Corporate taxation and its reform: the effects on corporate financing decisions in Italy

by

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Abstract

The aim of this paper is twofold. First, we measure the relationship between fiscal variables and companies debt choices in Italy using a dynamic representation of the modified pecking order model, where both trade-off and pecking order theories are nested. Second, our estimation results are used, jointly with some tax simulations undertaken with a company microsimulation tax-model (MATÍS), to assess the effects on leverage of two recent tax reforms in Italy since 1996. Main results suggest that: *(a)* fiscal effects are significant and robust explanations of firms' financial behaviour; *(b)* the reforms analysed are able to induce similar reductions in firms' leverage, when compared with the situation prevailing in 1996. However, the routes through which this occurs are different (relative price in the first case, cash flow in the second), tracing some important differences in the overall evaluation of the two reforms.

JEL classification: G32, H32, C23, C11

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1. Introduction

Corporate capital structure is one of the most studied areas of business decisions, and yet it remains one of the least understood and more difficult to quantify. In this field of research, a large body of work has modelled the interaction between taxation and corporate financing decisions, yet little empirical support has been found so far. The Anglo-Saxon research has found little clear evidence of the effects of tax benefits on debt financing (see Graham 2003, for a review).

There are several problems involved in analysing the role of taxation on debt financing. First of all, it is difficult to translate the technical details of the tax code into a proper measure of the relative tax benefits of debt versus equity finance. Various empirical approaches have been adopted in an attempt to account for the interaction between tax rates, interest deductions, non-debt tax shields and loss carry-back and carry–forward provisions. However, none of them has proven completely satisfactory, due in part to the lack of confidential firm-level tax return data.

Secondly, fiscal variables are endogenous: for example, the greater a firm’s borrowing, the lower the effective tax benefit from interest deductions, since the tax advantage of debt falls as companies become tax-exhausted, and this could in fact be the case with growing interest payments.

Thirdly, fiscal and non fiscal variables are intra- and inter-correlated. Correlation between fiscal factors worsens the endogeneity problem: current operating losses, non-debt tax deductions (losses carried forward and depreciation allowances) and interest deductions from already existing debt, may together with interest deductions on new debt, contribute towards increasing the tax-exhaustion of firms. Moreover, borrowing also depends on other factors linked to tax status. If these factors were omitted from the model, this would lead to bias in the fiscal parameter estimates.

The current paper has two principal objectives. The first objective is to provide a systematic quantitative analysis of the relationship between fiscal variables and borrowing in Italy, and thus to try and tackle the problems outlined above. There is still relatively little empirical evidence regarding this issue in Italy (see *e.g.* Bonato-Faini-Ratti, 1993, Staderini, 2001, and Alworth-Arachi, 2001).

The second objective is to use our framework in order to shed some light on the effects of tax policy changes on corporate financial policy. This is of particular relevance in the Italian case, where a tax reform was introduced at the end of the 1990s with the main aim of reducing the tax advantage of debt and of stimulating company capitalisation. Unfortunately, the said reform was reversed shortly afterwards (in 2001), thus eliminating the chance of undertaking a "natural experiment". Nevertheless, the analysis presented in the present paper should provide some useful insights into the effects on debt of these alternative reforms.

The paper is set out as follows. Section 2 describes the model used to represent debt-financing choices. This is a dynamic representation of the modified pecking order theory (MPO) where both trade-off and pecking order theories are nested. The specification of the major potential determinants of debt financing avoids bias in the relationships between borrowing and the tax variables due to omitted variables eventually correlated with fiscal factors.

Section 3 explains how we measured the tax variables introduced into the model. To this end, a fundamentally important role was played by a microsimulation model (MATIS) capable of taking into account the complex interaction of the various aspects of tax law.

Section 4 presents an econometric estimate of the debt-ratio determinants, based on an unbalanced panel of about 24,000 manufacturing companies for the 1982-1999 period. The endogeneity problem of fiscal and other explanatory variables is tackled by using the instrumental variable estimation technique. Moreover, we carry out an analysis of the robustness of alternative MPO model specifications.

Section 5 presents several simulations designed to disentangle the effects on borrowing decisions of the two recent tax reforms mentioned above: the one introduced in 1997-98, and the reform proposed in 2001 by the newly-elected government. Section 6 concludes by summarising our main findings and suggests possible developments for future research.

2. The MPO model

Studies of the determinants of corporate financial structure focus on two opposing explanations: the trade-off (TO) and the pecking order (PO) theories. Following up from a suggestion made by Myers (1984) and its empirical representation in a previous paper by one of the present authors (Bontempi, 2002), we have adopted the modified pecking order (MPO) model, where both TO and PO leverage determinants are nested.

The TO focuses on the benefits and costs of issuing debt (for a survey, see Harris-Raviv, 1991). The benefits include: the tax deductibility of interest paid (fiscal factors); the use of debt to indicate high-quality company performance (signalling factors); the use of debt to reduce the amount of a company's resources that managers are free to waste on unprofitable projects (agency factors). The costs include: the likelihood and cost of inefficient liquidation, and the agency costs due to debtors' propensity towards taking actions that may be detrimental to lenders (failure factors); the possibility of losing the tax benefit of other (non-debt) tax shields (fiscal factors).

The TO debt-ratio determinants are sub-divided into four different groups of regressors (fiscal, failure, agency and signalling effects), included in the $trade_{it}$ vector, so that for company i at time t, we have:

$$d_{it}^{*} = (b'/ -a)\ trade_{it} \qquad (1)$$

where vector b and scalar a are parameters. In the long run, these variables characterise the target leverage d_{it}^{*} that firms have to achieve in order to maximise shareholders' wealth. In the short term, debt-ratio (d_{it}) dynamics ought to follow an equilibrium-correction mechanism towards the target debt-ratio, so that:

$$\Delta d_{it} = a\ (d_{it-1} - d_{it-1}^{*}) \qquad (2)$$

where Δ is the first-difference operator.

The PO theory, originally developed by Myers-Majluf (1984), considers the role of information asymmetries (with regard to presently-held assets and investment opportunities) between firms and capital markets. PO predicts that companies will adopt a hierarchy of financing options: internal funds will be given preference over external ones. If external financing is needed to fund investment, firms first seek low-risk debt funding that cannot be sold for more than it is worth. New shares are issued only as the last resort, when debt financing would be extremely costly. The PO determinants can be grouped into three variables: cash-flow, investment needs and financial slack (cash, liquid assets and marketable securities), that are included in the fcf_{it} vector:

$$\Delta d_{it} = c' fcf_{it} \tag{3}$$

where c is a vector of parameters.

The components of the *fcf* vector in equation (3) are proxies for so-called "*free cash flow*", that is to say, internal funds in excess of investment opportunities.

As already mentioned, the MPO empirical specification is a general model that nests "pure" PO and TO theories:

$$\Delta d_{it} = c' fcf_{it} + a\, d_{it-1} + b' trade_{it-1} + u_{it} \tag{4}$$

where $u_{it} = \mu_i + \lambda_t + \varepsilon_{it}$ represents individual, time and random unobservable components. According to this specification, firms may modify their leverage position not only in order to readjust to their long–term target, but also because they need short-term external funding.

In equation (4), the vectors fcf_{it} and $trade_{it-1}$ contain both fiscal and non-fiscal variables. In order to focus on the effects of the former, the next Section is specifically devoted to a detailed explanation of how they can be measured.

3. The measurement of tax variables

Our explanatory fiscal variables are: in the *trade* vector, the relative cost of debt and equity capital and non-debt tax shields; and in the *fcf* vector, the after-tax cash flow.

Measurement of the cash flow variable is fairly straightforward and uncontroversial: cash flow is generally defined as the sum of operative earnings before depreciation, non-operative and extraordinary items, and other non-cash expenses, net of total interest expenses, taxes and dividends paid. Thus, cash flow is influenced by taxation through the fiscal liabilities in each accounting period.

Measurement of the TO fiscal factors (the relative cost of capital and non-debt tax shields) proves more difficult. Theoretically, their effect on leverage is relatively clear: the deductibility of interest charges from taxable income lowers the cost of debt financing compared to the cost of equity financing, which is not usually granted a similar deduction. The tax advantage of debt, however, declines as companies become tax-exhausted. This might occur as a consequence of current operating losses, non-debt tax deductions (like the carry-back and carry-forward of losses or depreciation allowances), and interest deductions from already-existing debt.

