EFFECTIVE MARGINAL AND AVERAGE TAX RATES IN ITALY, 1990-2003

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Abstract

The following paper represents a study of effective tax rates in Italy during the period 1990-2003. We have adopted the micro, forward-looking approach originally developed by Devereux and Griffith (1998), subsequently modified in order to take the specific Italian tax regime into account. The advantage of this method is that it computes effective "average" tax rates, in addition to the traditional measure of effective "marginal" tax rates. Over the period in question, both indicators are used to assess the effects of changes in corporate taxation on the nature of those incentives offered to companies when making their financial and investment decisions.

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1. Introduction

The traditional measurement of the impact of the tax system on investment decisions is based on the concept of "c*ost of capital",* that is, the minimum pre-tax real rate of return required in order to undertake an investment. The percentage wedge between the cost of capital and the post-tax real rate of return is called the *Effective Marginal Tax Rate* (EMTR), and it takes into account several aspects of the tax code: national and local business tax rates, depreciation allowances and other deductions from the tax base, tax credits and personal taxation of interest, dividends and capital gains.

Originally proposed by King and Fullerton (1984), the EMTR method has been extensively used to compare the effective tax rates levied on capital income from different domestic investments over time and across countries. Subsequently, it has been extended to calculate and to compare the tax component of the cost of capital for international investments (OECD, 1991).

However, as Devereux and Griffith (D&G, 1998) demonstrate, this indicator may not be a suitable one when the purpose of the analysis is the international location of capital[2]. In these circumstances, firms usually face a choice between two or more mutually exclusive investment projects that are expected to earn some economic rent. The location choice will be made on the basis of the highest post-tax economic rent, that is to say, where the proportion of total income taken in taxes is the lowest. The most suitable measure for a highly profitable multinational to adopt when deciding where to invest is the *Effective Average Tax Rate* (EATR): that is, the present value of the expected total tax burden in relation to total profits.

Once the strategic location choice has been made, on the basis of the lowest EATR, the cost of capital and the EMTR play an important role in determining the optimal scale of the investment. Both the EMTR and the EATR are micro forward-looking

[2] D&G (1998) stress that their model has also a broader application. For instance, the EMTR is not the appropriate indicator when a firm faces a choice between a number of alternative means of production, or between the type or quality of goods to produce.

indicators, in as far as they are based on the present value of the pre-tax and post-tax income stream expected from a hypothetical investment (national or international), which may be either marginal or infra-marginal in its post-tax returns.

The measure proposed by D&G is based on the standard approach to computing the EMTR, and as such has certain attractive characteristics[3]. Firstly, in the presence of a marginal investment, and in the absence of personal taxes, it coincides with the traditional EMTR. Secondly, it summarises the distribution of effective tax rates over the whole range of profitable investment projects, with the EMTR representing the special case of a marginal investment.

In this paper, we compute the Italian effective marginal and average tax rates for the period 1990-2003 for five different types of investment (machinery, buildings, intangibles, financial assets and inventories) and three alternative sources of finance (debt, new share issue and retained earnings). We compare past and present tax regimes as we analyse the most important factors influencing these effective tax schedules. Our method is based on the approach developed by D&G - albeit modified to take into account the peculiarities of the Italian tax regimes – as used in a recent Study by the EC Commission Services (EEC, 2001)[4].

The paper is organised as follows. Section 2 provides an overview of the D&G model and its primary assumptions in calculating the effective tax rates in a domestic context. Section 3 discusses the main features of the evolution of Italian corporate tax legislation and describes how they have been reproduced in the DG model. Section 4 illustrates the parameters used to calculate the effective tax rates. Section 5 shows and comments the results for the period 1990–2003. Section 6 concludes.

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[3] For a deeper analysis of the pros and cons of this approach, see Giannini and Maggiulli (2002).

[4] This present study is based on a previous analysis developed in conjunction with the independent panel of academic experts appointed by the European Commission in 1999 to carry out an extensive study of company taxation in the EU. Our contribution to the quantitative computations presented in the Study consisted in adapting the D&G model to the peculiarities of Italian tax legislation in 1999

Personal taxation is not included in the calculation, but this does not affect our basic results. The Appendix includes a closer look at the D&G analytical model of domestic investment taxation, adjusted for Italy and incorporating personal taxation of interest income, dividends and capital gains.

This paper focuses on domestic investments only; an analysis of international investments would be a fairly straightforward extension of the methodological approach used for domestic investment. Moreover, as we will notice in the paper, the results obtained for the domestic case can also shed some light on the effects of taxation on international investment.

2. The D&G model within a domestic setting

In order to calculate the effective tax rates, the D&G model makes the following assumptions. In period t a shock takes place, which increases capital stock K_t, and investment I_t, by one unit. In period t+1 this trend is reversed, with investment consequently reduced by $(1-\delta)(1+\pi)$, where π represents the nominal increase in prices between t and t+1, and δ represents the economic rate of capital depreciation. In period t+1 the addition to K_t generates a positive change in output of $dQ_{t+1}=(p+\delta)$, where p represents the real return on capital, and a change in net revenue of $dQ_{t+1}(1+\pi)=(p+\delta)(1+\pi)$. The price of output and capital goods is normalised to one in period t, and shows the same rate of variation π over time.
The company's financial policy closely reflects the perturbation of capital stock. Firms can finance the investment in three different ways: through retained earnings, through new share issue, N_t, and by means of debt, B_t.

In the case of debt finance, the amount borrowed in period t, plus interest, is repaid in period t+1; similarly, in the case of new shares the amount issued in t is repurchased in t+1 at the original price. In the case of retained earnings, the investment is financed by a corresponding reduction in dividends, D_t, while all the remaining funds are distributed to the shareholders in t+1.

and 2001, and in providing (or checking) the relevant fiscal parameters for computing effective rates in Italy.

The net present value of post-tax economic rent, R_t, deriving from the hypothetical investment made during period t, is defined as the change in the firm's equity value, V_t:

$$(1)\quad R_t = (1+\rho)dV_t = d\gamma D_t + dN_t + dV_{t+1} = \sum_{s=0}^{\infty} \frac{\gamma dD_{t+s} - dN_{t+s}}{(1+\rho)^s}$$

where ρ is the shareholder's nominal discount rate, equal to the nominal rate of interest, i, in the absence of personal taxation; D_t represents the net dividends paid by the company during period t; γ is a parameter equal to 1 in this simple representation of the D&G model, in which the taxation of dividends and capital gains is not considered.

D_t is defined as:

$$(2)\quad D_t = Q(K_{t-1}) - I_t + B_t + N_t - (1+i)B_{t-1} - T_t$$

and total tax liabilities, T_t as:

$$(3)\quad T_t = \tau\left[Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T) - iB_{t-1}\right]$$

where: τ is the statutory tax rate, ϕ is the rate of fiscal depreciation allowances, and K_{t-1}^T is the tax-written down value of capital stock. As we will see in the next section, the firm's total tax liabilities, T_t, can be modified in order to account for changes and differences in tax legislation over time and from one country to another.

In order to solve (1) we first need to consider the changes in investment during t and t+1, the way this investment is financed, the increase in net revenue during t+1, and any changes in dividends and taxes during t and the subsequent periods, resulting from the policy of perturbation. Within this one framework, D&G compute an effective tax rate, ETR, which encompasses both the EATR for different levels of profitability, and the EMTR for a marginal investment.

The EMTR is calculated by setting the post-tax economic rent, R_t, at zero and solving it for p, so as to give the minimum pre-tax real rate of return, $\tilde{p}$, i.e. the cost of capital. The EATR, which is of relevance for those projects generating positive post-tax economic rent, is calculated for different values of the pre-tax real rate of return, p, higher than the minimum pre-tax real rate required in order to undertake the investment, $\tilde{p}$.

