# APPRAISING THE EFFECTS OF THE BUDGET ON THE ECONOMY WITH AN ECONOMETRIC MODEL: THE ITALIAN FISCAL ADJUSTMENT IN THE NINETIES

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## 1. Introduction and summary conclusions

Recent years have witnessed a renewal of interest in the stabilisation role of fiscal policy,[1] for a number of reasons. In Japan, the textbook limits of monetary policy have long emerged. In the US, the achievement of substantial budget surpluses and the recession that started in March 2001 have stimulated a debate, both in the academic and political arena, on how fiscal stimulus should be wielded to contrast the downturn.[2] In the euro area, a more activist role of fiscal policy is being considered, given that national policymakers can no longer rely on monetary and exchange rate policies to cope with macroeconomic shocks which affect their individual countries.

In short, in all major economic areas of the world fiscal policy has returned to centre stage in the political and academic debate; its effects on output growth and other aspects of the macroeconomy are being heatedly discussed, after years of relative neglect.

Two approaches are generally used to evaluate the budget's impact on the economy.[3] One is based on synthetic indicators. They include the extremely crude reference to the change in the primary balance-to-GDP

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[1] Measuring the effects of the government budget on economic activity was the main focus of public policy studies from the fifties to the seventies (see e.g. Brown (1956), Oakland (1969), and Blinder and Solow (1974)). This reflected the importance of the objective of cyclical stabilisation that was assigned to fiscal policy and a theoretical framework that tended to focus on the short run. In the following decades the focus of most fiscal studies shifted to medium and long-term considerations, owing to changes in the theoretical frame of reference and to the empirical context, characterised by unsustainable fiscal positions in many of the major industrialised economies.

[2] See e.g. Seidman (2001) and *The Economist* (2002).

[3] A review of the theoretical and applied literature on the subject is beyond the scope of this work. See e.g. IMF (2000) and the review of fiscal policy indicators in Bosi *et al.* (1990).

ratio, sometimes cyclically-adjusted, and slightly more sophisticated indicators, constructed by weighting the various components of the budget according to their estimated impact on aggregate demand. The second is based on simulation of an econometric model.[4] [5]

This paper describes a procedure belonging to the latter approach and focused on evaluating the short-term impact of the budget[6] on economic activity. In a nutshell, the appraisal is based on a comparison between the historical macroeconomic outcome and the result of a counterfactual simulation of the model in which, for each year under investigation, it is imposed that the ratio of each budget item to GDP remain unchanged from the preceding year.

Being based on using an econometric model, the proposed procedure allows one to take into account the interaction of the economic variables over time and, in general, a larger number of relationships between the budget and the economy than more synthetic indicators. It provides not only a measure of the effect of the budget on output, but also of its impact on prices and other macroeconomic variables. Finally, it can be used to attribute these effects to different budgetary features, including year-on-year changes in the level and composition of the balance and the quarterly performance of revenue and expenditure during the year.

The methodology proposed is then used to appraise the impact of the budget on the Italian economy in each of the ten years of the period 1991-2000, using the Bank of Italy's Quarterly Econometric Model (BIQM).[7] It should be underscored that the procedure described here does not make a distinction between budgetary changes deliberately sought by the public sector through the active use of economic policy instruments

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4 A standard reference is Blinder and Goldfeld (1972).

5 In recent years, a number of analyses of the effects of fiscal policy have used a structural vector autoregression (SVAR) approach (see, e.g., Blanchard and Perotti (1999)), and hence are meant to evaluate the impact on the economy of exogenous shocks in fiscal policy. Thus, they are not strictly comparable with the two approaches mentioned here, which aim at assessing the overall effects of the budget on economic activity.

6 In this paper the term "public sector", which is often used in this context, is generally replaced by "budget", which is intended to indicate that the analysis does not cover all the possible effects generated by the wide-ranging and complex activities of the Government but is limited to those that can be traced to the budget, i.e. to the items on the income statement and balance sheet.

7 The procedure described here has been regularly used as the basis for the comments on the impact of the budget on output traditionally contained (in the Section on Public Finances) in the Bank of Italy's Annual Report, starting with the Report for the year 1995.

available to it and changes otherwise induced, including automatic changes in budget items due to macroeconomic developments, particularly the phase of the cycle. In other words, the indicator points to the overall consequences of the government's active and induced conduct, but cannot attribute those consequences to automatic or discretionary mechanisms. A number of methodologies have been developed to evaluate the effects of discretionary policies alone, some of which are based, like the approach presented here, on econometric models (see Artis and Green (1982), Bosi (1986), Bosi, Golinelli, Mantovani and Stagni (1990) and Sartor (1998)). However, the identification of discretionary policies calls for the adoption of numerous hypotheses, which heavily influence the results.[8]

It should also be noted that while on the one hand an econometric model can clearly define an ample range of effects on output generated by the budget, on the other it is unlikely that it can provide indications regarding some potentially significant channels for the transmission of budgetary policy to the economy. This is particularly true in the case of the effects of the behaviour of the public sector or of its announcements on operators' expectations regarding interest and exchange rates.

Given the very considerable difficulties involved in defining these relationships, in applying the proposed methodology to the Italian economy in the 1990s we deemed it preferable to consider only the channels of influence explicitly codified in the BIQM. However, we investigated the sensitivity of the results to changes in the basic structure of the model, which is largely backward-looking, aiming at making some of its key components forward-looking. In particular, the experiments were re-run after replacing the main private consumption equation in the basic version of the BIQM with a new specification, in which consumer spending reacts to current as well as to future expected disposable income. Moreover, in some additional experiments we formulated a different assumption regarding the reaction of monetary policy to the counterfactual changes in fiscal policy (for this purpose, the monetary policymaker was

[8] The variety of institutional authorities (the government, parliament, regional and local authorities) which can influence the general government budget, as well as the complexity and interaction of the decision-making processes in which they are involved, make it difficult even to identify all the categories of action to be classified as budgetary policies in a given year. Additional problems arise when dealing with actions that do not have an immediate impact on the public finances and with rules which are formally temporary but in fact are extended every year in a semi-automatic way.

assumed to behave according to an estimated forward-looking Taylor-type rule).

It should be emphasised that our analysis focuses on the impact of the fiscal policy of *year t* on the economy *in the same year.* Hence, the lagged effects of the public budget on the economy are largely ignored. It is the counterfactual nature of the experiments that suggested that we confine ourselves only to the short-term effects of the budget, as counterfactual simulations become increasingly meaningless as the simulation period is extended. One should think, for instance, of the difficulties inherent in running a counterfactual simulation that assumes no fiscal adjustment at all for the whole decade 1991-2000. To formulate the scenario that might have stemmed from such an assumption (in terms of its likely repercussions on monetary policy, the exchange rate, the expectations and behaviours of consumers and firms) is virtually impossible. In other words, if the question "What would have happened if the adjustment process had been suspended for any given year?" seems to be a sensible one, the question "What if there had not been any adjustment at all in Italy in the Nineties?" appears to be almost meaningless. A counter-history stretched to cover too long a span of time is exposed to the criticisms amusingly exemplified in Preston McAfee (1983).[9]

Section 2 discusses the main characteristics of the BIQM, focusing on general government and the mechanisms that determine its linkages with the level of output. Section 3 outlines the assumptions used in constructing the counterfactual baseline simulation meant to identify the macroeconomic context that would have resulted, given the behavioural relations embodied in the model, had the public budget balance been "neutral". Specifically, Section 3.1 concentrates on the definition of "neutrality" used in the present paper, while Section 3.2 sets out several *ceteris paribus* assumptions referring to such hard-to-quantify phenomena as expectations and risk premia in the financial and foreign exchange markets.

In Appendix 1 a full description of the variant simulations that have been carried out to attribute the overall effect to a number of features of the public budget is given. Appendix 2 presents how some of the main assumptions underlying the basic results have been relaxed in a set of

[9] Regarding the strengths and weaknesses of counterfactual simulations see also the remarks in Locarno and Rossi (1995).

alternative simulations. Appendix 3 describes three synthetic indicators of the budget's impact on economic activity, referred to in the discussion of the method adopted here and its results.

The key results obtained when this procedure is applied to the period 1991-2000 are described in detail in Section 4. They may be summarised as follows.

1. The adjustment effort of the period 1991-97, which eventually resulted in the Italian participation in the EMU, was unsurprisingly very restrictive, implying a reduction of the rate of growth of output of about 0.6 percentage points in each of the 7 years. The impact of the budget was greatest in 1995 (–1.4 percentage points) while it was almost neutral in 1991 and 1996. As fiscal policy relaxed after 1997, the budget's effects became positive in 1998 and in 1999, neutral in the year 2000.
2. While retaining its basically restrictive impact throughout the decade, the effect of the budget on economic activity was mildly counter-cyclical, confirming the results of earlier studies for the 1970s and 1980s. Indeed, the largest negative effects were recorded in 1994 and 1995, when GDP growth was relatively high.
3. The impact of the budget is attributed to four different factors: a) changes in the balance, in the absence of any change in its composition and in the number of public employees; b) changes in the composition of the budget; c) changes in public sector employment; d) the quarterly pattern of accounts. Overall, the first three factors were, on average, restrictive, while the fourth had a negligible impact on the results. Focusing on the consolidation period 1991-97, about 6 tenths of the overall restrictive impulse is to be attributed to the first factor. Interestingly, almost 3 tenths of the overall restrictive effects in the period 1991-97 came from the second factor (composition of the budget) and the remaining tenth from the third (dynamics of public employment). The changes in the composition of the budget exerted large effects on economic activity in several years: in 1991, they nearly offset the restriction determined by the improvement in the primary balance; in 1994, they more than offset the deterioration of the balance; in 1995, more than half of the large negative contribution of the budget to economic activity reflected changes in the composition of the primary budget.

