A NEW METHOD OF ASSESSING THE STRUCTURAL BUDGET BALANCE: RESULTS FOR THE YEARS 1995-2000

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1. Introduction

The *structural budget balance* is an indicator developed for medium-term analysis of budgetary policies. It is designed to determine what the budget balance would be if the economy followed a "normal" growth path characterized by roughly constant increases in output over the medium term.

The indicator allows the performance of the budget aggregates to be assessed excluding the effects of fluctuations in economic activity on revenue and expenditure[1]. The sum of these effects is usually called the *transitory (or cyclical) component of the budget.*

In recent years, as medium-term analysis has gained importance in budgetary policy assessment, growing attention has been paid to the

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[1] Some studies use the variations in the structural primary budget balance as an indicator of discretionary policies. This approach is more controversial, as factors other than discretionary measures can influence the cyclically adjusted budget balance.

structural balance. For the members of the European Union, the structural balance has taken on special meaning in the light of the *Stability and Growth Pact*, whereby the member states "commit themselves to respect the medium-term budgetary objective of positions close to balance or in surplus". Both in budgetary policy at national level and in the evaluations of the European Central Bank and the European Commission[2], it has become a standard practice to assess convergence with the above objective primarily on the basis of a structural budget balance indicator.

The Commission, the OECD and the IMF regularly publish estimates of national general government structural balances. In this paper we propose a method of assessing structural balances which, while following the general approach developed by the Commission, differs from it in several significant elements.

The main change concerns the macroeconomic variables taken as referents in assessing the impact of economic activity on the budget. Innovating with respect to the methods used in the literature to date, we seek to take account of the budgetary effects of fluctuations in the composition of output and the distribution of income and not just in the growth rate. Other differences relate to the procedure adopted to calculate the "normal" growth path of the macro variables. Finally, the method relies on new estimates of budget elasticity with respect to the relevant macroeconomic aggregates.

The main results obtained by applying this method to the period 1995-2000 are as follows:

1. From 1994 onwards, the macroeconomic variables with the greatest impact on the budget (consumption and employees' gross earnings) are constantly below their trend values, i.e. their cyclical position is

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[2] According to the Opinion by the Monetary Committee on the Content and format of Stability and Convergence Programmes, endorsed by the European Council on October 12th 1998: "It is therefore clear that the assessment of the appropriateness of Member States' medium-terms objectives and the examination of their fulfilment has to take explicit account of the cyclical position and its effect on the budget".

unfavourable to public finances. The transitory component of the deficit, as high as 0.7 per cent of GDP in 1995, decreases slowly to 0.2 points in 2000.

2. The estimates of the cyclical component of the budget balance presented in this paper differ significantly from those calculated by the OECD and the IMF. They are closer to those of the Commission, except for 1995.

3. According to our estimates, the budgetary effect of an output gap of 1 percentage point, assuming balanced economic growth (i.e. changes of equal magnitude in the variables of relevance for the budget), is equal to 0.3 per cent of GDP in the first year; if the output gap remains constant, the effect on the budget in the second year is 0.4 per cent.

The remainder of the paper is organised as follows: Section 2 briefly examines the methods adopted by the Commission, the IMF and the OECD; Section 3 describes a new method of assessing the structural balance; Section 4 presents the main results.

2. The methods of the European Commission, the IMF and the OECD

The methods examined measure the structural balance by adjusting the budget for the effects of fluctuations in GDP. The calculation procedure can be divided into two stages:

a) a "reference GDP" is estimated, and the difference between this and actual GDP (the output gap) is calculated;

b) the transitory component of the balance is computed by multiplying the output gap by the GDP elasticity of the various budget items. The structural balance is obtained by subtracting this component from the actual balance.

The methodological debate has concentrated on the procedures for calculating reference GDP and devoted only modest attention to the second stage. This is because differences in the estimated elasticities typically have a smaller impact on the outturn than differences in the

estimated output gap. The estimation of the latter can involve considerable uncertainty as to size and even sign. The international organizations which publish structural balance indicators do not frequently revise their estimates of the budget's elasticities and generally rely on averages calculated for large intervals of time in order to weight the elasticities associated with the various components of the budget.

2.1 *Reference GDP*

Owing to the impact on the results, in these methods the definition and the calculation of reference GDP constitute the most important choices in constructing a government budget indicator.

The choices made in these respects by the international organizations refer to a large body of theoretical and empirical literature regarding the determination of the cyclical position of the economy. These studies also have important implications in fields beyond public finance and have particular relevance for stabilization policies and for the analysis of the causes of inflation.This literature usually employs the terms "trend GDP" and "potential GDP". The term "trend GDP" generally refers to the result of the direct application of purely statistical methods to GDP series.

Until the early nineties the OECD used trend GDP (estimated by peak interpolation with straight line trend segments) to calculate the structural balances. The current approach of the Commission is another example. In its method (see European Commission, 1995, and Ongena and Roger, 1997), reference GDP is computed by applying the Hodrick-Prescott filter (see Hodrick and Prescott, 1980) to the real GDP series, which is extended forward for two years in accordance with the Commission's forecasts and for four more years by means of a univariate model (selected with a semi-automatic procedure). Using the HP filter (see the box below) is justified by its simplicity and transparency and because it allows uniform treatment of countries.

The Hodrick-Prescott filter (HP)

The HP filter calculates trend GDP by minimizing the weighted sum of two elements:

a) the sum of the standard deviation between trend GDP (Y^*) and actual GDP (Y) in each year for all the periods considered;

b) the sum of the squares of the change in the growth rate of potential GDP from one year to the next for all the periods considered.

As a formula:

$$\min \Sigma_{t=1,T} (lnY_t - lnY^*_t)^2 + \lambda \Sigma_{t=2,T-1} [(lnY^*_{t+1} - lnY^*_t) - (lnY^*_t - lnY^*_{t-1})]^2$$

The weighting parameter λ determines the relative importance of the two constraints imposed on potential GDP: that it should not display excessive deviations with respect to actual GDP and that its rate of growth should be as constant as possible over the period considered. There does not seem to be any objective criterion for determining this parameter; the value most commonly used in the literature, and adopted in the Commission's estimates, is that proposed in Kydland and Prescott (1990), equal to 100 for the yearly series. The sensitivity tests carried out by the Commission show that small variations in the value of λ do not significantly affect the results (see Ongena and Roger, 1997).

