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Who bears the burden of debt reduction in Italy?

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**Wirtschaftswissenschaftliche Fakultät
der Eberhard-Karls-Universität Tübingen**

**Who Bears the Burden of
Debt Reduction in Italy?***

Hans Fehr
Anna Ruocco
Wolfgang Wiegard



Tübinger Diskussionsbeiträge

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Debt Reduction in Italy? *

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Abstract

In this paper we ask who bears the burden of recent deficit reduction schemes in Italy. We implemented a reduction of the public deficit to 3 per cent of the GDP, the value that would allow Italy to meet the Maastricht Treaty criteria. The cut-down is financed by the so-called Eurotax (introduced temporarily or permanently), combined with an adjustment of the consumption tax rate or, alternatively, of lump-sum transfers, which are endogenously calculated to balance the budget. The policy reforms are simulated in a small open economy, with firms facing adjustment costs in the investment technology. The quantitative analysis is based on a numerically specified overlapping generations model of the Auerbach-Kotlikoff (AK) type. The traditional framework is extended by distinguishing between five different lifetime income classes within each age cohort. After each policy reform, we decompose the total individual welfare effects into their efficiency and redistributive components. This makes it possible to compare the implied intergenerational income effects and the efficiency effects quantitatively.

Our simulations suggest that the debt reduction in Italy will increase the welfare of the future generations between 1 and 2 per cent of their lifetime resources. The main reason is the implied reduction in the future net tax burdens. In order to sustain an upper deficit limit of 3 per cent of GDP permanently, an increase in consumption taxes rather than the Eurotax would be preferable.

1 Policy problems and policy questions

In the last few years the political debate in Europe has mainly focused on the transition to the third stage of the EMU (European Monetary Union) and therefore on the relevance of the fulfillment of the convergence criteria laid down by the Maastricht Treaty. According to the official statistics edited by the European Commission (the Spring Economic Forecast 1997), the economic performances of almost all the Member countries in 1996 have been remarkably good. Still the public finances situation is quite critical. Despite the impressive budgetary adjustment efforts, the majority of the countries have, in fact, not yet made sufficient progress in achieving the reference value for the debt as a ratio of GDP.

The progress made by Italy in relation to the convergence criteria has been considerable, and now the prospect that it will take part in the Euro zone from the outset is much more realistic. With the goal of complying with the relevant Maastricht criteria, the Italian government has programmed a massive increase in tax revenue and an expenditure cut for 1997. The government gross debt ratio will still remain about 122.4 per cent of GDP, which is basically the double of the reference value (60 per cent of GDP), but, as we said, almost all countries would not be able to meet this target. On the other hand, the public deficit will be reduced in one shot by more than 50 per cent. The European Commission estimates that the deficit will decline to 3.2 per cent of the GDP, which is only slightly higher than the required 3 per cent. To meet this goal, a deficit cut of about 68.000 billion lire is needed¹. 62 per cent of this fiscal adjustment² is due to expenditure cuts, which constitutes a permanent reduction that will have an effect beyond 1997. 20.4 per cent is due to a permanent increase of indirect and direct taxes, while 17 per cent would be financed by the so called Eurotax

¹ Source: Documento di programmazione economica e finanziaria per gli anni 1998-2000, Ministero del Tesoro, del Bilancio e della Programmazione Economica, Direzione Generale del Tesoro, Roma, Italia. May 1997.

² Part of this accrues from a reclassification of financial items in line with EU comparability and transparency rules on public finance accounting.

(Contributo Straordinario per l'Europa). In this paper we focus our attention on the Eurotax, which is an „extraordinary“ revenue in that it is scheduled to apply just for 1997. In essence, the Eurotax is an additional progressive income tax, with the tax base being given by total income subject to the regular income tax.

Even if this severe fiscal consolidation programme of the Italian government is successful in achieving the 3 per cent deficit criterion of the Maastricht Treaty, its economic evaluation seems to be less clear. Economists judge the desirability of tax and expenditure programmes according to the implied welfare effects, which for their part depend on efficiency properties and redistributive content of the policy in question. Our specific goal, therefore, is to evaluate the welfare effects of the current Italian public debt reduction schemes. More precisely, we will qualitatively and quantitatively examine the efficiency as well as the redistribution effects of adjusting the Italian budget deficit to comply with the 3 per cent deficit criterion. The deficit reduction is financed by a temporary (or permanent) introduction of the Eurotax, by a change in indirect taxes or, on the expenditure side of the budget, by an adjustment of transfers.

With respect to redistribution, two different distributional channels have to be distinguished. The first one is the **intergenerational** redistribution implied by public debt policy. As is well known, public debt changes the time structure of taxation and thereby redistributes income and welfare between present and future generations. This at least holds if an operative altruistic bequest motive is absent. Reducing the public deficit will favour future generations at the expense of presently living ones which are burdened with higher taxes in order to finance the deficit cut-down. Even if the direction of intergenerational redistribution should be unambiguous, its quantitative extent remains dubious. Therefore, the first contribution of our paper is a quantification of the burden which the Italian budget consolidation imposes on present generations.

The second kind of redistribution considered is **intragenerational** redistribution, i.e. the redistribution between different income classes within the same generation. While the progressive Eurotax clearly redistributes from rich to poor households, indirect taxes are more or less regressive and any increase will work in the opposite direction. As a consequence, the overall intragenerational redistribution remains an open question and its examination is the second

objective of our paper.

Finally, the efficiency effects of the Italian consolidation efforts are unclear because both kinds of taxes involved, the direct Eurotax as well as indirect taxes, are distortionary. One could even expect the marginal excess burden due to the current tax increases to be quite substantial. The Eurotax increases the effective marginal income tax rates. Because excess burden, as a first approximation, increases quadratically in tax rates, efficiency losses may impose considerable welfare burdens on present generations. The third aim of the paper is therefore to calculate the overall and generation-specific efficiency effects of Italian debt reduction schemes.