4. The results show that, according to the relationships included in the BIQM, an improvement (worsening) of the primary balance of 1 per cent of GDP, distributing the change proportionately among all the items of the budget, results in a reduction (increase) in the rate of growth of output of about 0.3 percentage points.
5. The assessment of the effects of the budget on economic activity in the Nineties appear significantly different, both quantitatively and qualitatively, from those obtained using the synthetic budget indicators commonly used to assess the fiscal stance.
6. The average impact of the budget on inflation was basically nil in the decade, being slightly negative in the years 1992-96 and positive afterwards.
7. Finally, the results seem to be robust with respect to changes in some of the key assumptions embodied in the basic structure of the BIQM, regarding in particular the process of expectations formation and the conduct of monetary policy.

## 2. An indicator based on the BIQM

The BIQM provides considerable detail on government budget items and their interaction with the rest of the economy. In particular, it takes more complete account of economic agents' behaviour patterns than do more synthetic indicators: the latter by and large neglect the multiplier and accelerator effects of variations in budget items, because they only take into account the direct impact on the various components of demand.[10] The model also permits evaluation of the consequences of the changes induced in prices and stocks. For example, higher indirect taxation leading to an acceleration in domestic price inflation may harm competitiveness, reducing net export demand. This in turn alters the country's net external position, hence the wealth of the private sector, resulting in a contraction

[10] In constructing summary indicators the impact of the public sector on demand components is generally calculated according to an estimate of their long-term elasticities (an exception is the weighted, lagged budget balance suggested by Ceriani and Di Mauro (1986)). A reliable quantification of the multiplier and accelerator effects, however, requires a detailed description (like that of the quarterly model) of the lags with which consumption and investment respond to changes in net public transfers. It is possible that in some circumstances the multiplier and accelerator mechanisms do no more than modify the results in scale (see Ceriani and Di Mauro (1986), p. 13), without affecting the analytical conclusions in qualitative terms. When there are significant non-linearities within the model, however, this is no longer the case.

of consumption. These mechanisms may only be captured if a fully-fledged econometric model is used in assessing the impact of the budget on the macroeconomy.

In addition to remedying some of the shortcomings of summary indicators, a BIQM-based indicator helps meet a significant requirement, namely strong internal consistency with the cyclical and forecasting analysis of the Bank of Italy Research Department, which relies on that model.

### *2.1 Main features of the model*

The new version of the BIQM shares many of the characteristics of the previous one, released in 1986 (see Banca d'Italia (1986)). Its long-term properties are consistent with a neoclassical model postulating exogenous growth, in which full employment of factors is accompanied by a constant rate of inflation, hence constant relative prices. The levels of output and of the employment of capital and labour are consistent with the parameters of the aggregate production function and with relative factor costs. The steady-state growth path of the model, stemming from technical progress and the accumulation of real and financial wealth, interacts with the dynamics of the adjustment process to determine short-term characteristics. The adjustment processes essentially reflect three factors: the stickiness of prices and wages, which prevents their instantaneous adaptation to the situation of full resource utilisation; the non-malleability of installed physical capital, which limits the short-term modifiability of the relative composition of productive factors; and the possibility that expectations and outcomes may not coincide. In the short run, therefore, given these rigidities, the characteristics of the model fit the Keynesian framework in which the level of output is determined by the trend in aggregate demand, in a situation of oversupply in both the goods and the labour market.[11]

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[11] The coexistence of a neoclassical macroeconomic equilibrium framework with Keynesian short-to-medium-term adjustment processes is a feature shared by most existing macroeconometric models (see, e.g., Church, Sault, Sgherri and Wallis (2000)).

A detailed description of the relations incorporated into the BIQM lies beyond the scope of the present paper.[12] To facilitate the interpretation of the results discussed in Section 4, however, it is helpful to examine the principal mechanisms whereby the level of economic activity and price dynamics react to changes in the public budget.

### *2.2 The role of the budget in determining the level of economic activity and prices*

In describing the mechanisms whereby changes in the aggregates of the public finances affect the level of economic activity, it is appropriate to distinguish (as in some synthetic indicators, see e.g. Ceriani and Di Mauro (1986)) between the consequences attributable to the impact of net transfers on the behaviour of households and enterprises and those due to variations in expenditure on goods and services, investment and wages and salaries.

Changes in any one of the latter items are directly reflected in the identity that determines GDP at current prices; however, the impact on real GDP also depends on any effects such changes may have on relative prices.[13] The demand of the public sector triggers the multiplier and accelerator mechanisms associated with the consumption and investment functions. In part, moreover, it is directed abroad, but general government expenditure on goods and services has a smaller impact on imports than the average of the other components of demand, so that the leakage effects are relatively limited. This feature is shared, to a smaller extent, by public investment.

As regards the net transfers of the public sector, their main influence is on households' consumption, which, in accordance with the classic life-cycle model, is a function of permanent income and wealth. In addition to these two variables, the equation also contains the real interest

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[12] For a more detailed description of the main properties of the model, see Banca d'Italia (1986), Galli, Terlizzese and Visco (1989), and Terlizzese (1994). A discussion of the latest versions of some of the principal equations is in Siviero and Terlizzese (1997). An up-to-date description of some of the main equations in the supply block of the model can be found in Parigi and Siviero (2001). Extensive simulation experiments may be found in Altissimo and Siviero (2002).

[13] In particular, it is necessary to specify, for the stimulus associated with changes in wages and salaries, whether such changes are the result of changes in unit earnings or in the number of public employees. For more details, see Section 3.2.1.

rate, which plays the dual role of capturing intertemporal substitution effects and correcting, albeit approximately, the error caused by measuring wealth at replacement cost instead of market prices. In the standard version of the model, consumers' behaviour is backward-looking. A forward-looking consumption function is specified and estimated in Appendix 2.

The disposable income underlying households' consumption decisions is defined with reference to the entire private sector (hence without distinguishing between general government net transfers to households and enterprises) and includes only the current items of the general government accounts. This is consistent with the classification adopted for the national accounts, which exclude net capital transfers from the income account. This exclusion has a particularly pronounced effect on the results presented in Section 4.1 owing to the substantial recourse made in the period in question to one-off revenue measures, the proceeds of which are counted as capital revenue.

Given the presence of the private sector's total wealth in the consumption function, households' expenditure also varies with changes in the stock of public debt.

Enterprises' demand for factors of production is modelled as the result of a cost-minimisation process in a putty-clay context: hence, only the marginal vintage reflects the behaviour of relative factor prices.[14] The latter are a function both of the direct tax rate applicable to enterprises, which contributes to the cost of capital (with a series of adjustments to take account of tax measures designed to encourage investment) and of employers' social security contribution rate. The tax component of the behaviour of general government thus has a direct influence on enterprises' investment choices.

The indirect effects produced by the operation of the accelerator mechanism in the wake of a change in aggregate demand depend on the dynamic structure of the investment equation. The latter, in fact, is not exclusively a function of current variables. The existence of delivery lags

[14] The theoretical approach referred to in the text is applied only to investment in machinery, equipment and transport equipment. For the components relative to residential and non-residential construction, the model uses a simplified approach that is less constrained by restrictions imposed by theory.

means that the flow of investment includes plant and machinery belonging to earlier vintages, corresponding to different values of relative factor prices and hence of the optimal relationship between capital and output. Also, the desired changes in production capacity, which in principle reflect the expected development of demand, are proxied by a distributed lag of the level of value added.

One further aspect of enterprises' behaviour that is directly affected by changes in the budget is the demand for credit, since an increase in investment subsidies reduces their financing needs.[15]

In contrast with what generally happens in the simplified models underlying the synthetic indicators discussed above, the quarterly model takes account of the reactions of the components of aggregate demand to changes in prices produced by a fiscal stimulus, both directly through changes in indirect tax rates and indirectly insofar as an acceleration in aggregate demand as a result of increases in public expenditure causes a short run gap between capacity and the actual level of economic activity, with potentially inflationary consequences.[16] An increase in prices, regardless of the cause, reduces competitiveness and accordingly net exports. There is also a negative effect on consumption decisions owing to the reduction in disposable income necessary to take account of the diminished purchasing power of financial wealth.

As will be seen from the results presented in Section 4, prices often diverge significantly from the values observed in the counterfactual simulations underlying the indicator presented here. It is thus possible that considering the interrelationships between quantities and prices may give rise to significant differences from the results obtained with indicators that ignore them.

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15 The policy adopted for financing the Treasury's borrowing requirement also affects the financial, monetary and credit variables. These effects are not considered here because their role in determining the short-term effects of the budget on economic activity is almost negligible.

16 For an evaluation of the effects of the capacity utilisation rate on prices in the quarterly model, see Gavosto and Siviero (1995). In addition to the influence of the mechanisms described in that work, the inflation rate is affected by public sector employment policies, insofar as these influence the unemployment rate and hence, via the Phillips curve, the rate of increase in wages.

## 3. The design of the counterfactual benchmark simulation

Using the econometric model to measure the impact of the budget on economic activity in a given period involves comparing the historical values with those given by a counterfactual benchmark simulation serving to identify the macroeconomic scenario that would have been produced by a "neutral" budget.[17] In order to define the counterfactual simulation, it was necessary to make a series of methodological and operational choices. The most important decision, on the definition of a "neutral" budget, is examined in Section 3.1. The hypotheses on the main exogenous and policy variables are discussed in Section 3.2.

Before moving on to describe the experimental design, it is necessary to discuss a potential weakness: as is inevitably the case with all analyses that require appraising the effects of a change in policy, our results are affected by the well-known difficulties associated with the evaluation of policy measures on the basis of behavioural relationships found to hold under a different policy set-up (Lucas (1976)).