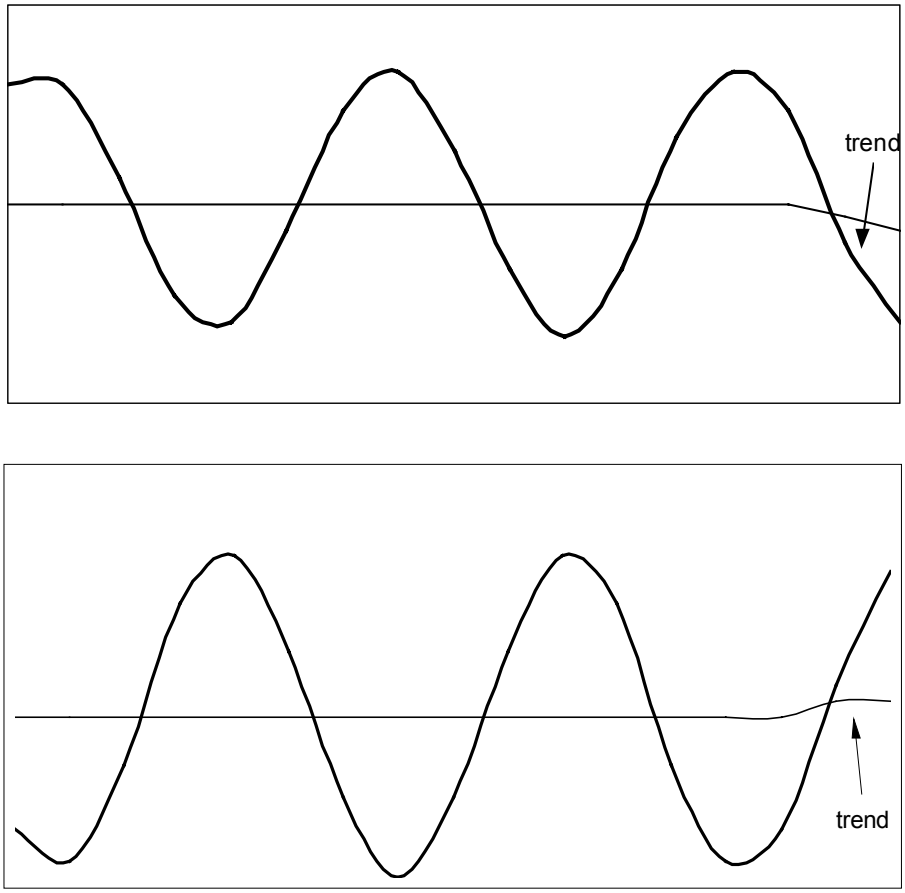
The output gap calculated on the basis of the HP filter is, by construction, equal on average to zero. In the central periods of the original time series, the trend value of each year corresponds to a weighted average based symmetrically on the observations preceding and following the reference year. If $\lambda = 100$, the sum of the weightings for the year in question and the four observations surrounding it is equal to 0.8, while the sum of the weightings of the observations for the more distant years is equal to 0.2.

The literature abounds with criticisms of the HP filter (see Maravall, 1995, and St. Amant and van Norden, 1996). One objection is that it does not correctly distinguish fluctuations of higher frequency, typically associated with economic cycles, from those of lower frequency. This problem would be significant above all in the case of time series having high variability and relatively low frequencies.

The main problem with the method, however, concerns the calculation of the trend for the last few years observed. As it approaches the end of the field of observation, the weighted average tends to be based only on past observations, among which those for the last 2 or 3 years are assigned preponderant weight. As is shown in Figure 1, this can considerably bias the results in relation to the cyclical phase marking the last observations. A possible solution is to extend the observed series with forecasts, but this is not altogether satisfactory because the following dilemma is posed: if the forecasts incorporate all the available information, as when simulations of a large-scale econometric model are used, the method is not transparent and elements of arbitrariness are inevitable; if a mechanical method is adopted, the forecasts are less reliable.

Fig. 1

The Influence of the Last Few Observations on HP Filter Estimates of the Trend



The term "potential GDP" usually refers to approaches based on a production function and the estimation of the "potential" values of the productive factors. In the methods developed in the sixties, potential output corresponded to full-employment output; in those currently used, it generally corresponds to the output level consistent with non-accelerating inflation. The methods currently used by the OECD and the

IMF, though differing in significant respects, can be classified in the category of "potential GDP" methods.

Since 1994, in order to calculate the structural budget balance published in its *Economic Outlook*, the OECD has adopted as reference GDP an estimate of potential GDP based on a 2-factor Cobb-Douglas production function (see Giorno et al., 1995, and Giorno and Suyker, 1997). Potential output is determined by the capital stock and "potential employment", i.e. the employment level consistent with a non-accelerating rate of wage inflation. The Hodrick-Prescott filter is used at various stages of the procedure for calculating potential GDP: to eliminate outliers in the estimate of the non-accelerating wage rate of unemployment and to calculate the potential values of the labour force participation rate, man-hours worked and labour productivity. This makes the OECD's procedure quite similar to the Commission's. Indeed, for the seven leading OECD countries the estimates of potential GDP by this method differ only slightly from the results of directly applying the HP filter to the GDP time series (see Giorno and Suyker, 1997).

The IMF regularly publishes estimates of member countries' structural balances in *World Economic Outlook*. For the industrial countries, these balances are based on an estimate of potential GDP (except in the case of the United States, whose reference GDP is calculated by peak interpolation with straight line trend segments), which is calculated in turn using a production function. Estimating potential GDP has involved substantial research work by the staff of the IMF to reduce the weight of the exogenous component of technical progress in the production function and identify the explanatory factors of the non-accelerating inflation rate of unemployment. However, the procedure is not homogeneous across countries and the results rely in a significant way on assessments made by country experts (De Masi, 1997).

2.2 *The criteria for estimating budget elasticities used by the Commission and the OECD*

To assess the effects of the output gap on revenue, both the Commission and the OECD currently use the results of a 1995 OECD study (see Giorno et al., 1995) giving country estimates of the GDP elasticity of the main components of public revenue: personal income taxes and corporate taxes, social security contributions and indirect taxes.

A residual component of total revenue is not considered, implicitly assuming it to be independent of the cycle. The estimates are based on various sources and criteria. In particular, the GDP elasticities of personal income taxes and social security contributions are the product of two elasticities: those of their respective tax bases to GDP (taking account of the effect of output both on employment and, via employment, on average earnings) and those of personal income taxes and social security contributions to their bases. The latter elasticities are calculated for each country using the marginal and average tax rates for a representative taxpayer at different levels of income, with the rates weighted on the basis of information on income distribution in the country.

In the European Union, the average elasticity of the sum of these four components to current GDP ranges from 0.77 in Italy to 1.32 in Spain. In some countries GDP also influences corporate taxes with a one-year lag; these effects are generally insignificant; only in the UK does the elasticity of revenue to the previous year's GDP exceed 0.1; in Italy it is estimated to be nil.

Concerning expenditure, both the OECD (see Giorno et al., 1995) and the Commission (see European Commission, 1995, and Ongena and Roger, 1997) assume that only unemployment-related spending is influenced by the level of economic activity. The GDP elasticity of expenditure is the product of two components: the elasticity of the unemployment rate to output (the so-called Okun ratio) and the elasticity of expenditure to the unemployment rate. Taking these two steps into account, the OECD's estimates of the GDP elasticity of non-interest expenditure in the European Union ranges from zero to 0.3; as in the case of revenue, the two outliers are Italy and Spain. The Commission's estimates of elasticities are generally higher than the OECD's; that for the elasticity of expenditure in Italy is particularly high, amounting to 0.14.

3. The method developed in this paper[3]

In this paper we decided to use a statistical filter to calculate the path of reference GDP; this choice is discussed in Section 3.1. While alternative smoothing techniques are currently under review, in this version of the paper the HP filter is used, as in the Commission's method. However, different criteria and time horizon, examined in Section 3.2, are used in extending the GDP series forward. Section 3.3 focuses on the main contribution of the paper, i.e. the extention of the analysis to macroeconomic variables other than GDP to take into account the effects of changes in output composition and in income distribution on the budget aggregates. Finally, Sections 3.4 and 3.5 describe the methods used to estimate the elasticity of the budget to macroeconomic variables.