In order to do all this, a sufficiently detailed economic model of the Italian economy is required. This model has to be dynamic in nature in order to capture the intergenerational dimension of redistribution. It must also distinguish between different income classes within one generation in order to cope with intragenerational redistribution. To evaluate efficiency effects, decisions with respect to the supply of labour and savings and to investment demand must be determined endogenously. And finally, the model must be able to represent the details of the progressive Eurotax and of other institutional features of the Italian economy. All together, an extended and modified Auerbach/Kotlikoff (AK) model seems to be the best choice to fulfill all of these requirements. In the last ten years since its full documentation (Auerbach and Kotlikoff, 1987), this computational intertemporal general equilibrium model has become a standard tool in evaluating dynamic fiscal policy issues. Here, we extend the original AK model by dividing each generation into different income classes.

In order to derive our conclusions we proceed as follows: in the second part of the paper we sketch the basic characteristics of the model (section 2.1), describe the main institutional features of the Italian tax system (section 2.2) as well as its model-equivalent representation (section 2.3), and present the way in which the welfare effects have been decomposed into their efficiency and redistributive components (section 2.4). Part 3 is devoted to the presentation and economic explanation of our simulation results. We conclude with some qualifications and a summary in the last part.

Our main emphasis is on the description and economic explanation of the numerical results obtained when simulating debt reduction strategies in Italy. For the technical details of the

extended AK model, including the behavioural equations and equilibrium conditions, the reader is referred to Fehr and Ruocco (1997).

2 The economic model

2.1 The theory: an extended OLG-model for a small open economy

As already mentioned above, we use a numerical overlapping generation (OLG) model of the Auerbach/Kotlikoff (AK) type in order to evaluate Italian deficit reduction policies. During the last fifteen years, the AK model has established itself as a widely acknowledged and indispensable part of the applied branch of public economics. Hence, there is no need to repeat the structure and the equations of this model in detail. For our purposes it should suffice to describe in short the four sectors of the AK model as it is applied to Italy: private households, firms, the government and the foreign sector.

As for the household sector, consumption, savings and labour supply decisions are derived from a 55 period life-cycle model. The idea is that each household or generation enters the labour force at the age of 20 and expects to die 55 years later. There is no uncertainty with respect to the time of death. Labour supply as well as participation decisions are endogenous; each household chooses how many hours to work in each period and when to exit the labour market. The latter decision is made by comparing the market wage with the household's reservation wage rate. A new feature³ of our model is that for each generation born in any period t , we distinguish five different types of households, differing with respect to labour productivities and savings ratios. Hence, in each period, our model distinguishes 275 types of households according to age and income. Each household maximizes a time-separable constant-elasticity-of-substitution (CES) utility function, defined over leisure and consumption, subject to a lifetime budget constraint. Parameter values and functional forms are assumed to be the same for each household. This reflects the belief that poor households

³ It seems fair to mention, however, that some still unpublished work by Altig and Carlstrom (1995) and Kotlikoff (1996) employs a similar disaggregation of the household sector.

would behave as rich ones, provided they had the same (higher) income. The population is assumed to grow at some exogenously fixed rate n .

At first sight it might appear to be very restrictive that we do not explicitly model bequests or gifts. Empirical evidence suggests that a considerable part of a nation's capital stock is accounted for by bequeathed wealth, even if the precise figures are controversial⁴. And from a theoretical point of view, bequests and bequest motives are of crucial importance for the possibility and extent of intergenerational redistribution. In the presence of operative altruistically motivated bequests, it is irrelevant whether public expenditures are financed by debt or by taxes. In the literature, this is known as Ricardian equivalence between debt and taxes⁵. Any increase in public deficits will be compensated by an increase in bequests such that the intergenerational distribution of welfare and income remains unchanged. Neoclassical economists, however, cast serious doubts on the empirical and theoretical validity of the Ricardian Equivalence Theorem and argue that deficits crowd out private investment, reduce steady state consumption per capita, deteriorate the current account and burden future generations⁶. Up to now, the neutrality of public debt remains an unresolved issue. This dubiousity is taken into account in our paper by modelling both positions. Even if bequests are not explicitly modelled, we have found an indirect way of eliminating all intergenerational redistribution effects of debt policies, generating first order neutrality of public debt. In a later section, this will be discussed more precisely.

The producer side of the economy is represented by a constant-returns-to scale production function using labour and capital as inputs. Investment decisions follow Tobin's (1960) Q-theory of investment, according to which firms will invest whenever the stock market value of their assets exceeds the cost of replacement. As was shown later (Hayashi, 1982), this is consistent with investment behaviour derived from maximizing the market value of firms

⁴ See, for example, the interchange between Modigliani (1988) and Kotlikoff (1988).

⁵ Even if Ricardo himself denied this equivalence; see O'Driscoll (1977).

⁶ Both positions are carefully surveyed in the papers by Barro (1989) and Bernheim (1989); see also the collection of articles in Kaounides and Woods (1992b).

when capital formation is subject to convex installation costs. Note that there are no installation costs when the investment rate has reached its steady state level, corresponding to the sum of the rate of economic depreciation and the population growth rate. Adjustment costs, implying lags in the investment process, can only occur during the transition from one long-run equilibrium to the other. We assume that (marginal) investment expenditures are financed by retained earnings⁷. The government supplies a given amount of public goods, which enter the individual utility function in an additively separable manner. Transfers to households constitute a second item on the expenditure side of the public budget. In an annual perspective, these outlays are financed by issuing new debt and collecting taxes from individuals and firms. Because the economic effects of public debt reduction and tax increases are the main concerns of the paper, we devote separate sections to the description and the model-equivalent representation of the Italian public revenue system.

With respect to the foreign sector, the Italian economy is modelled as a small open economy. Commodities are traded with the rest of the world and international capital flows make sure that the balance of payments is in equilibrium.

The model is completed by considering the equilibrium conditions on factor and commodity markets in each period. In a long-run, steady state equilibrium, the growth rate of GDP, consumption, investment and of all other variables is the same.

2.2 The institutional features of the Italian tax system and public debt situation

In this section we describe the public debt situation in Italy and the main characteristics of the Italian tax system. The reader who is familiar with all of the institutional details can readily skip our exposition. The next section then describes the model-equivalent representation of the fiscal system and indicates how well our benchmark steady state equilibrium represents some relevant Italian macro data.

As in all other Member States of the EU, recent fiscal policies in Italy have been mainly influenced by the necessity of fulfilling the convergence criteria of the Maastricht Treaty.

