TAX REFORMS AND FISCAL STABILISATION IN ITALY

M. Rosaria Marino,[*] *Daniela Monacelli*[*] *and Stefano Siviero*[*]

Introduction

The goals and responsibilities of European fiscal policy underwent a number of significant changes in the course of the Nineties. In particular, the introduction of the single monetary policy on 1st January 1999, has resulted in a clear division of labour between monetary and fiscal policies. Monetary policy, being conducted at a supranational level, was assigned to dealing with shocks that are common to the whole euro area. Idiosyncratic shocks, by contrast, are to be tackled by national fiscal policies, which have thus become the sole instrument available for country-specific cyclical stabilisation measures.

The stabilisation features of fiscal policy depend on a number of factors, the most relevant ones being: the government size; the degrees of progressivity of taxes; the sensitivity of the tax bases with respect to the business cycle.

The tax reforms enacted in a number of European countries in the last few years are likely to have had a significant impact on all of those factors, and hence on the degree of automatic stabilisation of the government budget. One may think, for instance, of the Italian tax reform of 1998, that partially shifted the financing burden from relative stable revenues (state tax on health contributions) to more cyclical ones (regional tax on business activities).

The policy debate has not paid much attention to these issues, as the discussion has tended to focus instead on the implications of those tax reforms for overall economic efficiency, and on their effects on income distribution and government deficit financing.

By contrast with the prevailing focus in the existing literature, this paper investigates the relationship between recent tax reforms and the stabilisation properties of fiscal policy in Italy. To do so, we develop and use an econometric-model-based approach that, in a nutshell, relies on quantifying the (unconditional) variance of output fluctuations associated with different tax structures.

To anticipate the main empirical result, recent tax reforms in Italy are found to have had only a modest impact on the stabilisation properties of fiscal policy.

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[*] Banca d'Italia, Servizio Studi. Correspondence:
marino.mariarosaria@insedia.interbusiness.it
monacelli.daniela@insedia.interbusiness.it
siviero.stefano@insedia.interbusiness.it

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The paper is organised in five sections. Section 1 briefly surveys the existing literature on automatic fiscal stabilisation. Section 2 describes the approach for the appraisal of the stabilisation properties of tax structures adopted in this paper. Section 3 illustrates the main features of the model used in the empirical application. Section 4 describes the main results and performs a number of sensitivity exercises. Section 5 concludes. The effects of recent changes in the Italian personal income tax structure on the sensitivity of tax revenue to cyclical fluctuations are appraised in the Appendix, using micro data collected in the Banca d'Italia Survey on Household Income and Wealth.

1. A review of the literature

The empirical literature on automatic fiscal stabilisers has flourished since the Maastricht Treaty came into force and the Stability and Growth Pact was adopted. Most of the studies find that output fluctuations are significantly reduced when automatic stabilisers are allowed to operate freely.[1] However, the measurement of the capacity of automatic stabilisers to smooth cyclical fluctuations is not uncontroversial. The results vary depending also on the techniques employed in evaluating the impact of the automatic stabilisers and on the shocks considered.

The approaches that have been proposed so far in the literature can be grouped into four main categories: macroeconometric model simulations; simulation of simple AD-AS models; vector autoregressions; analysis of microdata.

Macroeconometric model simulations take a (possibly very) large number of interrelations among economic variables into account. Differences in the empirical results that may be found in the literature depend on both the characteristics of the models and the sources of the shocks.[2] In many cases only demand shocks are taken into account determining results biased towards larger stabilisation effects, since automatic stabilisers work through disposable income. Sometimes the limited number of deterministic simulations run in the exercises also enhances the bias. The main result of this stream of the literature is that automatic stabilisers are expected to do their job in case of demand shocks (especially on private consumption) but not in case of supply shocks.

In Meyermans (2002) the model of the Belgian Federal Planning Bureau (NIME) is used to appraise the effects of a temporary real demand shock (a drop in private consumption), a permanent monetary shock (an increase in nominal money

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[1] See, among others, OECD (1993), Barrell and Sefton (1997); Buti and Sapir (1998); Auerbach and Feenberg (2000); Barrell and Pina (2000); van den Noord (2000).

[2] Brunila *et al.* (2002) compares the results obtained by INTERLINK model of the OECD (van den Noord, 2000) and by NiGEM of the NIESR (Barrell and Pina, 2000). Van den Noord finds, on average, a smoothing effect of automatic stabilisers between 20 and 30 per cent for the euro area, as opposed to Barrell and Pina, who measure an effect of 11 per cent using NiGEM. Differences in the results depend on the fact that simulations with NiGEM focus not only on demand disturbances but also on other sources of uncertainty, which reduce the effectiveness of the automatic stabiliser.

supply) and a permanent supply shock (a decline in trend productivity). In the first two cases, characterised by the absence of permanent real effects from the shocks, the impact on output is smaller if automatic stabilisers are allowed to work freely. On the contrary, in case of real permanent shocks additional discretionary measures are required to reduce the impact on output. In Barrell and Pina (2002) similar results are drawn using NiGEM. The role of automatic stabilisers is discussed for an economy subject to both demand and supply shocks, assuming financial markets are forward looking and monetary policy makers are reactive. Automatic stabilisation is assessed identifying the revenue and expenditure items that are dependent on the cycle and quantifying their dependence by constant elasticities with respect to the output gap. The stabilising effect is evaluated comparing the outcomes of two policy regimes: one where taxes and unemployment benefits are determined according to the elasticities and another where these items are set to their structural trajectory levels. No fiscal feedback mechanism operates to stabilise the economy. In Brunila *et al.* (2002) the European Commission quarterly model (QUEST) is used to simulate demand shocks (to private consumption, private investment and export demand) and supply shocks (labour productivity). Tax revenues have unitary elasticity with respect to their tax bases so that their sensitivity to output fluctuations reflects the sensitivity of the tax base to output shocks. The conclusion is that in case of supply side shocks automatic stabiliser are largely ineffective and the reduction of the impact on output calls for structural adjustments. In van den Noord (2000) the INTERLINK model was used to conclude that automatic stabilisers may raise long-term economic performance and avoid frequent changes in spending or tax rates. However, they should be employed symmetrically over the cycle in order to avoid costly debt accumulation. Using FRB/US model Cohen and Follette (2000) show that demand shocks have small effects on GDP multiplier and supply shocks have no effects whatsoever.

AD-AS model has been used recently in Buti *et al.* (2002) to show that there might be a critical level of the tax burden beyond which a reduction in taxation may render fiscal automatic stabilisers more effective depending on the nature of the economic shock. The conclusion draws on the evidence that lower taxation improves the short-run inflation/unemployment trade-off, *i.e.* it makes the Phillips curve flatter, by reducing the wedge between the marginal cost of labour and the marginal take-home pay. Buti and van den Noord (2003) go beyond this result by introducing a distinction between, on one side, the "optimal" tax burden at which, in case of supply shocks, automatic stabilisers are most powerful and beyond which favourable stabilisation properties decline, and, on the other, a "critical" tax burden beyond which these properties become perverse (destabilising effects on output in case of a supply shock and on inflation in case of supply and demand shocks).

Recently, vector autoregression techniques have been used to estimate short-term and long-term fiscal multipliers. The sign of these multipliers are generally in line with Keynesian theory but sometimes their size is much smaller, signalling that sizeable fiscal expansion may produce modest impact on economic activity. Examples of this body of literature are Blanchard and Perotti (1999), Perotti (2000), Fatás and Mihov (2001), Perotti (2002). The last paper evaluates the effects of fiscal policy on GDP and its components, on price level and on short-term interest rate for five countries. The main conclusions are that the size of estimated effects is small and that they have become weaker in the last twenty years.

Results based on microdata analysis have been presented, among others, in Auerbach and Feenberg (2000) and Kniesner and Ziliak (2002). In the first paper the authors computed individual tax elasticities simulating a model based on a file of actual tax returns (NBER TAXSIM model). They find that in USA automatic stabilisers through income and payroll taxes together would offset about 8 per cent of any initial shock to GDP. Kniesner and Ziliak (2002), using the Panel Study of Income Dynamics, argue that across the eighties the progressivity of income tax has stabilised household consumption by 15 per cent in response to a given reduction in gross income.

Another source of differences among the results of the existing studies arises from the methods that can be used to measure the sensitivity of budget items to the cycle. In particular, there are four different approaches.

In the first one, elasticities are estimated running regressions of tax proceeds and public expenditure on discretionary changes in tax and benefit parameters, a trend and a cyclical term (Bismut, 1995). This approach requires a big effort to collect detailed information on policy changes over the years and makes international comparisons very difficult.