The ETR is simply the difference between the pre-tax economic rent, R_t^*, and the post-tax economic rent, R_t, scaled down by the present net value of the pre-tax income stream, net of depreciation, Y_t^*:

$$(4)\quad ETR_t = \frac{R_t^* - R_t}{Y_t^*}$$

In the case of a marginal investment, the ETR is equal to the EMTR and usually increases with the rate of profitability. In the absence of personal taxation on interests income and capital gains, it tends towards the statutory tax rate as the profitability of the investment project tends towards infinity.

3. The Italian corporate tax system: 1990-2003

The main features of the Italian corporate tax system during the period 1990-1991 can easily be summed up using equation (3). The overall corporate tax rate τ was made up of two components: the nominal corporate tax rate Irpeg levied at the rate τ_h (36%) and the local tax rate Ilor levied at the rate τ_{Ilor} (16%), applied on a similar tax base[5], that is, the sum of total net revenue less interest payments and fiscal depreciation allowances. In 1990 Ilor was deductible from the Irpeg tax base; hence: $\tau = \tau_{ilor}+\tau_h (1-\tau_{ilor})$. In 1991 this deductibility was limited to 75% and was completely eliminated in 1992.

Moreover, in 1992:

- a tax on net business wealth (*Patrimoniale*) was introduced. Although this tax was intended to be of a temporary nature, it was subsequently extended until finally abolished by the 1997-1998 tax reform;
- an extraordinary local tax on buildings was levied (ISI). In 1993 this tax was transformed into an ordinary real estate tax (ICI).

[5] Differences in the tax base are not relevant for the purposes of our analysis.

In order to take into account these transformations, equation (3) is written as follows:

(5) $T_{92-96} = \tau\left[Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T) - iB_{t-1}\right] + \tau_e K_t^B + \tau_w E_{t-1}$

where

$\tau = (\tau_h + \tau_{ilor})$;

τ_e = the nominal real estate tax rate (ICI)[6], equal to 0.55%, which is a simple average between the minimum and maximum rates, respectively 0.4% and 0.7%, applied by the different local authorities. This rate is applied on the cadastral value of the capital invested in industrial buildings, which is assumed to amount to the 50% of the tax base K^B, that is the acquisition cost of building;

τ_w = is the nominal tax on net wealth, levied at the rate of 0.75%. Its tax base, E, includes the capital stock generated from new share issues and from retained earnings. The net wealth tax is thus of importance only for equity-financed investment.

In 1995, in order to avoid fiscal discrimination against new capital subscriptions the latter were excluded from the wealth tax base. Moreover, the Irpeg tax rate was increased by one percentage point.

In 1997-1998 a wide reform of capital income and business taxation took place[7]. This began in 1997, with the introduction of a Dual Income Tax (Dit). Under this new system, profits are split into two components taxed at different rates, a new lower rate τ_l (19%), and the Irpeg rate τ_h (37%). The first component taxed at the lower rate is meant to approximate the imputed opportunity cost for the shareholder. However, the overall average tax rate cannot be lower than the minimum intermediate rate t_m (27%).

In 1998 Ilor and the net wealth tax were replaced by a new regional tax on business activities (Irap) levied at the rate τ_r (4.25%). The value-added tax base is of the net-income type (sales revenue less depreciation allowances, in our notation). Real

[6] From 1993 onwards the deduction of the imputed cadastral rent from the ILOR tax base was allowed: however, we do not take the effect of this minor provision into account here.
[7] A deeper analysis of the aims and rationale of this reform is undertaken in Bordignon et al. (2001).

estate duty is deductible from the Irap tax base, but Irap is not deductible from the corporate tax base.

Due to these changes, equation (5) is modified as follows:

$$
(6)\quad \begin{aligned} T_{98-01} &= \tau_r \left[Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T) \right] + (1-\tau_r)\tau_e K_t^B + \\ &+ MAX \begin{Bmatrix} \tau_h (Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T) - iB_{t-1} - i_E E_{t-1}) + \tau_l (i_E E_{t-1}); \\ \tau_m (Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T) - iB_{t-1}) \end{Bmatrix} \end{aligned}
$$

The Dit rate is applied to the "ordinary return" calculated as the product of the Dit base, consisting of new capital subscriptions and undistributed profits, E_{t-1}, and an imputed nominal interest rate i_E. Each year the Italian government fixes a *coefficiente di remunerazione ordinaria*, CRO, according to a weighted average of the market interest rates on government and private bonds, i_m, which may be increased by up to three percentage points in order to take account of the higher risk of equity capital. From 1997 until 2000 CRO was kept stable at 7%, with the decrease in market interest rates being counterbalanced over time by an increase in the risk component. Thereafter it was lowered to 6%, and in 2003 it was reduced once more to 5.7%. Given the economic hypothesis underlying the hypothetical investment (section 4), we define i_E as the sum of the nominal interest rate, i, and the risk premium component, given by the difference between the imputed interest rate provided by government, CRO, and the weighted average market interest rate, i_m. In this way, i_E may differ from the nominal interest rate, depending on the risk premium component.

The Irpeg tax rate τ_h is applied to remaining profits, i.e., to taxable profits as defined in D&G, less the 'ordinary return'. Considering the interaction of the different statutory rates, it turns out that companies will hit the floor of the minimum 27% average tax rate whenever the "ordinary return" is higher than 55.56% of profits. If a company is fully "Dit exhausted" (it reaches the 27% minimum average tax rate constraint) then it is easy to see that $\tau_h=\tau_l=\tau_m=27\%$ and we return to the original D&G equation (3)[8]. When the system came into force in 1997, the Dit base, E, was calculated with reference to the new subscription of capital and retained earnings from 1996 onwards. The main reason for this initial restriction was the need to limit tax revenue losses. However, the government has progressively strengthened the DIT system by allowing companies to multiply the Dit base by a coefficient greater than one (1.2 in 2000 and 1.4 from 2001). This was designed to speed up the transition towards a system where the Dit base would encompass the entire stock of equity capital. Clearly companies could only benefit from such increased allowances as long as their Dit base had not covered the entire stock of equity capital.

In 2001 the minimum tax rate constraint was eliminated, and the Irpeg tax rate began to come down. In the second part of the same year, however, the newly-elected government made an about-turn regarding such reform measures. The DIT allowance was abolished on new equity-financed investments made after June 2001, and the government announced a new reform[9]. The basic idea was to go back to a flat rate system of 33% and gradually abolish Irap, starting from a reduction in the burden on labour costs[10]. In focusing solely on the tax liabilities on income from new investment projects, the Dit allowance disappeared, whereas nothing changed with regard to Irap. From 2002 onwards, therefore, equation (6) could be re-written as:

$$(7)\ T_{02-03} = \tau_h \left[Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T) - iB_{t-1} \right] + \tau_r \left[Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T) \right] + (1-\tau_r)\tau_e K_t^B$$

4. Economic and fiscal parameters

Table 1 provides a complete list of the tax rates incorporated into the model. The second column gives the corporate tax rate, while the third indicates the local tax

[8] In fact, that part of ordinary income that does not benefit from the lower 19% tax rate, either because of the minimum tax rate constraint or because total profits are lower than the ordinary income, can be carried forward for five years. However, we do not take this possibility of reporting into account here.

[9] For a discussion of the new reform of business taxation, see Giannini (2002).

[10] This would be of little importance to our model since it concerns the taxation of capital.

rates on profits (1990-1997) and on value added (from 1998 onwards). The fourth column gives the overall statutory rates inclusive of local taxes. The fifth and sixth columns illustrate, respectively, the Dit rates, with the multiplier of the Dit base in force in 2000 and in 2001, and the risk premium (the difference between the imputed rate CRO and the average market interest rates on bonds i_m). The last two columns show the net wealth tax and real estate tax rates respectively.