3.1 *The choice of the reference GDP*

In Section 2.1 above we have briefly examined the method for assessing reference GDP employed by the European Commission, based on the HP filter, and those adopted by the IMF and the OECD, relying on production functions. These approaches are only a small fraction of a large body of empirical and theoretical literature concerning the determination of the economy's cyclical position. Recent contributions include several methods intermediate between univariate statistical filters and approaches based on a production function[4]. Another interesting area

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[3] A preliminary version of the method presented here was used for the Bank of Italy's Annual Report for 1997, published in May 1998 (see Banca d'Italia, 1998, pp. 157-58).

[4] These are purely statistical multivariate methods, which often use VARs (an example is Gavosto and Pellegrini (1991), who estimate the permanent component of industrial production also using series of employment and industrial orders), and mixed multivariate methods, in which the smoothing procedure usually includes minimization of a structural residual. The smoothing procedure can use the Hodrick-Prescott filter (see Laxton and Tetlow, 1992, Butler, 1993, St. Amant and Van Norden, 1996) or other statistical methods (see Gerlach and Smets, 1997).

of research tries to identify univariate smoothing techniques that present better statistical properties than the HP filter (see Baxter and King, 1995).

The surveys of this literature generally stress that the results of research are far from solid and suggest that considerable caution is called for in using them (e.g. see Cette and Delessy, 1994)[5]. The different methods are difficult to compare in the absence of a consensus on the economic and statistical nature of economic fluctuations and they generate divergent results. It is also pointed out that, for technical reasons, the differences between methods based on a production function and those that directly apply purely statistical methods to GDP are less marked than might be supposed. In methods based on a production function, statistical smoothing procedures are often used in calculating the potential values of factors (or, in some cases, the potential growth in productivity). As was noted above in the description of the OECD's method, this produces results that are close to those obtained by direct application of statistical procedures to the GDP series (see Cette and Delessy, 1997, and Ongena and Roger, 1997).

The need for further theoretical and empirical study is heightened by the fact that a given method can produce significantly different results depending on the parametric values adopted; an especially important assumption concerns the variability of reference GDP[6].

Without clear-cut indications coming from the literature it is sensible to limit the choice to the methods adopted by the international organizations. Among these methods, the HP filter was selected. In an ongoing research project, however, we are considering an alternative

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5 A relatively recent OECD paper observed: "..it is clear from this work and the wide range of analytic and survey-based indicators which are available, that significant margins of error are involved in their estimation and use." (Giorno et al., 1995, p. 6).

6 For the statistical methods, an example is the setting of parameter λ in the Hodrick-Prescott filter, discussed in Section 2.1. In the methods based on a production function, it is the relative variability of the equilibrium unemployment rate that largely determines the results.

smoothing technique, based on a band-pass filter, which has the property of separating more neatly, in the spectrum of the series, the trend from both the cyclical and the erratical segments. The preference given to the HP filter was dictated by three considerations, namely its relative simplicity and transparency, the properties we think GDP must have for the specific purposes of constructing a structural balance indicator, and the availability of reliable medium-term macroeconomic forecasts at the Bank of Italy.

If the structural balance is to perform its function of excluding the cyclical component of the budget, it is essential that the differences between actual GDP and reference GDP (i.e. the output gaps) average out to zero, thereby ensuring that the transitory component of the budget is nil on average. Moreover, this property must hold over the medium term.

By its construction, reference GDP as estimated using the HP filter satisfies this requirement. More precisely, regardless of the value of λ, the differences between actual GDP and reference GDP average out to zero over the entire time-span in which the filter is applied; with an appropriate choice of λ, this property approximately holds over a medium-term horizon.

The methods based on a production function do not necessarily satisfy the above-mentioned requirement, but the method of peak interpolation with straight line trend segments does satisfy it when trend GDP is appropriately scaled. However, unlike the HP filter, it requires a preceding stage of analysis to identify the turning points; moreover, it adopts the implausible assumption that the structural breaks only coincide with the peaks.

The main problem with the HP filter (discussed in the box above), as with all centered filters, concerns the calculation of reference GDP in the final part of the considered period. As the end of the time series approaches, the HP filter calculates reference GDP on the basis of a weighted average that is no longer symmetrical and that necessarily tends to reflect only the last observations; depending on the cyclical phase characterizing the last observations, this may seriously bias the results. The problem can be dealt with by extending the GDP series with forecasts and applying the HP filter to the series so obtained; in this case, even for the last years of actual observations, reference GDP remains a

symmetrical weighted average based on both the actual time series data and the forecasts[7].

It has been argued that methods based on a production function yield a better estimate of trend GDP than the HP filter, as they use information on cyclical conditions over and above the GDP series. However, they are superior from the informational point of view only if the GDP series is not extended forward or is extended with methods that only take into account the information contained in the actual GDP time series. No method is informationally superior *a priori* to the others when medium-term forecasts of GDP are available that make adequate use of available information. The indicator developed in this paper uses the medium-term forecasts made by the Bank of Italy with the aid of a large-scale econometric model whose general characteristics are described in Banca d'Italia (1986) and Terlizzese (1994)[8]. These forecasts seek to incorporate all the available information on cyclical conditions and the medium and long-term prospects.

Another point to stress is that the use of the production-function method involves making difficult methodological choices in a setting of pronounced theoretical and empirical uncertainty (Le Bihan et al., 1997). These choices can affect the results substantially. An example of particular significance for Europe concerns the interpretation of the rise in the unemployment rate since the eighties: large differences are possible in the estimates of potential GDP for the current year and future years, depending on whether one assumes that the equilibrium unemployment rate has shifted upwards or has remained constant.

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7 If these forecasts are assumed to be statistically correct, then reference GDP thus calculated will also be a correct estimator of medium-term GDP.

8 In particular, its long-term properties are basically consistent with those of a neoclassical model with exogenous growth, while in the short term the characteristics of the adjustment processes reflect a Keynesian scheme in which the level of output is determined by aggregate demand. The latest versions of some of the model's principal equations are discussed in Siviero and Terlizzese (1997).

In addition to this general problem it must be considered that the concept of potential GDP that the OECD and the IMF currently use is geared mainly to analysis of the determinants of inflation and does not necessarily meet the needs of an indicator of the structural budget balance. Indeed, in many circumstances the level of GDP associated with a non-accelerating inflation rate of unemployment does not represent a correct estimate of the medium-term value of GDP, as in periods when inflation is coming down from high levels. The decision of the OECD and the IMF to use a single definition and measure of the output gap in order both to calculate the structural balance and to estimate the determinants of inflation appears unduly penalizing for the former[9].

3.2 *Extending the GDP series forward*

In the previous section we have argued that using medium-term forecasts to extend the GDP series improves the reliability of the estimate of the reference GDP, as these forecasts should incorporate additional relevant information on the state of the economic cycle. To check this assertion we have compared the trend growth estimates calculated *ex post*, by applying the HP filter to the period 1988-1997, with the results of three alternative *ex ante* experiments.

In the first, we obtain the trend GDP growth for each year of the period 1988-1995 by applying the filter to the GDP series available at that date. In the second, for each year we apply the filter to the GDP series extended forward for eight years with a univariate statistical method, which uses only data available at that date[10]. In the third, which

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[9] At the start of the eighties the OECD had actually devised two distinct indicators: a trend GDP for calculating the structural budget balance, calculated on the basis of peak interpolation, and a potential GDP (or aggregate supply indicator), obtained with the INTERLINK model and, used in analyzing inflation. Since 1994 the second indicator is also used to calculate the structural balance (Giorno and Suyker, 1997).