The most adequate measure of the tax advantage of debt should be a forward-looking indicator that takes account of the present status and future profitability of the company, the presence of other tax deductions or credits that might reduce the advantage of interest deduction, and the details of tax legislation on the carry-back and forward of losses. Ideally, one should take into account all interactions at the company level by using a unique measure, rather than separate variables (Graham, 2003). However, an effective tax rate of this type is not available, since it is based on unknown managers' expectations of the future tax status of the company (Shevlin, 1990). As a result, empirical studies adopt alternative approaches, all of which have their pros and cons.

In their debt regressions, a number of authors (*e.g.* Titman-Wessels, 1988) try to encapsulate fiscal effects by including non-debt tax shields only. One problem with this fiscal indicator is the often-estimated wrong sign. Instead of a tax substitution effect (tax shields against interest deductions), non-debt tax shields, in the form of depreciation allowances for example, encapsulate the presence of highly profitable investments and greater guarantees (securability effect). The estimation of the substitution effect between interest deductions and non-debt tax shields requires either particular measures to be taken (for example, loss carry-forwards only) or that non-debt tax shields interact with a variable which identifies those companies near to tax exhaustion (see *e.g.* MacKie-Mason, 1990), especially when they consist of investment tax credits or depreciation allowances.

In addition to non-debt tax shields, Graham (1996a) introduces the estimated marginal tax rate (MTR) into his debt regressions. This effective tax rate measures the present value of current and expected future taxes paid on an additional unit of income earned today. Expected future taxes are computed by assuming that managers forecast future taxable income using a random walk model with drift, and by accounting for the present features of the tax legislation. Despite the considerable appeal of this particular indicator, it may present a number of limitations. From the behavioural point of view, it is reasonable to assume that "some managers make decisions based on their firm's current statutory tax status", and that "not all firms simulate marginal tax rates" (Graham, 1996a, pp. 55, and 62). For this reason, Graham also includes in his debt-model specification the difference between the statutory tax rates and the MTR. From the statistical point of view, the forecast of expected taxable income requires a considerable time span *before* the period of MTR computation. For example, the MTR estimation for 1990 requires a stream of future incomes expected in 1990, which can only be forecasted on the basis of past company earnings (prior to 1990). The forecast horizon depends on carry-back and carry -forward provisions.

In the specification of our empirical MPO model, we adopt Graham's approach (1996a), since we include both non-debt tax shields and simulated effective tax rates in the *trade* vector of equation (4). However, our approach differs in two ways. Firstly, we do not adopt a specific measure of non-debt tax shields, but implement different measures to check the robustness of the MPO model estimates to alternative specifications (see Section 4). Secondly, our effective tax rates derive from a micro-simulation model (MATIS) based on the detailed accounting items reported by the companies in our sample. The MATIS calculates the taxes due on present income, and is not based, therefore, on the expected stream of taxable income. This choice is due to the short-term nature of our sample, which does not allow for a reliable representation of the stochastic process of future profitability, and hence the MTR's computation. However, for a sub-sample of companies, we can estimate the perfect foresight marginal tax rate (Graham, 1996b), *e.g.* the expected effective tax rate based on realised taxable income rather than on simulations of future income. A comparison between the performance of our simulated tax rates and the perfect foresight MTR is in Section 4.

Our simulated tax rates possess a number of positive features. The MATIS takes into account the tax code treatment of net operating losses and tax credits, *e.g.* the complex interaction of the various aspects of tax law. Even though there are differences between accounting and taxable profit (the latter could only be properly measured using individual data for tax returns, see Plesko, 1999), the wealth of accounting information in our sample, together with the details of the legislation included in the MATIS model, allow us to imitate tax-code formulas to a rather precise degree.

By using the MATIS simulated tax rates we subsequently calculated the relative cost of the capital variable (*ccnsitd*) as the ratio between the user cost of capital under debt and that under equity financing.[1] The following formulas illustrate the changes in tax legislation over our sample period (1982-1999):

$$ccnsitd_{82-91} = 1 - t_{sc} \tag{5}$$

$$ccnsitd_{92-95} = \frac{1 - t_{sc}}{1 + \frac{t_{spat}}{ieq}} \tag{6}$$

[1] The user cost of capital is derived from a model of market equilibrium with no arbitrage opportunities and ignoring risk, so that investors earn the same net return on debt and equity investment. We do not include personal tax rates for two major reasons. Firstly, they are not relevant for those companies raising funds on the international market or through tax-exempt financial institutions. Secondly, information about each firm's tax clientele is not available.

$$ccnsitd_{96} = \frac{1-t_{sc}}{nsitd + (1-nsitd)(1+\frac{t_{spat}}{ieq})} \qquad (7)$$

$$ccnsitd_{97} = \frac{1-t_{sc}}{nsitd(1-agev) + (1-nsitd)(1+\frac{t_{spat}}{ieq} - agev)} \qquad (8)$$

$$ccnsitd_{98-99} = \frac{1-t_{sirpeg}}{1-agev} \qquad (9)$$

In equations (5)-(8), $t_{sc} = t_{silor} + (1-\beta\ t_{silor})t_{sirpeg}$, where t_{silor} and t_{sirpeg} are the MATIS simulated tax rates for local income tax on profits (Ilor) and national corporation tax (Irpeg) respectively, and β is the share of Ilor deductible from the Irpeg tax base[2]. These MATIS simulated tax rates take into account the carrying forward of losses, granted for five years under Italian legislation (no carry back is allowed). Compensation of losses is allowed against Irpeg, but not against Ilor. Since no information is available about losses prior to the first year of our sample, we have assumed that they are equal to zero during the initial period; this means that, during the first five years, the simulated effective tax rate may overestimate the true effective tax rate.

In equation (6), valid for the 1992-1995 period, the denominator is greater than one because of the presence of a tax on net company wealth (levied at the MATIS simulated rate t_{spat}). This tax increased the cost of equity (both retained earnings and new share issue)[3]. To transform the tax rate on net wealth into a corresponding rate on income suitable for inclusion in a cost of capital formula, the former is discounted by the Treasury bills interest rate, *ieq*.

From 1996 onwards, the tax on net wealth was not due if the marginal source of finance was the new subscription of capital. In order to account for this change in tax codes, equations (7) and

[2] During the period 1982-1997 the statutory Ilor tax rate stood at 16.2%; this tax was abolished in 1998. The statutory Irpeg tax rate was 27% in 1982, 36% during the period 1983-1994, and has been 37% since 1995. The share of Ilor deductible from the Irpeg base was 1 in 1982-1990, 0.75 in 1991, and has been 0 since 1992.

[3] The statutory tax rate on net wealth stood at 0.75%.

(8) weight the two different sources of equity financing with *nsitd*, the percentage of financing by new share issues over the total financing by new equity.

Both the net wealth tax and the local tax were abolished in 1998 by a tax reform that also introduced a new allowance on equity capital calculable from 1997. For the purposes of this allowance, corporate income is divided into two components. The first component, called "ordinary income", is computed so as to approximate the opportunity cost of new financing with equity capital. To do so, a notional interest rate, set yearly by the government on the basis of the market interest rate, is applied to a part of new equity (new subscriptions and retained earnings from 1996 onwards) invested by the firm. This "ordinary return" (normal profit) is taxed at the reduced rate of 19%. The remaining profits are taxed at the statutory Irpeg rate. The tax saving due to this allowance is $agev = (0.37 - 0.19)\frac{IMP_{Dit}}{RO + RIP_{Dit}}$. The difference between statutory and reduced tax rates is multiplied by the ratio $\frac{IMP_{Dit}}{RO + RIP_{Dit}}$, to account for the possibility of tax exhaustion, which might prevent the firm benefiting from this allowance. To be more precise, the term $RO+RIP_{Dit}$ represents the amount of income that in theory may be taxed at the reduced tax rate (19%), where *RO* is the opportunity cost of shareholders' funds and RIP_{Dit} is the carry-forward of the fiscal allowance not utilised because of earnings' exhaustion; IMP_{Dit} is the amount of Irpeg-taxable income that actually benefits from the reduced tax rate. All these values are simulated by the MATIS model. The variable *agev* ranges form a minimum of zero - when firms are not able to exploit the Dit advantage - to a maximum of 18% - when firms can use the Dit advantage to the full.