In calculating the effective tax rates, the following additional assumptions are made:

- the real rate of return on an alternative project is assumed to be 5%, and in the base case with no personal taxes this coincides with the post-tax return required by the shareholder on the hypothetical investment;
- the inflation rate is assumed to be constant at 2%;
- five separate investments in different assets are considered, with the following true economic depreciation rates: machinery 17.5%, buildings 3.1%, intangibles (such as the purchase of patents) 15.3%, and 0% for inventories and financial assets. The fiscal depreciation coefficients are: 13.25% for machinery, 4% for buildings, 33.33% for intangibles and 0% for inventories and financial assets. In presenting the averages for these different forms of investment, the assets are equally weighted;
- the effective tax rates are calculated for three different sources of finance: retained earnings, new share issue and debt. Averages for these three forms of finance are weighted in the following way: retained earnings 55%, new equity 10% and debt 35%[11].

[11] Weights and non-tax parameters are equal for all countries in the EC Study, in order to focus attention on the differences brought about by the tax code.

Tab.1 Italian Tax Rates

	Nominal corporate tax rate (τ_h)	Local tax rate (τ_{Ilor}, and since 1998, τ_r)	Overall statutory tax rate τ	Dit rate (τ_l)	Risk premium (CRO-i_m)	Tax rate on net wealth τ_w (Patrimoniale	Effective real estate tax rate** τ_e (Ici)
1990	0.36	0.162	0.4637				
1991	0.36	0.162	0.4783				
1992	0.36	0.162	0.522			0.075	0.0026
1993	0.36	0.162	0.522			0.075	0.0026
1994	0.36	0.162	0.522			0.075	0.0026
1995	0.37	0.162	0.532			0.075	0.0026
1996	0.37	0.162	0.532			0.075	0.0026
1997	0.37	0.162	0.532	0.19	0.0045	0.075	0.0026
1998	0.37	0.0425	0.4125	0.19	0.0237		0.0026
1999	0.37	0.0425	0.4125	0.19	0.0281		0.0026
2000*	0.37	0.0425	0.4125	0.19	0.0164		0.0026
2001*	0.36	0.0425	0.4025	0.19	0.0130		0.0026
2002	0.36	0.0425	0.4025				0.0026
2003	0.34	0.0425	0.3825				0.0026

* In 2000 and 2001 the value of the Dit base is multiplied by the acceleration coefficient, respectively 1.2 and 1.4

**The effective real estate tax rate is the product of the tax base (0.5 of the acquisition cost of building) and the average local tax rate (0.55). Moreover, it takes account of deductibility from the Irap tax base: 0.27*(1-0.0425).

4. The results

The ETRs presented in this section illustrate the effects of Italian tax legislation on the incentive system companies face when choosing between different types of investment and alternative sources of finance. Although we focus attention on the question of domestic investment and corporate taxation, the results obtained also provide a useful insight into the evolution of international tax competitiveness in Italy. In fact, the lower cost of capital will positively affect the international competitiveness of resident companies when exporting to other countries.

Moreover, in many circumstances domestic ETRs, in the absence of personal taxation, constitute useful indicators of the effective tax burden faced by a foreign parent company investing domestically. Therefore they provide some insight into the attractiveness of the country as a location for direct foreign investment[13].

4.1 The evolution of effective tax rates

Fig 1 illustrates the statutory tax rate, the EMTR and the EATR for two different profitability rates (20% and 50%) over the period 1990-2003. The EMTR and EATR are averages obtained from all the range of different assets and sources of finance considered in this study.

The increase in all indicators, and in particular the EMTR, at the beginning of the 1990s was the result of two measures. On the one hand, there was the rise in the statutory rate, from 46.37% to 52.2%; on the other hand, 1992 saw the introduction of a net wealth tax together with the effective real estate tax on buildings.

From 1995 onwards, the tax on net wealth only applied to new investment financed by retained earnings, while the overall statutory rate was raised by one percentage point, to 53.2%. These two provisions shaped the effective tax schedules in opposite ways. The abolition of the net wealth tax on those investments funded by new share issue affected the ETR, and in particular the EMTR, in a positive manner. The increase in the statutory rate had the opposite effect of raising the ETR. In the case of the EMTR, the first effect predominated, although the reduction was of a limited nature (from 36.3% in 1994 to 35.8% in 1995) due to the limited importance of new equity as a marginal source of finance. The second effect predominated in the case of the EATR, as shown in the diagram, and its negative impact increased with increased profitability. Overall, the change in the EATR remained limited[14].

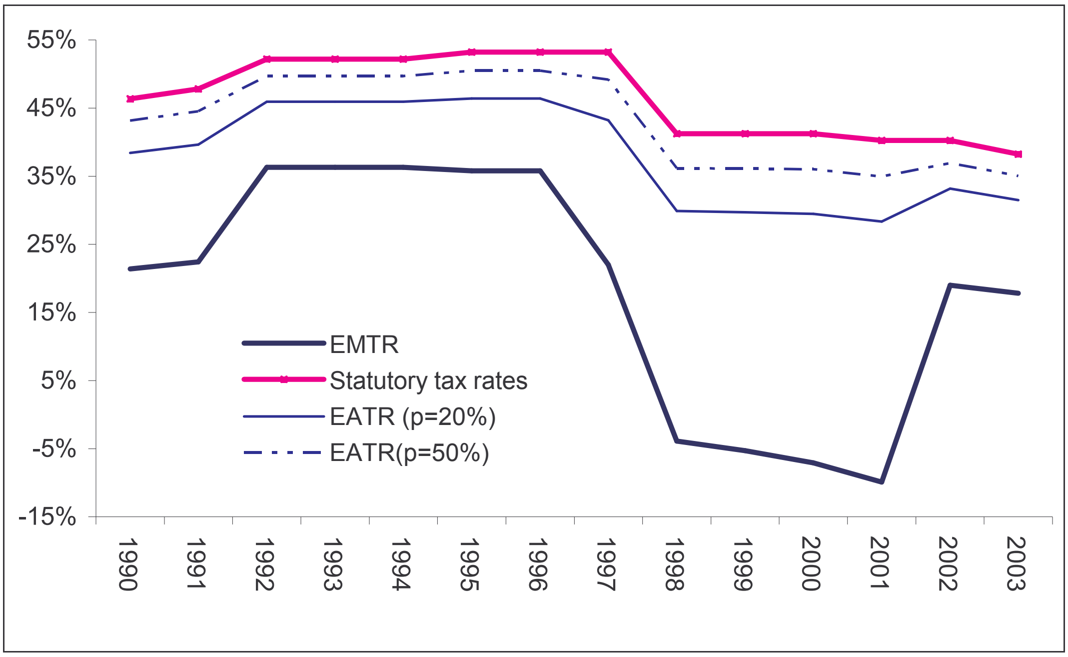
[13] This is the case when a domestic subsidiary fully owned by a foreign parent company uses retained earning or new share issues, assuming in this latter case that the parent company fully exempts cross-border dividends. Personal taxation of the domestic shareholder tends to be irrelevant within this international context (see EEC, 2001; Giannini, Maggiulli, 2002).

[14] At a 20% profitability rate, the EATR increases from 45.6% to 46%. For a rate of return as high as 50%, the EATR rises from 49.7% to 50.5%.

Fig.1 Effective Italian Tax rates on domestic investment

- average across all forms of investments

- only corporation taxes



In 1997 the introduction of the Dit allowance brought about a significant reduction in the EMTR, which fell from 35.8% to 22.0%. The fall in the EATR was much less dramatic: from 46.4% to 43.2%, under a 20% profitability assumption.

In 1998 the global application of the tax reform, and in particular the replacement of the net wealth tax and the local profit tax by the new Irap, significantly reduced all indicators. The effect was again particularly significant in the case of a marginal investment, where the EMTR fell dramatically and even attained a negative value (-3,9%).