[10] Extending the GDP forecast series from six to eight years produces an almost entirely satisfactory response to the observation (Maravall, 1995) that the trend GDP estimate by the HP method tends to stabilize only when at least nine successive periods are available (for $\lambda = 100$).

corresponds to the procedure used in this paper, the series is extended for four years using internal forecasts made in that year (no forecasts with longer horizon are routinely made) and for an additional four years on the basis of a univariate statistical model. As mentioned in the previous section, forecasts are made with the aid of a large-scale econometric model.

The results tend to support the view that internal forecasts do effectively exploit additional information: the average difference (in absolute value) between the *ex post* trend GDP growth and the results of the first experiment is equal to 0.5; the difference reduces to 0.4 for the results of the second experiment and to 0.3 for the third.

The possible improvement in the estimates of the reference GDP obtained with the use of forecasts based on a large-scale model have, however, some costs. These forecasts are not easily reproducible and require a number of arbitrary choices. The use of statistical models, though it probably leads to less reliable estimates, has the advantage of permitting uniform and transparent treatment of different countries and being quite economical.

The GDP forecasts used in this paper are based on the assumption that the general government primary budget surplus forecast for 1998 remains approximately constant in the following years. This constancy, which reflects the medium-term Government targets, implies a return of GDP to its normal growth path, after the downward pressure exerted by the financial adjustment of the last few years. Thus applying the HP filter to the extended series probably yields a better interpolation of the growth rate trend of the nineties (Figures 2 and 3) than its application to a shorter projection horizon, which would assign greater weight to past observations (affected by the budget adjustment) than to forecasts.

The differences between our procedure and that adopted by the European Commission seem to have significant effects on the assessment of the output gap only in year 2000, when our estimates, based on the HP filter, still indicate a significant distance between actual and potential GDP (Table 1). In Table 1 we also present the preliminary results of applying a band-pass filter, instead of the HP one, to the GDP series extended forward with the same procedure described above. The results tend to coincide, in qualitative terms, with those obtained with the HP filter, but they indicate smaller absolute values of the gaps.

Fig. 2

Output Gap, Actual and Trend GDP in Italy

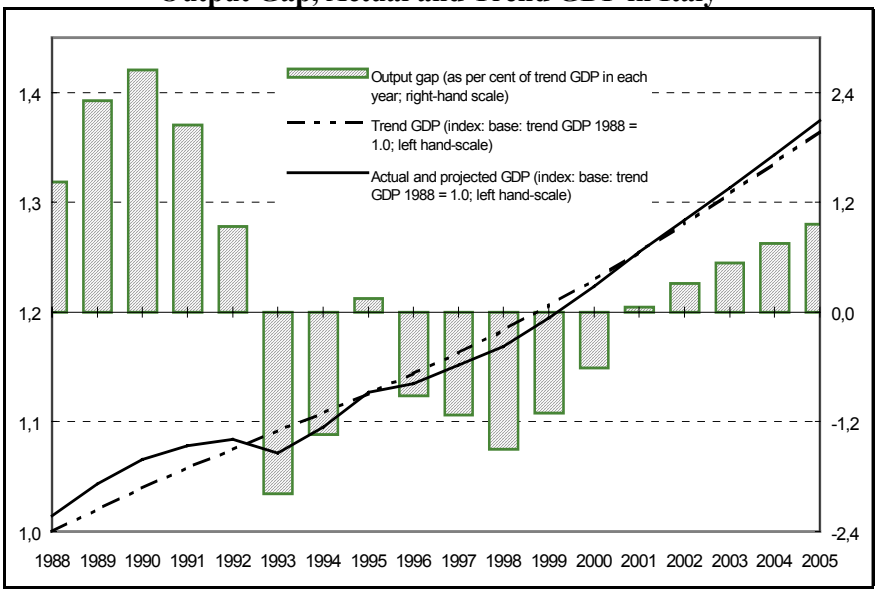

Fig. 3

Output Gap, Actual and Reference GDP Growth Rates in Italy

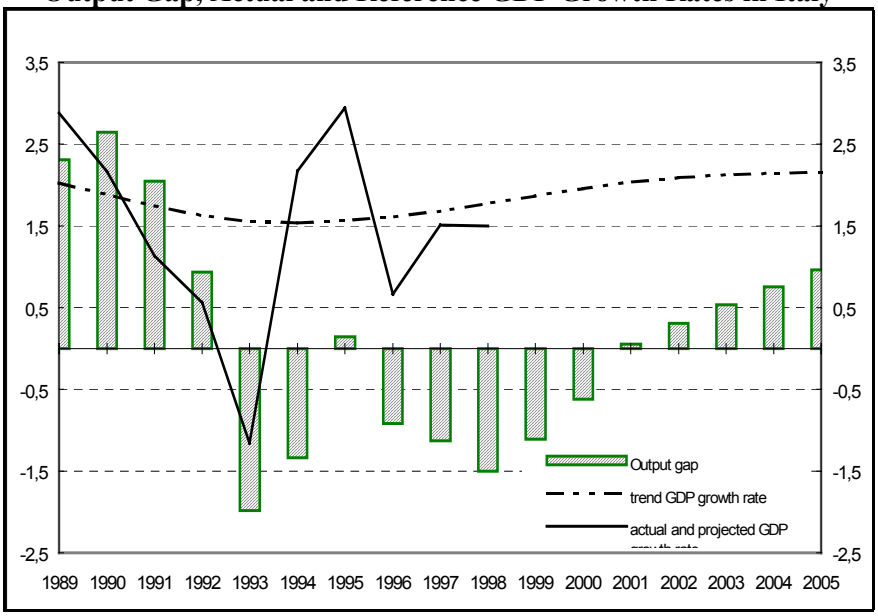

Table 1

Output Gap Estimates

Estimate	Filters			Commission (Nov. 1998)	
		HP	Band-Pass		
	GDP change	*output gap*	*output gap*	GDP change	*output gap*
1994	2.2	-1.2	-0.6	2.2	-1.3
1995	2.9	0.1	0.9	2.9	0.1
1996	0.7	-0.8	0.0	0.7	-0.9
1997	1.5	-1.0	-0.2	1.5	-1.0
1998	1.5	-1.3	-0.5	1.7	-1.1
1999		-0.9	-0.3	2.1	-0.8
2000		-0.5	-0.1	2.5	-0.1

N.B.: Negative values for the output gap indicate that actual is lower than reference GDP.

3.3 *Extending the analysis to variables other than GDP*

One of the most problematic features of the methods currently used to assess structural budgets is their reliance on a single macroeconomic parameter (real GDP) to evaluate the impact of economic fluctuations on revenues and expenditures. As it is acknowledged that GDP is not a good proxy for tax bases, in some methods (notably those of the Commission and the OECD) the GDP elasticities of revenues are the product of two sets of elasticities: those of tax bases to GDP and those of revenues to their bases (or to the closest macroeconomic proxy of these bases). The same indirect approach is used to link GDP, through the Okun parameter, to unemployment benefits.

These procedures truly capture the cyclical effects on the budget only under conditions of balanced economic growth, where the composition of output and the distribution of income do not change; if employment or the fiscal bases are in a different cyclical phase from GDP, these approaches are very imprecise. These composition and distribution effects could be responsible for the large fluctuations in the GDP elasticity of the budget over the economic cycle reported in Brandner et al. (1998) for the OECD countries.