⁷ This corresponds to the „new“ view of the corporate income tax: see Sinn (1991) or Sørensen (1995).

And indeed, progress in fiscal consolidation has been substantial since the mid-nineties, as is acknowledged by the OECD (1997, 55) and by other critical observers. Table 1 illustrates the Italian public debt and deficit path during the current decade.

Table 1 Italian deficit and public debt path*

	1990	1991	1992	1993	1994	1995	1996	1997**
Deficit	10.9	10.2	9.5	9.6	9.0	7.0	6.7	3.2
Debt	97.9	101.3	108.4	119.4	125.4	124.4	123.7	122.4

Source: Europäische Kommission (1996) and Spring 1997 Economic Forecasts. * Deficits and debt are expressed as per cent of GDP; ** Forecasts

The most remarkable fact, of course, is the projected halving of the public deficits (as a ratio of GDP) in 1997. This could only be achieved by cutting expenditures and by adjustments in the tax system, to which we turn now.

The Italian tax system is a rather complex one. The numerous and over-complicated taxes, duties and formalities are a burden for tax-payers. In the course of time, major tax reforms have been announced by successive governments, but until now, no substantial progress has been made.

Despite the complexity of the Italian fiscal system in terms of the number of taxes and in terms of modalities, the bulk of total tax revenue accrues from a very limited number of taxes. Table 2 illustrates the structure of the tax revenues in 1995 in absolute amounts and as a per cent of total tax revenue. One particular feature of the Italian fiscal system is the relative importance of direct taxation in comparison to indirect taxes, with a share of direct taxes in total tax revenue of almost 60 per cent.

Table 2 The structure of Italian tax revenues in 1995

Taxes	Tax revenue in billions lire	Per cent of total tax revenue
1. Direct taxes	280.087	58.27
1.1 Personal income tax (IRPEF)	165.269	34.39
1.2 Taxes on interest income	40.700	8.47
1.3 Corporate tax (IRPEG)	29.140	6.06
1.4 Local income tax (ILOR)	17.335	3.61
1.5 Other taxes	27.643	5.75
2. Indirect taxes	193.097	40.18
2.1 VAT	91.597	19.06
2.2 Taxes on mineral oil	44.591	9.28
2.3 Taxes on tobacco	10.030	2.09
2.4 Other indirect taxes	46.879	9.75
3. Lottery and games activity	7.45	1.55
TOTAL	480.634	100

Source: Ministero delle Finanze, 1996.

Among direct taxes, the personal income tax (imposta sul reddito delle persone fisiche; IRPEF) amounts to 60 per cent of direct taxes or one third of total revenue. Individuals whose residence or habitual abode is in Italy are subject to unlimited tax liability, covering total income from domestic and foreign sources. Non-resident individuals are subject to limited tax liability, which means that only income from Italian sources is taxed in Italy. The tax base for IRPEF includes: income from land and buildings; capital income, excluding, however, interest income, which is subject to a definitive withholding tax (see below); labour income; income from self-employment and from trade or business; and finally, other incomes. Taxable income is derived by deducting allowable business expenditures or a limited amount of income-connected expenditures for each income category separately, and by adding together the net income from all sources. For tax purposes, negative incomes are counted only when accruing from self-employment or from trade and business, whereas

losses can be offset against corresponding gains only. Taxable income is subject to a progressive rate schedule. Marginal tax rates and income brackets are illustrated in Figure 1. Married couples (and children) are assessed separately. A number of expenses are deductible from the gross tax liability, the most important of which are family-related deductions and 22 per cent of mortgage payments and of qualified insurance premiums.

For 1997, a one-time fiscal package has been implemented in order to qualify for the EMU. The so-called Eurotax package, totalling 11.5 billion lire, essentially consists of introducing additional levies between 1 and 3.5 per cent of taxable income subject to IRPEF in 1996. Marginal tax rates and income brackets are reproduced in Figure 1.

Figure 1 Marginal tax rate schedules for IRPEF and Eurotax



We have already mentioned that interest income is not subject to the IRPEF. Instead, it is taxed at a flat rate of 27 per cent at the bank level. This is considered a definitive withholding tax for individuals who do not have to pay any additional taxes on them. If, on the other hand, the interest income accrues to trade or businesses, the withholding tax is just a pre-payment on the assessed income tax. A definitive withholding tax of 12.5 per cent also applies to interest yields on public bonds, and a rate of 30 per cent on selected kinds of capital income.

Turning to the corporate income tax (*imposta sul reddito delle persone giuridiche*; IRPEG), Italy introduced a full-imputation system in 1978. However, while the corporate income tax rate was raised from 36 to 37 per cent in 1995, the tax on dividends to be credited against IRPEF remained unchanged. Hence, at the shareholders' level, distributed corporate earnings are subject to IRPEF after being increased by 9/16, with a tax credit being granted for the imputed tax liability. The same applies for a 10 per cent capital yields withholding tax on dividends.

The next direct tax to be considered is the so-called local income tax (*imposta locale sui redditi*; ILOR). Actually, ILOR is a local tax in name only, because the tax revenue accrues to the central government⁸. ILOR is levied at a 16.2 per cent proportional tax rate on domestic capital income, on business income and on other income subject to the IRPEF. An important exception is that all kinds of capital income subject to definitive withholding taxes are exempt from ILOR. There are no tax credits or deductions for ILOR under IRPEG or IRPEF. As a consequence, corporate income from domestic sources is effectively taxed at a rate of 53.2 per cent.

There are some other direct taxes, for example a tax on realized capital gains or taxes on estates, inheritances and gifts, which, however, only constitute a minor source of government revenue.

As for indirect taxes, the value added tax (*imposta sul valore aggiunto*; IVA) is the most important source of revenue. Whereas its tax base is more or less the same across the Member States of the EU, the tax rates still differ between countries. While the normal rate is 19 per cent in Italy, there are reduced rates of 4, 10 and 16 per cent on selected commodities. Exports and intra-community supplies are zero rated, while other items are exempt from IVA. For sales of the latter, no tax credit for taxes paid on purchases of

⁸ Note, however, that ILOR is scheduled to be replaced by a new regional tax (*imposta regionale sulle attività produttive*; IRAP) and possibly a limited regional surcharge to IRPEF.

intermediate or investment goods is allowed.

