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Corporate tax reforms and financial choices: an empirical analysis

by

Maria Elena Bontempi[*], Silvia Giannini[**] and Roberto Golinelli[**]

Abstract

The aim of this paper is to assess the effect of different types of corporate tax reforms, recently implemented in Italy, on the debt choices of companies. To do so, we merge the information of a micro-simulation corporate tax-model (MATIS), with an empirical representation of the modified pecking order model, and we apply this analytical framework to a panel of Italian manufacturing companies. Main results suggest that: *(a)* the Italian fiscal code of the period 1982-1999 is well implemented by MATIS model, which delivers reliable predictions of fiscal account data for a sample of about 20,000 companies; *(b)* the reforms analyzed are able to induce similar reductions in firms' leverage, when compared with the situation prevailing before tax reforms. However, the routes through which the two reforms operate are different (mainly relative cost of capital in the first case, cash flow in the second), tracing some important differences in the overall evaluation of the two normative changes.

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1. Introduction[1]

There is a large agreement that forecasts and quantitative policy analyses are at the heart of the policymaking process. In fact, a large number of economic policy issues require a prediction, and the study of the impact of legislation relating to company taxes upon financial leverage choices is not an exception to the rule. However, the methods for making quantitative analyses often engender much less agreement.

In this paper we suggest an empirical framework able to shed some light on the effects of policy actions upon tax and financial behavior of companies. In Italy, a tax reform was introduced in 1997-98 with the main aim of reducing the tax advantage of debt, relative to equity, and of stimulating company capitalization. This reform was shortly reversed in 2001 by an alternative reform, thus eliminating the chance of undertaking a "natural experiment". However, given that the two reforms operate through different routes (mainly the relative cost of capital in the first case, and cash flow in the second), it can be of interest to disentangle the relevance of each route in driving companies' financing decisions.

In principle, this kind of analysis could be done in different ways: (*a*) by comparing *ex post* predictions 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 reforms: the reform introduced in 1997-98 was in fact abolished before its full implementation, and the new 2001 reform is still in progress. We decided therefore to adopt approach (*b*) by using alternative microsimulations to assess the impact of the two alternative

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reforms on the tax explanatory variables of a behavioral model of companies' borrowing choices.

By so doing we follow a partial approach that does not account for the feedback effects going from the firms' debt choices (modified by the fiscal reforms) to the macroeconomic scenario that, in turn, should modify firms taxation and financial choices of an amount that depends on their reactivity to macro impulses. However, a pure macroeconometric model, that would embody such feedback effects, lacks of micro-information about companies balance-sheets. Therefore, the macro (general-equilibrium) approach is not able to appropriately model the tax code language (unless very tight assumptions are made), and so to deliver satisfying answers to the policymaker questions about the firms capital structure effects of a corporate tax reform.[2]

The paper is set out as follows. Section 2 describes the main features of a microsimulation model (MATIS) capable of taking into account the complex interaction of the various aspects of tax law for a sample of about 20,000 Italian companies. Section 3 analyses the MATIS model ability in predicting the companies account data on tax payments over the period 1982-1999. Section 4 introduces the main features of the two reforms under scrutiny. In Section 5 companies' financial behavior is explained by an empirical representation of the modified pecking order (MPO) model, developed in a previous paper by the authors, see Bontempi, Giannini and Golinelli (2004). Section 6 presents several MATIS simulations scenarios designed to measure the effects on the companies' taxation of the two tax reforms under scrutiny, and in Section 7 the impact of each fiscal scenario on firms' debt choices is assessed through our MPO financial model. Section 8 concludes by summarizing our main findings and suggests possible developments for future research.

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[2] For surveys about pros and cons of the micro and macro modeling approach see Golinelli and Mantovani (1992), and Higson and Holly (1990).

2. The MATIS micro-simulation model of corporate taxation

MATIS (Modello per l'Analisi della Tassazione e degli Incentivi delle Società) is a micro-simulation model for the calculation of the tax burden on companies in Italy. The data base is a wide unbalanced sample of about 24,796 companies' accounting balance sheets over the period 1982-99, extracted from CADS (Centrale dei Bilanci) data base. This data base contains very detailed information on individual companies' accounting items, which are used, along with the details from the tax code, to approximate the basis of the major taxes levied on companies and the consequent overall tax burden.

The model is recursive and not behavioral: the tax burden and its changes over time are computed without modeling reactions by companies which in turn would change the relevant items to compute the tax base, thus making the latter partly endogenous. To consider these effects one should include properly estimated behavioral equations, which is a plan for future research.