We take into account the budgetary effects of changes in the composition of output and in the distribution of income by directly calculating reference values for those macroeconomic variables which represent good proxies for tax bases or whose impact on public finances is particularly large. To compute the reference values (and the corresponding gaps between actual and reference values) we use the same procedure adopted for GDP (i.e., applying the HP filter to a time series extended forward). The variables selected are: private consumption and imports (in real terms), employees' gross earnings and operating surplus (both adjusted using the GDP deflator) and the employment rate in the private sector. The first two couples of these variables proxy, respectively, for the indirect and direct tax bases; the private sector employment rate is assumed to have an automatic impact on unemployment spending (see Section 3.4 below).

The effects of output composition and income distribution may be especially large, seriously undermining the accuracy of the average elasticity estimates used to translate GDP growth into government revenue and expenditure projections. A good instance is the Italian cyclical upturn of 1995, which was led by exports and investment, demand components that are VAT-exempt, and marked by a large-scale shift in income from wages, which are subject to high tax rates, to profits, whose contribution to government revenue is proportionally smaller (mainly because the aggregate subject to taxation is only a component of the national accounts aggregate) and is received with a one-year lag. Taking into account only the output gap produces an overestimate of the impact of the 1995 economic recovery on that year's budget larger than 0.6 per cent of GDP; similar results are obtained for 1990 and 1991[11].

The particular structure of the 1995 upturn can be fully appreciated examining the movements in the gaps between actual and

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[11] To assess the impact of the extension of the analysis to variables other than GDP we have computed the transitory component of the budget applying our budget elasticities to the output gap of each year. In 1995 the transitory component computed in this way is less than .1 per cent of GDP, against our estimate of .7 per cent.

reference values of the mentioned macroeconomic variables. Whereas in 1995 actual GDP goes above its reference value in 1995, the gaps between actual gross earning and employment, on the one hand, and their reference values, on the other hand, widen (Table 2). As for consumption, the gap between its actual and trend values narrows, but much less than the output gap. Only imports, whose budget impact is much smaller, and operating surplus, whose impact is relatively small and lagged, display a cyclical improvement larger than that of GDP.

3.4 *The estimates of revenue elasticity*

Taxes were first grouped into categories according to the relevant tax base, which were approximated with national account variables. For each category we then estimated the elasticity with respect to the relevant national account variable.

Table 2

Gaps Between Actual and Trend Values

	GDP (output gap)	Gross earnings	Operating surplus	Household Consumption	Imports	Employment
1991	1.9	4.4	-1.7	3.3	5.3	1.9
1992	0.9	4.3	-6.9	2.6	5.8	1.7
1993	-1.8	0.3	-8.6	-1.4	-7.3	0.1
1994	-1.2	-0.9	-4.6	-1.5	-4.2	-0.7
1995	0.1	-2.4	1.6	-1.2	0.1	-0.9
1996	-0.8	-3.1	2.4	-1.9	-6.7	-0.8
1997	-1.0	-2.1	2.6	-1.2	-0.7	-0.8
1998	-1.3	-1.7	0.6	-1.5	2.9	-0.5
1999	-0.9	-1.3	-1.4	-0.5	3.4	-0.3
2000	-0.5	-0.9	0.3	-0.3	1.9	0.1

N.B.: Negative values indicate that a variable is below its reference value.

3.4.1. Defining the method

The classification of receipts in categories

In grouping the taxes we referred to the OECD classification, which considers four categories of receipts: a) direct taxes paid by households, b) direct taxes paid by the corporate sector, c) indirect taxes, d) social contributions[12].

However, we made some adjustments. First, we took into account a component of revenue not considered by the OECD classification: other revenue. Second, we adopted a different criterion in splitting direct tax revenue: while the OECD classification takes into account both the basis on which the tax is levied and who is subject to it, our methodology only considers the base. This is more relevant to us since we measure the cycle individually for each base. For the business taxes, the classification criterion was certain and unambiguous: we grouped only taxes on profits[13]. The household tax category was then computed as a residual from total direct taxes; in this way we obtained an aggregate that grouped taxes with several similar tax bases. This loss of precision is consistent with the objective of virtually classifying all forms of revenue at the general government level, in order to get the overall cyclicality of the revenue side of the budget[14].

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[12] The OECD classification (see *Revenues Statistics of OECD member countries*) is also used by the Commission.

[13] We broke down the personal income tax (Irpef), which is usually wholly included among the household taxes, into two parts: the withholding part of the tax and the self-assessed one. Since the first is levied on the gross earnings and the second on small firms profits, Irpef receipts were split between household taxes and business sector ones.

[14] If we had followed the base criterion in a more rigid way, we would have been able to classify only 70 per cent of total revenues, whether our less stringent criterion allowed the classification for the 90 per cent of revenue, i.e. all receipts except the other revenue.

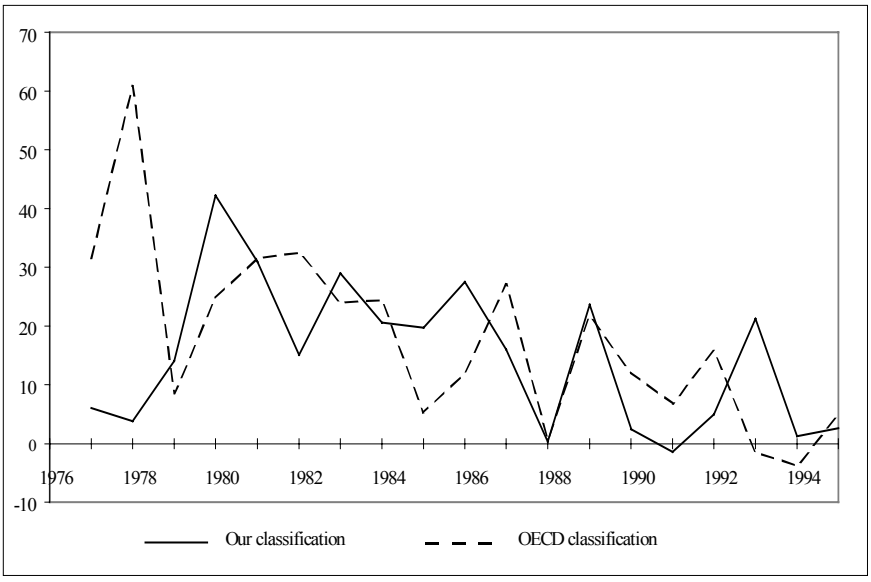
The business tax category includes corporate taxes (Irpeg and Ilor) and the portion of the personal income tax levied on unincorporated businesses. Our aggregate for business taxes differs greatly from the OECD category in its dynamics during the period which is relevant for the estimation of the elasticity (Figure 4).

The estimates of revenue elasticities

Proxies for the tax bases have been obtained using national account variables. The remunerations of production factors, as recorded in the cost component of the GDP account, were used to get an approximation of direct tax bases. We selected employees' gross earnings as the reference base for direct taxes on households, and operating surplus (net of the consumption of fixed capital and interest expenditures) for direct taxes on business. We identified private final consumption as the main base of indirect taxes.

Fig. 4

Business Sector Taxes
(annual percentage changes)



We then estimated the elasticity of tax revenue, *T*, to the relevant macroeconomic variable, *MV*. The elasticity is given by:

$$\varepsilon = \frac{\frac{\Delta T}{T}}{\frac{\Delta MV}{MV}}$$

Estimation of the elasticity can be obtained by different approaches. It can be based on econometric estimate, but several problems prevented us from using this approach for all categories. First, there is a very limited number of observations: annual data are available only starting with 1976, since the major tax reform of the mid-seventies produced deep changes, making it impossible to adjust data to avoid this break[15]. Second, there are difficulties in correcting the time series for the effects of the budget measures; the frequent changes in tax rules enforced in Italy during the last decade seriously alter the underlying relation between revenues and the cycle[16].