From 1998 to 2001, the ETR schedules were importantly influenced by three factors (see Table 1): the variation in risk premium, the multiplier applied in 2000 and 2001 to the Dit base, and the reduction in 2001 of the corporate tax rate from 37% to 36%. During this period the EMTR remained negative, averaging -6.5%. This means that given all the deductions from the corporate tax base, in the form of depreciation allowances and interest payments deductibility, together with the recent allowance on equity financing, a marginal investment was subsidised at the margin. In order to understand this result more fully, we need to bear in mind that the underlying assumption for computing ETRs is that the firm can always take full advantage of all the fiscal benefits granted by the tax code, including the Dit at the 19% rate. This could be possible, for example, if the company had sufficient income from previous investment units against which all those deductions can be made.

As mentioned in Section 3, in 2002 the Dit allowance on new investment was abolished[16]. This led to a huge increase in the EMTR, from a negative value of –9.9% in 2001 to a positive value of 19.0% in 2002. The impact on the EATR was much lower, especially for high profitability rates. In 2003 the reduction in the Irpeg tax rate, from 36% to 34%, had the opposite effect of reducing the ETRs.

Fig. 1 shows that tax legislation during the whole period in question had a greater impact on the cost of capital, that is to say on marginal investment, than on the EATR or the statutory rate. The most important changes occurred at the beginning of the period, mainly as a consequence of the increase in the statutory rate, and with the 1998 tax reform, which had the opposite effect of reducing ETRs.

As Fig.1 shows the EATR is generally higher that the EMTR and, as mentioned when presenting the model, in the absence of personal taxation it tends to increase towards the statutory rate, with an increase in the rate of return on the investment.

The figure also shows that in some circumstances the indicators in question may move in opposing directions. For example, if we compare 2001 and 2003 we can see that the huge increase in the ETR at the margin tends to disappear with the increasing profitability of the investment. For a better understanding of this result, and of the relations between EMTR, EATR and the statutory rate, see Figure 2

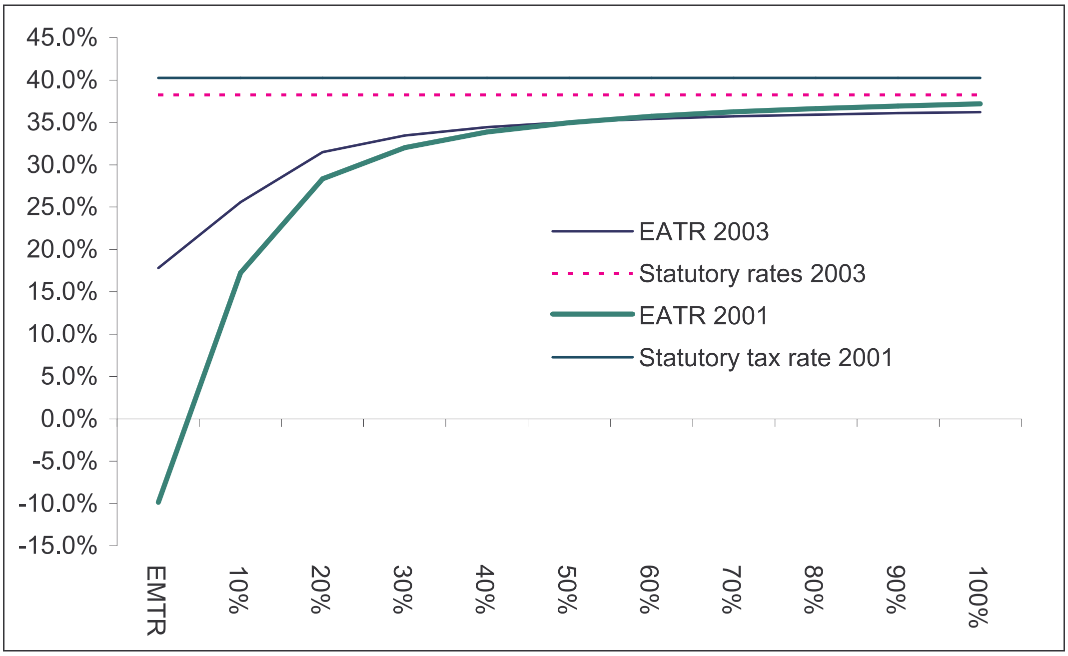
[16] The Dit was "frozen" on all investment funded by new equity until the end of June 2001. In the ETR calculation the assumption is made that this provision began to affect the ETR from 2002 onwards.

showing the ETR for different levels of profitability and the statutory rate during these two years.

Fig.2 2001-2003. A comparison of the effective and statutory tax rates in Italy

- average across all forms of investments

- only corporation taxes



The EMTR is usually lower than the effective EATR because of the benefit of tax allowances from the tax base for depreciation and interest payments that are more effective in reducing the tax burden on marginal investments. As profits grow above the minimum required, these allowances became relatively less important and the effective tax burden is increasingly affected by the statutory tax rate. This explains why the EMTR is higher in 2003 than it was in 2001, whereas the EATR is either higher or lower, depending on the rate of profitability. In fact, with regard to the EMTR, the effect of the abolition of the Dit allowance is considerably greater than the reduction in the statutory rate. In the case of the EATR, on the other hand, the opposite may be the case. However, the EATR is only lower in 2003 than it was in 2001 in the case of an incredibly high rate of return on the investment (i.e. more than 55%). For lower rates of return, on the other hand, it is greater than it was two years previously.

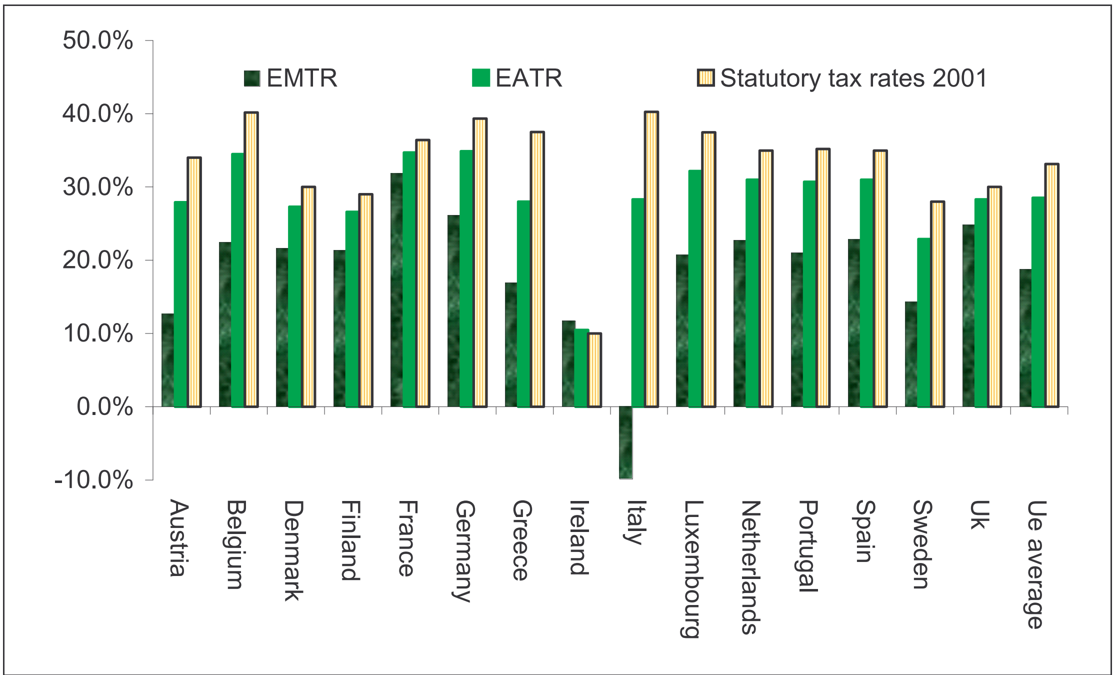
This result is of particular importance within the international context because, as we have already mentioned, the EATR is the most important fiscal factor for those foreign multinationals deciding where to locate.
Summing up then, the abolition of the Dit had the primary effect of increasing the expected tax burden on marginal investment and, to a lesser extent, on most infra-marginal investments too. The reduction in the statutory rate accompanying abolition of the Dit was insufficient to compensate for this effect. Both the location decisions of multinationals and the choice of scale of domestic investment could have been negatively affected by these provisions.