4. The econometric estimate of the debt-ratio determinants

The source of data for this study is drawn from the Company Accounts Data Service (CADS), a large database with information on the balance sheets and income statements of more than 50,000 Italian companies operating in the entire range of industrial sectors, from 1982 to 1999 (for a further description of the CADS, see Bontempi, 2002, section 4.1). Our selection rules include: all manufacturing industries; only those companies whose data are available for at least four consecutive years; only those companies who comply with our clearing criteria (i.e. no inconsistencies in the accounting items, no strong outliers of any of the interest variables)[4]. The resulting sample is an unbalanced panel of 24,796 companies (225,333 observations).

In empirically testing the MPO equation (4), we wish to explain the changes in the ratio between bank-debt and net assets (see the Appendix). The choice of bank-borrowing is suggested by the extensive demand for this type of debt from Italian manufacturing companies. This is principally due to the Italian institutional and legal system, which failed to encourage active public participation in the capital bond markets, and to the long-term ties between major banks and their client firms.[5] Bank-debt represents about 90% of total financial debt (while bonds account for 5%, loans from subsidiaries, affiliates and parent companies account for 3%, and shareholder loans account for 2%).

The empirical difficulties raised by the estimation of equation (4) can be summarised as follows: (*a*) the endogeneity of the explanatory variables; (*b*) the correlation of the regression residuals across firms (see, for example, Fama-French, 2000, p. 20); (*c*) the specific choice of the variables included in the *fcf* and *trade* vectors. Parameter estimates are obtained by adopting the instrumental-variables approach to the formulation of dynamic panels with both individual (μ_i) and temporal (λ_t) fixed effects (see Anderson-Hsiao, 1981). In our view, this approach could account for the econometric issues (*a*) and (*b*).

As far as issue (*a*) is concerned, theory assumes that when choosing their form of financing, companies are faced with various capital market imperfections and agency costs, which would imply the reciprocal influence of the availability of internal funds, investment decisions and borrowing. Moreover, as already foreseen, the effective tax rate against which interests can be deducted is also a decreasing function of borrowing. In order to avoid the simultaneity bias resulting

[4] Details of the selection rules are available from the authors.

from the endogenous nature of some of the variables used to predict financial policy, we instrumented all the explanatory variables with the corresponding two-period-lagged levels (see Arellano, 1989). Any efficiency problems inherent to the instrumental-variables approach are overshadowed by the size of the sample.

As far as issue (*b*) is concerned, modelling cross-section dependence is more complicated than modelling time-series dependence, since individual cross-section observations display no natural order or structure. In our fixed effects panel specification in equation (4), the time-specific common effect λ_t allows for a degree of dependency across individuals due to individually unimportant, but collectively significant, effects (*e.g.* widespread optimism or pessimism), although it relies on a strong parametric assumption of cross-section dependence.

Another advantage of our two-way fixed-effects panel approach is that it reduces or indeed avoids the presence of omitted-variable bias. This problem, included in *(c)* above, arises because "variables traditionally used to control for taxes do not appear to sufficiently disentangle taxes from numerous other factors related to firm behaviour". Hence, "inferences based solely on the estimated coefficients of the tax proxies or other variables may be incorrect" (Plesko (1999, p. 29). For example, a profitable firm with a considerable debt tax advantage may borrow less than would be predicted if we were to use a pure TO model, as a result of PO behaviour. Point *(c)* is also tackled by our general, dynamic MPO model which encompasses both TO and PO behaviour.

Economic theories often do not explicitly say which explanatory variables belong to "true" regression. From this point of view, the MPO theory is no exception to the rule: it does not fully specify the empirical model, but simply suggests a number of potentially influential effects classified as PO and TO debt-ratio determinants. Thus one difficulty in analysing the effect of tax factors on companies' financial behaviour, is that some explanatory variables may be imperfect or mixed measures of the "ideal" determinants: for example, the possible measurement errors involved

[5] For a discussion of this issue, see Bontempi (2002).

in the proxy for non-debt tax shields may alter the sign and significance of the estimated coefficients of tax variables (as discussed in Section 3). In order to tackle this issue, we have adopted a number of different measures, as proposed in the literature, for all the variables that can be defined as "control variables". Table 1 illustrates these alternative measures: the first column shows the theoretical debt-ratio determinants included in the *fcf* and *trade* vectors (see also Section 2); the second column shows the parameter labels (*e.g.* c_1 is the first parameter in vector *c*, and measures the effect of cash flow on debt-ratio); while the subsequent columns list the alternative measures (explanatory variables) we used for each effect.[6]

Table 1 here

As Table 1 clearly shows, the only explanatory variables we have not changed are cash flow (*casha*) on the PO side, and the relative cost of capital (*ccnsitd*) on the TO side. There are two reasons for this: the first is the satisfactory precision of PO theory in defining internal funds, and the relative advantages of our MATIS-simulated cost of debt versus equity capital over other available indicators. The second reason derives from our objective of assessing the relevance of taxes on debt policy through the simulation and evaluation of alternative fiscal regimes (Section 5). According to this objective, *casha* and *ccnsitd* are the direct transmission channels of tax policies on corporate borrowing. Hence, it is particularly important to check for the robustness of *casha* and *ccnsitd* parameter estimates when faced with changes to the specifications of the MPO model.

In order to facilitate presentation of our sensitivity analysis, equation (4) can be rewritten as follows:

$$\Delta d_{it} = \beta_I I_{it} + \beta_M M_{it} + \beta_X X_{it} + \varepsilon_{it} \qquad (10)$$

where: Δd_{it} is the debt-ratio in first differences; the vector *I* includes the deterministic individual and time effects μ_i and λ_t , *i.e.* the variables common to all alternative models; M = ($casha_t$,

[6] Detailed definitions and descriptive statistics of these variables are given in the Appendix; a survey of the reasons for their inclusion can be found in Harris-Raviv (1991).

$ccnsitd_{t-1}$, $dfbta_{t-1})'$ includes the three focus variables, while β_M is the corresponding vector of parameters $(c_1, b_1, a)'$; finally, X is the conditional information set which includes the seven control variables (belonging either to *fcf* or *trade* vectors in Table 1) with parameter vector $\beta_X = (c_2, c_3, c_4, b_2, b_3, b_4, b_5)'$. Although the estimation of β_X is not directly of interest from the point of view of our policy evaluation, alternative measurements of X imply different β_M estimates. Since the focus here is on assessing the significance of such changes to β_M estimates, we have carried out a sort of Leamer (1985) extreme bound analysis (EBA). EBA consists in varying the measures of X in order to find the widest range of $(c_1, b_1, a)'$ estimates: the latter are considered to be "robust" if they are significantly of the same sign, regardless of any alterations in the specification of the conditional information set X.

Our application of EBA to the MPO model implies the estimation of all the possible combinations of the alternative explanatory variables in X (see the list in Table 1), and produces 2,880 estimates of the three parameters of interest. Estimation results are summarised in Table 2.

Table 2 here

The cash flow parameter c_1 estimates are always negative, as predicted by PO theory; their distribution suggests a significant effect on companies' leverage, since a further percentage point in the cash flow/assets ratio leads to an average reduction of ¼ in the debt ratio. The dispersion of results is rather limited, with a standard deviation of 0.026. The dynamics parameter a estimates, in the last column of Table 2, are even less dispersed, and suggest a speed of adjustment of about 1.2 years to reduce half the deviation between actual and target debt-ratios. The relative cost of capital parameter b_1 estimates is always negative, as predicted by TO theory; if *ccnsitd* doubles, firms reduce their debt-ratios by an average of approximately 0.15%[7]. Though statistically significant, the relative cost of capital seems of less economic importance than cash flow in explaining borrowing.

[7] In fact, -0.0305*0.4855 = 0.00148, where 0.4855 is the mean value of *ccnsitd* (see the Appendix).

However, at this stage the comparison is difficult, as will be clear when we look at the effects of tax reforms on debt (Section 5).

In order to call our estimates "robust", MPO-theory predictions and the stability of dynamics condition require that all c_1, b_1, and a estimates be significantly negative. The three histograms in Figure 1 allow for a visual inspection of the robustness of the estimates of our focus variables: they show the distribution of test-statistics for the null hypothesis that the parameters are either equal to, or greater than, zero.

Figure 1 here

The statistics always reject the null hypothesis that c_1 and a parameters are either zero or positive, whereas as far as the b_1 parameter is concerned, the null hypothesis is not rejected but in a very limited number of cases (96 out of 2,880). Strictly speaking (*i.e.* in EBA terms), only c_1 and a are robust, whereas b_1 is not. However, as Sala-I-Martin (1997) noted, the EBA approach is often too strong for any variable to pass the test. For this reason, he proposes a less "extreme" approach in order to assign some level of confidence to the variables under scrutiny, based on the complete distribution of the parameter estimates, instead of the EBA zero-one labelling of "robust" vs. "non-robust".