In the second approach, tax and expenditure elasticities are directly derived from macroeconometric model estimations.

The third approach is used, among others, in van den Noord (2000). It requires three steps. In the first one the elasticities of tax bases and unemployment with respect to economic activity are computed by means of regression analysis. In the second step, the elasticities of tax proceeds and transfers to the relevant bases are either extracted from the tax code or set to other meaningful values. In the last step the two elasticities are combined in “reduced-form elasticities” that link the cyclical components of taxes and expenditure to the output gap.

The last approach consists of dividing the budget items in three components: a trend, a cyclical and an irregular component, the latter capturing the dynamics not explained by the first two. The parameters associated to each component are estimated by maximum likelihood methods (Cuaresma *et al.*, 2002).

2. The approach: stochastic-simulation-based appraisal of the unconditional variance of target variables

As described in the previous section, an approach often adopted to investigate the stabilising properties of fiscal mechanisms consists of appraising the effects on the economy of a variety of shocks over a fixed time horizon. This is the case, for instance, of Brunila *et al.* (2002) and Barrell and Pina (2002). Usually, only the reactions to a limited number of shocks are computed over a relatively short time horizon. The results delivered by this approach tend to indicate that the performance of automatic stabilisers crucially depends on the nature of the shocks: automatic stabilisers are by and large effective in the wake of demand shocks, while they are not desirable if shocks are prevalently supply-side ones.

Notwithstanding the useful and sharp insights that such simple approach has provided, it has at least three relevant limitations.

First, the state of the economy hardly ever corresponds, at any given point in time, to equilibrium. By contrast, this is the implicit assumption formulated in the works mentioned above, where only the effects of single-period shocks are investigated. Rather, the state of the economy reflects the cumulated effects of all current and lagged shocks that have hit the economy since the (infinite) past.

Second, the effects of different shocks are usually examined in isolation from one another. This raises the following practical issue: suppose, as indeed is often the case, that one finds that supply and demand shocks are found to have rather different (and in fact, as it turns out, opposite) implications regarding the optimal degree of automatic stabilisation. To draw any firm conclusion, one needs to know the relative size of the various shocks as well as their covariances.

Third, basing one’s conclusions on a limited number of multipliers for the first so many periods may be dangerous. It may indeed well be the case that policy mechanisms that appear to perform best if one’s assessment is based on their short-to-medium run effects only turn out to be relatively under-performing if their very long-run effects are also taken into account. It may even be the case that marginally unstable eigenvalues (and hence explosive paths) cannot be detected on the basis of the first few multipliers, whereas such instabilities are obviously of the utmost relevance. A more suitable approach should thus simultaneously take the whole infinite sequence of multipliers into account.

A possible way to overcome those three limitations consists of casting the problem of assessing the stabilisation properties of different fiscal schemes in a framework similar to the one routinely used to appraise the performance of competing monetary policy rules. A large body of literature has been developed that selects the optimal monetary policy reaction function on the basis of the unconditional variance of the variables of interest associated with all competing rules.

More formally, suppose that the following model of the economy is to be used to appraise the performance of a number of competing policy rules:

$$y = C_1 y_{-1} + C_2 x_{-1} + e \ , \qquad e \sim (0, \Xi)$$

where the vector *y* includes all model variables (in deviation from their respective equilibrium values), *x* is the policy instrument (e.g., the policy-controlled interest rate), *e* is a vector of disturbances, all the rest are parameters.

Suppose next that one is interested in appraising the performance of simple feedback rules of the form:

$$x = \gamma\ y$$

on the basis of a (pre-defined) welfare loss function, whose arguments may be both endogenous variables and the instrument (typically, its volatility over time). In the context of the optimal monetary policy rule literature, if y only includes current inflation and the output gap, then the rule above belongs to the popular Taylor-type family, first introduced in Taylor (1993). A number of variants to the basic output-dependent feedback rule above have been proposed in the literature, including lagged-information dependent and forward-looking rules.[3]

The system above may be written more compactly in state-space form as follows:

$$\underline{z} = Az_{-1} + v \ , \qquad v \sim (0, \Sigma)$$

where: $z' = (y', x')$ $\qquad v' = \begin{pmatrix} I & 0 \\ -\gamma & 1 \end{pmatrix}^{-1} (e', 0) = B(e', 0)$

$$A = B\begin{pmatrix} C_1 & C_2 \\ 0 & 0 \end{pmatrix} \qquad \Sigma = \begin{pmatrix} B\Xi B' & 0 \\ 0 & 0 \end{pmatrix}$$

The policy-maker is typically assumed to be interested in minimising the fluctuations of a limited set of variables of interest around their respective equilibrium value over the infinite future. Under certain conditions, the period loss function will be a function of the elements of the unconditional variance-covariance matrix Ω of the variables z,[4] which can be computed by solving the following expression:

$$\Omega = A\Omega A' + \Sigma$$

This expression may be solved either by vectorisation or, more efficiently, by means of some iterative algorithms. It is clearly a pre-requisite for the expression above to be computable that all the eigenvalues of the matrix A be smaller than 1 in absolute value; in other terms, an optimal rule must satisfy the basic requirement that it eliminates all explosive roots of the matrix C_2, if any. The (period) loss

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[3] For a general overview, see the papers collected in Taylor (1999).

[4] See, e.g., Rudebusch and Svensson (1999).

function associated with various rules may then be easily computed by weighting and combining the elements of Ω.

In this paper we propose to suitably adapt the scheme sketchily described above for the purpose of investigating the stabilising properties of different fiscal mechanisms. It should be emphasised that we by no means set ourselves the (arguably overly ambitious) target of defining the fiscal policy-maker's objective function and thus compute the corresponding optimal fiscal policy rule. Rather, our much more limited goal is that of using that framework to compute, for different fiscal mechanisms, the resulting volatility of various macroeconomic variables.

With a small linear model, the approach sketchily outlined above may be used as is; this is done in Momigliano *et al.* (2003), where a small model of the euro area is used for the purpose of appraising the performance of fiscal stabilisers. As in virtually all the literature on optimal monetary policy rules, the model is linear and specified in terms of deviations from equilibrium.

By contrast, the Banca d'Italia's quarterly model of the Italian economy (BIQM) – which our analysis is based on – is of medium-to-large size and nonlinear. Moreover, it is not specified in terms of deviations from equilibrium. Given these features of the model, the standard approach described above cannot be applied as is.

The solution adopted to deal with the unwieldy size of the original BIQM consists of using a reduced-scale version of it (so-called *maquette*); a brief description of the *maquette* and of the way it relates to the original model is given in the next section.

As to nonlinearity, two alternative routes seem feasible. First, one could compute a linearisation of the *maquette* around its steady-state growth path. This approach, however, is demanding and some of the sources of model nonlinearities that would be ignored as a result of linearizing the model could well be of relevance. As a second alternative, one may retain the nonlinear model as is, and compute the variance-covariance matrix of the endogenous variables by means of (suitably long) stochastic simulations around an equilibrium growth path. This is the option adopted here. The practical aspects relating to the implementation of this approach are described in Section 4.1.

3. The tool: a modified version of the Banca d'Italia's Quarterly Model

3.1 A brief description of the Banca d'Italia's Quarterly Model of the Italian economy

The BIQM is a medium-to-large scale model, comprising, in its standard version (*i.e.*, in the version usually employed for forecasting and policy analysis purposes), over 900 endogenous variables. The standard version of the BIQM provides a fair deal of detail on government budget items and their interaction with the rest of the economy.

The current version of the BIQM shares many of the characteristics of the previous one, released in 1986.[5] 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 short-term adjustment processes that are super-imposed to the exogenous growth skeleton 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 aggregate demand, in a situation of oversupply in both the goods and the labour market.[6]

The aim of providing a detailed description of the most relevant institutional features of the Italian economy and the need to produce reliable projections on a variety of aspects of the economy have resulted in the model being of relatively large size, which makes it rather unfit for our purposes in this paper. The solution we adopted is presented in the following section.

3.2 *The core version of the BIQM*

Due to the maze of feedback relationships that are typically at work in a medium-to-large size model, it is often impossible to identify the key causal links among the model variables; hence, the theoretical underpinnings of the model structure cannot be easily grasped. A solution to these drawbacks that has been proposed in the literature consists of building a reduced scale (or core) version of an original model, that retains the latter's basic properties while at the same time being more transparent as to the model's theoretical framework.[7]

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5 See Banca d'Italia (1986) for a full documentation of the previous version.

