two equations gives:

$$Def = (-aRes1 + Res2)/(1 + am)$$

The deficit can be broken down into a structural (DefS) and a cyclical components (DefC):

$$DefS = (Res1)/(1 + am) \text{ and } DefC = (-aRes2)/(1 + am)$$

If the impact of the deficit on GDP is not taken into account, a fiscal package of 1 percentage point of GDP will worsen the structural deficit by 1 GDP point. Under traditional keynesian assumptions, the expansionary fiscal policy will reduce the output gap. Consequently, the *ex-post* impact of the boost on the structural deficit should be less than 1% of GDP.

A fiscal boost corresponds to a shock on Res1. The impact of the 1% of GDP shock on the structural deficit is now $1/(1 + am)$. If $a = 0.6$ and $m = 0.8$ (mean value of the multiplier), the *ex-post* impact of the shock on the structural deficit is 0.7% of GDP (instead of an *ex-ante* impact of 1%).

The structural bivariate VAR model makes it possible to decompose the fluctuations in the deficit to GDP ratio into different sources of disturbances, namely those arising from output (which have long-term effects) and those arising from the deficit itself (which have only short-term effects). The cyclical and structural parts of the deficit are not correlated (they are induced by independent shocks vectors). Following an approach pioneered by Blanchard and Quah (1989), the identification is obtained by imposing a restriction on the long-run effect of one variable (only one restriction is needed in a two-variables model).

We assumed that only GDP shocks have a long-term impact and imposed the value of the sensitivity of the deficit to activity: one percentage point increase of GDP induces a 0.6% reduction of the deficit (as a share of GDP). This value results from the hypothesis of an apparent overall elasticity of the revenues vis-à-vis GDP close to unity, a tax burden of approximately 45% and an elasticity of unemployment benefits vis-à-vis GDP of -0.1.

Two VAR models were estimated, on French quarterly data (1970-1997), extending earlier work by Bac, Meary and Sobczak (1997)[8]: one using the primary budget balance (as a share of nominal GDP) and the log of business activity; the other concerning the total budget balance (also as a share of nominal GDP). The model incorporates 8 lags (the current year and the preceding year to account for lags in the collection of direct taxes).

Box 4. Structural VAR methodology

We consider two variables: the budget balance in % of GDP (Def_t) and business GDP ($Lgdp_t$ in log terms). The VAR representation $A(L)X_t = \varepsilon_t$ of the vector $X_t = \begin{pmatrix} Def_t \\ Lgdp_t \end{pmatrix}$ can be expressed in its moving average representation:

[8] Bac C., Meary R., Sobczak N. (1997). "Déficit structurel, déficit conjoncturel: l'apport d'une modélisation multivariée", AEA 59th conference, Rome, November.

$$X_t = C(L)\varepsilon_t \text{ where: } C(L) = A(L)^{-1} \text{ and } C(0) = I_n .$$

The following properties are satisfied:

$$E(\varepsilon\ ) = 0 \text{ and } E(\varepsilon_t \varepsilon_t^{'}) = \Sigma = \begin{pmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{21} & \sigma_2^2 \end{pmatrix}$$

This VAR representation gives a good description of the dynamic relations between the two series, but the estimated coefficients have no economic meaning. The residuals ε_t are not temporally correlated but are mutually correlated.

The VAR model can be expressed as a reduced structural form:

$$X_t = R(L)u_t \ \Leftrightarrow\ X_t = \begin{pmatrix} r_{11} & r_{12} \\ r_{21} & r_{22} \end{pmatrix} \begin{pmatrix} u_{def} \\ u_{Lgdp} \end{pmatrix} \text{ where } E\left(u_t u_t^{'}\right) = I_2 \text{ i.e.}$$

the reduced form residuals are mutually and temporally uncorrelated. It is therefore possible to separate the activity shocks and the fiscal shocks.