4.2 Effective tax rates in the EU

A proper evaluation of Italy's position, from a fiscal point of view, in competing for foreign investment, would require a comparison with other countries. The calculation of ETRs also needs to take into account all the possible types of investment, the sources of financing and the country of residence of the parent company. This current paper cannot provide a complete analysis of all such matters. The above-mentioned EC Study provides a complete calculation of EATRs in 1999 for various different types of trans-national investment within the EU, Canada and the Usa. Calculations for a domestic investment are updated to 2001. Here, we limit ourselves to comparing, in Figure 3, these 2001 results. The EATR is computed under the assumption of a rate of profitability at 20%.

The range of effective and statutory rates in the EU is noteworthy, particularly when bearing the EMTR in mind. As the EC study underline, such differences may harm the efficient allocation of capital in the internal market. The figure also shows that in some countries the three indicators in question do not seem to diverge significantly, whereas in others the differences are noticeable. Italy is the extreme example. In the case of the EMTR indicator, Italy has the lowest tax burden, –9.9%, compared to an EU average of 18.7%. The highest EMTR is in France, at 31.8%. However, the picture is dramatically different if we look at the EATR. In this case, the Italian tax regime does not preserve its competitive position. The EATR is very similar to the EU average, 28,3% compared with 28.5%, while the statutory tax rate is even higher: 40.25% compared with 33.16% in the EU. By looking at these different indicators, we can see that the EU rankings change. Ireland, for example, which has a higher EMTR than Italy does, is much more attractive from the EATR point of view, as the latter is as low as 10.5%, or if the statutory rate at 10% is considered.

Fig. 3 EU: EMTR, EATR (20% profitability) and statutory tax rates (2001)
- average across all forms of investments
- only corporation taxes.



Source: EEC 2001.

We have not repeated these results for 2003. However, as we saw in Figure 2, the Italian 2002-2003 reform had the effect of increasing both the EMTR and, apart from highly profitable investments, the EATR as well. Despite the benefit of a low statutory rate, Italy's relative standing seems to get worse rather than better.

4.3 The discrimination between different sources of finance and types of investment

In addition to increasing the cost of capital, the changes introduced in 2002/3 increased the gap between the taxation of equity and that of debt finance. Figure 4 shows the cost of capital separately for retained earnings, new share issues and debt finance.

Fig. 4 The cost of capital in Italy according to the source of finance - only corporation taxes

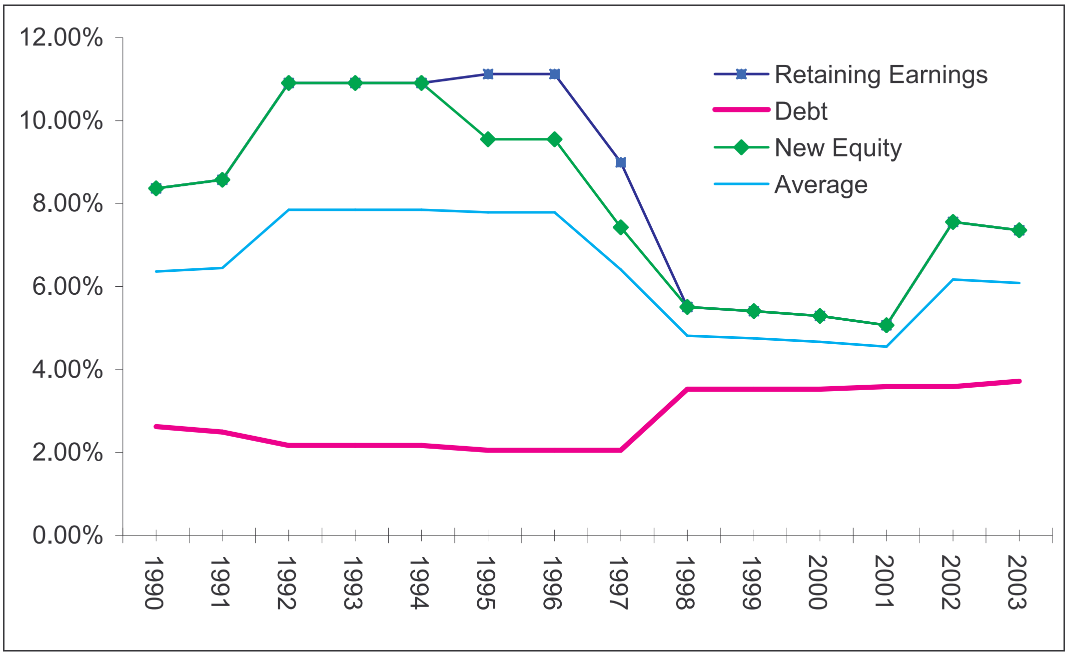


Fig. 4 shows that, except for the period 1995-1997 when the net wealth tax was not levied on investment financed by new share issues, there is no difference between the cost of capital of an investment financed by retained earnings or of one funded by new equity. This is because, in the absence of personal taxation, there is no difference in the tax rate on distributed and non-distributed profits.

The cost of capital of a debt-financed investment has been considerably lower then that of an equity-financed investment (retained earnings and new share issues), especially in the period up to 1997. This significant gap has been due to the possibility of deducting interest payments, in addition to depreciation allowances, from the profit tax base, as well as to the high statutory rate, 53,2%, against which this deduction was allowed. The "opportunity-cost" of equity was not granted a similar deduction.

The 1997-1998 reform largely succeeded in reducing the difference between debt and equity capital. The introduction of the Dit mechanism, together with the abolition of Ilor and of the net wealth tax, significantly decreased the cost of equity capital, which changed from an average of 10.0% in 1990-1996 to 5.9% in 1997-2001. The corresponding EMTR[17] (not shown in the diagram) fell from an average of 49.6% in 1990-1996 to an average of 12.4% in 1997-2001. At the same time, the 1998 reform increased the cost of debt-financed investments, mainly as a consequence of the introduction of Irap, which does not allow for the deduction of interest payments from its tax base. The cost of capital remained around the 2.2% mark from 1990 to 1997, and then rose to an average of 3.5% in the following years up until 2001. The EMTR was still negative, but the rate of subsidy significantly fell, from -126% until 1997, to -41.2% thereafter.

With the abolition of the Dit mechanism in 2002, discrimination in favour of debt finance re-emerged. The gap is now smaller than it was at the beginning of the period in question, due to the lower statutory rate. Nonetheless, the previous policy aimed at greater neutrality was substantially reversed.

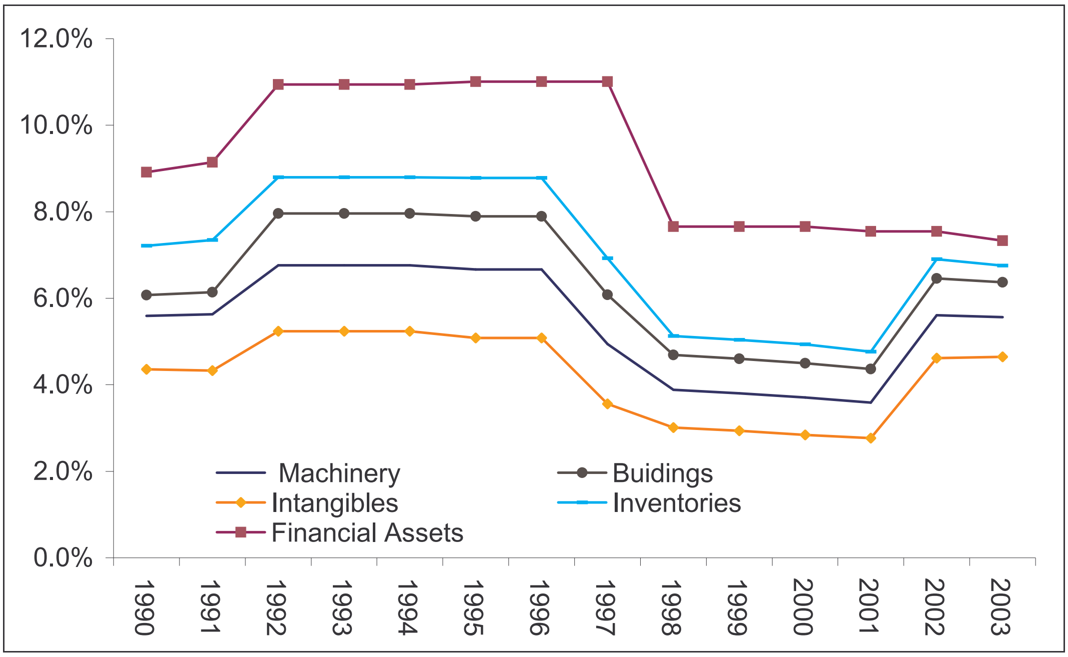
If we now focus on inter-asset distortions, Fig. 5 illustrates the cost of capital for the five different assets included in this study, averaged for all forms of finance. During the period in question, the cost of capital displayed a similar trend for all the various assets, but the end of the period is characterised by less inter-asset distortion, mainly as a result of lower statutory rates and the abolition of the Dit, which penalised investment in financial assets.