An alternative approach consists in breaking down the elasticity into two factors: *a*) the elasticity of the tax with respect to its tax base and *b*) the elasticity of the tax base with respect to the macroeconomic variable:

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[15] Monthly data are characterized by a strong seasonality due to the timing of tax collection.

[16] These difficulties induced Giorno et al. (1995) to use elasticities calculated on ad hoc basis, instead of the ones obtained with regressions of tax revenue on output.

$$\varepsilon = ET_{TB} \times ETB_{MV} = \frac{\frac{\Delta T}{T}}{\frac{\Delta TB}{TB}} \times \frac{\frac{\Delta TB}{TB}}{\frac{\Delta MV}{MV}}$$

The first elasticity, ET_{TB}, depends on both legal tax rates and the timing of payments as they are structured in the law (i.e., the legal tax structure). The second, ETB_{MV}, reflects the sensitiveness of the tax base (i.e., the fiscal definition of the base) to the corresponding macroeconomic variable fluctuations.

As long as the macroeconomic variable coincides with the taxable base (i.e. $ETB_{MV} = 1$), ε can be derived from the legal structure of the tax. For instance, for a tax with constant tax rate and no lags in the collection time, $\varepsilon = 1$; for a progressive tax, information on the distribution of income are also required.

The closer the tax base is to the macroeconomic variable, the more reliable this approach is. Moreover, the approach based on the legal structure of the tax has the advantage of eliminating the bias in the estimation stemming from the approximation implicit in the measurement of tax revenue and tax base. This is the approach followed, for example, by Ceriani and Di Mauro (1987), whereas Giorno et al. (1995) resort to this approach for the elasticity of indirect taxes.

In this paper we used a mixed approach: for some components an econometric approach was followed, for others we used the deterministic model developed by the Public Finance Division for its regular analysis and forecasting activity.

We resorted to econometric regressions for: *a*) taxes on business and *b*) other revenues. For the latter, the absence of a legal structure defining the amount of revenue simply prevented us from using the deterministic approach. As to business taxation, on the one hand, the collection timing and the rules concerning the definition of the tax base (deductibility of losses) made it very difficult to estimate ET_{TB} on the basis of the legal structure. On the other hand, ET_{TB} would have been a bad proxy for ε, given the diversities between the taxable base (firm profits) and the macroeconomic variable chosen (the operating surplus net of consumption of fixed capital and interest expenditures). Moreover

for such a specific component of revenue we were able to correct the time series for the effects of discretionary changes in policy.

For the other categories, taxes on households and indirect taxes, we followed the deterministic approach. For each tax included in the category, ET_{TB} was estimated using the model developed by the Division. Moreover, the highly detailed breakdown of taxes characterizing this model enables it to promptly adapt to institutional changes. In particular, since tax revenue items are set out in the greatest possible detail, at the level of the individual components of each tax, the procedures and timing of the payments of each tax can be taken into account, as well as the impact of budgetary measures and other rule changes.

3.4.2 Empirical results

For each category we estimated the elasticity with respect to the relevant macroeconomic variable. Table 3 gives the main results for the elasticities over the period immediately preceding 1997[17]. By adding the individual elasticities, under the assumption of balanced economic growth (i.e. changes of equal magnitude in the variables of relevance for the budget),the effect of the cycle on revenue amounts to 0.6 per cent in the first year; for an output gap that persists into the second year it increases, in cumulative terms, to 0.7 per cent.

According to our method the output gap plays a very limited role, as it affects only the other revenue component, which represents the 9 per cent of the total revenue.

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[17] The estimates are based on data referring to the fiscal system in force until 1997. At the beginning of 1998, a reform of the tax system was introduced. The reform affects the elasticity of taxes, but the available data are still insufficient to estimate the new elasticities.

Table 3

Revenue Elasticity With Respect To Macroeconomic Variables

	Business Income Taxes	Household Income Taxes	Indirect Taxes	Social Contrib.	Other Revenue	Total Revenue
GDP	-	-	-	-	0.25	-
Employees' Gross Earnings	-	0.44	-	0.6	-	-
Operating Surplus (t)	-	0.03	-	-	-	-
Operating Surplus (t-1)	0.49	0.18	-	-	-	-
Private Consumption	-	-	0.94	-	-	-
Imports	-	-	0.06	-	-	-
Effect of 1% increase for all variables:	-	-	-	-	-	-
First year	-	-	-	-	-	0.6
Second year	-	-	-	-	-	0.1
Sum	-	-	-	-	-	0.7

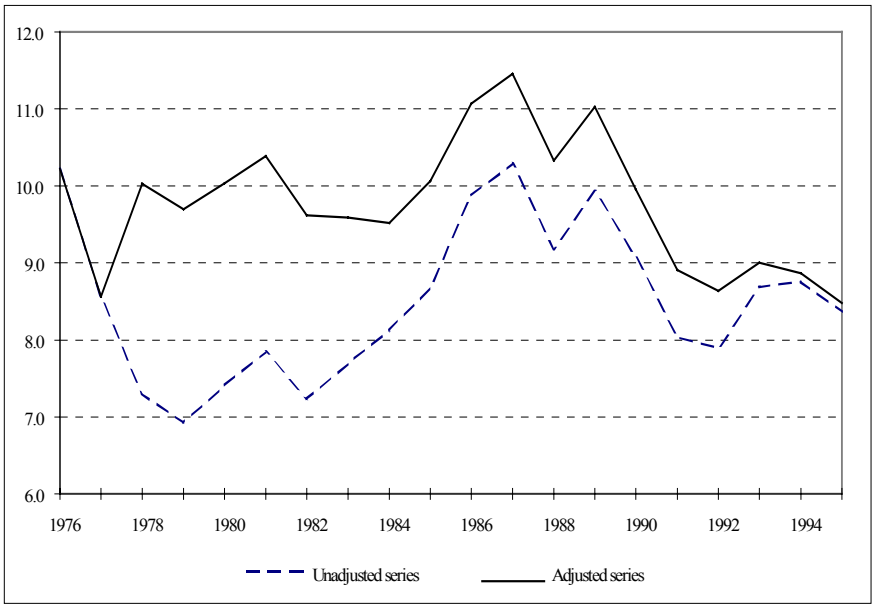
Direct taxes paid by the business sector

The actual series was adjusted to isolate the changes in revenues due to modifications in the tax structure. We corrected them for the effects produced by increases in legal tax rates and other measures introduced with the annual budgets. Between 1976 and 1997, the legal rate of taxes on profits rose from 39.7 to 53.2 per cent. The adjusted tax revenue is equivalent to that produced by a constant tax regime, the one in force in 1997 (Figure 5)[18].

[18] The impact on revenue of discretionary changes was evaluated on the basis of the expected nominal increase in revenue associated with the budget measure. This value, adjusted with a GDP deflator, was then added to the previous years revenue. We also applied the "Proportional data adjustment" by which the proportionate revenue impact of a tax change is assumed to be constant through time. We obtained similar results. See Paisley and Salmon (1995) and Virley and Hurst (1995), as examples of methods of controlling tax revenues for changes to the tax system.