There are, however, several reasons to believe that in practice the Lucas Critique may be less disruptive than one may tend to think. First, the behaviour of economic agents may be backward-looking rather than forward-looking, and forward-looking behaviour is a key ingredient in Lucas-type non-structurality. It is thus possible to test empirically which of the two behavioural schemes is appropriate (Hendry (1988), Favero and Hendry (1992)).[18] Second, even if the agents' expectation formation process is assumed to be forward-looking, the possibility exists that, because of the indeterminacy of the equilibrium, one may still specify rational and "Lucas-proof" decisional rules (Farmer (1991)). Third, the institutional changes or policy measures in question may not be the "regime shifts" necessary for the Lucas Critique to apply (Sims (1982)). Finally, even if each individual agent were to modify her/his decisional

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[17] The classic reference for this methodology, based on counterfactual simulations of an econometric model, is Artis and Green (1982), which sets out to measure the impact on growth of discretionary fiscal policy measures.

[18] As the sample used in the estimation of the BIQM (from mid-1970s to end-1990s) arguably embeds numerous changes in both the policy stance and the institutional set-up (for a detailed description of the operational and institutional changes in monetary policy see Passacantando (1996)), and given that no clear signs of coefficient instability can be found (see Siviero and Terlizzese (1997)), one might feel somewhat re-assured, in this respect, about the reliability of the results presented below.

rule as a consequence of a policy regime shift, the aggregation of heterogeneous reactions may result in an aggregate response that is much less pronounced than each of the underlying individual reactions, so that the actual, aggregate macroeconomic effects of a policy change may be better approximated by an approach that disregards the inherent non-structurality (Altissimo, Siviero and Terlizzese (1999)).

Nevertheless, in an attempt to alleviate the potential impact of the Lucas Critique on our results, we also investigated how the conclusions are likely to be affected if the assumption that consumers do not take future expected policy into account when forming current decisions is relaxed (see Section 3.2 and Appendix 2).

### *3.1 The definition of a "neutral" budget*

In order to construct a counterfactual benchmark simulation it is necessary to have an *a priori* definition of public sector behaviour patterns that are "neutral" with regard to changes in the level of economic activity. The adoption of a definition of "neutrality" is not simply a technical "operational" choice but reflects a particular view of the working of the economy.

The criterion adopted in this paper is similar to that underlying a number of other works on this issue: *the activity of the public sector is neutral if all the items of the general government budget, excluding interest payments, remain unchanged in relation to GDP from one year to the next*.[19]

Defining $y_{t,q}$ as the ratio of any budget item in the $q$th quarter of year $t$ to GDP at current prices in the same period, the following constraint was imposed in the simulation for the construction of the benchmark for the year $t$:

$$y_{t,q} = \bar{y}_{t-1}$$

where $\bar{y}_{t-1}$ is the average value of the variable in the previous year.

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[19] As noted in the Introduction, the results produced with the concept of "neutrality" adopted here do not coincide with those that would be obtained by assuming unchanged legislation. In the case of excise taxes, for instance, the yield would remain unchanged in relation to GDP from one year to the next only in the event of changes in the law, except in special circumstances.

Synthetic indicators of the budget's impact on aggregate demand (see Appendix 3) face a basically analogous problem. A different definition of neutrality is proposed in Ceriani and Di Mauro (1986), namely the absence of change in the different items of the budget in real terms.[20] In other words, the budget is deemed "neutral" if the quantities of resources levied and distributed remain unchanged. By contrast, Blanchard (1990) and the IMF's *Fiscal Impulse* define neutrality as the absence of change in relation to GDP.

The reference to unchanged quantities in real terms is hardly compatible with the models of balanced growth determined by technological progress and the availability of productive factors. In fact, in a situation of long-term equilibrium the demand of each institutional sector (which is "neutral" by definition with respect to growth) remains unchanged in relation to GDP, whereas the definition of "neutrality" based on unchanged real quantities implies a progressive decline in the public sector's importance in the economy.[21]

The choice of the definition of neutrality to be used is also constrained by institutional factors. The reference to GDP, in particular, is justified by the tendency for the size of the public sector in each country to be related to the level of economic activity. This tendency is a consequence of the operation of automatic fiscal mechanisms and of the fact that the number and scale of the activities performed by the public sector tend to be a function of the size of the economy.

A different criterion was adopted for interest payments; these are not determined on the basis of a definition of neutrality but kept endogenous as a function of interest rates and the size of the public debt.[22] Consequently, the counterfactual simulation takes account, via the channel of interest payments, of the indirect effects associated with the divergence of other items of the budget from their historical values.

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[20] In the literature on Italy, the same criterion was adopted by Morcaldo and Violi (1989), who assess the effects of the budget on the basis of counterfactual simulations of a simplified income-determination model.

[21] The criterion of constancy in real terms also has operational drawbacks. In particular, where both revenue and expenditure are rising, it results in counterfactual simulations marked by a composition of the budget that is systematically different from that actually recorded (with lower levels of both revenue and expenditure). This in turn risks making the results less reliable.

[22] For the treatment of interest rates in the counterfactual benchmark simulation, see Section 3.2.

### *3.2 The* ceteris paribus *hypotheses*

In order to complete the description of the design of the benchmark simulations, it is necessary to explain the assumptions made with respect to the exchange rate of the lira, interest rates and the mechanisms involved in the formation of expectations.

As regards interest rates, in a first set of experiments (which we designate as "standard" or "basic") the choice was made to keep the monetary policy stance unchanged with respect to history; thus, the real *ex post* interest rate on Italian Treasury bills (the average of 3, 6 and 12-month maturities) is set equal to the value historically observed. The other interest rates react to the movement in the Treasury bill rate in accordance with the relationships built into the quarterly model.

It might be argued, however, that a better approximation of the counterfactual behaviour of the monetary policymaker could be attained if a sensible policy rule could be used for this purpose, rather than simply imposing a "normative" constraint such as the one underlying the standard simulations. In order to meet this criticism of the basic simulation results, the experiments were repeated with a slightly modified version of the BIQM, in which the monetary policy authority reacts to inflation and output developments according to an estimated Taylor-type reaction function of the forward-looking kind. Hence, this modification of the basic model structure also pulls forward-looking elements into the picture. A detailed description of the Taylor rule specification and estimation is given in Appendix 2; further information may be found in Altissimo and Siviero (2002).

As regards the (nominal) exchange rate, the technically simple hypothesis of unchanged values with respect to those observed was adopted. Incidentally, this is consistent with the exchange rate policy pursued for most of the period in question, with the exception of the period between September 1992 (when Italy abandoned the ERM) and end-1996 (when it rejoined).[23] Any assumption that required postulating a different exchange rate policy would have taken us onto very slippery ground.

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[23] The simulations were also repeated keeping the real exchange rate unchanged with respect to its historical values. The results obtained in this exercise are briefly discussed in Section 4; in short, this robustness check does not signal any significant sensitivity of the results with respect to this modification in the exchange rate assumption.

Instead of the foregoing hypotheses it would have been possible, in theory, to try and take account of the effects of the public finances on the risk premium associated with the issuer and expectations concerning inflation and the exchange rate.[24] However, it was felt that following such a course would have necessarily required the adoption of criteria characterised by a wide margin of discretion, given the well-known difficulties of finding sensible and empirically robust explanations of risk premia dynamics. The only alternative exchange rate assumption that was experimented with (unchanged PPP with respect to history) did not alter the main conclusions.

As regards the treatment of economic agents' expectations, the latter are by and large assumed to be of the adaptive type in the BIQM, with the exception of inflation expectations, which are generated by an equation modelling expectations data taken from the Isco-Mondo Economico survey; see Nicoletti Altimari (1997).[25]

It should be noted, however, that some phenomena that may play an important role in determining the effect of fiscal policy on the economy cannot be easily taken into account. Consider, for example, the effect of announcements of future tightening or of measures perceived by economic agents as indicating a turning point in the orientation of budgetary policy. Obviously, however, constructing counterfactual indicators for the effects of announcements or perceived changes in fiscal policy orientation would be a hopeless task.

Nevertheless, a modification of the basic version of the BIQM that allows consumers to behave in a forward-looking manner was tested: specifically, a consumption function was estimated that assumes consumer spending to be affected by future as well as current disposable income. The specification and estimation details are discussed in Appendix 2. In the experiments that rest on the BIQM modified as described just above, the simulations cannot be run only for period *t* (the year under investigation), but must embrace a longer time span, so as to provide an estimate of the current effects of future (expected) changes in the budget balance and composition. Specifically, it was imposed that all items of the

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[24] As described below, the basic BIQM structure allows for macroeconomic policy to affect inflation expectations.

[25] The model can also be simulated under the assumption of rational expectations; see, e.g., Nicoletti Altimari, Rinaldi, Siviero and Terlizzese (1995).

public sector balance (as a share of GDP) remain constant at the average value of year $t$–1 for years $t$, $t$+1, $t$+2 (as a terminal condition, it was assumed that public items as a ratio to GDP go back to their historical values starting in the first quarter of year $t$+3; sensitivity analyses showed that, if the terminal condition is moved further forward, and the simulation period is accordingly extended, the results remain basically unaffected).[26] Thus, the experimental set-up presents elements of similarity with the forward-looking synthetic indicator proposed in Blanchard (1990), which assumes consumption to depend on current as well as future transfers. There are, however, important differences with respect to that indicator, in that:

- propensity to consume is not assumed to be equal to 1, but is determined according to the estimated parameters presented in Appendix 2;
- if relative future transfers are assumed to be different from what they were in history, this implies that future output, real wage payments, etc., should also be expected to differ from their historical values; implicitly, the forward-looking indicator in Blanchard (1990) ignores these second-round effects, whereas, by simulating a full macroeconomic model, these effects are also taken into account.