Financial assets, e.g. interest-bearing bonds, are the most heavily taxed. The reasons for this are that, firstly, they do not benefit from any depreciation allowances, and secondly, that the tax rates apply to nominal interest. The gap was wider during the period 1997-2001 because this type of investment was not eligible for the Dit allowance. In fact, the Dit base had to be reduced by any increase in financial assets other than shares. Such effect more than compensated the benefits due to the irrelevance of interest received for the Irap tax base.

[17] The EMTR is simply the percentage change in the difference between the cost of capital and the market interest rate (in our calculations with respect to the former)

The EMTRs on machinery, buildings and inventories are significantly affected by the generosity of fiscal depreciation rate, compared with the "true" economic depreciation rate. Given the assumptions made, fiscal depreciation is most effective in reducing the EMTR for intangibles. Then comes machinery, followed by buildings. Investment in inventories does not benefit from any fiscal depreciation; its EMTR is thus higher than that on buildings, but lower than that on financial assets.

Fig. 5 The cost of capital in Italy for different types of investment - only corporate taxes



Concluding remarks

The present analysis of the evolution of corporate taxation in Italy during the period 1990-2003 can be summarised as follows. The effective tax burden on new investment was very high at the beginning of the 1990s, and only started decreasing at the end of the decade. Changes are particularly visible for those investments characterised by low profitability. The wide-reaching reform made in 1997-98 had the greatest effect, with a significant reduction in all the indicators in question (EMTR, EATR and the statutory rate).

In 2001, Italy was the EU country with the lowest cost of capital as far as tax is concerned. However, despite the large cut in the overall statutory rate on profits, the latter remained fairly high.

In more recent years, there have been increases in the EMTR and, to a lesser extent, the EATR, whereas the statutory corporate tax rate has continued to fall (to 34%). A further reduction to 33%, announced by the government, will bring Italy close to the EU average. Nevertheless, if we take into account Irap, whose abolition is largely uncertain, Italy remains among the most highly taxed of EU nations.

If we widen our analysis from the traditional EMTR to the new concept of EATR, then the Italian picture changes completely. The relative generosity of fiscal legislation with regard to depreciation allowances, and the high statutory rate, together explain the divergence between these two indicators. The gap was enhanced during the period in which the Dit allowance was in force. As was the case with depreciation allowances, the Dit had a greater impact on investments with low returns. Italy therefore appears competitive compared to other countries when we look at the cost of capital, whereas the story is very different when we take into consideration the EATR, which is the most important tax factor affecting the location decisions of multinational companies.

In addition to reducing the overall statutory rate, the 1997-98 reform reduced the cost of capital and closed the gap between the fiscal costs of debt and equity finance. The tax system thus moved towards a position of greater neutrality.

The subsequent reform introduced in 2002-03 took a different direction, reducing the legal rate, but at the cost of significantly increasing the cost of capital. The former effect seems too limited to improve Italy's attractiveness as an investment location for multinationals, while the second could be strong enough to have detrimental effects on the total amount of domestic investment in the country. Moreover, the increase in the cost of capital resulted from the abolition of the Dit allowance (which raises the cost of equity capital) might negatively affect the setting up of new companies and the growth of existing ones, particularly for high-risk projects requiring a higher proportion of equity finance.

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Appendix
Effective tax rates on domestic investment

This appendix has two purposes:

a) to develop the formal D&G model for the ETRs calculation;

b) to introduce the modification to the D&G model designed to take into account the specific Italian tax regime for the period 1997-2001. In particular, the corporate tax liability equation is modified in order to take into account the Dual Income tax and the Regional tax on productive activities.

1. The model

The value of a profit-maximizing firm is derived from the following equilibrium capital market condition, ignoring risk:

(1.A) $(1-m^i)iV_t = \frac{1-m^d}{1-c} D_t + (1-z)[V_{t+1} - V_t - N_t]$

where:

V_t is the market value of the firm,

m^i is the personal tax rate on interest income,

i is the nominal market interest rate,

m^d is the personal tax rate on dividend income,

c is the imputation rate on dividends,

z is the tax rate on accrued capital gains,

N_t is new equity issued in period t,

D_t are dividends paid in period t.

According to this condition, the representative shareholder, a domestic resident, will hold equity of the company up to the point where the post-tax return (RHS of (1.A)) is equal to the post-tax return from selling the company and investing the assets in the best alternative available investment, i.e. bonds (LHS of (1.A)).

Equation (1.A) can be rewritten as:

(1.A1) $V_t = (\gamma D_t - N_t + V_{t+1})/(1+\rho)$

where γ is a term indicating the tax discrimination between distributed and retained profits:

$$\gamma = \frac{(1-m^d)}{(1-z\ \ )(1-c)}$$

while ρ is the shareholder's nominal discount rate:

$$\rho = \frac{(1-m^i)}{(1-z\ \ )} i$$

Net dividends paid by the firm can be derived by equalizing sources and uses of funds for each period:

(2.A) $D_t = Q(K_{t-1}) - I_t + B_t + N_t - (1+i)B_{t-1} - T_t$

where B_t is one period debt issued in t, $Q(K_{t-1})$ is output value in period t, I_t is gross investment and T_t is the tax liability. As underlined above, the general definition for T_t, provided in the D&G model, is:

$$T_t = \tau\left[Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T) - iB_{t-1}\right]$$

where τ is the statutory tax rate, ϕ is the rate at which capital expenditure can be offset against tax, and K_{t-1}^T is the written-down fiscal value of capital stock. However, for the period in which both the Dit and the Irap tax were in force, tax liabilities must be modified as follows:

$$T_t = \tau_r\left[Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T)\right] + eK_t^B +$$

(3.A) $$+MAX\begin{cases} +\tau_l(i_E E_{t-1}) + \tau_h\left[Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T) - iB_{t-1} - i_E E_{t-1}\right] \\ \tau_m(Q_t(K_{t-1}) - \phi(I_t + K_{t-1}^T) - iB_{t-1}) \end{cases}$$

The first component represents the new regional tax on business activities (Irap) levied at rate τ_r. The company's Irap tax base is computed as the difference between sales revenue and the cost of intermediate goods and services, that is, in our notation, net output Q_t. Neither labor costs nor interest payments are deductible from the tax base. However, as from the corporate tax base, the company can deduct capital expenditure at rate ϕ, and can claim 'anticipated' depreciation in the first three years. Irap is not deductible from the corporate tax base.

The second component represents the effective real estate tax *e* defined as $(1-\tau_r)\tau_e$, on the industrial buildings K^B(see Tab.1 in section 4) We call it 'effective' because we take into consideration deductibility from the Irap tax base.