Considering the numerous excise taxes, the tax on mineral oil (*imposta di fabbricazione sugli oli minerali*) generates the largest revenue, followed by taxes on tobacco which are subject to the State monopoly.

We conclude the description of the Italian fiscal system with a cursory remark on the social security system. Social security is almost totally managed by public entities. INPS is the largest of these bodies. It manages funds for more than 90% of the Italian workers and pensioners, covering mainly sickness, maternity, family benefits and allowances, pensions, retirement and unemployment. Contribution rates are applied on gross salaries and wages. There are different rates which vary according to both the kind of business and the category of employee. For example, special lower rates are also accorded to businesses located in the south of the country. Accident at work insurance, covering professional disease, disability and death, is totally managed by a public body called INAIL. The cost of this insurance is paid by the employer, and varies from 2 per cent to 10 per cent of the gross amount of salaries and wages, according to the dangerousness of the activity.

2.3 Model parametrization and comparison of benchmark values with Italian macro-data

In order to simulate the welfare consequences of Italian debt reduction strategies, the intertemporal general equilibrium model as briefly described in section 2.1 has to be supplemented by numerical values for parameters and policy variables. In the present section we present our choice of parameter values for utility and production functions and describe the model-equivalent representation of the Italian fiscal system. A basic assumption is that initially, i.e. before any change in fiscal policy, the Italian economy grows along a long-run steady state path. Parameters and tax rates are then specified such that the model's benchmark equilibrium replicates some stylized macro data of the Italian economy in 1995. Needless to say, this parameterization procedure involves many ad-hoc assumptions and short cuts.

Table 3 shows the numerical parameter values chosen for consumers, firms and for fiscal variables. In the upper part, we present the utility and production function parameters. Here, our choice is roughly in accordance with Auerbach and Kotlikoff (1987,50 ff). The scale parameter of the production function was endogenized to normalize the wage rate to unity (except for an efficiency parameter). The human capital profiles for the different income classes are approximated by a second order polynomial, the parameters of which have been estimated from income data. Over its lifetime, each income class experiences a different longitudinal growth in earnings at different levels of earnings. The absolute earnings levels were calibrated such that workers of the lowest income class receive (after subtracting some tax allowances from gross income) an annual taxable income of 7 million lire when starting their working life at age 20. Annual taxable income reaches a peak of 20 million lire when they are at an age of 37 and falls afterwards. The richest people, belonging to the fifth quintile, have an annual taxable income of 63 million lire at age 20. Their income increases up to 142 million at age 40, to fall afterwards until they retire at the age of 64.

Even though we have disaggregated the household sector into five income classes, our intertemporal equilibrium model still represents a highly aggregate picture of the actual economy. As a consequence, we cannot adequately handle all the complexities of the Italian fiscal system. An important feature of our model is that we exactly reproduce the marginal tax rate schedule of the personal income tax. We consider this to be an important methodological advance over other simulation models. In Fossati (1990), for example, the IRPEF has been implemented as a continuous quadratic function of taxable income, which was, at that time, a quite sophisticated formulation. One of the main difficulties with a discontinuous marginal rate schedule is that marginal tax rates may change abruptly for small changes in labour supply. To cope with this problem we introduced so-called „virtual“ tax rates which place the optimizing household exactly at the kink of his budget constraint⁹.

⁹ The virtual marginal tax rates are calculated from the first order conditions of the household's optimization problem.

Even if the model-representation of the tax schedule is very precise, the modelling of allowances and tax deductions has to remain quite crude in the absence of further socio-demographic household characteristics other than age and income.

Table 3 Parameterization of the model

Parameters	Value
<i>Utility function</i>	
Subjective discount rate	0.01
Elasticity of intertemporal substitution	0.25
Elasticity of intratemporal substitution	0.6
Leisure preference parameter	1.5
<i>Production Technology</i>	
Substitution elasticity between capital and labour	1.1
Capital share in production	0.3
Rate of economic depreciation	0.05
Adjustment cost parameter	7.5
<i>Policy variables (in per cent)</i>	
Aggregate average personal income tax rate	13.7
Interest income tax rate	10
Corporate tax rate	28
Consumption tax rate	19
Deficit-GDP-ratio	6
Gross interest rate (in per cent)	9.5
Population growth rate (in per cent)	5

Another problem was that by applying statutory tax rates to respective tax bases, one obtains unrealistically large tax revenues. One obvious explanation is that we did not incorporate tax evasion into our model. The reason is that without uncertainty, irregular activities cannot be modelled adequately. On the other hand, there is a widespread perception that Italy has a significant underground economy and a high degree of tax evasion. As far as the corporate income tax is concerned, we only modelled economic but no accelerated depreciation or other investment incentives. To compensate for these complications we have reduced statutory tax rates to the levels depicted in Table 3. This allows us to reproduce actual tax revenues quite accurately. All indirect taxes have been

aggregated to a proportional consumption tax, while ILOR has been split and imputed by 70 per cent to IRPEG and by 30 per cent to some income categories taxable under IRPEF. In addition to tax rates, we had to fix the deficit-GDP-ratio on the initial steady state growth path. As a round number we have chosen 6 per cent, which is a little bit less than the actual value in 1995. Given the relation that links steady state public debt with the annual deficit, we fixed the population growth rate at 5 per cent to obtain a debt-GDP-ratio of 120 per cent. Finally, the economy has been calibrated by exogenously specifying the gross interest rate in order to obtain a surplus in the trade balance which almost reflects the actual one in 1995. Once we have specified the parameter and policy variable values we can compute the model's benchmark equilibrium. Table 4 gives an idea of how well our model replicates some important macro data of the Italian economy in 1995. All in all, our model does not perform too badly. The only thing that deserves some comments is the column concerning the social security system. In the present paper we did not model the Italian „pay-as-you-go“ social security system; this is reserved for a future paper. Given that households do not receive any pension in old age, they are obliged to save more during their working life, which explains the higher average savings rate in comparison to the actual one. Another consequence is that public transfers do not include pension payments in our model and, hence, are much lower than in official statistics.