## 4. The results

Before starting to examine the results, it should be stressed again that they refer strictly to the short-term impact of fiscal policies. More precisely, they refer to the impact of the fiscal policy of *year t* on the economy *in the same year*. Model simulation in general and the method we propose could in theory be used to assess the impact of fiscal policy over the medium term. However, results become less and less reliable the longer the period of simulation. This loss of reliability is mainly connected with the large number of *ceteris paribus* assumptions that are implicitly needed to run the simulations: as the simulation period extends, upholding these assumptions become less and less reasonable, undermining the significance of results.

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[26] It should be recalled that, as full historical figures are only available up to 2000, the forward-looking experiments rest on projected values for the years 2001 onwards; this suggests some caution in interpreting the results for the last 3 years in the sample.

This problem is particularly evident in the decade examined in this period, which witnessed a dramatic improvement of Italian public finances. As they were clearly on an unsustainable course at the beginning of the decade, in the absence of fiscal adjustment a dramatic financial crisis was inevitable, with strong negative implications for economic activity and growth. While extremely difficult to quantify, these implications could not be overlooked in an overall assessment of the costs of the fiscal adjustment, covering the cumulated effects of the budgetary policies of *years t to t+n*. The results we are presenting, on the contrary, only require assuming that no financial crisis would have been immediately triggered by a yearly pause in the adjustment process. This sounder basis clearly comes at a price. In particular, the sum of the results for the individual years cannot be interpreted as the overall cost, in terms of growth, of the fiscal policies adopted over the period.

### *4.1 The impact of the budget on the Italian economy in the period 1991-2000* [27]

The decade examined in this paper can be divided into two sub-periods: 1) the run-up to the European Monetary Union (1991-97); 2) the years following (1998-2000).

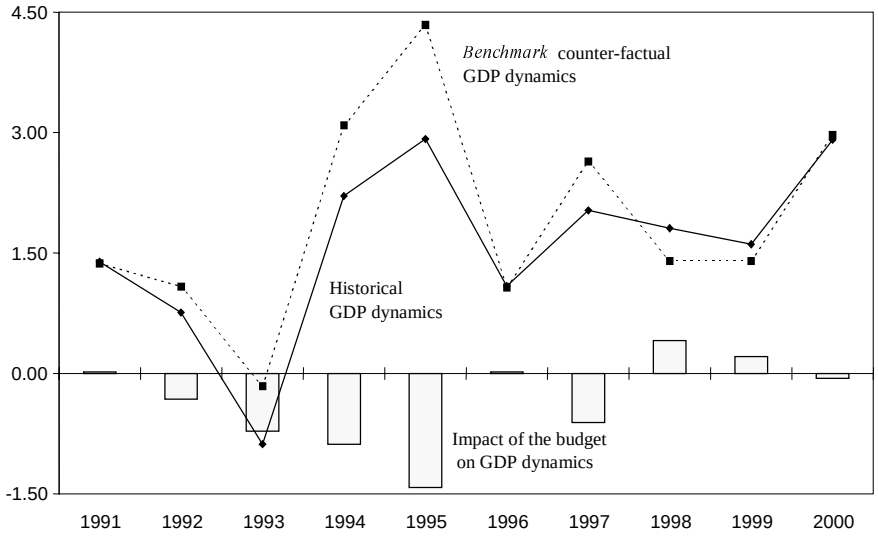
In the first period, the primary balance shifted from a deficit of 1.3 per cent of GDP to a surplus of about 6.7 per cent, as fiscal policy focused on the objective of bringing the overall deficit ratio below the 3 per cent Maastricht threshold. Over the period, the short-term impact of the budget on output was restrictive by almost 0.6 percentage points each year on average. If we compare the average yearly growth registered in the period (1.4 per cent) with that of the previous decade (2.3 per cent), close to 70 per cent of the decline could be attributed to the budget. The size of the overall impact on growth varied from year to year; it was greatest in 1995 (–1.4 percentage points) and close to zero in 1991 and 1996.

In the three years following the inception of the Third Stage of EMU, fiscal policy could relax, taking advantage of the lagged effect on interest payments of the fall in the market rates registered in 1996 and in

[27] The results for the last part of the period examined here must be interpreted with care, as they are based on provisional national accounts data which will presumably be revised.

**Fig. 4.1.1**

**GDP growth rates, actual and in the benchmark simulations and budget impact**




1997. The primary surplus fell significantly in 1998 and then stabilised at around 5 per cent of GDP. The effects of the budget on economic activity were positive in 1998 and in 1999, neutral in 2000.

Figure 4.1.1 shows the historical rates of change of GDP between 1991 and 2000, together with those produced by the benchmark simulation; the difference between the two provides an estimate of the impact of the budget on GDP.

The correlation between this estimated impact and the rates of growth of GDP of the benchmark simulation (i.e. excluding the effects of the budget) is negative (–0.5 per cent), thus suggesting that the effect of the budget was mildly counter-cyclical. These results confirm those obtained by Ceriani and Di Mauro (1986, pp. 15-21 and 43-52) for the period from 1971 to 1984.

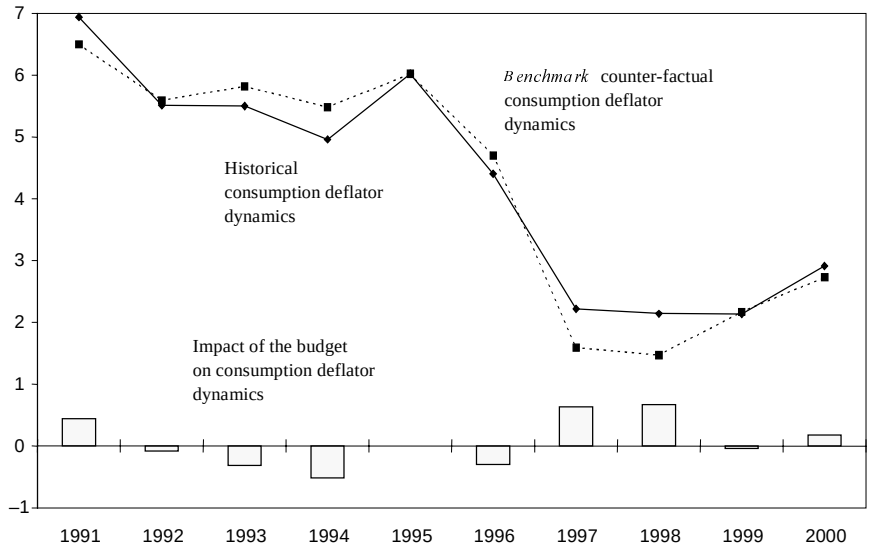
The effects of the budget on a number of macroeconomic variables are shown in Table 4.1.1. On average, the budget made a slightly positive

contribution to inflation (as measured by the private consumption deflator). Negative contributions to price dynamics are concentrated in the period from 1992 to 1996, when external inflationary pressures likely prevented the adoption of potentially inflationary measures (Figure 4.1.2). It is worth noting that the contribution of indirect taxation to price dynamics, especially if assessed on the basis of the changes in total indirect taxes, differs substantially from the figures shown in Table 4.1.1 for two sets of reasons.

Firstly, the BIQM distinguishes between the various components of indirect taxes, both in terms of timing of impact on prices and of deflators involved. In 1993, for instance, the significant increase in the indirect tax ratio, being due to the introduction of a tax levied on the estimated value of buildings (ICI), implied almost no immediate impact on prices, on the basis of the links codified in the model. In 1998, an even larger increase, being related to a new tax mainly levied on wages (IRAP) was not transposed onto prices, as it compensated for a reduction in social contribution rates. Secondly, changes in indirect taxation are not the only source of inflationary or deflationary impulses in the BIQM. Price

**Fig. 4.1.2**

**Percentage change in the consumption deflator, actual and in the benchmark simulations, and budget impact**



**Tav. 4.1.1**

## Effects of the public budget on some macroeconomic variables

| | | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GDP, 1990 prices | (1) | 0.02 | -0.32 | -0.72 | -0.88 | -1.42 | 0.02 | -0.61 | 0.41 | 0.21 | -0.06 |
| Public consumption, 1990 prices | (1) | 1.11 | -0.72 | -0.94 | -3.18 | -4.73 | -1.31 | -1.30 | 0.83 | 1.09 | 0.35 |
| Balance of current accounts / GDP | (2) | 0.08 | 0.14 | 0.17 | 0.40 | 0.74 | -0.10 | 0.36 | -0.34 | -0.07 | 0.03 |
| Total employment | (1) | 0.13 | -0.12 | -0.27 | -0.38 | -0.49 | -0.14 | -0.49 | 0.00 | -0.05 | -0.14 |
| Unemployment rate | (2) | -0.11 | -0.09 | 0.13 | 0.20 | 0.36 | 0.08 | 0.21 | 0.01 | -0.02 | 0.15 |
| GDP deflator | (1) | 0.65 | -0.49 | -0.76 | -1.34 | -0.85 | -0.15 | 0.96 | 0.22 | 0.03 | 0.03 |
| Private consumption deflator | (1) | 0.44 | -0.08 | -0.32 | -0.52 | 0.00 | -0.30 | 0.63 | 0.67 | -0.04 | 0.18 |
| Gross fixed investment deflator | (1) | 0.36 | 0.18 | -0.03 | -0.45 | -0.20 | -0.30 | -0.13 | -0.05 | -0.27 | -0.19 |
| Exports deflator | (1) | 0.35 | 0.14 | -0.07 | -0.49 | -0.24 | -0.28 | -0.13 | -0.03 | -0.25 | -0.21 |
| Public consumption deflator | (1) | -0.46 | -2.39 | -1.42 | -4.15 | -4.67 | 1.13 | 1.26 | -2.12 | -0.14 | -0.54 |
| Wage rate, private sector | (1) | 0.27 | -0.28 | -0.31 | -0.75 | -0.97 | 0.01 | -0.53 | 0.70 | -0.04 | -0.06 |
| Labor cost per employee, private sector | (1) | 0.48 | -0.29 | -0.89 | -1.85 | -1.32 | 0.05 | 0.36 | 1.42 | -0.06 | 0.01 |
| Cost of labor per unit of output, private sector (trend productivity) | (1) | 0.47 | -0.20 | -0.82 | -1.63 | -1.00 | 0.02 | 0.54 | 1.27 | -0.06 | 0.04 |
| Mark-up, private sector (trend productivity) | (1) | -0.36 | 0.08 | 0.63 | 1.21 | 0.69 | -0.02 | -0.49 | -1.00 | 0.04 | -0.04 |

(1) Percentage differences between the historical data and the results of the benchmark simulation.