The procedure adopted here is a slight variation on the Sala-I-Martin proposal. We have constructed the mean estimate and the average standard error of each parameter of interest by using all 2,880 regressions; each mean estimate is a weighted average of all individual estimates, where the weights are proportional to the generalised R^2 (see Pesaran-Smith, 1994) of each individual regression. In keeping with seminal Theil's (1971) criterion of model selection, the reason for using this weighting scheme is to give greater weight to the regressions characterised by a better fit (the implicit hypothesis is that the better the fit, the higher the probability of the model being true). Moreover, compared to the Sala-I-Martin proposal (1997), we have avoided any problems of a spurious good fit due to endogenous regressors by instrumenting all the explanatory variables instead of using OLS.

Averaging out the entire distribution of all 2,880 outcomes, we get the results shown in the last two rows of Table 2. Given that each average parameter estimate is (in absolute value) well above twice its average standard error, we confirm the EBA results for cash flow and dynamic parameters. In addition, we can be confident about the significance of the relative cost of capital too: the average estimate over the average standard error is 2.46, and falls within the range whereby the null hypothesis is 5% rejected.

The validity of our measure of relative cost of capital can be further assessed by adding an explanatory variable that measures the difference between two relative costs of capital: one includes the perfect foresight MTR, while the other includes our simulated average effective tax rate. If the associated coefficient is significantly negative, then this indicates that expected tax status, and not only current tax status, partly explains borrowing (for a similar approach, see Graham, 1996a, p. 55). The perfect foresight relative cost of the capital variable replaces t_{sc} with the perfect foresight MTR in equations (5) and (6). This variable is computed, and the corresponding MPO model estimated, for the period 1992-1994 only; the reason for this is the 5-year loss carrying-forward provision of Italian tax legislation, which requires knowledge of future taxable income for a period of at least five years. Over this period, the 2,880 estimation results show that: 1) the difference between the two relative costs of capital only has a significantly negative effect on debt ratio in a very limited number of the 2,880 cases (less than 10%); 2) as opposed to cash flow, lagged debt-ratio and the MATIS-simulated cost of capital parameters, the relative cost of capital calculated using perfect foresight MTR, lacks robustness to the use of alternative MPO specifications and instruments[8]; 3) our MATIS-simulated cost of capital estimates appear remarkably stable in the

[8] Since lagged values of the MTR cost of capital may only be used as instruments for lags greater than 6, we use more parsimonious lags of earnings before taxes and of interest expenses. Other possible instruments (such as lags of sales or

1982-94 sub-sample (the average estimate and t-statistic are -0.0043 and -1.71 respectively); 4) the average R^2 of our model specifications in table 2 is 0.200; in the sub-sample up to 1994 it is 0.174; it drops to 0.135 if we use the MTR cost of capital instead of the MATIS cost of capital[9]. Although confined to the sub-sample up to 1994, these outcomes, which would appear to discourage the use of the perfect foresight MTR cost of capital, probably reflect the difficulty of modelling the managers' expectations of taxable income. During the period focused on in our analysis, the Italian economy was characterised by a considerable degree of uncertainty, which exacerbated the difficulties encountered in trying to model expected-income. Moreover, there are other specific facts that may reduce the difference between MTR and MATIS average effective tax rates in the present context: the absence of carry-back of losses and the short period for carrying losses forward (five years only); the large percentage of our sample companies with positive taxable income (approximately 78%); and the high tax status-persistence probabilities (companies with positive taxable income will also have a 89.6% probability of positive income).

Overall, the results in this section show that the tax effects on debt-ratio are robust and significantly have the right signs.

5. An evaluation of the financial effects of alternative tax reforms

As we mentioned in Section 3 above, the corporate tax code in Italy has undergone several changes in recent years. The most important changes have been the introduction of the Dual Income Tax system (Dit) in 1997 and the abolition of Ilor and the net wealth tax in 1998. These taxes, along with a contribution levied on wages and earnings and earmarked for health expenditure, were replaced by a new regional tax (Irap) levied on a measure of value added of the net-income type. In the manufacturing sector, the tax base is computed as the difference between sales revenue on the

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estimated taxable income, and further lags of cash flow) would have worsened the MTR cost of capital estimation results.

[9] Detailed results are available upon request from the authors.

one hand, and costs for intermediate goods and services and depreciation on the other. Neither labour costs nor interest payments are deductible from the Irap tax base.

This reform significantly altered both the tax liabilities of companies and the relative cost of capital. In fact, one of the major goals of the reform was the reduction of the wide gap between the tax costs of debt and equity finance, in order to stimulate the capitalisation of Italian firms (Bordignon *et al*, 2001). The original reform was incremental: only new equity financing from 1996 onwards was eligible for the allowance. However, when fully in force it meant the full application of the Dit system to the stock of net equity (and not only to the new equity capital addition). Moreover, a reduction in the Irpeg statutory tax rate to 35% in 2003 was envisaged.

Prior to its full implementation, this reform was substantially reversed by the newly-elected government following the 2001 election. Italy's new government soon abolished the Dit system for new equity financing, and is now gradually eliminating the allowance on previous investments as well. The new system proposed by the government marks a return to a flat corporate tax rate, reduced to 33%. In addition, the Irap tax is planned to be gradually abolished. The first objective could be easily achieved without any detrimental effects on tax revenue. This is not the case, however, with the abolition of Irap, which provides up to 30 billion euros of revenue for the government, a similar amount to that raised by corporation tax. The government has not yet made it clear exactly how this loss of revenue will be funded. The progressive abolition of this tax will be decided on a year-to-year basis, depending on the general state of the budget deficit and on the need to respect the European Stability and Growth Pact.

Within the framework of a "partial approach", tax reforms enable us to further explore the effect of taxation on the financial decisions made by companies. This we can do in two different ways: (*a*) by comparing what was forecasted and what actually happened; (*b*) by measuring the financial debt responses to tax impulses that embody "how much" the tax variables in question are modified by the reforms. The first path, which has been taken, for example, by Gordon-Mackie

Mason (1990), is not suitable within the present context, since too little time has lapsed subsequent to the reform: the reform introduced in 1997-98 was in fact abolished before its effective implementation, and the new reform begun in 2001 is still in progress.

Thus it is that we have decided to adopt approach (*b*). In Section 5.1 we use alternative MATIS microsimulations to initially assess the impact of these tax reforms on the tax variables of the model; then in Section 5.2, we measure the dynamic response of debt-ratios by using the model estimated in Section 4.

5.1 The microsimulation of fiscal impulses

In order to assess the effect of the 1997-98 and 2001 reforms on MPO fiscal variables (cash flow through tax liabilities, and the relative cost of capital through effective tax rates), we perform *microsimulation* exercises using the MATIS model for three different tax regimes: the legislation in force before 1997, which we use as the benchmark (microsimulation B); the 1997-1998 reform (microsimulation V); and the newly-proposed system (microsimulation T). In each microsimulation, indexed *ms*, the MATIS model applies each tax code in question (*ms* = B, V, and T respectively) to *all* the company annual balance sheets in our sample of more than 200,000 cases.

In other words, in each microsimulation the fiscal variables are endogenised (and then simulated) by the MATIS structure that reproduces the workings of the tax code in question in each company-year case by using all the information available for that company-year: for example, the microsimulation B applies the same tax code in force in 1996 to all available company-year observations, and not only to companies in 1996. This procedure is designed to increase the number of specific cases analysed for each company: the greater the number of cases, the more informed the model answers will be.

The tax burdens included into the cash-flow definition are simulated by the MATIS according to the following equations for B, V, and T tax regimes:

$$T^{B} = T_{Irpeg37} + T_{Ilor} + CS + T_{Pat} \qquad (11)$$

$$T^{V} = T_{Irpeg19\text{-}35} + T_{Irap} \tag{12}$$

$$T^{T} = T_{Irpeg33} + T_{Irapcl} \tag{13}$$

T^{B} is the tax burden according to the tax legislation in force in 1996, and consists of: the simulated tax burden for corporation tax, levied at the rate of 37% ($T_{Irpeg37}$); the Ilor tax (T_{Ilor}), not deductible from the Irpeg tax base; national insurance contributions (CS); and the net wealth tax (T_{Pat}).