Table 4 Initial steady state macro data

	Model Benchmark	Italy 1995 ¹
<i>Expenditures on GDP (Percentage of GDP)</i>		
Private consumption	63.0	62.6
Government consumption	17.0	16.5
Gross investment	17.5	18.1
Export - Import	2.5	2.8
<i>General government indicators (percentage of GDP)</i>		
Transfer to households	5.2	19.9
Public debt	120.0	124.4
Interest paid	11.4	11.1
<i>Tax revenues</i>		
Personal income tax (IRPEF, ILOR)	9.4	9.6 ²
Taxes on interest income	2.9	2.3 ²
Corporate income tax (IRPEG, ILOR)	3.4	2.3 ²
Tax on goods and services	12.0	11.8
Social security contributions	0.0	14.7
Saving rate ³	17.1	14.8

Source: ¹ OECD, 1997. ² Ministero delle Finanze, 1996.

³ As a percentage of disposable income.

2.4 Measuring the burden of public debt and decomposing it into redistributive and efficiency components

In the early sixties there was an intense and heated debate about the burden of public debt¹⁰. Musgrave, Vickrey and Modigliani considered the reduction in GDP per capita as the appropriate indicator for the burden of public debt. Buchanan, on the other hand, had earlier emphasized that the burden of debt essentially corresponds to the utility loss which is due to the taxes necessary to finance the repayment of and the interest on public debt. Even if his original ideas were not precise and were later revised, they hit the crux of the problem. For a given supply of public goods, the present value of tax financing on the one hand, and of debt

¹⁰ See Ferguson (1964) or Kaounides and Woods (1992a) for a collection of relevant articles.

finance on the other is exactly the same. Hence, measuring the burden of public debt and measuring the tax incidence in present value terms are equivalent problems. Our task therefore is to determine the lifetime tax incidence corresponding to different debt reduction strategies, where the incidence or burden of taxation is measured by the change in economic welfare or utility (ΔW) over the lifecycle (in present value).

The change in welfare itself must be due either to (re)distributional effects or to efficiency effects. The latter ones occur whenever taxes are distortionary. Redistributively determined welfare effects may arise for two different reasons. On the one hand, they are due to changes in net tax burdens. In fact, each single household may face a different tax payment (ΔT) before and after any fiscal reform, even if the reform is revenue-neutral in present value for the public household. But there is a second reason for distributional changes. Tax reforms typically do not only change relative after-tax prices, but also gross-of-tax prices. The latter, which is irrelevant for efficiency considerations, are a source of redistribution between agents on different sides of the market. For example, if the market wage increases for whatever reasons, workers will gain at the expense of the owners of firms. In the following, ΔP will denote that part of total welfare change which is due to changes in gross-of-tax factor or commodity prices.

Turning to the efficiency component of welfare changes, behavioral reactions come to the fore. In order to avoid taxes, households or firms will substitute away from more heavily taxed activities. We will denote the change in economic welfare that is exclusively due to tax avoidance activities with ΔTA . Now, Fehr and Kotlikoff (1996) or Fehr and Wiegard (1997) have demonstrated in detail that total welfare changes (ΔW) following some policy experiment can indeed additively be decomposed into three components: redistribution due to different present value tax payments (ΔT), redistribution due to a change in gross-of-tax prices (ΔP) and tax avoidance activities (ΔTA), or formally:

$$\Delta W = - \Delta T + \Delta P + \Delta TA.$$

In this equation, ΔT has a negative sign because an increase in tax payments by ΔT corresponds to a *reduction* in welfare. Note that tax avoidance efforts refer to behavioral reactions, including income as well as substitution effects. Optimal taxation theory, however, made clear that efficiency effects or excess burdens of taxes are related to substitution effects only. Therefore, tax avoidance should not be confused with efficiency losses. The transition between avoidance and efficiency requires eliminating all income effects by compensating households for any distributional gains or losses. In our context, the redistributive content of debt or tax policies ($-\Delta T + \Delta P$) has to be neutralized by countervailing transfers. After eliminating income effects by appropriate transfers, tax avoidance effects are converted into pure efficiency effects or changes in excess burden (ΔEB). These can be considered as the efficiency part of debt or taxation policies.

In the following section, we numerically calculate the welfare burden (ΔW) for different households and generations and decompose it into its redistributive components ($-\Delta T, \Delta P$) and its efficiency part (ΔEB). Note, however, that efficiency and redistribution terms do not add up exactly to total welfare change. This, of course, is due to the fact that in general $\Delta EB \neq \Delta TA$.

We will close this section with a final remark. We isolated changes in excess burdens by neutralizing all income effects between households. This holds for intragenerational as well as for intergenerational income effects. If, however, debt policies do not provoke any intergenerational redistribution effects we are effectively in a Barro-Ricardo world, where successive generations are linked by an operative altruistic bequest motive. This explains our above remark that our model incorporates the Ricardian Equivalence Theorem in an indirect way. Because of distortionary taxes, the equivalence does not hold in a strict sense. The changes in excess burdens (in present value terms) stand for the welfare consequences of debt or taxation policies.

3 The model results

This part of our paper is devoted to the presentation and explanation of our numerical results. We will start, however, by briefly describing the policy reforms underlying our simulation exercises. As already said in the introduction, we examine a reduction of the Italian public deficit from its benchmark level of 6 per cent of GDP to the 3 per cent target laid down in the Maastricht Treaty. We will consider this as a permanent upper limit on the deficit-GDP-ratio, as established by the Growth and Stability Pact the Member countries of the EU agreed upon in Dublin and Amsterdam.

To finance part of this massive deficit reduction, the Italian government introduced the progressive Eurotax as described in section 2.2. Whereas the Eurotax is actually limited to the fiscal year 1997, in our simulations we assume that the Eurotax is either introduced for a three years period or even permanently. This reflects our belief that Italy will not be able to meet the requirements of the Growth and Stability Pact without some longer term fiscal reforms. The Eurotax alone, however, is not sufficient to finance the short run revenue losses from deficit reduction. To balance the public budget we consider two different measures. On the one hand we assume that transfers to private households are adjusted to fulfill the public budget constraint. As an alternative we balance the public budget by endogenously adjusting the consumption tax rate. Whereas in the short run we would expect an increase in the consumption tax rate and a decrease in the level of transfers to be necessary, in the long run the deficit reduction will even allow for a tax decrease or an increase in transfers, provided the interest rate exceeds the rate of growth (no Ponzi condition). The adjustment in transfers is mainly considered as a didactic device by facilitating the economic interpretation of simulation results.