6 For a more detailed description of the main properties of the standard model, see, in addition to Banca d'Italia (1986), Galli *et al.* (1989). A discussion of the latest versions of some of the main equations is in Siviero and Terlizzese (1997); an up-to-date description of the main equations in the supply block of the model can be found in Parigi and Siviero (2001) and in Altissimo and Siviero (2002), where extensive simulation experiments are also presented. It is worthwhile noting that the coexistence of a neoclassical macroeconomic equilibrium framework with Keynesian short-to-medium-term adjustment processes – which, as described in the text, is one of the foremost properties of the BIQM – is a feature shared by most existing macroeconometric models (see, e.g., Church *et al*., 2000).

7 See, e.g., Deleau *et al.* (1988) and Masson (1998) for two different approaches.

A core version of the BIQM (also called *maquette*) was originally built by Terlizzese (1994); a more recent version of the *maquette* is presented in Locarno (2002). As shown in those papers, the *maquette* mimics the most relevant features of the parent model. However, its structure is much more transparent than that of the BIQM. Moreover, it is far easier to use. Thus, a number of exercises that cannot be carried out with the original model are relatively simple to perform with its core version. Most notably for our viewpoint, the equilibrium steady-state growth path of the *maquette* may be computed in a comparatively easy way.

Given these features, the reduced-scale version of the BIQM appears to be the ideal candidate tool for our purposes: once the *maquette*'s steady-state growth path is computed, one may examine the stabilising features of various fiscal mechanisms by investigating the extent to which they succeed, or otherwise, in limiting the oscillations of various macroeconomic variables around their respective steady-state equilibrium values, in the wake of a variety of shocks.

While a full description of the *maquette* is beyond the purpose of this paper, it may be useful to discuss briefly the strategy underlying its construction and to discuss its main features.[8]

The key characteristic of the *maquette* is that it was built with the explicit goal of reproducing the main properties of the original BIQM. Given that goal, the following building strategy was adopted: (1) pseudo-data were generated by means of stochastic simulations of (selected blocks of) the BIQM; (2) those pseudo-data underwent a double process of aggregation: (i) as the degree of sector aggregation of the *maquette* is much higher than that of the BIQM (e.g., the latter separately describes the demand for a relatively large number of investment goods, while only one investment good is considered in the former), the BIQM-consistent pseudo-data were aggregated according to the chosen degree of detail of the *maquette*. As a result, the version of the *maquette* used in this paper comprises about 100 endogenous variables, thus being in scale 1:10 (approximately) with respect to the original model; (ii) the choice was made to use annual, rather than quarterly, data, so as to simplify the lag structure of the *maquette*; (3) the aggregate data were used to estimate the structural relationships of the reduced-scale model. Thus, the *maquette* tends to mimic the BIQM by construction, as indeed suggested by evidence presented in Terlizzese (1994) and Locarno (2002).

Notwithstanding the general principle that the *maquette* should reproduce the features of the BIQM, a few differences exist between the two models. Most importantly from our viewpoint, while the relationships of the original model are not always homogeneous of degree 1 (most often because of the need to match some institutional features), all such non-homogeneities were eliminated in the process of building the *maquette*, so that the latter's equilibrium may be computed. By contrast, all violations of dynamic (or super) non-homogeneities that can be found in the BIQM were retained in the *maquette* as well, as they appear to be a key feature of

[8] For more details see Locarno (2002).

the data (the corresponding parameter restrictions are always sharply rejected). This implies that the equilibrium of the *maquette* is not independent of the growth rate assumed for the exogenous driving variables.

The concept of long-run equilibrium that best applies to the BIQM, and hence to the *maquette*, is that of a steady-state growth path. Along such a dynamic equilibrium, all variables grow at a constant rate. Hence, all intensive variables are constant. In other words, the ratios between variables that are characterised by similar equilibrium dynamics are independent of the point in time in which they are computed. This implies that the steady-state of the *maquette* is driven solely by the following three growth factors: (i) rate of growth of technical process; (ii) rate of growth of population; (iii) rate of growth of prices. The steady-state growth rates of all exogenous and endogenous variables are thus given by different combinations of those three basic growth rates.

Since the equilibrium dynamics of all model variables is known a priori, the easiest way to compute its steady-state equilibrium is to write a static version of the original *maquette*, replacing all dynamic terms by an appropriate function of the three basic growth rates listed above.[9] Simulating the resulting model for just one period delivers a set of steady-state starting values that are also a solution of the original dynamic *maquette* and ensure that the latter does not depart from equilibrium if the system is not hit by any shocks.

Turning now to more practical issues pertaining to the computation of the steady-state equilibrium, it remains to be specified what was assumed regarding the starting values of the exogenous variables and the dynamic-equilibrium-driving exogenous growth rates.

Since the *maquette* could have multiple steady-state solutions, the choice of the initial conditions for the exogenous variables is most important. In general, the choice was made to fix those starting values at their respective averages in the recent past (usually, the second half of the Nineties).

As to the three basic growth rates, the following values were assumed:

(i) rate of growth of technical process = 2 per cent;

(ii) rate of growth of population = 0.2 per cent;

(iii) rate of growth of prices = 2 per cent.

These are the values underlying the benchmark experiment discussed below. An analysis of the sensitivity of the results with respect to the choice of the steady-state growth path will be presented in the Section 4.3.

The steady-state solution of the *maquette* resulting from the assumptions listed above is presented, for a few key intensive variables, in Table 1, along with the corresponding historical averages in the 5 years from 1997 to 2001. On the whole, the computed steady-state growth path seems to be plausible: first, all

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[9] For a detailed description see Siviero (1995) and Locarno (2002).

Table 1

Steady-State and Historical Values for Some Key Intensive Variables

	SSGP	Average 1997-2001
Private consumption/GDP	0.63	0.60
Investment/GDP	0.20	0.20
(Exports-Imports)/GDP	0.02	0.02
Fixed capital/GDP	3.34	3.16
Public deficit/nominal GDP	0.02	0.02
Current accounts/nominal GDP	0.00	0.01
Private sector labour share	0.62	0.61

intensive variables assume sensible values; second, a number of comparative statics exercises documented in Locarno (2002) indicate that if the exogenous assumptions on which the steady-state hinges are modified, then the steady-state solution changes in a way consistent with what theory predicts, with a few limited exceptions due to violations of dynamic homogeneity constraints.

Finally, Locarno (2002) points out that the steady-state solution of the model, while easily computable, is not dynamically stable. If the system is hit by shocks, it drifts away from the steady-state growth path and eventually becomes explosive, unless the *maquette* is supplemented with stabilising policy rules. Locarno (2002) further finds that a Taylor rule is per se not enough to guarantee stability, and that a fiscal rule is also needed. In the next two sections we discuss how those rules were specified in the *maquette* used in this paper.

3.3 Added maquette *features: monetary policy reaction function*

For the purpose of performing the experiments presented below, the *maquette* was supplemented with a simple monetary policy reaction function, similar to the one originally proposed in Taylor (1993).[10] Thus, the policy-controlled interest rate

[10] 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, 1999); in this context, it is usually found *(continues)*

only reacts to departures of the current inflation rate and output gap from their respective targets. In addition, we allow for the possibility that the lagged value of the instrument is also taken into account in setting monetary policy, inducing a smoother dynamics of the short-term interest rate. Thus, the monetary policy reaction function inserted in the *maquette* was the following:

$$i_t = \gamma_0 + \gamma_1 \cdot (1-\gamma_3) \cdot (\pi_t - \pi_t^*) + \gamma_2 \cdot (1-\gamma_3) \cdot gap_t + \gamma_3 \cdot i_{t-1}$$

where i_t is the short-term (policy-controlled) interest rate, π_t and π_t^* are, respectively, current and target inflation (changes in annual consumption deflator) and gap_t is the output gap. In the benchmark experiments below, the following parameter values were assumed: $\gamma_1 = 2$; $\gamma_2 = 2$; $\gamma_3 = 0.5$. γ_0 must be set consistently with the assumed exogenous growth rate of prices.[11] Section 4 also reports a number of sensitivity experiments with respect to these parameters.

Inserting a Taylor rule in the *maquette* poses one further problem. The policy interest rate is no longer controlled by the national central bank, but by the Governing Council of the ECB, whose decisions are taken on the basis of the economic conditions of the euro area as a whole. Thus, the inflation and the output gap terms in the expression above should refer to the euro area, rather than to Italy only. However, the *maquette* does not include a description of the former. In order to partially tackle this problem, the following expedient was adopted: we computed the (historical) variance of the difference between the Italian and the euro area average inflation rates, and similarly for the output gap, and supplemented the *maquette* with two additional equations:[12]

$$\begin{aligned} \pi_t^{Euro} &= \pi_t^{Italy} + \varepsilon_\pi \\ gap_t^{Euro} &= gap_t^{Italy} + \varepsilon_{gap} \end{aligned} \tag{1}$$

Of course, those two equations are not to be interpreted as determining the euro area inflation and output gap: rather, they are meant to mimic the fact that,

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 *et al.* (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.