(2) Differences between the historical data and the results of the benchmark simulation.

dynamics also reflects changes in social contributions and the wage rate in the public sector; moreover, it reacts to pressures exerted by the dynamics of aggregate demand (this effect being proxied by the degree of capacity utilisation). In 1995, for instance, the contribution of indirect taxation to inflation can be estimated to have been positive, whereas the overall effect of the public budget was neutral.

The results for the other deflators differ somewhat from those found for the private consumption deflator; for the GDP deflator the differences stem from the fact that it is directly affected by changes in per capita compensation in the public sector.

The general government budget had a significant negative effect on employment over the period (in particular, in 1995 the budget raised the unemployment rate by almost 0.4 percentage points). As a result of the impact of the budget on domestic demand being significantly restrictive on average, the balance on current account improved more than it would have done otherwise throughout the whole period; this is particularly true for 1995, when 0.7 percentage points of the increase in the current account surplus can be attributed to the budget. Thus, a non-trivial portion of the extraordinary improvement in the external balance in the period 1993-97 was due to the effects of the budget on demand and output (see also the results reported for the period 1992-93 in Locarno and Rossi, 1995).

### *4.2 Decomposing the effect of the budget on GDP*

In addition to the counterfactual benchmark simulation, additional simulations have been produced to assess the role played by a number of features of the general government budget in determining the overall results. In particular, the following factors have been assessed separately: changes in the level (but not in the composition) of the primary balance (it is worth recalling that the estimates presented in this paper are based on the assumption that interest payments react to changes in the monetary policy stance; see Section 3.2); changes in the composition of the budget; public employment policies; modifications in the quarterly profile of revenues and expenditures. The results show that the first three factors played an important role in determining the size of the effects of the budget in the years examined, the first two being predominant. Focusing on the adjustment period 1991-97, about 60 per cent of the average overall

restrictive impact of the budget is to be attributed to the first factor; almost 30 per cent to the second and 10 per cent to the third. These results indicate that the restrictive impulses to the economy stemming from the need to reduce the deficit could have been reduced by choosing a different set of measures. The effects of changes in the quarterly profile are, by contrast, generally negligible (Figure 4.2.1).

In the years 1991-97, the impact of the primary balance, keeping all the other characteristics of the budget unchanged, was generally restrictive (the only exception being the expansionary impact in 1994).[28] Over the period, the effects were close to –0.3 percentage points per year on average (with a spike of –0.6 points in 1997); they were close to zero, on average, in the following years. *Ceteris paribus*, changes in the primary balance have had a fairly stable impact on GDP: if the balance improved by 1 per cent of GDP, growth was reduced by about 0.3 percentage points.[29]

The portion of the overall impact accounted for by changes in the composition of the budget from one year to the next[30] was often significant. In 1991, together with the increase in public employment this factor offset the restriction associated with the improvement in the balance. In 1994, it more than compensated for the deterioration of the balance. In 1995, it accounted for more than half of the large negative impulse coming from the budget. Over the fiscal adjustment period, this factor exerted, on average, a negative impulse close to –0.2 percentage points (with a spike of –0.9 points in 1994); in the following years the impulse was on average of the same magnitude, but positive.

These results are mainly determined by two features of the fiscal policies followed in the period: the relatively large reliance on measures reducing direct expenditure and the frequent adoption of one-off measures. The first element explains the average restrictive impulse exerted by

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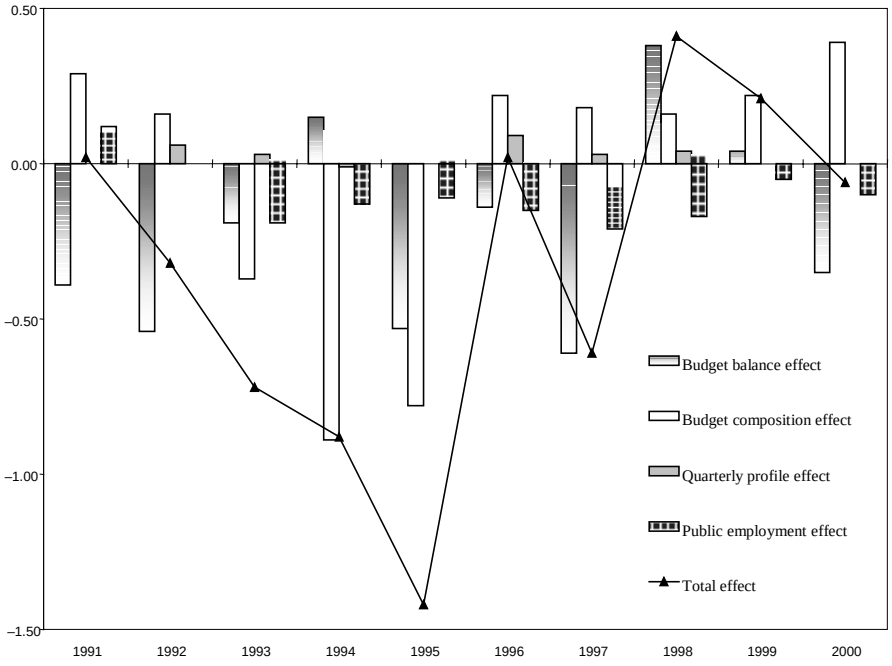
28 These effects have been computed by comparing. for each year, two counterfactual simulations that differ only in the ratio of the budget to GDP, equal to the historical level in the first simulation and to that of the previous year in the second (see Appendix 1).

29 By construction, this multiplier equals the weighted average of the multipliers associated with the different items on the revenue and the expenditure sides of the general government balance sheet (excluding interest payments).

30 To identify these effects, for each of the years examined in this paper a counterfactual simulation has been produced in which the level of the balance (as a ratio to GDP) is constrained to be at its historical figure, but the composition of the balance reflects that of the preceding year (see Appendix 1).

**Fig. 4.2.1**

**Decomposition of the budget impact on GDP growth**




changes in the composition of the budget in the fiscal adjustment period and the reverse impact in the following years. The sum of purchases of goods and services (net of sales on the market) and public investment declined significantly as a share of GDP from 1990 to 1997; and then rose from 1998 to 2000. As pointed out in Section 2.2, these components have a direct effect on demand and thus on output, whereas the impulses stemming from a change in net transfers have only an indirect and relatively limited impact on aggregate demand (through disposable income and consumption).[31] The second element helps to explain the large impact of composition effects in specific years. One-off measures are recorded as capital account revenue/expenditure in the general government budget.

[31] The focus on the first year effects of the budget is likely to amplify the difference in the impact of the budget components on the economy: in particular, that between transfers and direct expenditures.

According to the national accounts, which provide the framework for the quarterly model, these items do not affect private sector disposable income, so that the main channel through which they would exert an effect on demand and output is not activated. Their impact is consequently very limited.

The introduction of one-off measures is relatively important in explaining the positive sign of composition effects in 1992, 1997 and 2000 and the size of the negative effects in 1993-94 (when the 1992 one-off measures declined to zero).[32] A relatively large shift in the composition of the budget is also registered in 1995 and, with the opposite sign, in 1996. It comes from the attribution to capital expenditures in 1995 of a one-off payment to pensioners (close to 1 per cent of GDP and, in cash terms, spread over a few years) determined by a sentence of the Constitutional Court. For the same reasons given for the one-off measures, the shift in the composition of the budget determined by this payment in 1995 exerts, *ceteris paribus*, a negative impulse on growth; the undoing of this shift in the following year had a positive impact.

### *4.3 Sensitivity analyses*

As mentioned in Section 3, the results above hinge on a set of key assumptions, in particular regarding the reaction of monetary policy to the counterfactual fiscal policy shocks. Moreover, they rest on the backward-looking specification of consumers' behaviour embedded in the basic BIQM structure. In this section we investigate how sensitive the results are to changes in those assumptions.