T^{V} is the simulated tax payment under the 1997-98 tax reform, including the new tax on productive activity (T_{Irap}) and the dual corporate tax system ($T_{Irpeg19\text{-}35}$). The lower rate (19%) is applied to the whole stock of net equity capital, as it would have been with a fully-implemented reform.

T^{T} is the tax burden under the new reform; its calculation assumes that the Dit system has been completely abolished, that the corporate tax rate has been reduced to a uniform figure of 33%, and that the Irap tax burden is reduced by subtracting 20% of labour costs from the tax base. It is important to note that this simulation does not reproduce the exact content of the new reform. As previously mentioned, the timing and final design of the latter is still rather uncertain, in particular with regard to the complete abolition of Irap. The assumption made here is one of a possible intermediate step in the abolition of Irap, as announced by the government when the reform was originally presented. For our purposes, this enables us to compare the effects of two alternative tax regimes on debt, each with opposing effects on cash flow and on the relative capital cost of debt versus equity finance.

As far as relative capital cost is concerned, we have the following formulas for the V and T reforms (the formula for $ccnsitd^{B}$ is the same as in equation (7)):

$$ccnsitd^{V} = \frac{1 - t_{sirpeg35}}{1 - agev} \tag{14}$$

$$ccnsitd^{T} = 1 - t_{sirpeg33} \tag{15}$$

where $t_{sirpeg35}$ and $t_{sirpeg33}$ are the MATIS simulated Irpeg tax rates in the case of the V and T reforms, respectively; $agev = (0.35 - 0.19)\frac{IMP_{Dit}}{RO + RIP_{Dit}}$.

The changes in cash flow, as a ratio of total net assets, A, and in the relative cost of capital are the basic fiscal impulses to the debt-ratio relationship. They are defined as:[10]

$$\Delta casha^{ms}{}_{it} = -\frac{T_{it}{}^{ms} - T_{it}{}^{B}}{A_{it}}, ms = \text{V, T} \tag{16}$$

$$\Delta ccnsitd^{ms}{}_{it} = ccnsitd_{it}{}^{ms} - ccnsitd_{it}{}^{B}, \ ms = \text{V, T} \tag{17}$$

i.e. the differences between the MATIS-simulated total tax burden T_{it}^{ms} and relative cost of capital $ccnsitd_{it}^{ms}$ (where ms = V, T) with respect to the baseline solutions T_{it}^{B} and $ccnsitd_{it}^{B}$.

Tax impulses per company are then averaged out over two sub-periods, both of six years: 1988-1993[11] and 1994-1999, in order to check for any time effects on simulation results. Table 3 summarises the mean and standard deviation of the changes in cash flow ($\Delta casha$) and in the cost of capital ($\Delta ccnsitd$) produced by the two reforms (V, T), compared to the benchmark 1996 legislation (B).

Table 3 here

The reduction in the tax burden (*i.e.* the increase in the ratio of cash flow to total assets) is slightly greater under the T reform, while the rise in the relative cost of capital induced by the V reform is always well above that induced by the T reform (see the fourth and fifth columns of Table 3). As far as regards the company-variability of the changes in question, the effects of the V reform on the relative cost of capital show greater variability than do the effects of the T reform.

If we look at the difference between the T and V fiscal impulses, what emerges is that the former further increases cash flow but reduces the relative cost of debt capital. The first effect

[10] We assume that total net assets, A, do not change subsequent to the reforms compared with the benchmark value. Similarly, in examining the effects of the 1986 US tax reform, Gordon-MacKie Mason (1990) takes ITC and tax loss carry-forwards as given.

implies a reduction in the debt-ratio on top of that already produced by the V reform, while the second works in the opposite direction, increasing the same debt-ratio.

5.2 From fiscal impulses to financial responses

Since aggregate fiscal impulses per sub-period are quite similar (see Table 3), we have decided to focus on the 1988-1993 averages per firm only, in order to avoid any bias to Dit simulation outcomes due to a 1994-1995 temporary incentive (which reduced the tax burden and increased retained earnings and reserves), and to exclude those years in which the V reform was already in force.[12]

Given the MPO model structure, the company time-averages measure the permanent impulses to debt-ratios resulting from the V and T tax reforms. Thus the debt responses to the impulses of the reforms can be obtained by combining the time-average of the company-specific changes, $\Delta casha_{i.}^{ms} = \frac{1}{6}\sum_{t=1988}^{1993} \Delta casha_{it}^{ms}$ and $\Delta ccnsitd_{i.}^{ms} = \frac{1}{6}\sum_{t=1988}^{1993} \Delta ccnsitd_{it}^{ms}$ (ms = V, T), obtained by the MATIS microsimulations described in Section 5.1, with the estimates of parameters c_1, b_1 and a in the MPO model (see Section 4).

The dynamic nature of the MPO allows for the assessment of the timing of fiscal effects, that is: the impact effect (at horizon zero) in the year of introduction of the reform, the effect after one year, and the long-term effect (when fiscal impulses have exerted their full effect on debt choices).

As was mentioned in Section 4, the MPO model was specified in diverse alternative ways, and a different set of estimates corresponds to each specification. Consequently, the fiscal impulses to each company cause different responses of the debt ratio in the case of each of the 2,880 diverse MPO specifications. In other words, we obtained 2,880 debt-ratio responses for each of the approximately 24,000 firms in our sample. Overall, the bulk of these responses constitute the thick

[11] The first five years, from 1982 to 1985, were discarded in order to begin the loss carry-forward procedure.

[12] Results are robust to the use of the averages over the 1994-1999 period.

representation (see Granger-Jeon, 2001) of the fiscal impulses received from the V and T reforms. The advantage of a thick representation over a thin one (where the effects of the reforms on financial choices are measured using just one model, the "best" one) is that thick responses supply a range of potential outcomes to the policymaker intent on quantifying the uncertainty of the empirical specification of financial behaviour.

We are now going to concentrate on two measures of the financial effect of the alternative V and T policies: the percentage of firms reducing their leverage (Table 4), and the quantitative changes in debt-ratios (Table 5).

Table 4 here

Compared to the benchmark, the V reform induces more than 70% of firms in our sample to reduce the debt-ratio in the short term; this effect is monotonically reinforced in the long term (more than 88%), when the relative cost of the capital transmission channel leads to the full utilisation of its effects. The effect of shifting from the V to the T reform induces firms to further reduce their debt-ratios, and the percentage of companies doing so is similar in period 0. However, the reaction declines over time. The reason of this can be traced to the different effects of the two reforms on the two transmission channels analysed in this study: cash flow and the cost of capital. At horizon 0, when only the former operates, V against B effects, and T against V effects, give similar results: as mentioned in Section 5.1, the two reforms consecutively reduce the tax burden, albeit by different amounts. In the long term, however, the T reform gradually loses its initial debt-shrinking impetus, because the relative price effect comes into play and works against the stimulation of a debt decrease. The final two columns of Table 4 disaggregate the percentage of firms reducing debt under the T reform, depending on their behaviour under the V reform. Results show that the T reform maintains companies' tendency towards reducing their leverage previously engendered by the V reform, instead of inducing a genuine modification in their financial behaviour.

Table 5 illustrates the quantitative relevance of the V and T reforms in terms of debt-ratio variations. In order to resolve the question of the most relevant tax transmission channel, the total effect of the reforms has also been disentangled in order to consider the effects of cash flow and of the relative cost of capital separately.

Table 5 here

With respect to the benchmark, both the V and T reforms entail reductions in company debt-ratios: the reduction is of a limited entity at first, but increases in time. The difference between the T and V effects enables us to quantity the degree to which the last reform (T) further reduced debt-ratios compared with the previous one (V). At first, despite the fact that the T reform induces 68.9% of firms to further reduce their leverage (see Table 4), the average change of debt ratio is a mere –0.02%. In the long run, the sign is even reversed: the average change of the debt-ratio is positive (0.06%). As is clear from looking at the effects of cash flow and of the cost of capital separately, the T reform further reduces the debt ratio compared with the V reform, in so far as it increases cash flow, but it can also be seen to increases the same debt ratio since it widens the gap in favour of debt by reducing its relative cost. This latter effect gradually overcomes the former as time goes by.

Figure 2 offers a picture of the long-term changes in the debt-ratio of all of the above-mentioned 20,000 sample firms - with parameter estimates averaged over the 2,880 outcomes - induced by the shift from the T to the V reform. The figure summarises two interesting findings in Tables 4 and 5: the debt-ratio changes fall within the -0.5 / 0.5% interval, but the increases in debt ratios brought about by the T reform prevail over the reductions, and this phenomenon affects the majority of companies (about 64%).