11 The chosen Taylor rule parameters are higher than in Taylor's (1993) original formulation of the rule, but are close to the optimal ones that are typically found in the literature.

12 Note that, given the single currency, for the steady-state to exist it must be assumed that, in equilibrium, the average error in equation (1) be zero, which is not the case in history.

while on average appropriate, the single monetary policy may, at any given point in time, differ from what would be best from a strictly Italian perspective.

By modifying the variances of ε_π and ε_{gap}, one can assess how they impact on the optimal result, which is done in Section 4.3 below.

3.4 Added maquette *features: modelling of the public sector*

The public sector in the original *maquette* is modelled in a very sketchy way. Government contributes to aggregate demand through public consumption and investment, raises revenue and issues debt to finance expenditure. Public debt is included in the private sector's financial wealth; net public transfers are included in disposable income.

Given that the focus of this paper is on the stabilising features of the fiscal mechanisms, it was deemed appropriate to amend the original public sector block of the *maquette*. In the latter, the following expenditure side items are modelled separately: government consumption (*GC*), compensation of employees (*W*), investment (*GI*) and interest payments (*INT*). On the revenue side, in order to adequately capture the effects of indirect taxes (*IT*) on prices, *IT* is modelled with a finer degree of detail: for each component of the aggregate demand an implicit tax rate was considered, under the assumption that all indirect taxes are ad valorem. As for the rest of current tax revenue, net direct taxes (*NDT*) – the sum of direct taxes and social security contributions net of public transfers to households and firms – are endogenised assuming a proportional relationship between net revenue and a base, represented by GDP plus the real return on financial assets. A variable, indicated as "other net expenditure" (*OtherNExp*), collects the residual items of the general Government account. The general government deficit is thus given by the following expression:

$$DEF = INT + GC + GI + W - IT - IDN + OtherNExp$$

The modified version of the *maquette* used in this paper makes use of a further decomposition of *NDT*. In order to capture the features that one needs to describe if the stabilisation properties of taxes are to be appraised, we distinguish between the following main components: direct taxes (*DT*), social security contributions (*SSC*), transfers to households (*Tr_H*) and transfer to firms (*Tr_F*). These are endogenised separately in the model. The *OtherNExp* has been modified accordingly. Government deficit now reads as:

$$DEF = INT + GC + GI + W + \mathbf{TR\_F} + \mathbf{TR\_H} - IT - \mathbf{DT} - \mathbf{SSC} + OtherNExp$$

In what follows we focus on the changes to the *maquette* (the bold variables in the deficit expression above). Some of these changes, in particular those concerning direct taxes, are immediately relevant to the assessment of the stabilising effects of the model; others are only indirectly so, and have been introduced mainly in light of future developments of the work presented here.

The expenditure items we disentangled from the previous *NDT* expression are current government transfers to firms and to households. Both items are endogenised to nominal GDP. Transfers to households are mainly represented by social protection expenditure. A relevant fraction is covered by pensions, which we need to single out as part of the personal income tax (*PIT*) base.

Social security contributions paid by employers and employees are modelled separately as functions of gross of tax wages. Following the BIQM, we use implicit rates in the case of employers and a statutory rate in the case of employees. The implicit rates are computed on the basis of total labour cost and gross of tax wages. Moreover, a distinction is kept between public and private sector employers.

The most relevant amendments to the *maquette* obviously concerned direct taxes. In order to isolate the stabilising effect of direct taxes, we modelled with greater detail personal income tax (*PIT*), corporate tax (*CT*) and other direct taxes on households (*OtherDT*), which include withholdings on interest income and capital gains.

As far as the *PIT* is concerned, we distinguished between withholding taxes on labour income of dependent workers and self-assessed payments on other sources of income (independent labour income, unincorporated business income, etc.). The main reason relies on differences in the tax collection systems that influence the income elasticities of the tax.[13]

The general structure of the *PIT* and *CT* equations is similar. Tax revenue is modelled by applying an elasticity to the relevant tax base (gross of tax wages and pensions for dependent workers and pensioners, gross operating surplus of households for *PIT* on other incomes and gross operating surplus of firms for *CT*). The elasticities (η) have been estimated to be historically around 1.2-1.3 for *PIT* on dependent workers, 1.06 for *PIT* on other incomes and 1.07 for *CT*, over a period of nineteen years. They give a summary measure of the more complex tax structure underlying *PIT* and *CT*.[14]

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[13] Dependent labour incomes are subject to monthly withholdings; therefore, the collected receipts respond almost instantaneously to changes in the tax base. On the other hand, taxes on the other sources of income are collected through self-assessed payments (an account paid in two instalments and a settlement payment). The amount of the payment due on account is a fraction of the previous year tax liability, but it can also be computed as a fraction of the same year liability in case this is expected to decrease. The settlement payment is due in June of the following year. Note that the account payment reacts asymmetrically to changes in the year tax base: it does not fully adjust to the change when income increases or statutory tax rates are raised, while it can be reduced when income decreases or statutory tax rates are lowered.

[14] As far as the *CT* is concerned, the elasticity in this specification entails stabilising effects other than those induced by a progressive structure of the tax rates. In particular, it captures the responsiveness of profits to GDP, which is often expected to be higher than that of other GDP components. However, by allowing some carry-over of losses (4 years ahead, in the Italian case), the tax scheme tends to reduce the overall response of *CT* to the economic cycle (one issue for possible future work is to embed into the equation

(continues)

Clearly, elasticities different from 1 cannot in principle be tolerated, as a steady-state equilibrium only exists if all variables in the model grow at constant rates. Taxes increasing more than their tax bases would generate an explosive path for revenues. Therefore, an appropriate device is needed to reconcile values of the elasticities that may be greater than 1 at some point in time with the underlying unity elasticities in steady-state.

One way to solve the problem is to compute tax burden as the product of the relevant tax base and an implicit average tax rate, multiplied by an expression that modifies the elasticity along the cycle. The changes in the elasticity must ensure that when the system is in steady state equilibrium, the implicit tax rate coincides with the effective average tax rate (meaning that when the cycle is neutral the elasticity of tax revenues with respect to the corresponding tax bases must be unitary).

By doing so, it is implicitly assumed that in the long run the dynamics of tax revenues is corrected by some discretionary measures to avoid an indefinite increase in the tax burden due to the operating of the fiscal drag.[15] This is modelled in the *maquette* by introducing a fiscal rule that calls for continuous automatic corrections over the economic cycle, rather than for discrete corrections, as it happens in reality. In particular, in the case of the Italian system,[16] while corrections to re-absorb nominal fiscal drag have been often carried out explicitly (even by automatic rules in the late Eighties), real fiscal drag has been amended *de facto* by periodic adjustments in the tax schemes or by tax reforms.

We thus model direct taxes as follows:

$$T = \eta' \, \tau_0 \, Y$$

$$\tau_1 = T / Y$$

where τ_0 is the steady-state-consistent tax rate, Y is the tax base, T is the tax revenue, η' is the elasticity of taxes with respect to income, and τ_1 is the effective tax rate, which differs from τ_0 if the economy is outside the steady-state growth path. As to η', a basic requirement is that it has to be modelled in such a way that it be 1 all along the steady-state, where it must be $\tau_1 = \tau_0$.

The behaviour of the tax elasticity along the cycle is described by a bounded function of an indicator of the cyclical position of the economy, given by the distance between the effective rate of unemployment and the *NAIRU*. The function must be chosen in such a way that:

(i) $\eta' = 1$ when unemployment is at the *NAIRU*;

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some mechanism for losses carry-over, using data from tax returns). Finally, income elasticity ends up collapsing also the changes occurred in income distribution, which is modelled in the *maquette* in a very simplified way.

15 This is something that is periodically done in the actual tax systems.

16 On the evolution of the Italian tax system see Ceriani *et al* (1990).

(ii) η' tends to η as unemployment drifts increasingly away from the *NAIRU* from above,

(iii) η' falls as unemployment is below the *NAIRU*; specifically, we require η' to tend to $2-\eta$ as the cyclical situation worsens.