The two sets of residuals (the residuals of the VAR representation and the residuals of the reduced form) can be related using a new *S* matrix: $\varepsilon_t = Su_t$

The S matrix has n^2 elements. The expression $SS^{'} = \Sigma$ provides $n(n+1)/2$ relations and n^2 unknown elements. Therefore $n(n-1)/2$ restrictions are needed to allow identification.

$$\begin{cases} \sigma_1^2 = s_{11}^2 + s_{12}^2 \\ \sigma_2^2 = s_{21}^2 + s_{22}^2 \\ \sigma_{12} = s_{11}s_{21} + s_{12}s_{22} \end{cases}$$

In the case of a two-variable model, there are four unknown elements and three relations. Thus, one restriction must be imposed for a complete identification of *S*. The usual Choleski decomposition of the variance-covariance matrix (fixing $s_{12} = 0$ i.e. a restriction on the

contemporaneous effects of the shocks on the growth rates of the variables[9]) is simple but does not allow the effects of the two shocks to be separated (there is a contemporaneous correlation of the two shocks). Blanchard and Quah proposed a restriction on the long-term impact of the shocks on the levels of the variables.

We have assumed that only the GDP shocks have a long-term impact and imposed the value of the elasticity between deficit and activity. One additional percentage point of activity causes a 0.6%[10] reduction of the deficit. This value results from the hypothesis of an apparent overall elasticity of the revenues vis-à-vis GDP close to unity, a tax burden of approximately 45% and an elasticity of unemployment benefits vis-à-vis GDP of -0.1.

The two expressions $X_t = R(L)u_t$ and $X_t = C(L)\varepsilon_t$ give a new relation leading to the estimation of *S*:

$$R(L) = C(L)S \Rightarrow \begin{pmatrix} r_{11} & r_{12} \\ r_{21} & r_{22} \end{pmatrix} = \begin{pmatrix} c_{11}s_{11} + c_{12}s_{21} & c_{11}s_{12} + c_{12}s_{22} \\ c_{21}s_{11} + c_{22}s_{21} & c_{21}s_{12} + c_{22}s_{22} \end{pmatrix}$$

Considering the long-term representation

$X_t = \begin{pmatrix} r_{11} & r_{12} \\ r_{21} & r_{22} \end{pmatrix} \begin{pmatrix} u_{def} \\ u_{Lgdp} \end{pmatrix} = \begin{pmatrix} r_{11}u_{def} + r_{12}u_{Lgdp} \\ r_{21}u_{def} + r_{22}u_{Lgdp} \end{pmatrix}$, the long-term restriction consists in imposing the value of $\frac{r_{12}}{r_{22}} = \frac{c_{11}s_{12} + c_{12}s_{22}}{c_{21}s_{12} + c_{22}s_{22}} = -0.6$

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9 The Choleski decomposition consists on choosing the simplest lower triangular matrix as *S*.

10 The sensitivity of budget balance to the cycle estimated by the European Commission for France is 0.5. The result obtained by the IMF and the OECD is 0.6.

The structural component of the deficit is defined as the accumulation of fiscal shocks over the review period. Likewise, the cyclical component is derived from GDP shocks over the period. As the two shock vectors are independent, the two components are estimated separately and are not correlated.

The structural VAR and the two-step method results provide different information about the budget balances. The two-step method provides a cyclically-adjusted deficit, corrected for the impact of the output gap. The structural VAR results provide a deficit adjusted from all the cyclical variations captured by GDP except those induced by fiscal policy. Consequently, the structural component is less volatile.

Table 5

Results obtained with the Structural VAR models
(Maastricht accounts definition)
(as shares of GDP)