Figure 2 here

6. Concluding remarks

The analysis undertaken in this paper shows that both PO and TO tax variables, i.e. cash flow and the relative cost of capital, provide valid explanations of company borrowing within the

Italian context. This finding does not change even when we allow for model specification indeterminacy by means of a “reasonable EBA” analysis.

The tax reform undertaken in 1997-98 had both cash flow and relative price effects, each contributing towards reducing the debt ratio. In our sample, the average effect can be quantified as a 0.48 % reduction in the debt/asset ratio, almost equally shared between the increase in cash flow (0.27%) and the relative cost of capital (0.21%).

The former effect was brought about by the abolition of certain taxes and contributions which were not fully compensated for, in terms of revenue, by the introduction of a new regional tax (Irap). This substitution also had the effect of increasing the cost of debt compared to equity finance: two of the abolished taxes (the local profit tax and the net wealth tax) discriminated against equity finance to a significant degree, whereas the new regional tax is neutral with respect to financing choices, in as far as interest payments are not deductible from the tax base. In addition, a new allowance on new equity finance was introduced (DIT). Our results also show that debt-reducing behaviour was widespread, involving on average almost 90% of the companies in our sample.

The new, and only partially implemented, tax reform announced by the government in 2001 goes in the opposite direction, widening the relative tax benefit of debt finance. Discrimination remains much lower than it was in the mid-1990s, because the statutory rate is much lower (33% compared to 53.2%). Compared to the 1996 tax legislation, the relative cost of debt capital is now about 15% higher. However, as a consequence of the abolition of DIT, this relative cost is significantly lower than it was after the 1997-98 tax reform (about 13 percentage points). In terms of cash flow, the effect of the new reform is still very uncertain. The abolition of DIT should be substantially matched by the announced reduction in the legal corporate tax rate. Hence any reduction in the total tax burden would only depend on a reduction in the Irap tax base. The assumption made in this study - that of a deduction of 20% of labour costs - explains the increase of approximately 0.06% in cash flow between one reform and the other. However, this assumption is highly questionable. Due to the tight budget constraint, it would be very difficult for the government to gradually abolish Irap without implementing compensatory measures capable of maintaining the overall tax burden on companies. Despite our generous assumption of a 20% reduction in the Irap tax base, on average the price and cash flow effects induce a slight increase in the debt-asset ratio of about 0.06% compared with the 1997-98 reform. In the absence of this assumption (i.e. in a situation characterised by equal cash flow), the increase in the debt-asset ratio would be much higher: approximately 0.38%.

Generally speaking, those tax reforms that reduce the overall tax burden may be considered as effective in lowering corporate leverage as those reforms that reduce the relative tax advantage of debt versus equity. Both are important explanations of debt choices within the Italian context, where both PO and TO behaviour is widespread. However, the former effect is relatively much more costly in terms of loss of revenue for the State.

The results of this paper could be further developed by more extensive study. This could focus on an evaluation of the debt responses of tax changes in sub-samples of firms whose parameters are pooled according to PO and TO homogeneous behaviour. This could assess the robustness of our results compared with alternative methods of pooling potentially heterogeneous company behaviour. Moreover, an update of the entire database, together with the precise definition of the design and timing of the new reform, could in the future provide for a better understanding of its effects, and shed more light on the pros and cons of the two tax designs with regard to financing decisions.

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References

Alworth J. and G. Arachi (2001), "The effect of taxes on corporate financing decisions: evidence from a panel of Italian firms", *International Tax and Public Finance*, Vol. 8, pp. 353-376

Anderson T. W. and C. Hsiao (1981), "Estimation of dynamic models with error components", *Journal of the American Statistical Association*, Vol. 76, pp. 598-606

Arellano M. (1989), "A note on the Anderson-Hsiao estimator for panel data", *Economics Letters*, Vol. 31, pp. 337-341

Bonato L., R. Faini and M. Ratti (1993), "Empirical determinants of corporate debt decisions: some evidence for Italy", in V. Conti and R. Hamaui (eds.), *Financial Markets Liberalisation and the Role of Banks*, Cambridge University Press

Bontempi M. E. (2002), "The dynamic specification of the modified pecking order theory: its relevance to Italy", *Empirical Economics*, Vol. 27, pp. 1-22

Bordignon M. S. Giannini and P. Panteghini (2001), "Reforming business taxation: lessons from Italy?", *International Tax and Public Finance*, Vol. 8(2), pp. 191-210

Fama E. F. and K. R. French (2000), "Testing tradeoff and pecking order predictions about dividends and debt", *Working Paper*, No. 506, University of Chicago, December

Gordon R. H., J. K. MacKie-Mason (1990), "Effects of the Tax Reform Act of 1986 on corporate financial policy and organizational form", in J. Slemrod (ed.), *Do taxes matter? The impact of the Tax Reform Act of 1986*, MIT Press, pp. 91-131

Graham J. R. (1996a), "Debt and the marginal tax rate", *Journal of Financial Economics*, Vol. 41, pp. 41-73

Graham J. R. (1996b), "Proxies for the corporate marginal tax rate", *Journal of Financial Economics*, Vol. 42, pp. 187-221

Graham J. R. (2003), "Taxes and corporate finance: a review", *Review of Financial Studies*, forthcoming

Granger C. W. J. and Y. Jeon (2004), "Thick modeling", Economic Modelling, Vol. 21, pp. 323-343

Harris M. and A. Raviv (1991), "The theory of capital structure", *Journal of Finance*, Vol. 46, pp. 297-355

Leamer E. E. (1985), "Sensitivity analyses would help", *American Economic Review*, Vol. 82, September, pp. 308-313

MacKie-Mason J. K. (1990), "Do taxes affect corporate financial decisions", *Journal of Finance*, Vol. 45, pp. 1471-1493

Myers, S. C. (1984), "The capital structure puzzle", *Journal of Finance*, Vol. 39, pp. 575-592

Pesaran M. H. and R. J. Smith (1994), "A generalized R^2 criterion for regression models estimated by the instrumental variables method", *Econometrica*, Vol. 62, May, pp. 705-710

Plesko G. A. (1999), "An evaluation of alternative measures of corporate tax rates", *Working Paper*, MIT, Boston, MA, July, published in the *Journal of Accounting and Economics* (2003), Vol. 35, pp. 201-226

Sala-I-Martin X. X. (1997), "I just ran two million regressions", *American Economic Review*, Vol. 87, AEA Papers and Proceedings, pp. 178-183

Staderini A. (2001), "Tax reforms to influence corporate financial policy: the case of the Italian business tax reform of 1997-98", Bank of Italy, *Temi di Discussione*, No. 423

Theil H. (1971), *Principles of Econometrics*, John Wiley, New York

Titman S. and R. Wessels (1988), "The determinants of capital structure choice", *Journal of Finance*, Vol. 43, pp. 1-19

Appendix: Alternative explanatory variables of the MPO model

Key of the variables in Table 1 (with the exception of the relative cost of capital, all the variables are scaled by net assets)