First, the experiments were repeated after augmenting the model structure with an estimated forward-looking Taylor-type monetary policy reaction rule (see section 3.2.2 and Appendix 2 for details). The model was simulated under the perfect-foresight assumption, for two years (the year under investigation, *t*, and the following one, t+1), assuming that the policy-controlled nominal interest rate reverts to the historical values in

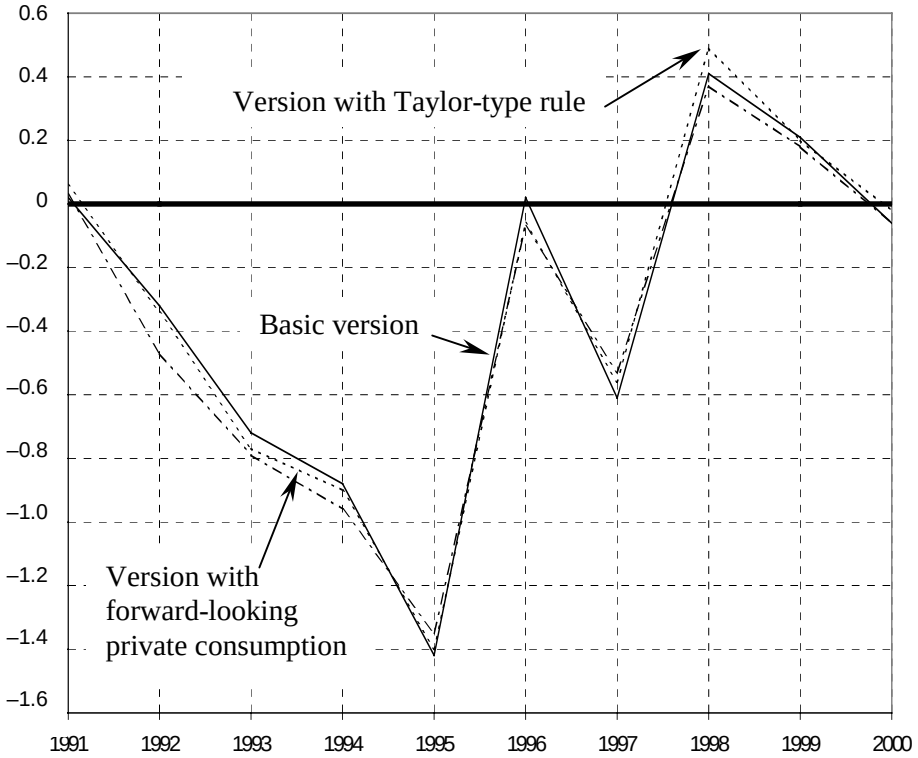
[32] The 1992 episode is a particularly clear example of the role of one-off measures. In that year, capital account revenue increased from 0.3 to 2.2 per cent of GDP, which entirely accounts for the increase in the overall surplus of 1.9 per cent of GDP. It is worth noting that one-off measures were adopted precisely with the aim of minimising the impact of the fiscal consolidation effort on demand and output.

the first quarter of year *t*+2 (moving the terminal condition further forward did not change the results significantly).

While in some years the policy-controlled rate is visibly different from that obtained under the assumption of unchanged short-term real interest rate (as in the standard simulations), the conclusions regarding the impact of the budget on the macroeconomy are hardly affected: for instance, the effects of the budget on GDP are very close to those under the standard assumptions (see Figure 4.3.1), with the largest discrepancy (in 1996) being less than 0.1 percentage points. Clearly, the overall picture is unaffected, and the results may thus be deemed reasonably robust with respect to changes in the assumption regarding the reaction of the monetary policy authority to the fiscal policy shock.

**Fig. 4.3.1**

**Budget impact on GDP: Sensitivity analysis**



In a second set of alternative experiments, a forward-looking consumption function was used, so that consumer spending reacts both to current and future (expected) changes in the budget.[33] While the impact of this modification is somewhat larger than in the previous case (the largest discrepancy with respect to the standard simulations amounts to 0.15 percentage points in 1992), the assessment of the budget's impact remains remarkably close to the standard version (the average discrepancy over the decade is virtually nil).

To conclude, the main results of the analysis would appear to be satisfactorily robust with respect to a range of substantial changes in some key assumptions.

### *4.4 A comparison with other budget indicators*

As mentioned above, the model simulation-based approach adopted in this paper has the advantage, with respect to synthetic indicators, of taking a larger number of relationships into account. However, it is more complicated to manage and less transparent. In this section we compare our results (with the standard version of our procedure) with those of a limited set of synthetic indicators, some of which are frequently used to assess the fiscal stance, to check whether the recourse to our more complex approach is warranted.

We consider six synthetic indicators. The first two, which are entirely based on accounting rules, are the changes in the ratios to GDP of: 1) the overall and 2) the primary balance. The others are only slightly more complex: 3) the indicator proposed in Blanchard (1990) in the version which employs only the current values of fiscal variables; 4) an indicator derived from that proposed in Ceriani e Di Mauro (1986) in which the changes in the ratio to GDP of fiscal variables are used as benchmark, instead of the changes in real terms (for the reasons given in chapter 3.1); 5) the *Fiscal Impulse* measure proposed by the IMF; 6) the change in the structural balance estimated by the OECD.[34]

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[33] The relevance of persistent changes in fiscal policy to explain Italian private consumption in the 1990's is particularly emphasised in Rodano and Saltari (2001).

[34] The latter inclusion is justified by the fact that, at least in recent years, in the OECD *Economic Outlook* the fiscal stance is generally measured in terms of the changes of the structural balance

(continues)

We find a significant dispersion in the results, both qualitative and quantitative (Table 4.4.1), suggesting that the choice of one method or another is not irrelevant. The correlation between indicators is generally positive, but usually not very high (Table 4.4.2). The only exceptions are the correlations between the IMF *Fiscal Impulse* and the OECD structural balance, on one side, and the overall balance, on the other. The high correlations reflect the simplifications used to construct these indicators, which drastically reduce the differences from the original accounting balance. Overall, the correlation matrix of our results and the six indicators shows that there no indicator is particularly "out of line" with respect to the others.

A relatively strong correlation exists between the results of the procedure presented in this paper and the indicator derived from that proposed by Ceriani and Di Mauro (1986). They share the feature of assigning different weights to the various budget items, though they do not apply the same weighting scheme.

(see e.g. OECD *Economic Outlook* n. 69, page 5). The structural balance is computed by adjusting the overall balance for the impact of the cycle; it also excludes one-off revenue from the sale of mobile telephone licences (relevant for Italy in 2000).

**Table 4.4.1**

**Budget impact on economic activity: results of different indicators**
*(percent of GDP)*

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|
| BIQM results | 0.0 | –0.3 | –0.7 | –0.9 | –1.4 | 0.0 | –0.6 | 0.4 | 0.2 | –0.1 |
| Balance (1) | –0.1 | –1.0 | –0.4 | –1.0 | –1.7 | –0.5 | –4.4 | 0.1 | –1.1 | 0.8 |
| Primary Balance (2) | –1.4 | –1.8 | –0.8 | 0.6 | –1.8 | –0.5 | –2.3 | 1.5 | 0.2 | 0.6 |
| Blanchard (1990) (3) | –0.1 | –0.5 | –0.1 | –0.8 | –3.1 | 0.8 | –2.1 | 0.2 | –0.7 | 0.2 |
| Ceriani e Di Mauro (1986) (4) | –0.1 | 0.2 | –0.6 | –1.3 | –2.2 | 0.8 | –0.7 | –1.0 | 0.1 | –0.2 |
| *Fiscal impulse (FMI)* (5) | –0.5 | –1.8 | 1.8 | –1.5 | –2.6 | –0.1 | –4.4 | 0.3 | –0.8 | 0.5 |
| Structural balance OECD (6) | –1.4 | –1.2 | –1.4 | 0.1 | –0.7 | –0.8 | –4.4 | 0.0 | –1.2 | 1.0 |

(1) Changes in the ratio to GDP of the overall balance of the General Government (multiplied by –1).
(2) Changes in the ratio to GDP of the primary balance of the General Government (multiplied by –1).
(3) Version with only the current values of the fiscal aggregates.
(4) Version with partial monetary illusion. Neutrality is defined as no change in the GDP ratio of fiscal variables.
(5) Based on OECD estimates of potential output (*Economic Outlook* n. 69).
(6) Changes in the ratio to GDP of the overall structural balance of the General Government (multiplied by –1).

**Tav. 4.4.2**

**Correlations among indicators**

| | BIQM result | Balance | Primary Balance | Blanchard (1990) | Ceriani e Di Mauro (1986) | *Fiscal impulse* (FMI) | Structural balance OECD |
|---|---|---|---|---|---|---|---|
| BIQM Results | 1 | 0.4 | 0.4 | 0.6 | 0.7 | 0.4 | 0.3 |
| Balance (1) | | 1 | 0.6 | 0.7 | 0.2 | 0.9 | 0.8 |
| Primary balance (2) | | | 1 | 0.5 | 0.0 | 0.6 | 0.6 |
| Blanchard (1990) (3) | | | | 1 | 0.7 | 0.7 | 0.2 |
| Ceriani e Di Mauro (1986) (4) | | | | | 1 | 0.3 | –0.1 |
| *Fiscal impulse* (FMI) (5) | | | | | | 1 | 0.4 |
| Structural balance OECD (6) | | | | | | | 1 |

(1) Changes in the ratio to GDP of the overall balance of the General Government (multiplied by –1).
(2) Changes in the ratio to GDP of the primary balance of the General Government (multiplied by –1).
(3) Version with only the current values of the fiscal aggregates.
(4) Version with partial monetary illusion. Neutrality is defined as no change in the GDP ratio of fiscal variables.
(5) Based on OECD estimates of potential output (*Economic Outlook* n. 69).
(6) Changes in the ratio to GDP of the overall structural balance of the General Government (multiplied by –1).

## APPENDIX 1

## THE SIMULATION DESIGN IN DETAIL

The general criterion adopted to define the neutrality of the public sector does not fully describe the procedure followed in this paper in the construction of the budget in the counterfactual scenarios. A few important additional choices that had to be made, and the resulting simulation designs, are briefly described below.

The use of a quarterly model makes it necessary to define the profiles of the different items of the budget during the year. In the construction of the neutral budget a "flat" profile was assumed, with each item remaining unchanged in relation to GDP at the average value of the previous year. In order to evaluate the consequences of this assumption, a variant of the benchmark simulation was performed (variant 2 in Table A.1.1), in which the profile of each item of the budget was made similar to the actual profile recorded in the year in question while keeping the average for the year at the level of the previous year.