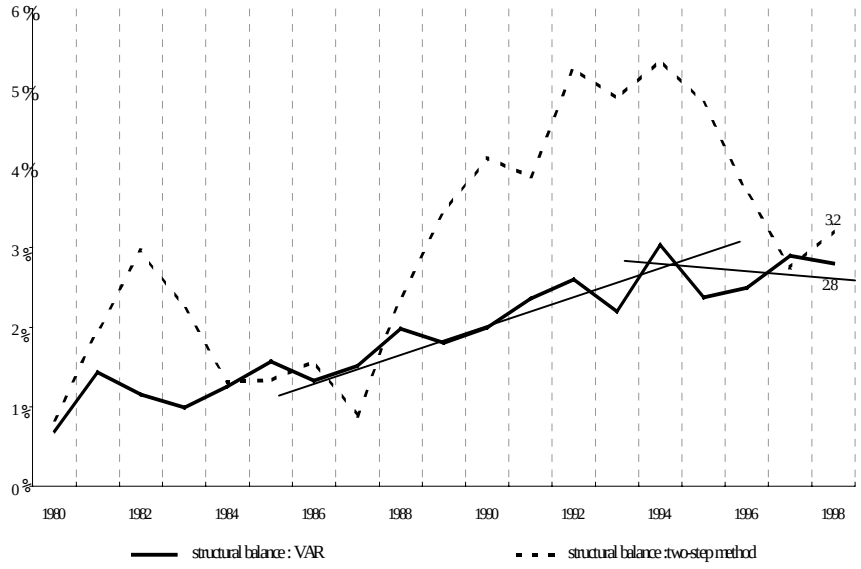
	Structural balance	Cyclical balance	Total balance	Primary structural balance	Primary cyclical balance	Primary balance
1993	-1.7	-3.9	-5.6	1.0	-3.5	-2.5
1994	-2.7	-3.0	-5.7	0.3	-2.7	-2.4
1995	-1.9	-3.0	-4.9	1.1	-2.5	-1.4
1996	-2.0	-2.1	-4.1	1.2	-1.8	-0.6
1997	-2.4	-0.6	-3.0	0.9	-0.6	0.3
1998	-2.3	-0.6	-2.9	0.9	-0.5	0.2

A positive figure means a budget surplus.

The VAR method provides a smoother and lower structural deficit series than two-step method. However, both methods provide over a three-year period the same picture about the direction of the cyclically-adjusted budget balance. They both show an improvement of the

structural balance since 1994. In 1997 and 1998, the cyclically-adjusted component accounts for the major part of the overall deficit. In 1998, with the output gap close to zero, the two-step method considers that the deficit is almost entirely structural (see table 5 and chart 3).

Chart 3. French structural balances: two different approaches (French national accounting)[11]



5. Conclusion: what we know and what we don't know

Our results give a readily understandable picture of past cyclical and cyclically-adjusted deficits. While we feel more comfortable with the

[11] National accounts differ from Maastricht definitions, for which no long term series are available. In 1997, the public deficit in Maastricht definition was 0.5% GDP below the National accounts definition.

two-step methodology, we find instructive to compare different approaches and to cross-check the results.

We have shown that a high degree of uncertainty is attached to the level of the cyclically-adjusted balance. We have also highlighted that the level of the cyclically-adjusted deficit provides a relatively poor picture of the sustainability of fiscal policy. Levels and variations in the cyclically-adjusted balances can provide relevant information to policy makers as long as they are part of a comprehensive analysis of fiscal policy including medium term forecasts and sensitivity analysis.

ANNEX 1

Budget elasticities regressions

$\frac{\Delta R_i}{R_i} = \alpha \frac{\Delta Y}{Y} + \beta T + \gamma$ where R_i are the different categories of revenue, Y is GDP and T a temporal trend.

	Indirects taxes			Total direct taxes			Direct taxes on Households			Direct taxes on business			Social security contributions			Total receipts			Social security benefits			Total expenditures		
	α	β	γ	α	β	γ	α	β	γ	α	β	γ	α	β	γ	α	β	γ	α	β	γ	α	β	γ
71-95	1.3	0.2	-6.1	2	0.5	-14.9	1.4	0.2	-4.0	3.2	1.1	-35.5	1.2	-0.1	0.5	1.4	0.1	-4.3	1.1	-0.1	2.2	1.1	-0.01	0.4
T	*4.0*	*6.8*	*0.2*	*2.2*	*3.8*	*0.1*	*1.7*	*2.9*	*0.1*	*0.8*	*1.4*	*0.0*	*4.0*	*6.7*	*0.2*	*5.7*	*9.7*	*0.3*	*3.1*	*5.2*	*0.2*	*3.4*	*5.8*	*0.2*
80-95	1.1	0.1	-1.8	1.2	-0.1	2.8	0.9	-0.2	7.3	1.9	0.2	-9.1	1.0	-0.2	3.8	1.1	-0.1	1.3	1.0	-0.2	5.2	1.0	-0.1	2.9
T	*2.9*	*3.6*	*0.1*	*1.8*	*2.2*	*0*	*1.1*	*1.4*	*0.0*	*0.7*	*0.9*	*0.0*	*3.4*	*4.2*	*0.2*	*3.9*	*4.8*	*0.2*	*2.2*	*2.7*	*0.1*	*2.3*	*2.9*	*0.1*