The third component represents taxation on corporate profits according to the Dual income tax system. As described in the main section of the paper, legislation between 1997 and 2001 divided the profit tax base into two components, taxed at different rates:[18]:

- the 'ordinary return', $i_E E_{t-1}$, taxed at a reduced rate τ_l;
- 'residual profits', equal to taxable profits as usually defined, minus 'ordinary income'. This 'residual profit' is taxed at the higher corporate tax rate (Irpeg), τ_h.

Average taxation on profits resulting from this system could not fall lower than a minimum average tax rate, τ_m. In this Appendix we develop the D&G model on the basis of equation 3.A, under the assumption that the minimum tax rate constraint is never binding. In other words, we assume that the company can always take full advantage of the Dit allowance.

Substituting (3.A) into (2.A) we obtain:

(4.A) $D_t = Q_t(K_{t-1})(1-\tau) - I_t[1-\phi\tau] + i_E(\tau_h - \tau_l)E_{t-1} + \phi\tau K^T_{t-1} + N_t + B_t + B_{t-1}[1+(1-\tau_h)i] + eK^B_t$

where $\tau = (\tau_h + \tau_r)$.

Because the new investment benefits from an immediate tax allowance in t at rate ϕ, the firm must raise funds from retained earnings, new equity or debt to the tune of (1- $\tau\phi$). In the case of retained earnings, the investment is financed by a reduction in dividends, implying in t an increase in the Dit base equal to net cost (1- $\tau\phi$), whereas debt and new equity remain unaffected. When the investment is financed by new equity, the amount of new equity raised in t is (1- $\tau\phi$), while in t+1 we assume that the firm repurchases the equity at the original price. In the case of debt finance, the firm borrows the same amount (1- $\tau\phi$), and in t+1 repays that amount plus interest. Table 1 summarizes all these changes for periods *t* and *t+1*

The equation of motion of the capital stock, K_t [19] is:

(5.A) $K_t = (1-\delta)K^T{}_{t-1} + I_t$

The tax-written-down stock of capital K_t^T is defined according to the system used to claim tax allowances. If fiscal allowances are granted on a Declining Balance

[18] A detailed description of the different tax values and specific information on the Dit system are provided in section 4 of part 1.

[19] Capital stock consisting of industrial building, K_t^B has the same motion equation.

basis, firms can claim an allowance ϕ for the additional investment in t, while in subsequent periods this allowance ϕ must be multiplied by the remaining value of the asset. Thus:

(6.A) $K_t^{T_{db}} = (1-\phi)(I_t + K_{t-s}^T)$

When fiscal allowances are granted on a Straight Line depreciation basis (a firm can claim the same allowance ϕ for each period until the asset is completely depreciated), the equation for the tax written down stock of capital K_t^T is:

(7.A) $K_t^{T_{sl}} = \sum_{s=0}^{N-1} I_{t-s}$

where N = 1/ϕ.

Tab.1 Financial constraints on investment according to different source of finance

Retained Earnings	
$dN_{t+s} = dB_{t+s} = 0$	$\forall s$
$dE_t = 1-\tau\phi$, $dE_{t+s} = 0$	$\forall s>=1$
New Equity	
$dB_{t+s} = 0$	$\forall s$
$dN_t = 1-\tau\phi$, $dN_{t+1} = -dN_t$, $dN_{t+s} = 0$	$\forall s>=2$
$dE_t = 1-\tau\phi$, $dE_{t+s} = 0$	$\forall s>=1$
Debt	
$dN_{t+s} = 0$	$\forall s$
$dB_t = 1-\tau\phi$, $dB_{t+s} = 0$	$\forall s>=1$
$dE_{t+s} = 0$	$\forall s$

The present net value of the tax savings resulting from depreciation allowances per unit of investment is, for a Declining balance and for a Straight line depreciation schedule, respectively:

(8.A) $A_{DB} = \tau\phi\left\{1 + \frac{1-\phi}{1+\rho} + \left(\frac{1-\phi}{1+\rho}\right)^2 + ...\right\} = \frac{\tau\phi(1+\rho)}{\phi+\rho}$

$$(9.A)\quad A_{SL} = \tau\phi\left\{1+\frac{1}{1+\rho}+\left(\frac{1}{1+\rho}\right)^{2}+\ldots\left(\frac{1}{1+\rho}\right)^{\overline{N}-1}\right\}+\frac{\tau\, rem}{(1+\rho)^{\overline{N}}}=\frac{\tau\phi(1+\rho)}{\rho}\left[1-\frac{1}{(1+\rho)^{\overline{N}}}\right]+\frac{\tau\, rem}{(1+\rho)^{\overline{N}}}$$

where $\overline{N}$ represents the integer part of N and *rem* is equal to (1- $\overline{N}\phi$), because if ϕ is not an integer number during the last year, only the proportion of the asset less than ϕ remains to be claimed.

When combined SL and DB methods are used, because the DB is employed for M years and the SL system is employed for the remaining N years, the expression for A is:

$$(10.A)\quad A_{mix} = A_{DB}\left[1-\frac{(1-\delta)^{M}}{(1+\rho)^{M}}\right]+\frac{A_{SL}}{(1+\rho)^{M}}$$

In Italy, fiscal depreciation allowances are permitted on a Straight Line basis. In the first year the depreciation rate is halved, but it is possible to double depreciation allowances during the first three years. Hence, the present net value of tax savings due to depreciation allowances is:

$$(11.A)\quad A_{Italian} = \tau\left[\phi+\frac{2\phi}{(1+\rho)}+\frac{2\phi}{(1+\rho)^{2}}+\sum_{i=3}^{\overline{N}-3}\frac{\phi}{(1+\rho)^{i}}+\frac{rem}{(1+\rho)^{\overline{N}-2}}\right]$$

where *rem* is 1-Nϕ-2ϕ.

2. The post-tax economic rent from the hypothetical investment

The variation in the value of the firm V_t due to the perturbation investment policy in period *t*, i.e. the present net value of post-tax economic rent generated by one unit of new investment, R_t, is defined as:

$$(12.A)\quad R_t = (1+\rho)dV_t = d\gamma D_t + dN_t + dV_{t+1} = \sum_{s=0}^{\infty}\frac{\gamma dD_{t+s} - dN_{t+s}}{(1+\rho)^{s}}$$

Summing up the different values for dD_{t+s} we obtain the expression for the post-tax economic rent, which depends on the firm’s financial policy.

2.1 Investment financed by retained earnings

If the investment is financed by Retained Earnings (RE), we have the following changes in γD_{t+s}:

$$for \quad s=0 \Rightarrow \gamma dD_t = \gamma\left\{-(1-\phi\tau)dI_t + edK_t^B\right\}$$

where:

$dI_t = 1$, $dK_t^B = 1$; $dK_{t+s}^B = 0$, $\forall s > 1$.

$$for\ s=1 \Rightarrow d\gamma D_{t+1} = \frac{\gamma}{1+\rho}\left\{-(1-\phi\tau)dI_{t+1} + i_E(\tau_h - \tau_l)dE_t + (1-\tau)dQ_{t+1}(1+\pi) + \phi\tau dK_t^T\right\}$$

where:

$dI_{t+1} = -(1-\delta)(1+\pi)$,

$dE_t = 1-\tau\phi$ and $dQ_{t+1} = (p+\delta)$ is the return generated by the additional stock, and p is the real rate of return on the investment, net of depreciation.

From s= 2 onwards, any modifications in the stream of post-tax economic rent are independent of the firm's financial policy, and are due to the effect of the perturbation policy on tax depreciation allowances only. To put it more precisely, $dI_{t+1+s} = 0$, $\forall s \neq t$; $dK_s = 0$, $\forall s > t$ and $dE_s = 0$, $\forall s > t$.

Then:

$$for \quad s >= 2 \Rightarrow \gamma dD_{t+s} = \gamma\tau\phi\, dK_{t+s-1}^T$$

The values of dK_s^T for s>=2 are defined as a function of the specific rules used by the country to claim tax allowances.