**Table A.1.1**

**Design of the simulations underlying the benchmark and its variants**

| Simulations | $y_{t,q}$ | $DIPAPD_{t,q}$, $q=1,...,4$ |
|---|---|---|
| *Benchmark* | $\overline{y}_{t-1}$ | $\overline{DIPAPD}_{t-1}$ |
| Variant 1 | $\overline{y}_{t-1}$ | $DIPAPD_{t,q}$ |
| Variant 2 | $y_{t,q} + (\overline{y}_{t-1} - \overline{y}_t)$ | $DIPAPD_{t,q}$ |
| Variant 3 | $[y_{t,q} + (\overline{y}_{t-1} - \overline{y}_t)]f(.)$ | $DIPAPD_{t,q}$ |

For the revenue items, the function *f(.)* is defined as:

$$f(.) = 1 + (BALANCE_t - BALANCE_{t-1}) / (REVENUE_{t-1} + EXPENDITURE_{t-1})$$

For the expenditure items, the function *f(.)* is defined as:

$$f(.) = 1 - (BALANCE_t - BALANCE_{t-1}) / (REVENUE_{t-1} + EXPENDITURE_{t-1})$$

*DIPAPD* = General Government employment

As regards expenditure on public employees, it should be noted that this item can be kept unchanged in relation to GDP by modifying either the number of employees or the rate of increase in earnings. The effects on the level of economic activity are likely to be more pronounced in the first case, the effects on prices in the second. In the benchmark simulation the number of public employees was kept unchanged at the average level of the previous year. Consequently, unit earnings were constrained to increase at the same rate as GDP at current prices (in order to maintain the ratio of total earnings to GDP unchanged).

By contrast, variant 1 of the counterfactual simulation is based on a different criterion, whereby the number of public employees is set equal to the actual number (while the ratio of total earnings to GDP is again kept unchanged).

Lastly, in variant 3 the ratio of the budget balance to GDP was set equal to the value actually observed for each of the years considered, but the composition of the budget kept unchanged with respect to that of the previous year. In the simulation the change in the balance is proportionally distributed among the different items of the budget, with the same sign as recorded by the balance for revenue and the opposite sign for expenditure (see the note to Table A.1.1).

Table A.1.2 shows how the benchmark and the three variants described above are used to decompose the total effect of the budget on economic activity.

Needless to say, static simulation residuals were added to all counterfactual experiments, so as to make the latter fully comparable with the historical outcomes.

**Table A.1.2**

**Breakdown of the total effect**

| Effect | Measurement method |
|---|---|
| Total effect | History – *Benchmark* |
| Employee effect | Variant 1 – *Benchmark* |
| Profile effect | Variant 2 – Variant 1 |
| Balance effect | Variant 3 – Variant 2 |
| Composition effect | History – Variant 3 |

## APPENDIX 2

## CHECKS OF THE ROBUSTNESS OF RESULTS

As noted in the main text, the standard simulations were run on the assumption that the monetary policy stance in the counterfactual experiments was the same as the historically observed; that is, the real *ex post* average interest rate on T-Bills was required to take the values actually recorded (the rest of the interest rates react to changes in the policy instruments according to the term structure embedded in the model).[35] Also, the standard simulations rest on a backward-looking specification of consumers' behaviour.

In order to check the robustness of our results, we departed from the benchmark assumptions in a variety of ways. Two such departures are described below (other, less significant modifications to the basic experimental set-up are referred to in the main text).

*A forward-looking Taylor-type rule*

A first departure consisted in enriching the basic structure of the BIQM with a monetary policy reaction function.

Following Altissimo and Siviero (2002), we repeated the counterfactual experiments using a version of the BIQM that includes a Taylor-type monetary policy rule, whereby the policy-controlled interest rate is a (positive) function of the (current) inflation rate and output gap (with parameters equal to 1.5 and 0.5, respectively). The original formulation of the rule is found in Taylor (1993), where it is shown that such a simple rule may provide an adequate description of the policy followed by the Federal Reserve during Volcker's time, despite the fact that it ignores a number of variables that constitute the information set upon which the setting of the monetary policy instrument is based. Subsequent research showed that the same rule satisfactorily describes the conduct of monetary policy in a variety of countries and for a variety of time periods.

[35] For the last few years of our sample (1999-2000), as Italy was already part of EMU, the simulations were also run under the assumption of nominal interest rates unchanged with respect to history, as one cannot assume that monetary policy reacts so as to leave the Italian short-term real interest rates unchanged. The results so obtained do not differ significantly from the benchmark.

Various authors have proposed variants to Taylor's original formulation. On the one hand, it has been shown that Taylor's formulation may be seen as an optimal monetary policy reaction function within an inflation targeting strategy (see, e.g., Rudebusch and Svensson (1997)); in this context, it is usually found that the optimal reactions to both the inflation rate and the output gap are likely to be considerably larger than the values postulated in Taylor (1993). On the other hand, several authors have tried to enrich the original framework in several ways: for instance, in some works current inflation has been replaced by future expected inflation (which, in turn, has raised the issue of the optimal degree of forward-lookingness of the monetary policy authority: on this point see, e.g., Batini and Haldane (1999)). Forward-looking behaviour is obviously justified by the considerable lags with which changes in the policy-controlled instrument affect the economy: see, on this issue, the recent results reported by van Els, Locarno, Morgan and Villetelle (2001), as well as earlier evidence in BIS (1995)); furthermore, in a number of papers the interest rate has been allowed to react smoothly to the changes in inflation and in the output gap.[36]

Altissimo and Siviero (2002) present estimates of a forward-looking Taylor-type rule for the Italian economy in the 1990s:

$$i_t = \gamma_0 + \gamma_1 \times i_{t-1} + \gamma_2 \times \pi_{t+1} + \gamma_3 \times gap_t$$

where $i_t$ is the short-term (policy-controlled) interest rate (taken to be the rate on overnight deposits), $\pi_{t+1}$ is future expected inflation (log changes in annual CPI) and $gap_t$ is the output gap (given by a 4-term moving average of the degree of capacity utilisation in the private non-farm and non-energy sector).

The equation was estimated using data from 1991.Q1 to 1997.Q4, using a GIVE approach (the instruments being current and past values of inflation, a 4-quarter moving average of capacity, and the annual change in the effective exchange rate). While the horizon is admittedly short, one should recall the caveats spelled out above regarding the intrinsic instability of estimated policy reaction functions (in the Italian case,

[36] See, e.g., Clarida and Gertler (1996) and Clarida, Gali and Gertler (1998), and Angeloni and Dedola (1998) for estimates of Taylor-type specifications showing both features just described. A common feature of the Taylor-type rules estimated in these papers is that, although the same specification is roughly adequate to describe the behaviour of monetary policy in a number of countries and for a variety of time periods, there are signs of a change in policy behaviour around the early 1980s.

moreover, the institutional and operating framework of monetary policy changed considerably between the 1980s and the early 1990s: see, e.g., Passacantando (1996)).

The empirical specification selected by Altissimo and Siviero (2002) is the following (Newey-West adjusted t-.statistics in parentheses):

$$i_t = \underset{(4.263)}{1.215} + \underset{(10.909)}{0.598} i_{t-1} + \underset{(4.989)}{0.528} \pi_{t+1} + \underset{(4.409)}{0.152} gap_t$$

$$R^2 = 0.949; \quad GR^2 = 0.626; \quad DW = 1.935; \quad \sigma = 0.619;$$

$$\text{Sargan's test (p - value)} = 0.735; \ \text{Serial correlation test (p - value)} = 0.418;$$

$$\text{Functional form test (p - value)} = 1.126$$

The implied long-run coefficients for inflation and the output gap are 1.31 and 0.38, respectively, thus in line with the average finding in the empirical literature, as well as with those found for the Italian economy by Angeloni and Dedola (1998) using monthly data.

Further details (including a comparison with a more standard specification that does not assume forward-looking behaviour) can be found in Altissimo and Siviero (2002).

*A forward-looking consumption function*

As described in the main text, the standard BIQM presents very slight forward-looking elements.

However, one may argue that the anticipation of future changes in the public budget is a key factor when it comes to assessing the effects of the budget on the economy. For instance, one of the indicators presented in Blanchard (1990) requires evaluating the impact of public transfers on consumers' behaviour by building an average measure of net transfers that includes both the current year's values and the historical figures for the following few years.

In order to build an indicator similar to the forward-looking ones of Blanchard (1990), we chose to replace the main consumption function in the BIQM with a forward-looking formulation. It should be emphasised that, in the BIQM, economic consumption (i.e. the sum of consumer non-durables, services and the flow of services from the stock of durable goods) depends on current and lagged private sector disposable income

and wealth; the demand for durable goods, on the contrary, is modelled under the assumption that consumers aim at reaching a desired level of the stock of durables, as a ratio to non-durables. The latter equation was not modified, on the ground of two considerations: first, durable goods represent only about 10 per cent of total consumer spending; second, once the economic consumption equation is forward-looking, the demand for durables itself becomes forward-looking, although only indirectly.

The forward-looking specification chosen is the same as that estimated in Taylor (1993) for a number of countries. The estimation results for the period 1980.Q1 to 1998.Q4 are the following (Newey-West adjusted t-statistics in parentheses):

$$C_t = \underset{(0.990)}{-966.94} + \underset{(91.270)}{0.950}\, C_{t-1} + \underset{(4.879)}{0.054}\, PY_t - \underset{(4.584)}{129.664}\, r_t$$

$$R^2 = 0.999;\ DW = 1.258;\ \sigma\,(\text{ratio to mean of dependent variable}) = 0.004;$$

where $C_t$ is economic consumption, $PY_t$ is a measure of permanent income and $r_t$ is a forward-looking measure of the real interest rate.