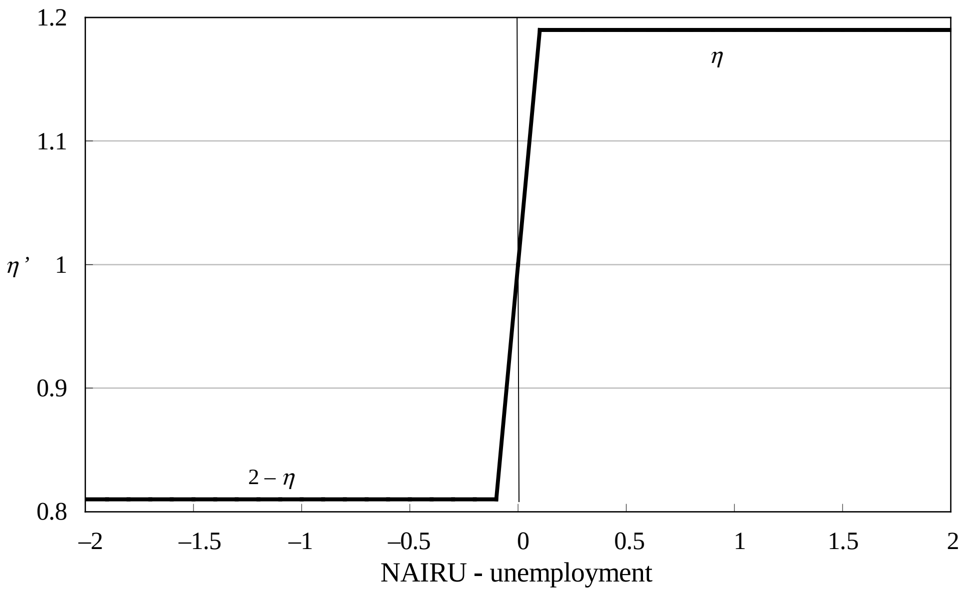
A function that conveniently allows for all these conditions is the following:

$$\eta' = A\left[\frac{\exp[\alpha + \beta(NAIRU - unemployment\ rate)]}{1 + \exp[\alpha + \beta(NAIRU - unemployment\ rate)]} - B\right]$$

where the parameters *A*, *B* and α are to be set consistently with the choice of η and with the constraint that η' = 1 when unemployment is equal to *NAIRU*. The parameter β measures the sensitivity of the elasticity with respect to cyclical positions, *i.e.* the discretionary correction enacted to amend the fiscal drag effect; the higher β, the faster η' approaches η when the cycle is positive ("above" the steady-state), and analogously for negative cycles. Therefore, the higher β, the prompter the policy response. The function η' underlying the benchmark results presented below is shown in Figure 1, for η being approximately 1.2, and for the discrepancy between unemployment and the *NAIRU* ranging from –2 to 2 per cent; as shown by the figure, the tax elasticity quickly approaches the theoretical η as the economy moves away from equilibrium.

Figure 1

Tax Elasticity Along the Cycle



This methodology applies to each of the main components of *PIT* and to *CT*. Through calibration of the relevant parameters it is thus possible to mimic different dynamics of the elasticities.

Other direct taxes on households are endogenised as a function of the gross operating surplus of the households. Since they are not modelled through elasticities like the other direct taxes components, they do not contribute to the stabilisation capacity of the tax system. The same is true for the social security contributions, which interact only in so far as they influence the PIT base.

4. The results

4.1 The experimental design

As described in Section 2, the approach adopted here to appraise the stabilising properties of different tax schemes consists of comparing, for a number of variables of interest, the unconditional variance of the oscillations around the equilibrium steady-state growth path that result if the model is simulated under various fiscal mechanisms.

Given the non-linearity of the BIQM *maquette*, the unconditional variance-covariance matrix cannot be computed analytically and thus needs to be estimated by means of (long-horizon) simulations.

The operational design underlying the basic experiment is the following:

(1) compute the deterministic steady-state growth path of the *maquette*;

(2) for each value of the tax elasticity parameter within the feasible range, extract 200 antithetic replications[17] for each of the 24 error components[18] of the model, using their historical joint distribution. Each replication comprises 400 realisations of the disturbances;

(3) simulate the model, for each replication of the residuals, over a 400 period timespan;

(4) compute the variance-covariance matrix of the variables of interest, using the average of the variance-covariance matrix computed, period by period, on the basis of all replications, using only the last 200 simulated values for each replication. The first 200 results are discarded because the simulations start from an initial equilibrium situation; it may thus take a while before the

[17] Antithetic replications are well known to be relatively effective in concentrating the mean outcome of stochastic simulations. See Calzolari (1979).

[18] We consider 24 possible sources of errors, belonging to the following three categories: (i) behavioural equations of the *maquette*; (ii) error terms referring to the less-than-perfect synchronicity between Italy's inflation and cyclical position and those of the area; (iii) the main 7 exogenous variables of the model (including, among others, foreign prices and world demand). For the latter, the disturbances are computed on the basis of the distribution of the residuals of a regression of the logarithm of the variables on a linear trend. For the time being, autocorrelation of residuals has been neglected; a way to deal with autocorrelated residuals is discussed in Siviero (1995).

variance of outcomes provides a reliable estimate of the corresponding unconditional value. It was found that the variance of outcomes is indeed stable (so that it may legitimately be interpreted as a good proxy of the unconditional variance) if the last 200 results are used.

4.2 Stabilisation properties of different tax structures

Figure 2 reports the main results for the benchmark experiment (β = 300; Taylor rule parameters set as specified above). The figure was obtained by letting the maximum elasticity of withholding tax on labour (η) vary between 1.18 and 1.85 (on the x-axis in the chart);[19] for each value in a grid in that interval, the procedure described in the previous section was applied to compute the corresponding value of the variance of the output gap, which is depicted on the y-axis (as a ratio with respect to its minimum value).

Figure 2 shows that the variance of the output gap has a minimum for $\eta = 1.27$; for values of the elasticity that lie to the right of the minimising one, the variance increases gently, remaining relatively flat for at least some interval (for instance, for η = 1.55, the variance is still less than 5 per cent higher than the minimum one). By contrast, as the maximum elasticity of withholding taxes is made to decline, the variability of the output gap around its equilibrium value increases very sharply (for η = 1.23, the variance of output is about 10 per cent higher than at its minimum, and increases very rapidly as one moves further to the left, being 30 per cent higher than at its minimum for η = 1.18).[20]

It would be premature to identify, on the basis of this evidence, the value of the tax elasticity that delivers the smallest variability around the equilibrium. However, a first interesting conclusion seems to emerge: the risks implied by "too high" a value of the maximum elasticity of taxes with respect to cyclical conditions are relatively limited, at least in a rather wide range, while, by contrast, "too low" values of the elasticity may quickly result in a sharp loss of stabilising properties of the tax system.

During the last decade, in most countries tax reforms moved towards a flattening of tax schedules and a widening of the tax bases, as the main focus was on removing the distortions induced by taxation. This is sometimes seen also as one cause of loss in the stabilisation properties of the tax systems. The results above suggest that the trade-off between efficiency and stabilisation might not prove to be relevant, depending on the starting point, *i.e.* on the initial elasticity of the tax system. Indeed, it may well be the case that a tax structure is characterised by a "too high" elasticity, setting the system outside the variances-minimising interval. In this

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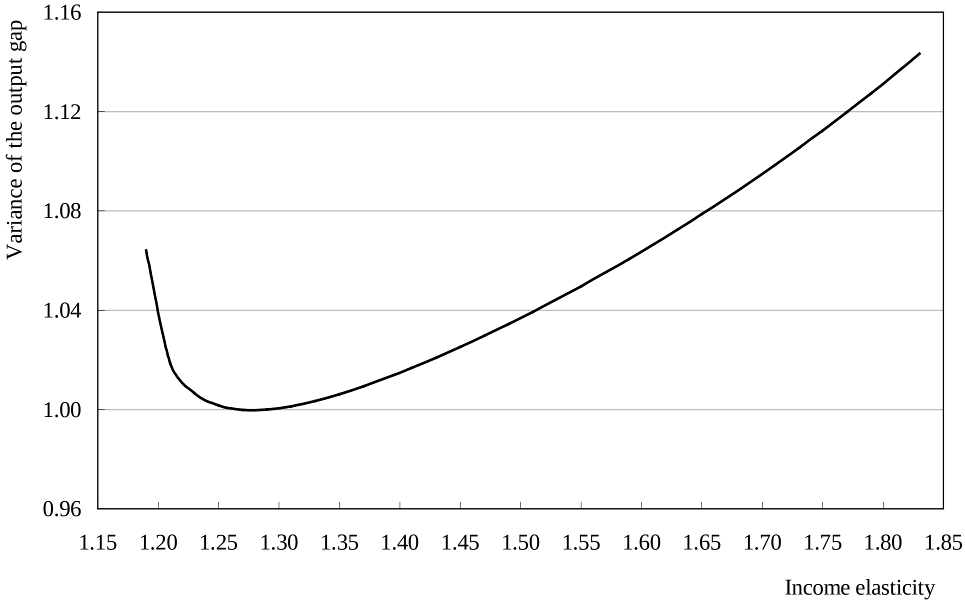
[19] In this experiment it was assumed that the elasticity of self-assessed payments related to personal and corporate income taxes move in accordance with the elasticity of the withholding taxes on labour income.