For a declining system, the tax-written-down capital for s>= 2 is:

$$(13.A) \quad dK_{t+s-1}^T = \frac{\left\lfloor (1-\phi)^s - (1-\delta)(1+\pi)(1-\phi)^{s-1} \right\rfloor}{(1+\rho)^s}$$

In the case of the straight line system, like the one adopted in Italy, until the asset is fully depreciated, the tax written-down capital is:

$$(14.A) \quad dK_{t+s-1}^T = \frac{[1-(1-\delta)(1+\pi)\ ]}{(1+\rho)^s}$$

Given the possibility of anticipating straight line depreciation, we have, in s=2:

$$(15.A) \quad dK_{t+1} = \frac{2[1-(1-\delta)(1+\pi)]}{(1+\rho)^2} \text{ and } for\ s>2: \ dK_{t+s-1} = \frac{[1-(1-\delta)(1+\pi)]}{(1+\rho)^s}$$

Summing up all the values for dD_{t+s} we obtain a general expression for R_t, the present net post-tax value of the economic rent; or more precisely, R_t can be expressed as the sum of two parts: $R^{\S}$, which is common to all sources of finance, and F_t^i , which represents the additional cost or benefit of raising a specific form of finance (i= Retained Earnings, New Equity, Debt):

$$R_t^i = R_t^{\S} + F_t^i$$

The first part, $R^{\S}$, common to all sources of finance, is the sum of:

- the effective net cost of the investments in period t, (1-A),
- the nominal net-of-tax return in t+1, $(1-\tau)(p+\delta)(1+\pi)$,
- the net benefit of the reduction in investment during period t+1, $(1-A)(1-\delta)(1+\pi)$.

All the cash flows involved are multiplied by γ, reflecting the difference in taxation of retained and distributed profits:

$$\text{(16.A)} \quad R_t^{\S} = \gamma\left\{-\left((1-A)+e\right)+\frac{(1-\delta)(1+\pi)(1-A)+(1-\tau)(p+\delta)(1+\pi)}{1+\rho}\right\}$$

The second part, F_t^i , changes with the source of finance. In case of retained earnings it is:

$$\text{(17.A)} \quad F_t^{RE} = \frac{\gamma}{1+\rho} dE_t\left[i_E(\tau_h - \tau_l)\right]$$

Contrary to the DG model, where F^{RE} is equal to 0, in the Italian model characterized by the Dit firms had a fiscal advantage when using retained earnings.

2.2 Investment financed by new equity

As in the previous case, for an investment financed with the issue of new equity, the changes in γD_{t+s} are as follows:

$$for \;\; s=0 \Rightarrow d\gamma D_t - dN_t = -\gamma\left\{\mathrm{dI}_t\,[1-\phi\tau] - edK_t^B - dN_t\right\} - dN_t$$

where $dN_t = 1-\tau\phi$

$$for \;\; s=1 \Rightarrow d\gamma D_{t+1} - dN_{t+1} =$$

$$= \frac{\gamma}{1+\rho}\left\{d\mathrm{I}_{t+1}\,[1-\phi\tau] + dE_t i_E\left(\tau_h - \tau_l\right) + dQ_{t+1}(1-\tau) + \phi\tau dK_t^T + dN_{t+1}\right\} - \frac{1}{1+\rho} dN_{t+1}$$

where $dN_{t+1} = -(1-\tau\phi)$.

As before, from s>=2 γD_{t+s} changes as a result of the effects of the perturbation policy on tax depreciation allowances only (see (13.A)-(15.A)).

Combining these effects, the present net post-tax value of economic rent can be expressed as:

$$R_t^{NE} = R_t^{\S} + F_t^{NE}$$

where $R^{\S}$ is defined in (16.A) while

$$\text{(18.A)}\quad F_t^{NE} = -(1-\gamma)dN_t + \frac{1-\gamma}{1+\rho}dN_t + \frac{\gamma}{1+\rho}dE_t\left[i_E(\tau_h - \tau_l)\right]$$

F^{NE} corresponds to the present net value of the additional cash flows arising from the use of new equity finance. Again, this equation differs from the D&G one essentially because of the Dit benefit.

2.3 Investment financed by debt

The case for debt financing is made in a very similar way, by using the values for dB_{t+s}, dE_{t+s} and dN_{t+s} shown in Table 1.

The solution for the present post-tax value of the economic rent is:

$$R_t^D = R_t^{\S} + F_t^D$$

where

$$\text{(19.A)}\quad F_t^D = \gamma dB_t - \frac{\gamma dB_t(1+i(1-\tau_h))}{1+\rho} = \frac{\gamma}{1+\rho}dB_t\left[\rho - i\ (1-\tau_h)\right]$$

This expression represents the present net value of additional cash flows resulting from the use of debt. In this case, the equation exactly corresponds to that of the DG model. Note, however, that in the Italian tax system the tax benefit of interest deductibility depends only on the corporate tax rate $\tau_{h.}$ More generally, the Irap rate is irrelevant to the definition of F regardless of the source of finance. It is in fact neutral with respect to these choices.

3. A summary of the post-tax economic rent

Combining all the expressions for the different forms of finance, the present post-tax value of rent is:

(20.A) $R_t = R_t^{\S} + F_t^i$

where

(21.A) $F_t^i \begin{cases} F_t^{RE} & \text{if financed with retained earnings} \\ F_t^{NE} & \text{if financed with new equity} \\ F_t^{D} & \text{if financed with debt} \end{cases}$

4. Defining the Effective Tax Rates

4.1 Effective marginal tax rate

Using the expressions described in the previous sections, the traditional measure of the cost of capital is derived by setting the post-tax economic rent at zero (R_t= 0), and solving for the cost of capital, or minimum required rate of return, denoted $\widetilde{p}$:

(22.A) $R_t = 0 \Rightarrow \widetilde{p} = \dfrac{(1-A)[\rho+\delta(1+\pi)-\pi]+(1+\rho)e}{(1+\pi)(1-\tau)} - \dfrac{F_t^i(1+\rho)}{\gamma(1+\pi)(1-\tau)} - \delta$

The effective marginal tax rate, EMTR, is given by the difference between the real pre-tax rate of return and the real post-tax return to the final saver, *s*:

(23.A) $EMTR_t = \dfrac{\widetilde{p}-s}{\widetilde{p}}$

The relation between s and the nominal market interest rate is:

(24.A) $s = \dfrac{\lfloor(1-m^i)i-\pi\rfloor}{1+\pi}$

where i= r(1+π)+π and where r is exogenously fixed (at 5% in our calculations)

4.2 Effective average tax rate

The measure of the EATR proposed by D&G is the difference between pre-tax and post-tax economic rent, scaled down by the present value of the pre-tax income stream, net of depreciation:

(25.A) $EATR_t = \dfrac{R^*-R}{p/(1+r)}$

As D&G clearly point out, the natural approach would be to scale down the numerator by the pre-tax rent R*; however, the measure would then be undefined for R*=0.

Pre-tax economic rent, which is independent of the source of finance used, R*, is:

$$(26.A)\ R^* = -1 + \frac{1}{1+i}\left\{(1+\pi)(p+\delta) + (1+\pi)(1-\delta)\right\} = \frac{(1+p)(1+\pi)-(1+i)}{1+i} = \frac{p-r}{1+r}$$

To implement this measure, in addition to exogenously fixing the real interest rate r, one must also choose a level of profitability, p. Since the EATR changes with the chosen p value, it is advisable to calculate the effective average tax rates for a range of values for p.

As demonstrated by D&G, the methodology adopted has some strong points. In particular:

1) for a marginal investment $R_t = 0 \Rightarrow EATR = EMTR$;

2) in the absence of personal taxation of interest and capital gains, the EATR tends towards the statutory tax rate as the profitability of the investment project tends towards infinity: $p \to \infty \Rightarrow EATR_t \to 1-(1-\tau)$.