The results and comparisons

	Budget balance (actual series, % of GDP)			Two-step method		Structural VAR			OECD		European Commission	
	National accounts (NA)	Maastricht (M)	Correction	Structural balance (NA)	Structural balance (M)	Structural balance (NA)	Structural balance (M)	Output gaps	Structural balance (M)	Output gaps	Structural balance (NA)	Output gaps
1992	-4.1	-3.8	0.3	-5.3	-5.0	-2.6		1.6	-3.6	-0.6	-4.4	1.2
1993	-6.1	-5.6	0.5	-4.9	-4.4	-2.2	-1.7	-1.7	-3.8	-3.5	-4.9	-2.0
1994	-6.0	-5.7	0.3	-5.4	-5.1	-3.0	-2.7	-0.9	-4.4	-2.4	-5.0	-1.1
1995	-5.4	-4.9	0.5	-4.8	-4.3	-2.3	-1.9	-0.8	-3.7	-2.1	-4.3	-0.9
1996	-4.6	-4.1	0.5	-3.7	-3.2	-2.5	-2.0	-1.3	-2.7	-2.5	-3.4	-1.4
1997	-3.5	-3.0*	0.5	-2.8	-2.3*	-2.9	-2.4*	-1.0	-1.7	-2.2	-2.3	-1.2
1998**	-3.4	-2.9	0.5	-3.2	-2.7	-2.8	-2.3	-0.2	-2.1	-1.2	-2.6	-0.3

* Including a 0.5% GDP transfer from France Télécom to the State budget.
** : Estimation.

ANNEX 2

The two-step methodology

1) The cyclically-adjusted balance is the difference between the cyclically-adjusted revenues and the cyclically-adjusted expenditures.

$$Def_{struct} = \left[\left(\frac{R}{Y}\right)_t * E_R * GAP_t\right] - \left[-\left(\frac{1}{Okun} * E_D * GAP_t\right)\right]$$

$\left(\frac{R}{Y}\right)_t$ is the average part of revenue in GDP.

$GAP_t = \frac{Y_t - Y_t^*}{Y_t}$ is the output gap, i.e. the deviations of actual GDP from its trend level in volume Y_t^*.

E_R is the aggregate revenue elasticity.

2) Estimation of revenue elasticity

$$E_R = \left(\frac{R_{indirect\ taxes}}{R_{total\ revenues}} * \varepsilon_1\right) + \left(\frac{R_{household\ taxes}}{R_{total\ revenues}} * \varepsilon_2\right) + \left(\frac{R_{corporate\ taxes}}{R_{total\ revenues}} * \varepsilon_3\right) + \left(\frac{R_{social\ contributions}}{R_{total\ revenues}} * \varepsilon_4\right) + \left(\frac{R_{other\ revenues}}{R_{total\ revenues}} * \varepsilon_5\right)$$

ε_i are the budget elasticities of each kind of revenue vis-à-vis GDP:

$$\frac{\Delta R_i}{R_i} = \varepsilon_i \frac{\Delta Y}{Y} + \beta_i T + \gamma_i$$

$$E_R = 1.09 = (0.26 * 0.99) + (0.11 * 1.23) + (0.04 * 1.14) + (0.34 * 1.12) + (0.24 * 1.1)$$

3) Estimation of expenditure elasticity

We assume that on the expenditure side, social security benefits only are sensitive to the business cycle. The Okun coefficient is obtained by regressing the output gap on the deviation of unemployment from its equilibrium rate.

$$\frac{Y - Y^*}{Y} = \alpha + Okun\left(U^* - U\right) + \varphi$$

U_t^* is an approximation of the equilibrium unemployment rate (using an HP filter).
E_D is the marginal cost in social security benefits with respect to unemployment rate.

$$\left(SSB_t - SSB_{t-1}\right) = \sigma + E_D\left(U_t - U_{t-1}\right) + \upsilon_t$$

4) Applied on French data, we obtain the following estimations:

$$Def_{struct} = \left[\left(\frac{R_i}{Y}\right)_t * 1.09 * GAP_t\right] - \left[-\left(0.48 * 0.14 * GAP_t\right)\right]$$

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