[20] The picture would be basically the same, at least qualitatively, if the variance of the rate of growth of output or that of unemployment were considered.

Figure 2

The Output Gap Variance Curve(1)



(1) Horizontal axis: income elasticities of the withholding tax on dependent labour income; vertical axis: ratio of the output gap variance to its minimum value.

case a reduction in the progressivity may result both in an improvement of the stabilising properties and in an efficiency gain.

How does the actual estimated elasticity fit into this picture?

The *PIT* elasticity estimated for the entire period 1981-1998 is slightly below the value that minimises the variance of the output gap, and, given the speed of adjustment of the elasticity along the cycle (β), it is actually rather close to the area in which instability increases significantly.

Since the end of the Nineties, however the Italian tax system has been subject to two major reforms. The first was enacted in 1998 and revised the *PIT* scheme, while the second is still underway. Both may have changed the value of the income elasticity, but it is not easy to predict how this may have affected the macro elasticity of the *maquette*. Some indications about the direction of the changes may be drawn from other sources of data. In particular, using data collected in the Banca d'Italia Survey of Household Income and Wealth (BISHIW), simulations have been carried out to assess the effects of the tax structures in force in single years, inside and outside the period 1981-1998 (see the Appendix). Simulation results were than used to compute an aggregate elasticity of *PIT* from the population sample, to be compared with the one resulting from the macro model.[21]

This analysis suggests that the aggregated micro income elasticity associated with the tax structures in force from 1998 onwards is higher than that of 1989,[22] which is a central year in the regression period used to estimate the macro elasticity but could be characterised by a below average elasticity compared to the overall period.[23] In particular, the micro elasticity increases in 1998 and decreases in 2001, also as a result of discretionary changes in the tax structure. It rises again in 2003 when the first step of the new reform came into force, implementing only the part of the measures enhancing *PIT* progressivity.

In light of these results, the macro elasticity may have grown in the last years, moving the Italian tax system towards the right-hand-side of Figure 1, in a direction for which the probability of having poorer stabilisation properties tends to be limited. Nothing can be obviously said, however, about the dimension of these changes or the specific position along the curve of the macro elasticity corresponding to the simulated micro one.

4.3 Sensitivity analyses

4.3.1 Effects of changing the sensitivity-to-cycle parameter

In the appraisal of the automatic stabilisation properties of the tax system a relevant role is played by the choice of the discretionary fiscal rule we super-imposed to the tax structure (synthesised by β). As a first sensitivity check, we therefore explored how the results are modified if the speed with which the actual elasticity adjusts decreases (for example, from $\beta = 300$ to $\beta = 250$). This amounts to assuming that small deviations from the cycle are less quickly followed by a change in the elasticity of taxes with respect to the tax base than it is the case in the benchmark experiment. As shown in Figure 3, the picture remains qualitatively unchanged. As expected, the value of the elasticity that minimises the variance of output is now somewhat higher than before (1.33), since more automatic stabilisation is needed when less discretionary stabilisation applies. The rest of the

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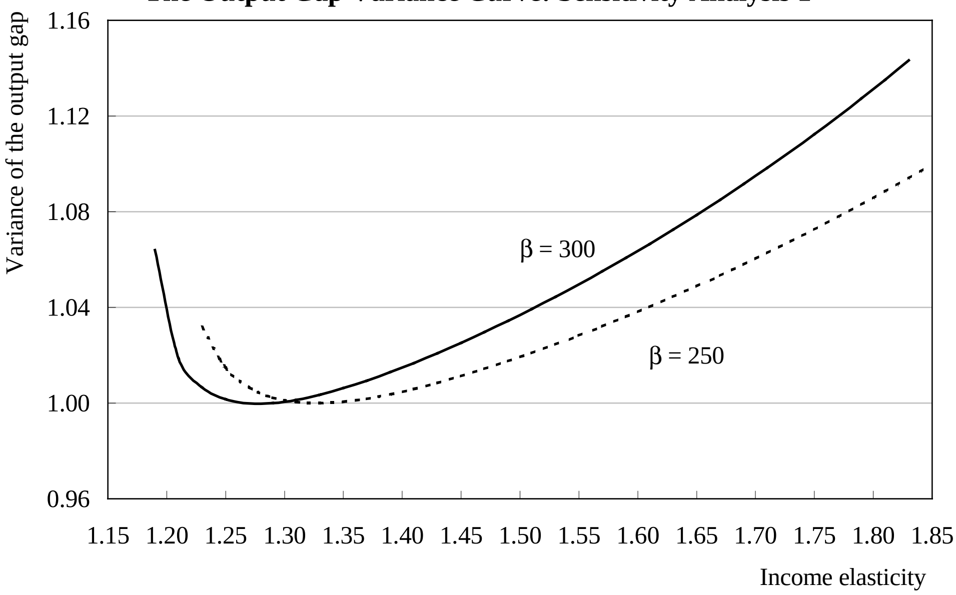
21 The intention is to carry out future work to estimate a relationship between the two elasticities, in order to tie the results obtained from the application of tax structures in all their relevant details at the micro level with the aggregate elasticity describing the system over time in the macro model. This relationship would allow, in principle, to create a direct correspondence between any tax structure simulated using micro data (e.g. a tax reform proposal) and the elasticity used in the macro model to assess the stabilising effects. For the time being, however, the comparison can only be impressionistic and should be considered with care.

22 In 1989 a revision of the tax structure was enacted in order to counterbalance the fiscal drag effects from previous years. As a consequence, the aggregate elasticity implicit in the micro data may be low relative to those characterising the years between 1981 and 1998; therefore, also in the macro data 1989 could be a below average year within the estimation period of the elasticity.

23 The ending year of the microeconomic analysis is 2003. At present it is not possible to evaluate the stabilising effect of the reformed tax system envisaged by the recently approved enabling law.

Figure 3

The Output Gap Variance Curve: Sensitivity Analysis 1



remarks made earlier still apply here, so that the choice of β does not seem to affect our results in a significant way.

4.3.2 Effects of less-than-perfect syncronicity with the Euro area

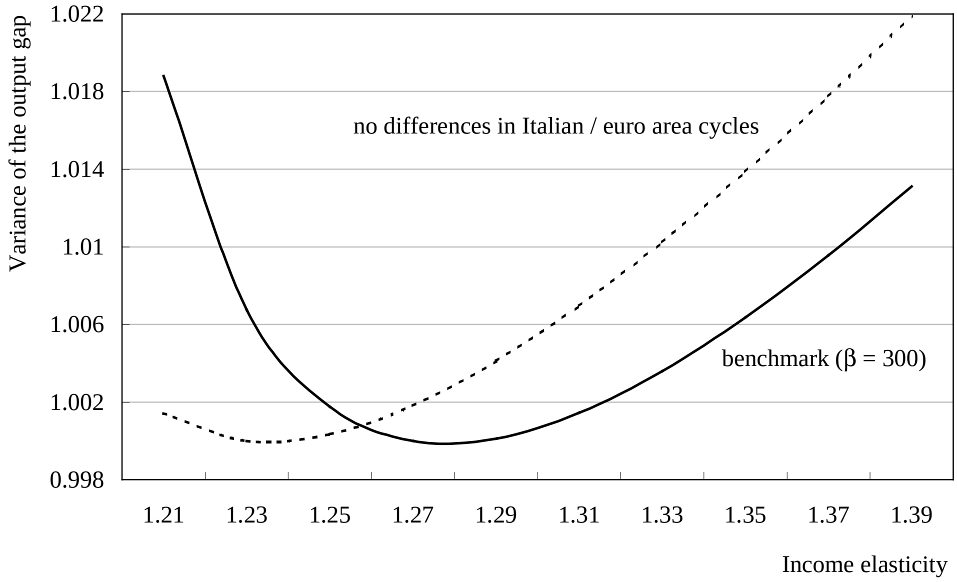
As described above, our experimental design is such that monetary policy reacts, in accordance with the single monetary policy established in 1999, to the euro area inflation and cyclical position, rather than to the corresponding Italian variables. Euro area variables are modelled in an admittedly crude way, as the assumption is made that the discrepancy between Italian inflation (output gap) and euro area inflation (output gap) is completely accounted for by a white noise disturbance. In other words, the assumption is implicitly made that there do not exist fundamental structural differences between the Italian and the euro area economies, but that accidental discrepancies do arise period after period.