Label	Measures	first decile	median	mean	last decile	standard deviation	pseudo stan. deviation
Δd	First difference in the book value of long- and short-term debt versus banks and quasi-bank intermediaries (such as factoring and leasing).	-.0966	.0007	.0061	.1150	.0944	.0717
casha	Operative earnings before depreciation, non-operative and extraordinary items, and other non-cash expenses, net of total interest expenses, taxes, and dividends paid.	.0087	.0651	.0719	.1551	.0735	.0527
iinva	Investment in advertising, R&D and other intangibles, not tax-deductible in the accounting year.	0	.0007	.0067	.0177	.0193	.0038
iinva1	iinva plus auxiliary expenses necessary to investment operations.	0	.0007	.0070	.0188	.0199	.004
iinvna	Net investment in intangibles (investment minus disinvestment).	-.0006	.0004	.0048	.0157	.0211	.0032
iinvna1	iinvna plus auxiliary expenses necessary to investment operations.	-.0006	.0005	.0051	.0168	.0216	.0034
iinvna2	First difference in the net stock of R&D, advertising, and other intangible assets.	-.0008	0	.0004	.0010	.0142	0
inva	Investment in plant, equipment, buildings and land.	.0043	.0344	.0567	.1330	.0711	.0442
invna	Net investment in tangibles (investment minus disinvestment).	.0017	.0309	.0497	.1265	.0766	.0429
vnwc	First difference in net working capital, computed as total current assets (inventories, short-term trade and financial credit, cash and other marketable securities) minus short-term trade and non-financial debt.	-.1130	.0338	.0299	.1782	.1570	.0999
vnwc1	First difference in net working capital, computed as total current assets minus total current liabilities (excluded short-term bank debt but included short-term bonds, shareholder loans and loans from subsidiary, affiliated and parent companies).	-.1156	.0332	.0289	.1778	.1573	.1005
ccnsitd	Ratio between cost of debt and equity funds. Corporate tax rates are the MATIS-simulated tax rates; the weights for the two types of equity financing are the percentages of new share issues and retained earnings in total equity financing.	0	.4410	.4855	.796	.2740	.0769
ndts	Depreciation allowances on tangible and intangible assets, including accelerated depreciation.	.0126	.0372	.0452	.0876	.0332	.0279
ndtsr	ndts plus advertising and R&D expenses tax-deductible in the accounting year.	.0139	.0407	.0502	.0969	.0394	.0306
ndtsrof	ndtsr plus interest expenses on pre-existing non-bank debt.	.0153	.0438	.0532	.1015	.0404	.0319
ndtsrrof	ndtsrof plus net operating loss carry-forwards simulated by MATÌS and lagged one period.	.0174	.0516	.0734	.1385	.0938	.0415
ndtstw	Difference between theoretical fiscal charge (computed on the basis of pre-financing taxable income, i.e. earnings before taxes, depreciation and interest on bank debt) and Irpeg charge simulated by MATÌS.	.0069	.0411	.0516	.1059	.0463	.0353
ndtstw1	Difference between theoretical fiscal charge (computed on the basis of post-financing taxable income, i.e. earnings before taxes and depreciation) and Irpeg charge simulated by	.0083	.0440	.0543	.1101	.0472	.0366

	MATÌS[13].						
matna	Net stock of all tangible assets, including those leased.	.0542	.2098	.2388	.4631	.1612	.1572
terna	Net stock of buildings and land.	0	.0628	.0862	.2072	.0927	.0876
termacna	terna plus net stock of plant and equipment	.0195	.1862	.2136	.4371	.1625	.1597
garna	Suretyships, warranties, and real guarantees received by controlled and associated companies, by others, and by banks and quasi-bank intermediaries, minus those laid down by the firm.	-.0382	0	-.0097	.0017	.2703	0
imatna	Net stock of all intangible assets.	0	.0052	.0176	.0465	.0353	.013
redna	Net stock of R&D, patents of invention, licences, concessions, and registered trade-marks.	0	0	.0042	.0072	.0194	.0004
redplana	redna plus net stock of plant expenses (technology expenses and soft capital inputs).	0	.0051	.0174	.0458	.0351	.0127
nwc	Net working capital, computed as total current assets minus short-term trade and non-financial debt.	.1293	.3759	.3661	.6028	.2093	.1825
nwc1	Net working capital, computed as total current assets minus total current liabilities (excluding short-term bank debt but including short-term bonds, shareholder loans and loans from subsidiary, affiliated and parent companies).	.1204	.3708	.3600	.5988	.2121	.1841

The PO vector of explanatory variables (*fcf*) includes all the components of free cash flow: profitability (casha) with envisaged negative sign on borrowing, together with alternative measures of growth opportunities (iinva, iinva1, iinvna, iinvna1, iinvna2, inva, invna, vnwc, vnwc1) with envisaged positive sign. The variations in net working capital (vnwc and vnwc1) point to the firm's attempts to build up financial slack (cash, liquid assets and marketable securities, unused borrowing power).

The TO vector of explanatory variables (*trade*) includes fiscal factors other than the relative cost of capital (ndts, ndtsr, ndtsrof, ndtsrrof, ndtstw, ndtstw1), failure factors (matna, terna, termacna, garna), agency factors (imatna, redna, redplana) and signalling factors (nwc, nwc1).

Tangible assets (matna, terna, termacna) increase a company's debt capacity, because they are readily marketable and more valuable in a situation of short-notice liquidation. The same thing goes for the guarantees (garna).

The value of intangible assets such as technology, human capital, trade marks and patents (imatna, redna, redplana) is something that managers prefer not to reveal because the secrecy surrounding corporate strategy is of crucial importance to competitive advantage. Thus, intangibles offer considerable opportunities for the discretionary behaviour of managers, which might be mitigated by increased borrowing.

[13] In other words, ndtstw and ndtstw1 include tax credits scaled by the MATIS simulated Irpeg tax rate in order to transform them into a deduction from taxable income. Tax credits on dividends are excluded because they may create positive taxable income when the firm has net operation losses, thus allowing for interest deductions.

Finally, the widespread use of multiple borrowing by Italian companies may lead to serious informational problems for banks and to free-riding problems. Liquid assets (nwc, nwc1) mitigate moral hazard and adverse selection problems in loan contracting. In fact, they proxy for those various financial services (such as letters of credit, deposits, check clearing and cash management services) which can increase the customer-specific information available to intermediaries beyond that information readily available to the public, and which can reduce the problem of asymmetric information resulting from multiple borrowing.

Tab. 1 - The structure of equation regressors in *trade* and *fcf* vectors

Theoretical effects	Parameter	Alternative measures (explanatory variables) by effect ([1])					
Dynamics	a	d_{it-1}					
PO (*fcf* vector):							
Cash flow	c_1	$casha_{it}$					
Investment needs:							
- intangibles	c_2	$iinva_{it}$	$iinva1_{it}$	$iinvna_{it}$	$iinvna1_{it}$	$iinvna2_{it}$	
- tangibles	c_3	$inva_{it}$		$invna_{it}$			
Financial slack	c_4	$vnwc_{it}$	$vnwc1_{it}$				
TO (*trade* vector):							
Fiscal:							
- relative cost of capital	b_1	$ccnsitd_{it-1}$					
- non-debt tax shields	b_2	$ndts_{it-1}$	$ndtsr_{it-1}$	$ndtsrof_{it-1}$	$ndtsrrof_{it-1}$	$ndtstw_{it-1}$	$ndtstw1_{it-1}$
Failure	b_3	$matna_{it-1}$	$terna_{it-1}$	$termacna_{it-1}$	$garna_{it-1}$		
Agency	b_4	$imatna_{it-1}$	$redna_{it-1}$	$redplana_{it-1}$			
Signalling	b_5	nwc_{t-1}	$nwc1_{t-1}$				

([1]) The reasons for the choices we made and a description of each label are to be found in the Appendix.

Tab. 2 - A synthesis of the 2,880 estimates

	$\hat{c}_1$	$\hat{b}_1$	$\hat{a}$
Summary statistics:			
Mean	-0.259	-0.00305	-0.427
Standard deviation (1)	0.026	0.00040	0.008
Minimum	-0.367	-0.00429	-0.447
1st quartile	-0.267	-0.00326	-0.431
Median	-0.255	-0.00309	-0.426
3rd quartile	-0.244	-0.00290	-0.422
Maximum	-0.201	-0.00160	-0.408
Weighted averages: (2)			
Estimate	-0.260	-0.00305	-0.427
Standard error (3)	0.048	0.00124	0.013

(1) Standard deviation in the 2,880 parameter estimates
(2) Weights are based on the generalised R^2 of each regression.
(3) Weighted average of the 2,880 standard error estimates

Tab. 3 – Summary of the microsimulated fiscal impulses

	$\Delta casha^{ms} = \frac{1}{N(T_2 - T_1 + 1)} \sum_{i=1}^{N} \sum_{t=T_1}^{T_2} \Delta casha_{it}^{ms}$		$\Delta ccnsitd^{ms} = \frac{1}{N(T_2 - T_1 + 1)} \sum_{i=1}^{N} \sum_{t=T_1}^{T_2} \Delta ccnsitd_{it}^{ms}$	
$T_1 - T_2$	*ms* = V	*ms* = T	*ms* = V	*ms* = T
1988 – 93:				
Mean	0.0044	0.0052	0.2901	0.1419
s.d.[a]	(0.0084)	(0.0085)	(1.5908)	(0.1023)
1994 – 99:				
Mean	0.0046	0.0052	0.2870	0.1519
s.d.[a]	(0.0088)	(0.0089)	(0.4182)	(0.1011)

[a] Standard deviations measuring the variability of individuals averaged over the period from T_1 to T_2.