Fig. 5

Business Sector Taxes
(percentage of total revenue)



We calculated the elasticity of business taxes using a simple regression model. The model reflects collection timing: in any given year, *t*, firms pay the balance of the tax on profits earned over the previous year, *t-1*, plus an advance relative to the profits earned over the same year, *t*. This advance is calculated on the previous year's liability; only in case of expectations of smaller profits, can it be calculated on year *t* income. In each year adjusted business tax revenue, *T*, is then given by:

$$T_t = B_t + A_t$$

where B_t is the balance of the tax payments relative to profits in time t-1 (which is a function of the time *t-1* profits and the installment payment at time *t-1* ($B_t = f(Y_{t-1}, A_{t-1})$), and A_t is the advance in the payment of the tax on time *t* profits (by law, $A_t = f(Y_{t-1}, A_{t-1})$). When $Y_t < Y_{t-1}$, the

installment payment can be reduced according to the new level of Y_t. Our model is given by:

$$T_t = f\left(OS_t, OS_{t-1}, T_{t-1}, D1\right)$$

where OS is the national account proxy for profits: the operating surplus net of consumption of fixed capital and of interest payments; D1 is a dummy variable introduced to take into account the year of recession and T_{t-1} is here considered as an approximation of A_{t-1} . In the estimation we started from the more general model, using the logarithmic form:

$$T_t = \beta_1 T_{t-1} + \beta_2 OS_t + \beta_3 \ OS_{t-1} + D1 + u_t$$

The contemporaneous profit variable and the dummy variable are insignificant and incorrectly signed. The $\chi 2$ test carried out for the deletion of the two variables allowed us to drop them. The final model we estimated is:

$$T_t = \beta_1 T_{t-1} + \beta_3 \ OS_{t-1} + u_t$$

The results are reported in the following table.

$log\ T_t$ = .43 $log\ T_{t-1}$ + .49 $log\ OS_{t-1}$

t-ratio (5.83) (7.9)

SE of Regression = .054

Diagnostic Tests (Significance level of the test in squared brackets):

LM test for residual serial correlation = .094 [.76]

$\chi 2$ Normality test = .86 [.65]

Ramsey Reset test for functional form = .18 [.67]

LM heteroskedasticity = .013 [.91]

The two coefficients have the sign predicted by the model and are significantly different from zero. Diagnostic statistics are satisfactory. The short-run elasticity of business taxes with respect to the previous year profit is 0.49 per cent. The long-run elasticity was also calculated, and amounted to 1.1.

The estimation confirmed the lag in the collection of business taxes, given the non-significance of the coefficient for OS_t. In calculating the overall elasticity, revenues had to be split into two parts: business taxes alone, which needed to be corrected for the cyclical fluctuations at time *t-1*, and the remaining part of the revenues, which was instead linked to the output gap of year *t*. In this respect, our results differ from those found by Chouraqui et al. (1990) and used by the European Commission and the OECD, according to whom there are no lags in the collection of corporate taxes in the Italian case.

Direct taxes paid by households

The elasticity of this category with respect to employees' gross earnings is 0.44. This result represents a weighted average of the elasticities of the personal income tax (only for the part levied on gross earnings) and of the other residual direct taxes, the first playing a more relevant role.

The elasticity of the direct taxes paid by households depends on one's assumptions on the composition of the overall dynamic of macroeconomic gross earnings, i.e. the relative shares accounted for by average earnings and by employment. The progressive income tax determines a revenue elasticity greater than one only if per capita income rises. An increase in the number of people working, with no change in per capita income, produces a proportional increase in income tax revenue, hence an elasticity approximately equal to one.

In this paper we assumed that the shares are equal. The following table displays the elasticity corresponding to different hypotheses on the increases in employment and average earnings, given a one percentage point rise in total earnings. The hypotheses are reported in the first column and in the first row:

Household Direct Tax Elasticity

Employment/Earnings:	0	0.5	1
0	-	-	0.60
0.5	-	0.44	-
1	0.28	-	-

In calculating the weighted average elasticity, the elasticity of personal income taxes with respect to earnings was set equal to 1.5. This value was derived using a methodology based on the distribution of the tax revenue (T) and of the taxable base (TB) by income classes[19]. Given that,

$$\frac{\Delta T_i}{\Delta TB_i} = the\ marginal\ tax\ rate\ at\ class\ i\ on\ the\ earnings\ distribution$$

$$\frac{T_i}{TB_i} = the\ average\ tax\ rate\ at\ class\ i\ on\ the\ earnings\ distribution$$

it follows that the ratio between the marginal tax rate and the average tax rate is the elasticity of the tax to its base. We first calculated the marginal tax rate and the average tax rate for each class of the income distribution and then obtained the weighted average of these rates, using weights derived from the income distribution itself. Having used data on actual tax payments, we took into account also tax credits and tax allowances.

[19] We used the distribution of income published by the Italian Ministry of Finance.

Other current revenues

This category includes non-tax receipts such as operating surplus, interest income, dividends, income from land property. In the Italian case they represent 9 per cent of total revenue. In the OECD and the European Commission approach, this category is not taken into account, implicitly assuming it to be independent of the business cycle. On the basis of a preliminary empirical investigation we decided to assign it a positive, though low, value of elasticity (0.25 per cent).

Social security contributions

For this category of revenue, the main tax base is employees' gross earnings. Since contributions are based on flat rates, their elasticity to gross earnings should be equal to 1. However, we must take into account the one-month lag with which changes in the tax base are reflected in contribution revenue. The elasticity is reduced, moreover, by the exclusion of the effects on the contribution receipts from general government as employer (since they have no impact on the budget balance). As a result, the elasticity of contributions with respect to gross earnings is 0.6 the first year and 0.8 the second.

3.5 *The estimates of expenditure elasticity*

On the expenditure side, we have followed the literature in assuming that only unemployment-related spending (in Italy, this means short-time earnings compensation - *Cassa Integrazione Guadagni* - unemployment and mobility benefits) is automatically affected by the level of economic activity.

Given the erratic fluctuations of these outlays and the numerous regulatory changes that have been made, including recently, we could not obtain a reasonably good estimate of their elasticity with respect to an appropriate variable relating to the state of the labour market. We have therefore assumed that the automatic mechanisms implicit in legislation and practice tend to maintain outlay per unemployed person constant in relation to GDP. On this assumption, a deviation of the number of jobless from the trend line affects public spending, other things being equal, by an amount equal to the size of the deviation multiplied by the per capita outlay (about 3 million lire in the years 1995-1997). Thus calculated, the

elasticity of total general government expenditure with respect to private sector employment was -0.04.

4. The results

The first part of the calculation of the structural balance involved estimating the reference values of the macroeconomic variables that are of particular relevance for the budget. The results of this part are the following.

- From 1994 to 2000, the macroeconomic variables with the greatest impact on the budget (consumption and employees' gross earnings) as well as employment, are always substantially lower than their trend values. The greatest gaps occur in 1996; since then, the differences between actual and reference values slowly decrease.

- The variables with a lesser impact (GDP, operating surplus and imports) present a less uniform cyclical pattern. In 1995, all of them move to levels above their reference values; this move is temporary for GDP and imports, while the operating surplus (a proxy for profits) remains substantially above trend values for most of the following years.

The second step was calculating the transitory component of the balance, on the basis of the estimated budget elasticities and of the above mentioned gaps (between trend and actual values) of the macroeconomic variables. We obtained the following results.