How would our results regarding the optimal elasticity be modified, should those discrepancies become nil? Figure 4 provides an answer to this question: in the figure, the benchmark results are compared with those that we find when the difference between the Italian and the euro area inflation rates and output gaps is systematically set to zero.

The value of the tax elasticity that minimises output gap fluctuations is now somewhat lower than before (1.23, as opposed to 1.27 in the benchmark case). Such

Figure 4

The Output Gap Variance Curve: Sensitivity Analysis 2



result should be expected, as in this variant experiment monetary policy is made to react to domestic economic conditions only, and is not "disturbed" by the need of pursuing area-wide objectives. As a consequence, it is reasonable to expect that fiscal policy does not need to make as large an effort as in the benchmark case, where monetary policy was assumed to be set on the basis of area-wide developments.

4.3.3 Sensitivity with respect to monetary policy rule parameters

A number of experiments were also conducted to assess the impact on the benchmark results of changing the assumptions regarding the numerical values of the parameters in the Taylor-type monetary policy rule included in the BIQM for the sake of the experiments carried out here.

The results are as expected: if the reactivity of monetary policy with respect to the output gap (*i.e.*, with respect to the cyclical conditions) is lowered, then the optimum tax elasticity moves to the right (Figure 4). In other words, as monetary policy becomes less aggressive in countering output gap fluctuations, fiscal policy must somewhat "fill the gap", by becoming more sensitive to the cycle. Similarly, if the parameter of the lagged interest rate is raised, so that the current interest rate become more inertial (*i.e.*, it depends relatively more on past history and less on current conditions), then the optimum tax elasticity is higher than in the benchmark case.

4.3.4 Sensitivity with respect to the sources of stochastic disturbance

The literature on fiscal stabilisers has long emphasised that whether automatic stabilisation is desirable or not from the viewpoint of dampening cyclical fluctuations depends in a key way upon the nature of the shocks. In particular, it has been consistently found that automatic fiscal stabilisers tend to help keeping cyclical fluctuations under control if the shocks are prevalently demand ones, whereas they are less effective, or even counter-productive, if supply shocks prevail.

The same finding seem to emerge in our set-up. We separated all sources of stochastic disturbance in the *maquette* of the BIQM in two categories – supply-side disturbances and demand-side ones – adopting the standard criterion of classifying as demand shocks those shocks whose effects on prices and output have the same sign (being both positive, or both negative), and as supply shocks the disturbances that affect prices and output differently.

If only demand shocks are retained, the tax elasticity for which the output gap variance reaches a minimum moves considerably to the right with respect to the benchmark case (Figure 5). While in the latter the optimum tax elasticity is just below 1.3, here it becomes larger than 1.5. Thus, as in the rest of the literature, a high responsiveness of the budget balance, or of one of its components (as is the case here), to the cyclical position seems to be more desirable the larger is the role played by demand shocks in driving the fluctuations of the economy.

A further feature is worth noting in Figure 5: once supply shocks are set to zero, the variance of the output gap not only moves to the right, but also becomes considerably flatter. Indeed, the stabilising performance of the tax elasticity remains acceptable for a rather wide range of the latter. This seems to suggest that supply shocks are a key factor when it comes to establishing the exact numerical value of the optimum elasticity. In other words, these results indicate that when the shocks originate prevalently in the supply side of the economy it becomes comparatively more difficult to contrast cyclical fluctuations. The correlations between supply and demand shocks do not seem to play any significant role.

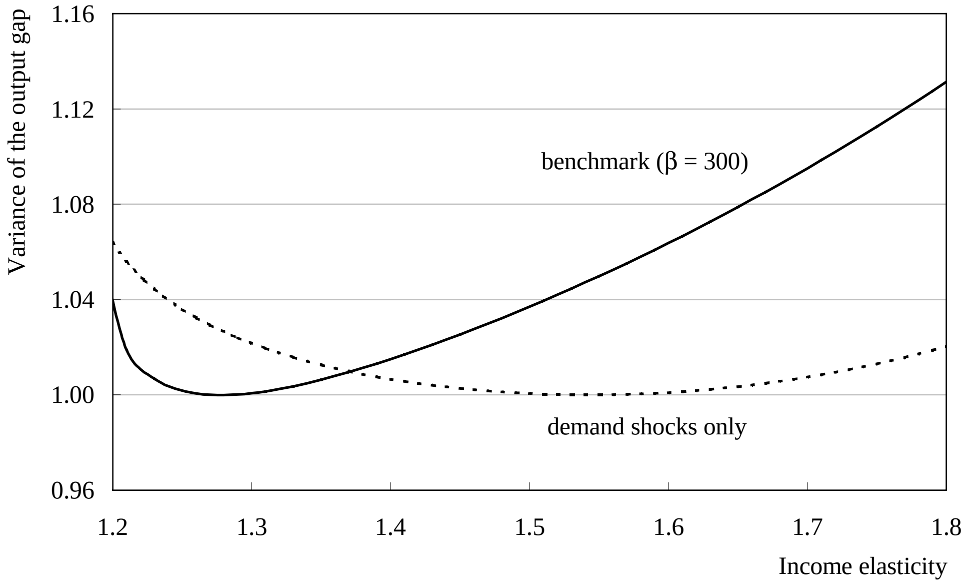
5. Conclusions

This paper proposes to assess the automatic stabilisation properties of different tax structures using a suitably adapted version of the approach routinely employed to select optimal monetary policy rules. In a nutshell, the approach relies on comparing the unconditional variances of the variables of interest associated with different values of the tax elasticity parameters.

An empirical application is presented that relies on a core version of the Banca d’Italia Quarterly Model of the Italian economy. The results suggest that, if one’s goal is that of stabilising the output gap, then the elasticity of taxes with respect to cyclical fluctuations should be in the neighbourhood of 1.3. Sensitivity

Figure 5

The Output Gap Variance Curve: Sensitivity Analysis 3



exercises show this result to be rather robust with respect to changing a number of accessory assumptions.

The results also suggest that values of the tax elasticity parameters higher than the optimum one do not considerably worsen the stabilisation properties of the tax system, at least as long as those elasticities are not pushed "too far to the right". By contrast, a sharp loss of stabilising properties of the tax system quickly emerges if the elasticity lies below the optimum, even if only by a small amount. Recent reforms seem not to have significantly modified the stabilisation properties of the Italian tax system.

Our results are qualitatively consistent with those from other studies, despite non-trivial methodological differences between the latter's approaches and ours.

First, there may be no trade-off between output stabilisation and efficiency, provided that one starts from a tax system whose sensitivity to the cycle is sufficiently high. In particular, if the tax structure is characterised by "too high" a degree of cyclical elasticity (*i.e.*, the system is "to the right" of the output gap variance-minimising point), a reduction in the progressivity may result both in an improvement of the stabilising properties and in efficiency gains.

Second, a comparatively high degree of automatic fiscal stabilisation tends to do a good job in keeping cyclical fluctuations under control when demand shocks prevail, whereas the opposite applies in the case in which supply shocks prevail.

APPENDIX

A BRIEF OVERVIEW OF THE ITALIAN PERSONAL INCOME TAX STRUCTURE

One of the main factors determining the stabilising effects of fiscal policy is progressive taxation, through its elasticity to income and the tax bases sensitiveness to the cycle. The PIT is undoubtedly, for its own characteristics, the main instrument of automatic stabilisation.

The progressivity of the PIT is determined by the working of both tax rates and income brackets and the tax credits recognised to employees and self-employed and for dependent people. PIT has been deeply modified in the last fifteen years. Income brackets and legal tax rates have been reduced from seven to five between 1989 and 1998[24] and are planned to become two at latest in 2006, along the lines laid down in the recently approved enabling law establishing the guidelines for the reform of central government taxation.[25] The unification or enlargement of some income brackets, the increase in the lowest tax rate (from 10 to 23 per cent) and the decrease in the highest rate (from 51 to 45 per cent) determined a reduction of the tax progressivity, which was more than compensated by modification to tax credits intervened in the same period.