Tab. 4 – The percentage of firms reducing their debt-ratios

Horizon	V against B	T against V			
			of which:	firms not reducing under the V reform	firms reducing under the V reform
0[a]	70.1%	68.9%		24.8%	44.1%
1[a]	84.2%	44.9%		11.3%	33.6%
range[b]	*79.5 / 86.7%*	*40.1 / 52.8%*		*9.3 / 14.9%*	*30.8 / 37.9%*
Long-term[a]	88.4%	36.3%		8.0%	28.3%
range[b]	*83.5 / 90.7%*	*31.0 / 46.2%*		*6.3 / 11.8%*	*24.7 / 34.4%*

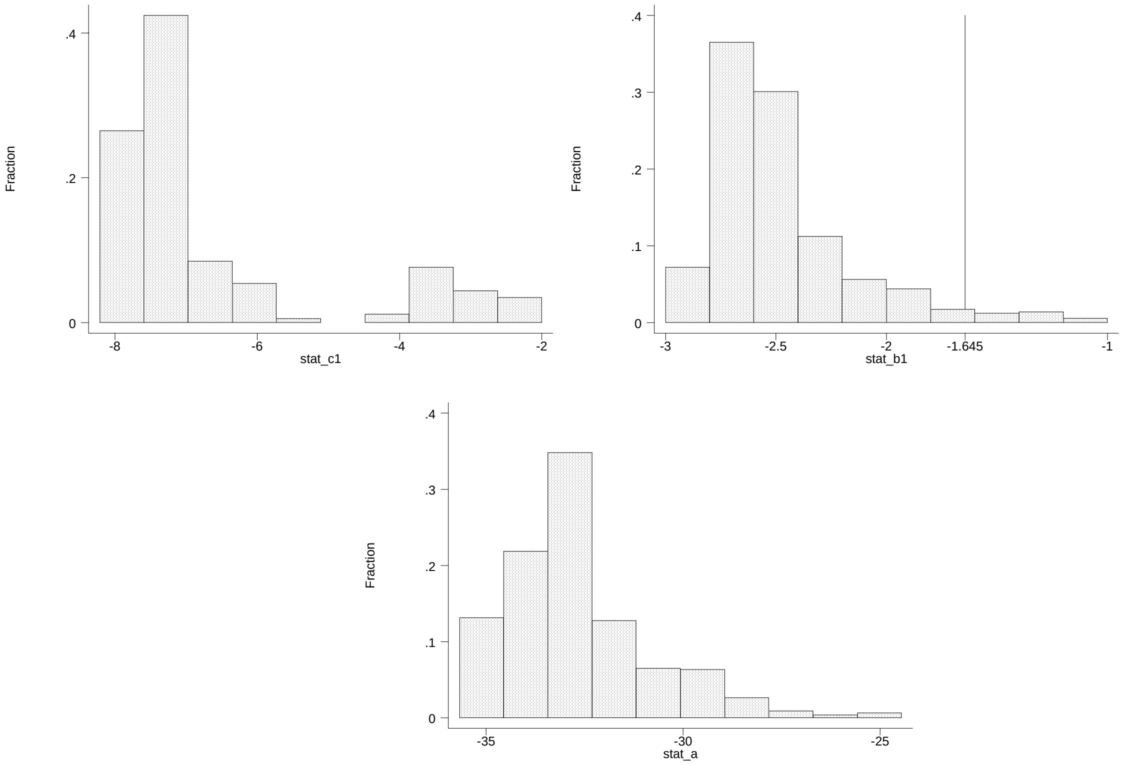
[a] Average percentage calculated from the 2,880 outcomes. [b] The lowest and highest percentages calculated from the 2,880 outcomes. As far as the impact effect is concerned, neither reform provided for an interval since all the short-term parameter estimates of the cash flow effect are negative (see c_1 estimates in Table 2), hence the 2,880 percentages coincide.

Tab. 5 – Deviations of debt-ratios from the benchmark

	Total effect		Cash flow effect		Relative cost of capital effect	
Horizon	V reform	T reform	V reform	T reform	V reform	T reform
0[a]	-0.11%	-0.13%	-0.11%	-0.13%	-	-
range[b]	*-0.16/ -0.09%*	*-0.19/ -0.10%*	*-0.16/ -0.09%*	*-0.19/ -0.10%*		
s.d.[c]	(0.22)	(0.22)	(0.22)	(0.22)		
1[a]	-0.27%	-0.25%	-0.18%	-0.21%	-0.09%	-0.04%
range[b]	*-0.37/ -0.19%*	*-0.36/ -0.19%*	*-0.26/ -0.14%*	*-0.30/ -0.16%*	*-0.12/ -0.05%*	*-0.06/ -0.02%*
s.d.[c]	(0.60)	(0.36)	(0.34)	(0.35)	(0.48)	(0.03)
....						
Long-term[a]	-0.48%	-0.42%	-0.27%	-0.32%	-0.21%	-0.10%
range[b]	*-0.68/ -0.32%*	*-0.60/ -0.30%*	*-0.39/ -0.21%*	*-0.46/ -0.24%*	*-0.30/ -0.11%*	*-0.15/ -0.05%*
s.d.[c]	(1.26)	(0.55)	(0.51)	(0.52)	(1.14)	(0.07)

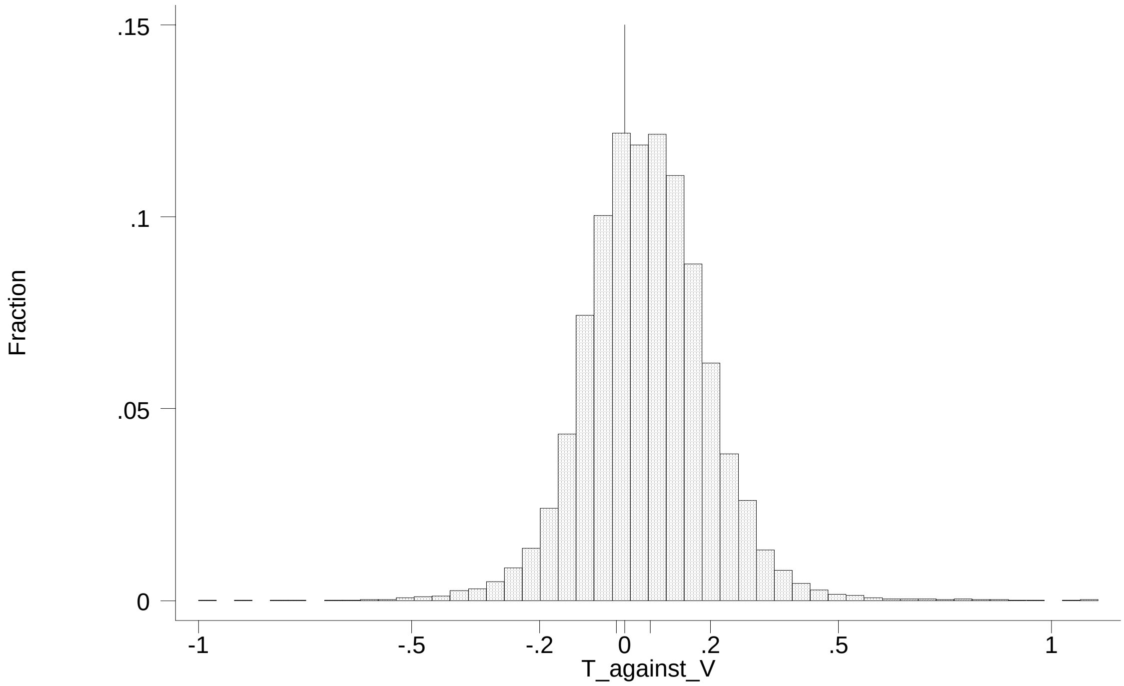
[a] Average debt-ratios changes covering the more than 20,000 firms in our sample, averaged out over the 2,880 outcomes.[b] The lowest and highest average deviations in the 2,880 outcomes. [c] Average of the 2,880 standard deviations, measuring company variability within the 2,880 simulation results.

Fig. 1 - The distribution of the test-statistics of parameters of interest (*)



(*) The vertical line at 1.645 is the critical value at one-tail 5% significance level: the statistics that fall to the right of the critical values suggest the corresponding estimates are not robust (the line is not plotted if the critical value falls outside the right-hand side of the histogram).

Fig. 2 - The distribution of the effects of the T reform against those of the V reform (*)



(*) The vertical line at 0 indicates no debt-ratio change. The figure is obtained by using all the above-mentioned 20,000 sample companies together with parameter estimates averaged out over the 2,880 outcomes.