Let us now turn to the numerical results. While Table 5 contains some main results for the case of a temporary Eurotax, Table 6 deals with the permanent Eurotax. In both tables, the numbers in the first four columns (except for the head column) refer to an additional adjustment in lump-sum transfers, while the last four columns depict the results for an

adjustment in consumption taxes.

In the head column we list the generations affected by the policy reform, which is assumed to take place in period one. The numbers in this column refer to the year of birth of a household or generation, taking the policy reform period as a point of reference. The number “-70” for example means that this generation is 70 years old at the time of reform and has 5 years to live.

Table 5 Welfare effects of debt reduction with a temporary Eurotax

Birth year	Lump-sum transfers				Consumption Tax			
	ΔW	$-\Delta T$	ΔP	ΔEB	ΔW	$-\Delta T$	ΔP	ΔEB
Lowest Quintile								
-70	-0.62	-0.55	0.03	0.00	-1.21	-0.95	-0.06	0.00
-50	-0.53	-0.48	0.02	0.00	-0.70	-0.55	-0.02	-0.05
-30	-0.61	-0.57	0.00	-0.01	-0.43	-0.35	0.01	-0.08
-10	0.06	0.08	-0.02	0.00	0.18	0.15	-0.01	0.03
1	0.78	0.71	0.00	0.00	0.68	0.55	0.00	0.08
Infinity	2.08	1.83	0.00	0.00	1.50	1.22	0.00	0.16
Third Quintile								
-70	-0.45	-0.41	0.03	0.00	-1.12	-0.87	-0.06	0.00
-50	-0.39	-0.36	0.02	-0.03	-0.63	-0.48	-0.02	-0.10
-30	-0.48	-0.47	0.00	-0.03	-0.41	-0.33	0.01	-0.11
-10	0.04	0.07	-0.02	0.00	0.17	0.15	-0.01	0.03
1	0.59	0.60	0.00	0.00	0.62	0.53	0.00	0.09
Infinity	1.56	1.54	0.00	0.00	1.36	1.16	0.00	0.20
Top Quintile								
-70	-0.18	-0.18	0.02	0.00	-0.86	-0.66	-0.05	0.00
-50	-0.20	-0.13	0.02	-0.10	-0.50	-0.32	-0.02	-0.02
-30	-0.33	-0.28	-0.01	-0.19	-0.41	-0.31	0.02	-0.18
-10	0.02	0.05	-0.02	0.00	0.15	0.15	-0.01	0.03
1	0.29	0.35	0.01	0.00	0.51	0.48	0.00	0.11
Infinity	0.75	0.92	0.00	0.00	1.11	1.03	0.0	0.24
Aggregate								
-70	-0.36	-0.33	0.03	0.00	-1.02	-0.79	-0.06	0.00
-50	-0.33	-0.28	0.02	-0.06	-0.58	-0.43	-0.02	-0.13
-30	-0.44	-0.41	0.00	-0.05	-0.41	-0.33	0.02	-0.13
-10	0.03	0.06	-0.02	0.00	0.16	0.15	-0.01	0.03
1	0.50	0.51	0.00	0.00	0.59	0.51	0.00	0.10
Infinity	0.75	1.32	0.00	0.00	1.28	1.11	0.00	0.20

1 Changes are expressed as percentage of the present value of remaining lifetime endowments.

Table 6 Welfare effects of debt reduction with a permanent Eurotax

Birth year	Lump-sum transfers				Consumption Tax			
	ΔW	$-\Delta T$	ΔP	ΔEB	ΔW	$-\Delta T$	ΔP	ΔEB
Lowest Quintile								
-70	-0.67	-0.52	-0.05	0.00	-1.24	-0.91	-0.13	-0.01
-50	-0.55	-0.44	-0.04	-0.02	-0.72	-0.51	-0.06	-0.07
-30	-0.61	-0.51	-0.03	-0.08	-0.43	-0.30	0.02	-0.15
-10	0.09	0.14	0.00	-0.07	0.21	0.20	0.01	-0.03
1	0.81	0.78	0.01	-0.07	0.70	0.62	0.00	0.01
Infinity	2.10	1.90	0.00	-0.07	1.52	1.30	0.00	0.10
Third Quintile								
-70	-0.51	-0.38	-0.05	0.00	-1.16	-0.83	-0.14	-0.01
-50	-0.42	-0.31	-0.03	-0.07	-0.65	-0.43	-0.06	-0.14
-30	-0.55	-0.43	0.00	-0.15	-0.47	-0.29	0.02	-0.23
-10	-0.03	0.11	0.00	-0.13	0.10	0.18	0.01	-0.10
1	0.51	0.64	0.01	-0.13	0.54	0.57	0.00	-0.03
Infinity	1.47	1.60	0.00	-0.13	1.27	1.21	0.00	0.08
Top Quintile								
-70	-0.24	-0.16	-0.04	0.00	-0.90	-0.63	-0.12	-0.00
-50	-0.27	-0.07	-0.02	-0.19	-0.55	-0.25	-0.05	-0.26
-30	-0.69	-0.38	0.00	-0.40	-0.76	-0.40	0.03	-0.49
-10	-0.44	-0.08	0.00	-0.37	-0.30	0.02	0.01	-0.34
1	-0.18	0.24	0.01	-0.37	0.04	0.36	0.00	-0.26
Infinity	0.27	0.83	0.00	-0.37	0.62	0.91	0.00	-0.12
Aggregate								
-70	-0.41	-0.30	-0.05	0.00	-1.06	-0.75	-0.13	-0.01
-50	-0.37	-0.23	-0.02	-0.11	-0.62	-0.37	-0.06	-0.18
-30	-0.61	-0.41	0.00	-0.23	-0.58	-0.33	0.02	-0.30
-10	-0.17	0.03	0.00	-0.21	-0.04	0.12	0.01	-0.18
1	0.28	0.49	0.01	-0.21	0.37	0.49	0.00	-0.11
Infinity	1.09	1.31	0.00	-0.21	1.05	1.09	0.00	0.00

1 Changes are expressed as percentage of the present value of remaining lifetime endowments.

Remember, however, that the working life of this generation started 50 years before our reference period. Similarly, the number "1" in this column refers to a newly born generation in the reform period, starting to work twenty years later. By "infinity" we denote the generations born after the new steady state equilibrium has been reached. As a supplement to Tables 5 and 6, Table 7 provides a summary overview of some relevant macro-aggregates and other variables along the transition path and in the new long-run equilibrium.