Tax credits for dependent spouse have been maintained constant in real terms from 1989 to 1995; since 1996 the amount has been diversified with respect to income and significantly increased for low-income classes. Also tax credits for dependent children and other dependent people have been raised, in particular from 1998. Tax credits for employees and self-employed became inversely related to income in 1993 and are in proportion much higher for low level of incomes.

In 2003 a first module of the mentioned tax reform has been implemented. Income brackets have been changed, as well as the first three tax rates. The transformation of tax credits into deductions from the tax base is under way. In particular, a new allowance has been introduced to ensure the progressivity of the tax schedule. It establishes a no-tax area, *i.e.* an income threshold below which no tax is due regardless of the nature of income (3,000 euro). The threshold is raised

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[24] Between 1989 and 1991 tax rates were left unchanged and the limit of the income brackets were increased on the basis of the inflation rate. After a one-percentage point increase of the rates of the five highest income brackets, the personal income tax structure was left unchanged up to 1998. For a more detailed description of the evolution of the personal income tax structure between 1989 and 2001, see Marino and Rapallini (2003).

[25] The reform aims at simplifying the tax system, increasing its neutrality and supporting the competitiveness of the economy. The new tax system will be based on five taxes: income tax, corporate income tax, VAT, tax on services and excise. The reform will radically change the structure of the *PIT*. The tax rates are to be reduced to two (23 per cent for incomes up to 100 thousand euro and 32 per cent above). The current tax credits are to be replaced by deductions from the tax base for tax-payers with incomes up to a certain ceiling. The structure of the deductions and their amount have not been specified yet.

depending on the source of income: to 4,500 euro for self-employed, to 7,000 for pensioners and to 7,500 for employees. Beyond these levels of income the allowance is inversely related to income and becomes zero for incomes higher than 30,000 euro (inclusive of tax credits and net of deductible items).[26]

Using data from the BISHIW conducted in 1998[27] it is possible to measure the income elasticity of the *PIT* on earnings from dependent labour simulating different tax structures.[28] This tool allows the measurement of income elasticity of the tax for different segments of the income distribution and for different sources of income.[29] Such information could than be used to compute an aggregate elasticity which is tied, through an appropriate relation still to be find, to the one estimated on tax proceeds and used in the macroeconometric model. In this way, it would be possible to evaluate the effects of proposed tax reforms on the income elasticity of the tax and consequently assess the stabilisation properties of the resulting new tax.

The analysis of the microdata aimed at investigating in which direction the Italian tax system is moving, *i.e.* towards higher or lower elasticities. The tax structures taken into consideration in this analysis are those in force in 1989, 1998, 2001 and 2003.[30] The exercises are conducted using the population recorded in the 1998 BISHIW and the gross income distribution consistent with the reported net income,[31] so that the results are unaffected by changes in demography and in the allocation of income. The different tax structures are applied to 1998 gross incomes after deflating or inflating the relevant parameters on the basis of the inflation dynamics between each year and 1998.

The comparison of the different tax regimes shows that after a slight reduction in the income elasticity of the tax in 2001 there was an increase in 2003, which brought the elasticity to a level above that registered in 1998 (Figure 6). However, behind these results there are much more complex considerations to make if the income distribution is taken into account.

The line representing the income elasticity of the tax resulting from the different structures per gross income deciles became flatter from 1998 to 2003. The tax elasticity in 2003 is always higher than that resulting from the structures in force in 1998 and 2001 except, respectively, for the second and for the second, eighth and ninth decile (Figure 7). In correspondence with the second decile, there has always

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26 For a more detailed description of the first module of the personal income tax reform see Banca d'Italia (2003).

27 Banca d'Italia (2002a).

28 The utilisation of these surveys has the advantage that institutional details of the tax schemes are taken into account. Clearly, it is not possible to implement some minor mechanisms of deductions and tax credits when provided on the basis of information not collected in the survey.

29 Moreover, these microdata can be used also to assess the effects on tax proceeds stemming from changes in the income distribution and in demography.

30 Between 1989 and 1993 the personal income tax scheme did not change significantly.

31 For more details on the procedure adopted to calculate gross incomes see the methodological appendix in Marino and Rapallini (2003).

Figure 6

Income Elasticity of Personal Income Tax Structures in Selected Years

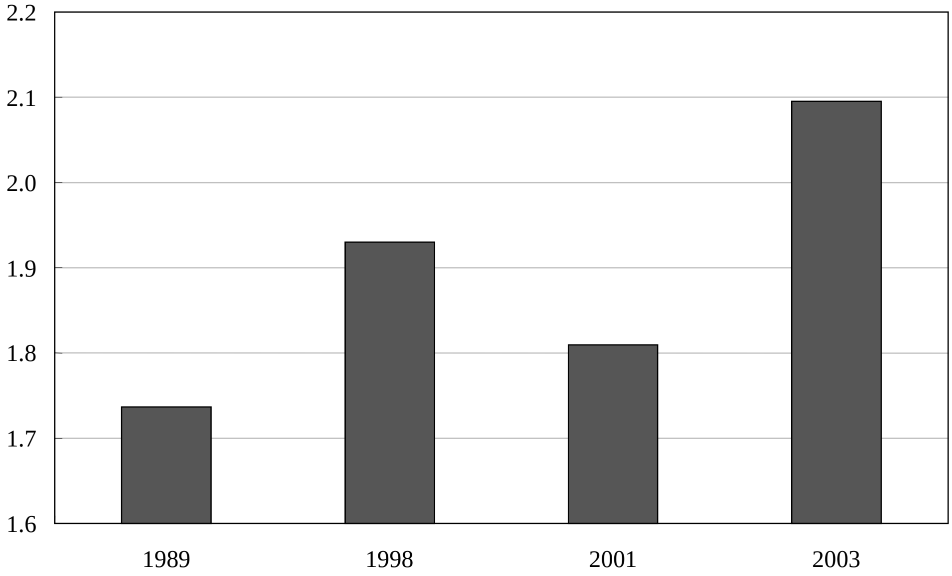
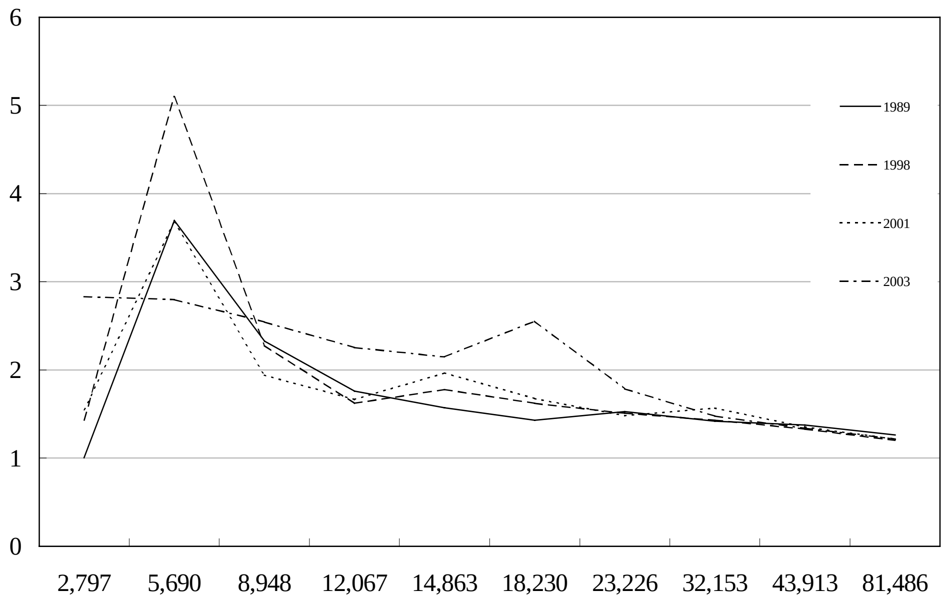


Figure 7

Income Elasticity per Gross Income Deciles



been before 2003 a pick in the elasticity. This was attributable to the existence of tax credits for employees and self-employed which where inversely related to income in a discontinuous way. These tax credits have been abolished in 2003. The difference in the eighth and ninth decile is quite marginal and due to changes in income brackets and tax rates.

Given that the income elasticity of the tax is higher in 2003 from the third to the eighth decile, we would expect that recent personal income tax changes and the planned tax reform would increase the tax reactivity to income. Using the macroeconometric model described in the text it is shown that this higher elasticity will not necessarily determine higher stabilisation. In fact, as argued in Section 4.1, there exists a range of income elasticities that minimise the variance of the output gap, so that for high enough level of elasticities the stabilisation properties of the tax scheme could in principle decrease.

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