Specifically, we constructed permanent income and the real interest rate as in Taylor (1993):

$$PY_t = \frac{\sum_{j=0}^{8} 0.9^j\ Y_{t+j}}{\sum_{j=0}^{8} 0.9^j}$$

where $Y_t$ is private sector disposable income; thus, our measure of permanent income includes both current and future net transfers.

As to the real interest rate, it is given by the difference between the current period nominal interest rate on bonds and future inflation (average inflation expected to prevail 4 to 7 quarters ahead). As in Taylor (1993), the real interest rate term is multiplied by an exponential trend, growing at the same pace as potential output, to prevent the effects of the real interest rate on consumption from vanishing as the economy grows.

As instruments we used, as in Taylor (1993), lagged values of consumption, disposable income, nominal long-term interest rates and the price level, as well as a linear trend.

The estimation results are similar to those found by Taylor (1993) for some of the countries he investigated. While the estimation results are not fully satisfactory, it should be considered that the purpose of this forward-looking consumption function is only to test the sensitivity of the results with respect to a rather dramatic modification in the behavioural assumptions underlying the basic BIQM and hence the standard counterfactual simulations.

With respect to Blanchard (1990), our indicator not only assumes that consumers react to future (expected) transfers, but are also able to assess how the future overall macroeconomic picture would be affected by a persistent change in the fiscal policy stance.

## APPENDIX 3

## SYNTHETIC INDICATORS OF THE IMPACT OF THE BUDGET ON ECONOMIC ACTIVITY

This Appendix examines three synthetic indicators that have been used to assess the impact of the budget on economic activity: the fiscal impulse measure published by the International Monetary Fund until 1997, the proposals of Blanchard (1990), and the weighted budget balance devised by Ceriani and Di Mauro (1986).

*The IMF's Fiscal Impulse (FI) measure*

From the mid-Seventies until 1997, the IMF published, in *World Economic Outlook,* an indicator of the impulse exerted by fiscal policy on aggregate demand in the principal OECD countries. The indicator, described in Heller, Mansur and Haas (1986), was calculated by comparing the budget balance as a proportion of GDP for a given fiscal year with the proportion that would have been recorded if the ratio of revenue to actual GDP and that of expenditure to potential GDP had remained unchanged with respect to a base year:

$$FI = (g_t - r_t) - ((g_0 Y_t / YP_t) - r_0)$$

where $g$ and $r$ are respectively public expenditure and revenue in relation to GDP, $YP$ is potential output, $Y$ is actual GDP and the indices $0$ and $t$ refer respectively to a base year in which potential and actual output were roughly equivalent and the year in question. The impulse in a given year is equal to the change in $FI$ relative to the preceding year.

This method of measurement did not weight the various components of the budget according to their potential impact on aggregate demand and did not consider the loss of purchasing power on the public debt, in contrast with the other indicators described below. It had the advantage of being very simple to calculate, except for the estimate of potential GDP, which was based on the assessments of the IMF's area experts. This simplicity involved limits in using the indicator, which the IMF's experts prudently presented as a "first step", designed to gauge the size of the initial stimulus exerted on demand, in analysing a country's fiscal policy.

Yet it is not clear whether the IMF indicator should be classified as a criterion for measuring the overall impact of the budget or a method for

isolating the effects of discretionary policies on the budget balance. The use of different reference criteria for expenditure and revenue in constructing the "neutral" budget balance (potential GDP for the former, actual GDP for the latter) is intended as a rough-and-ready cyclical adjustment of the balance; the indicator would therefore appear to identify, as a residual, the effects of discretionary policies. But this objective is explicitly excluded by Heller, Mansur and Haas (1986),[37] who emphasise that the point of adjusting for cyclical effects is to arrive at a measure of the "non-transitory" effects of the budget on aggregate demand.

*The indicators proposed by Blanchard*

The indicator of the budget's impact on aggregate demand proposed by Blanchard (1990) in an advisory paper for the OECD is characterised primarily by the importance it attributes to agents' expectations regarding net future taxes. The indicator is based on the following consumption function:

$$C = \alpha(D + K) + \beta\left[\varphi\int\left(Y(s) - T(s)\right)\exp(-\varphi s)ds\right]$$

where consumption expenditure $C$ depends on wealth ($D$=public debt, $K$=other private wealth) and present and future disposable income ($Y$=income from labour, $T$=total taxes net of transfer payments other than interest payments); future disposable income is discounted on the basis of a coefficient $\varphi$ that reflects the relevant time horizon for the consumer (determined by the combined effect of his forecasting capacity and liquidity constraints).

Excluding the components that are directly attributable to government and taking account of its demand for goods and services $G$, the contribution of the public finances to aggregate demand is thus given by the following expression:

$$I = \alpha D - \beta\left[\varphi\int T(s)\exp(-\varphi s)ds\right] + G$$

[37] In a more recent work, Chand (1993) justifies the indicator on the basis of a simplified Keynesian model and attributes a twofold value to it. In his view, the indicator makes it possible to identify both discretionary policies and the overall impact of the budget, and is superior to the criterion proposed by Blanchard (1990), examined below, since it identifies the government's "active contribution".

Blanchard proposes three indicators in which drastic simplifications are made for practical reasons. In the first, which assumes that consumers' time horizon does not extend beyond the current year (or, equivalently, that their expectations *T* remain constant) and that the propensity to consume is equal to unity both for income from labour and for property income (the latter is measured net of the loss of purchasing power on wealth), the above formula is reduced to:

$$I = iD - T + G$$

where *i* is the real interest rate on the debt. The indicator coincides with the current budget balance owing to the loss of purchasing power on the debt. For comparisons between different years, Blanchard suggests relying the indicator to GDP. In the other indicators, consumers' time horizon is lengthened. In the second, *T* is replaced by an average of the value of taxes net of transfer payments in the year examined and of those forecast for the two subsequent years. In the third, Blanchard suggests adopting the values of *T* expected by each cohort of the population over its life expectancy.

*Ceriani and Di Mauro's weighted budget balance*

Ceriani and Di Mauro (1986) propose an indicator conceptually analogous to that of *net real fiscal impulse* used by the OECD up to 1982. The impact on aggregate demand is calculated by aggregating the appropriately weighted changes in the following budget items, expressed in real terms:[38] direct expenditure (collective consumption and investment), net transfers to households (net of direct taxes payable by them and of part of the loss of purchasing power on their holdings of public debt[39]); net transfers to enterprises; indirect taxes net of production subsidies (including those granted to autonomous government agencies, which are assumed to influence the price level via public service charges). From the solution of a simple Keynesian income-expenditure model and of several synthetic national accounts identities, the authors derive the appropriate weights to assign to the changes of the various components: 1 for direct expenditure and indirect taxes (with a negative sign for the latter); 0.8 (estimated coefficient of the propensity to consume out of

[38] For net transfers and indirect taxes, an index of consumer prices net of indirect taxes is used. For the other items, the corresponding national accounts deflators are used.

[39] The authors use a money illusion coefficient of 0.5 derived from the estimates of Lecaldano, Marotta and Masera (1984).

disposable income) for net transfer payments to households; 0.1 for net transfer payments to enterprises.

In a second version of the indicator the authors replace the current value of net transfers to households with a moving average whose weights correspond to the lagged coefficients derived from an estimate of the consumption function. This specification is intended to make the indicator consistent with a "permanent income" specification of the consumption function in which the explanatory variable is expected income approximated with a lagged structure.

*An overview*

Though they share an underlying Keynesian rationale, the methodologies examined differ in a number of respects.

First of all, there is a lack of uniformity in the criteria used to define the "neutrality" of the fiscal impulse (on this see Section 3.1). Ceriani and Di Mauro (1986) refer to the constancy of budget components in real terms, whereas Blanchard (1990) and the IMF's *Fiscal Impulse* work use constancy with respect to GDP.

Moreover, one finds notable simplifications in the *Fiscal Impulse* and in Blanchard's criteria. These simplifications reflect the international organisations' need for the simplest, most transparent indicators in order to survey so many countries. Carried too far, however, such simplifications drastically reduce the indicators' value added with respect to balances computed on the basis of purely accounting rules.

One of the characteristic features of the methodologies developed by Ceriani and Di Mauro (1986) is differential weighting of budget items. As the authors show, this feature has an important impact on results.

Finally, all the indicators considered attempt, using a variety of instruments, to take account of the impact of market expectations in determining the effects of the government budget on economic activity.

The IMF's *Fiscal Impulse* indicator, in estimating the economic effects, excludes changes in the public accounts due to the business cycle during the year. Being transitory, these changes are held not to have significant effects on the behaviour of economic agents, who are engaged in optimising their spending plans over a rather ample time horizon. Even accepting these premises, however, the cyclical adjustment of the IMF indicator is quite crude. It may differ considerably from that adopted by

economic agents themselves. Moreover other, non-cyclical factors can produce transitory variations in the public accounts whose impact may be greater than that of the business cycle itself or more readily perceived and assessed by agents.

A more direct way to take expectations into account is incorporated in Blanchard's second indicator, in which the figure for taxes net of transfer payments is an average of current value and forecasts for the next two years. This approach presumes that transitory factors continue to exert some effects on economic activity. However, Blanchard's solution is not problem-free. In particular, it is open to the earlier objection to the IMF's *Fiscal Impulse*, namely the lack of assurance that the forecasts used in constructing the indicator correspond to those of economic agents.

A methodology that is consistent with adaptive mechanisms of expectation determination, finally, is the lagged-coefficient version of Ceriani and Di Mauro's indicator, which uses moving averages of lagged net transfers to households and firms.

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