Table 7 Macroeconomic effects of debt reduction; difference from the base solution

Year	Temporary Eurotax		Permanent Eurotax	
	Lump-sum Transfer	Consumption Tax	Lump-sum Transfer	Consumption Tax
Labour supply¹				
1	-1.1	-1.4	-0.3	-0.6
3	-1.0	-2.0	-0.2	-1.2
5	1.0	0.1	-0.2	-1.0
Infinity	-2.7	-1.1	-3.5	-2.0
Capital stock¹				
1	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	-0.1
5	0.2	0.0	-0.1	-0.2
Infinity	-2.7	-1.1	-3.5	-2.0
Consumption¹				
1	-1.1	-1.7	-1.5	-2.1
3	-1.1	-2.8	-1.5	-3.2
5	-0.7	-2.1	-1.6	-2.9
Infinity	1.9	3.0	0.8	1.9
Asset price¹				
1	0.1	-0.2	-0.2	-0.5
3	0.3	0.0	-0.2	-0.4
5	0.3	0.1	-0.1	-0.3
Infinity	0.0	0.0	0.0	0.0
Wage¹				
1	0.3	0.4	0.0	0.1
3	0.3	0.5	0.0	0.3
5	-0.2	0.0	0.0	0.2
Infinity	0.0	0.0	0.0	0.0
Saving rate²				
1	-0.6	-0.6	0.0	-0.1
3	-2.5	-2.2	-1.8	-1.6
5	-1.7	-1.4	-1.6	-1.4
Infinity	0.1	0.1	0.1	0.1
Trans./Cons.tax²				
1	-0.9	1.8	-0.8	1.7
3	-2.6	4.0	-2.5	4.9
5	-2.1	3.0	-2.1	4.0
Infinity	2.7	-4.3	2.9	-4.5
Trade Balance²				
1	-0.1	0.1	0.8	1.0
3	-0.2	0.3	0.8	1.3
5	1.0	1.3	0.8	1.1
Infinity	1.9	-3.0	-3.6	-2.9

¹ Percentage changes. ² Changes in Percentage points.

In this table, the numbers given for the first five variables indicate their change in per cent of the respective benchmark equilibrium values, while the changes of the remaining variables are given in percentage points. For example, a value of „1.8“ for the consumption tax rate means that it increased from 19 to 20.8 per cent in the reform period.

Let us now turn to the interpretation and explanation of our numerical results. Consider Table 5 first. The ΔW -columns present the welfare gains or losses following the temporary introduction of the Eurotax complemented either by an adjustment in transfers or in consumption tax rates. For reason of space, welfare changes are given for the lowest, the middle and the top quintiles of income classes and, in addition, for the aggregate of generations. While the intragenerational redistribution effects of debt policies follow from a comparison of different income quintiles, the intergenerational redistribution effects can be inferred after aggregating all income classes. As a final prerequisite we want to point out that welfare changes are calculated as a percentage of a generation's disposable full lifetime income. This is standard practice in dynamic simulation models as in Auerbach and Kotlikoff (1987) or Fullerton and Rogers (1993). For the generations already alive during the reform period, lifetime income during the remaining lifecycle only is used as the denominator when calculating welfare gains and losses.

As was to be expected, the Italian deficit reduction policies favour future generations, i.e. generations which enter the work force at any time after the reform period, at the expense of currently living and working generations. This is true for the aggregate as well as for each income-specific generation and does not depend on whether the public budget is balanced by transfers or by adjustments in consumption taxes. Whereas the new steady state generations experience a welfare gain between 1 and 2 per cent of their lifetime endowments, welfare losses amount to 1 per cent or less of the remaining full disposable income for currently living generations. As a final fact to be explained, we note that welfare losses as well as welfare gains are largest for the poorest households of each generation.

Because all these numbers are relatively small, one might conclude that the welfare

consequences of debt reduction policies are rather unimportant. This, however, would be a misleading conclusion. As mentioned above, the welfare changes are expressed as a percentage of lifetime endowments, which are quite large. One could easily inflate all numbers by choosing another denominator. For example, relating welfare changes to tax revenues instead of lifetime endowments would increase all numbers by factor four or five. This could change the optics but not the very essence of the argument.

Our decomposition of total welfare changes into its redistributive components (the numbers in the $[(-\Delta T) - \text{ and } \Delta P - \text{ column}]$ and its efficiency part [the $\Delta EB - \text{ column}]$ helps to explain these observations. Consider the case of lump-sum transfers first and start with the ΔEB -column. In this case, any efficiency effects can only be due to the temporary introduction of the Eurotax. After abolishing this tax after three years, deficit reduction policies involve redistributive effects only. Even during its existence, efficiency losses constitute only a negligible part of total welfare changes. The very old currently living generations are not at all hurt by the Eurotax because they have retired earlier and mainly live from their dissavings. Therefore, they have no substitution possibilities and efficiency effects are zero. The middle aged or younger currently living generations are affected by the Eurotax. They will reduce their labour supply (see Table 7) which provokes efficiency losses. Because the Eurotax is progressive, excess burdens are higher, the richer a household is for each generation.

Turning to the redistributive effects of the debt policies, we distinguish between redistribution due to a change in tax payments and to a change in gross-of-tax prices. In our model, net-of-tax commodity prices have been normalized to one and only gross-of-tax factor prices can change. At first sight, one might wonder how factor prices can change in a small open economy. For an explanation we remind the reader of our assumption concerning investment adjustment costs. A consequence is that the marginal products of capital and labour and, hence, the wage rate will change during the transition phase (see Table 7), while the domestic interest rate is pegged to the given world interest rate. After the new steady

state growth path has been attained, adjustment costs become irrelevant and the wage rate returns to its original level. A cursory glance at Tables 5 and 6 reveals, however, that redistributive effects due to a change in the market wage rate are very small in all our simulation runs. We will neglect them in the following.