- In the period 1995-2000, the transitory component is alway positive, i.e. increases the deficit/GDP ratio, and averages 0.5 per cent of GDP. As high as 0.7 in 1995 and 1996, it slowly declines in the following years, reaching 0.2 in year 2000.

Table 4

Breakdown of General Government Net Borrowing
(*as percentage of GDP*)

	Net borrowing	Transitory component	Structural net borrowing
1995	7.7	0.7	7.0
1996	6.7	0.7	6.0
1997	2.7	0.4	2.3
1998	2.6 (*)	0.4	2.2
1999	2.0 (*)	0.3	1.7
2000	1.5 (*)	0.2	1.3

(*) Source: *Documento di programmazione economica e finanziaria per il 1999-2001*.

Though based on slightly different forecasts, the current evaluations published by the international organizations confirm our result that the cyclical position of the economy should have an unfavourable impact on the Italian budget in each year of the second half of the 1990s (except for 1995, when the Commission estimates a neutral impact). Nonetheless, there are large differences in the size and pattern of these effects.

- Our estimates generally indicate a lower impact than those of both the OECD and the IMF. Moreover, the behaviour of the transitory component of the budget appears very different: in our estimates the component declines throughout the period, whereas in the estimates of the OECD it increases until 1999 and in those of the IMF it remains constantly above the level of 1995.
- Our results are more in line with those of the Commission, except for 1995. The difference reflects the large-scale shifts in income distribution and in the composition of output, that had a substantial negative impact on public finances in that year.

Table 5

Transitory Component of General Government Budget Balance
(*as percentage of GDP*)

	our estimates (November 1998)	EU Commission (November 1998)	OECD (November 1998)	IMF (November 1998)
1995	0.7	-	0.4	0.6
1996	0.7	0.4	0.9	1.0
1997	0.4	0.5	0.9	1.4
1998	0.4	0.5	1.2	1.1
1999	0.3	0.4	1.2	0.9
2000	0.2	0.1	1.0	0.7

N.B.: Positive values indicate that the cyclical component worsens the balance.
Sources: European Commission (1998); OECD (1998); IMF (1998).

Finally, our analysis of budget elasticities indicates that, given an unchanged output composition and income distribution, a one-point increase in GDP reduces net borrowing by 0.3 points the first year and 0.4 the next. Our estimate of the first-year impact is midway between the most widely used current evaluations (those of the international organizations and of the Italian Treasury). That for the second year coincides with virtually all these estimates (Appendix 1).

APPENDIX

The GDP Elasticity of the Italian Government Budget: A Comparison of Estimates

In this appendix we compare our estimates of the government budget's elasticity to macroeconomic conditions with those published by the Commission, the OECD, the Italian Treasury Ministry (State General Accounts Department) and the IMF.

To permit homogeneous comparison between our estimates, which refer to the relations between the budget and various macroeconomic variables, and the others, which concern the budget's GDP elasticity, it is hypothesized that the changes in GDP reflect balanced economic growth, i.e. changes of equal magnitude in households' final consumption, imports, total earnings and employment (the other macroeconomic variables considered by our methodology). Our estimate of the budget's elasticity to GDP is therefore calculated as the sum of the partial elasticities relative to the above-mentioned variables.

For the GDP elasticity of total revenue, the internal estimates calculated as described present values close to and generally falling between the other estimates examined (Table 6). Our estimate of the GDP elasticity of revenue for the first year (0.6) falls between the Treasury Ministry's estimate of 0.4 and the estimates of the intewrnational organizations (which range between 0.7 and 0.8). Our estimate of revenue elasticity in the second year (0.8) - in formulas: $(\Delta R_{t+1} / E_{t-1}) / \Delta GDP_t / GDP_{t-1})$ - falls between that of the IMF (0.9) and the estimate of 0.7 shared by the Treasury, the Commission and the OECD. The estimates calculated by the last two institutions do not take lags in receipts into account, so that elasticity coincides with that of the first year.

It is to be noted, however, that the pronounced similarity of results for total revenue conceals large differences in the estimates for the individual components.

Our estimates greatly differ in the case of the elasticity of direct taxes on firms: our 0.49 compares with 2.9 of the OECD and Commission estimates. The difference may reflect two factors. Firstly, as

already explained, we use a different criteria for grouping this category of taxes. Secondly, the high level of taxes elasticity to GDP calculated by the OECD may reflect the great sensitivity of profits to cyclical fluctuations. This aspect is no caught by our method since we estimate the elasticity with respect to a proxy of profits. The lower value of firm tax elasticity is partly compensated by the inclusion in our analyses of a positive elasticity for the other current revenues.

In the case of the elasticity of expenditure to GDP, whose quantitative importance is smaller, our estimates are again in the middle of the range of those examined, falling between the estimates of the OECD and the IMF, which indicate an elasticity close to zero, and those of the Commission and the Treasury Minister. Note that the Commission's estimate of the GDP-elasticity of expenditure (0.14) reflects two estimates: one of the elasticity of unemployment to GDP, the other of the elasticity of expenditure to unemployment (see Section 2.2). The latter, equal to 0.2 and strictly comparable with our estimate of 0.04 (which refers precisely to the elasticity of expenditure of employment), seems very high; in particular, it is higher than the average for the other European countries, despite the fact that the level of spending on unemployment in relation to GDP in Italy is roughly a quarter of the European average.

As a whole, the differing estimates of the expansionary effects of an output gap of 1 percentage point on the general government budget balance diverge substantially at least for the first year in which the gap emerges: they range between the Treasury's estimate of 0.2 per cent of GDP and the Commission's, OECD's and IMF's estimates of 0.4 per cent. According to our estimates, these effects amount to 0.3 per cent. By contrast, the estimates of the effects on the budget balance of an output gap that persists into the second year converge at 0.4 per cent.

Table 6

Elasticity of the General Government Budget with Respect to GDP and Effects of a 1 Percentage Point Output Gap on the Budget Balance: Comparison of Estimates

	European Commission (1)		OECD (2)		IMF (3)		Italian Treasury (4)		Our estimates	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
Direct *- household* *- firms*	1.1 *0.4* *2.9*	1.1 *0.4* *2.9*	1.1 *0.4* *2.9*	1.1 *0.4* *2.9*	n.d. *0.8* *1.7*	n.d. *0.8* *2.4*	n.d. *n.d.* *n.d.*	n.d. *n.d.* *n.d.*	0.3 *0.4* *-*	 *0.6* *0.5*
Indirect	1	1	1	1	0.8	0.8	n.d.	n.d.	0.9	1
Social Contributions	0.3	0.3	0.3	0.3	0.6	0.6	n.d.	n.d.	0.6	0.7
Other revenue	-	-	-	-	1.0	1.0	n.d.	n.d.	0.25	0.50
Total revenue	**0.7**	**0.7**	**0.7**	**0.7**	**0.8**	**0.9**	**0.4**	**0.7**	**0.6**	**0.7**
Total expenditure	**0.14**	**0.14**	**-**	**-**	**-**	**-**	**0.05**	**0.1**	**0.04**	**0.04**
Effect on balance (as a % of GDP)	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.4**	**0.2**	**0.4**	**0.3**	**0.4**

(1) Source: Based on European Commission (1995). The average for total revenue differs from that reported in the source document because it is calculated on general government's total receipts and not only on the total of the main components.
(2) Source: Suyker (1999).
(3) Source: Hagemann (1999).
(4) Source: Ministero del Tesoro (1998).

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