If efficiency effects as well as redistributive effects due to changed gross-of-tax factor prices are small, the bulk of welfare effects must come from a change in tax payments. A comparison of the first with the second column of Table 5 illustrates that this is indeed true. On average, almost ninety per cent of the welfare burden of the deficit reduction policy under consideration is due to a change in tax payments.

We can now explain the pattern of intragenerational redistribution, i.e. explain why currently living poorer households lose more than richer ones, whereas poorer households born in the future gain more than their richer contemporaries. This result depends heavily on our assumption on how to adjust transfers in order to balance the budget. Our specific assumption is that transfers are distributed equally between the different income classes, corresponding to a poll subsidy. In the short run, a decrease in transfers is necessary in addition to the Eurotax. This, however, corresponds to levying a poll tax which, of course, is a highly regressive policy. In the long run, on the other hand, transfers can be increased for future generations even if the Eurotax has been abolished long ago. This reflects the intergenerational redistribution of deficit reduction strategies. With respect to intragenerational redistribution, an increase in poll transfers naturally favours poorer people more than richer households. The last lines of Table 7 illustrate that transfers have indeed to be reduced in the short run, but can be increased in the long run.

The basic line of reasoning remains the same if consumption taxes instead of transfers are used in addition to the temporary Eurotax in order to balance the budget. There are only two main differences which have to be kept in mind. The first one is that consumption taxes are also distortionary and induce substitution and efficiency effects. The second one concerns the regressivity of indirect taxes over the lifecycle. Let us first comment on the efficiency

effects of the tax scenario under consideration. As before, in the short run consumption tax rates have to be increased while they can be reduced in the long run; see the lowest part of Table 7. Higher indirect tax rates induce additional substitution effects and that is why efficiency losses for currently living aggregate or income-specific generations are higher in the second policy experiment. In the long run when consumption tax rates may be reduced sequentially, efficiency effects become positive.

Once again, redistributive effects due to gross-of-tax factor price changes are small and can be neglected, and the bulk of the total welfare changes is due to changes in generation- or household-specific tax payments. Whereas the intergenerational distribution is more distinct under the present reform proposal than under the one previously considered, the intragenerational redistribution is much less pronounced. This is due to the fact that indirect taxes are only slightly regressive in a lifetime framework. The reason for the regressivity of a proportional consumption tax is that poor households save less than rich households over their whole lifecycle. On the other hand, the regressivity is high enough to override the redistributive effects of the progressive Eurotax.

It is easy to explain the simulation results summarized in Table 6 for the case of a permanent introduction of the Eurotax. We will confine our remarks to the "consumption tax scenario". The following differences to the corresponding results in Table 5 seem to be noteworthy. First, efficiency losses due to the Eurotax are permanent. For rich households, the present as well as future generations will suffer from efficiency losses. Hence, the efficiency losses stemming from the Eurotax are even stronger than the efficiency gains from the reduction in consumption tax rates which become possible in the long run. A second point to note is that efficiency effects now make up a much more important part of the total welfare changes. Even if distributional effects due to changes in tax payments still dominate on average, efficiency effects of deficit reduction policies can no longer be neglected. Our last remark refers to the intragenerational redistribution. On the one hand, the extent of intragenerational redistribution under the permanent Eurotax is higher than under the temporary progressive Eurotax. On the other hand, the increased efficiency losses of the permanent Eurotax dampen economic activity to an extent that total household- as well as generation-specific

welfare losses are higher and welfare gains smaller than under a temporary Eurotax. The clear-cut policy conclusion is that the Eurotax should be abolished as soon as possible. If it is necessary to increase taxes in order to finance a deficit reduction designed to fulfill the requirements of the Stability and Growth Pact after the third stage of the EMU has been realized, an increase in indirect taxes is clearly preferable from an efficiency as well as a distributional point of view.

4 Conclusions and qualifications

The time has come to summarize the main results from our simulation exercises. We have tentatively calculated the efficiency and redistributive effects of deficit reduction strategies in Italy. We are very well aware that our results cannot claim to be more than a very crude estimate of the actual effects. There are many ambiguities with respect to parameter values and functional forms and shortcomings in representing the complex institutional features of the Italian fiscal system. On the other hand, these simulations represent a further advancement on existing models estimating the welfare effects of recent tax and debt policies in Italy, and extend possibilities for developing improved applied fiscal policy models.

In short, these are the main lessons we could draw from our study:

- In the absence of an operative altruistic bequest motive, deficit reduction strategies intergenerationally redistribute in favour of future generations and at the expense of presently living generations. This is hardly surprising.
- Even if the Ricardian Equivalence Theorem holds, debt policy has intergenerational welfare consequences, the extent of which depend on the kind of tax policy which finances the deficit reduction.
- In the absence of Ricardian debt neutrality, redistributive effects are quantitatively more important than efficiency effects, at least in the policy experiments we have considered. Depending on the taxes raised to finance the deficit reduction, it may not be justified to neglect efficiency effects or, as Barro did, to speak of second order effects only.

- Deficit reduction policies do not only provoke intergenerational but also intragenerational redistribution effects. The direction of intragenerational redistribution depends on the specific tax reforms which complement the deficit reduction. Supplementing the progressive Eurotax with budget balancing adjustments of consumption taxes redistributes from richer to poorer households.
- Any deficit reduction requires a short run increase in taxes or reduction in expenditure, but allows for a long run decrease in tax rates or increase in expenditure levels.
- In order to meet the requirements of the Stability and Growth Pact, the deficit reduction has to be permanent. If Italy is faced with the choice of maintaining the Eurotax permanently or abolishing the Eurotax and replacing it by an increase in consumption taxes, the latter alternative is not only preferable from an efficiency point of view, but also has some advantages even under redistributive considerations.

In our opinion, these results clearly justify our efforts and overshadow possible shortcomings of the model.

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