Table 1 summarizes the several changes occurred in the tax legislation of companies since the beginning of 1980s. After a period of progressive increase in the tax burden on companies, two major reforms were enacted, going in the opposite direction. To simplify we will label them the "V reform" introduced by the left-wing government in 1997-98 and the "T reform", subsequently enacted by the right-wing government since the second half of 2001. As we will see later on, neither of these reforms has been completed. The first one was progressively dismantled by the new government elected in 2001, and the second has not yet made any progress concerning the abolition of Irap.

Table 1 here

MATIS simulates the following taxes and contribution over the sample period 1982-99:

a) the corporation tax (Irpeg);
b) the local income tax (Ilor);

c) social security contributions for health expenditure;

d) the net wealth tax;

e) the regional tax on value added (Irap);

f) the Dual income tax (Dit).

For example, the corporate tax burden (T_{IRPEG}) is computed as follows:

$$T_{IRPEG} = \tau\, IMP_{IRPEG} - Cr \qquad (1)$$

where τ is the corporate tax rate, Cr are tax credits and the IMP_{IRPEG} is the corporate tax base:

$$IMP_{IRPEG} = [U(P)_{CE} + T_{IND} - Cr] + CrD - RIP_{IRPEG} \qquad (2)$$

As shown in expression (2), the corporate tax base is derived by firstly adding to accounting profits (losses) ($U(P)_{CE}$) non deductible taxes (T_{IND}) and subtracting tax credits (Cr). This before-tax income is further increased by considering the tax credit on dividends (CrD), included in the corporate tax base, and by allowing for the possibility of carrying forward tax losses for five years (RIP_{IRPEG}).

In the presence of the Dit system, the corporate tax burden is

$$T_{IRPEG} = \tau\, (IMP_{IRPEG} - IMP_{DIT}) + t_d\, IMP_{DIT} - Cr \qquad (3)$$

where: IMP_{DIT} is the share of the corporate tax base that is taxed with the lower rate t_d.

By considering all the aspects of the tax legislation, we have:

over the period 1997-2000:

$$IMP_{DIT} = min[RO+RIP_{DIT}\,;\, 0.556\, IMP_{IRPEG}] \qquad (4)$$

and in 2001, when the minimum average tax rate of 27 per cent was abolished:

$$IMP_{DIT} = min[RO+RIP_{DIT}\,;\, IMP_{IRPEG}] \qquad (5)$$

Thus, IMP_{DIT} is computed by taking into account the method adopted to obtain the ordinary return (RO)[3], the possibility of carrying forward for five years that part of ordinary

[3] The notional interest rate fixed by the tax authorities is applied to the definition of incremental equity, as contained in the tax legislation. The details of the data base allowed a fairly precise calculation of these increments in equity capital, considering also the most important limitation introduced in the legislation to prevent tax avoidance.

income which has not been able to benefit for the reduced rate (RIP_{DIT}), and, up to 2000, the constraint that set a floor for the average tax rate equal to 27%.

Along with the DIT tax, the introduction of regional tax Irap was the other major innovation of the V reform. The base of this tax is 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 one hand, and costs for intermediate goods and services and depreciation on the other. Neither labor costs nor interest payments are deductible from the Irap tax base.

In the MATIS model the tax base is computed by summing up 130 positive and negative items to obtain a definition of "value added" as close as possible to the one defined in the tax code.

Similar interaction of the information contained in the tax code and those made available by the balance sheets in our sample were used to compute the tax burden of the other taxes and contributions levied on companies in the period considered.

The dimension of the MATIS microsimulation model consists of about 7 Gb of basic balance-sheet data, transformed in about 800 Mb of MATIS input data, that are elaborated by a specific Stata program procedure for each of the six types of taxation listed above (a procedure consists of about 500 program lines).

The way in which the model computes the tax burden on companies allows: (a) to simulate the effects on each companies' balance sheet of the tax legislation actually in force each year (historical simulation); (b) to simulate the effects on companies' tax burden of alternative tax reforms hypotheses (counterfactual simulation). Moreover, MATIS provides effective tax rates that are used to construct a measure of the relative cost of capital which, in turn, is employed, along with variations of cash flow, to estimate the effects of taxes and of tax reforms on companies' leverage (see Bontempi, Giannini and Golinelli, 2004).

3. The predictive ability of the MATIS model

The MATIS model has, along with various advantages, also important limitations. In particular, it is well known that for properly estimating the individual company's tax burden one should have access to individual tax return data, which are unfortunately not available. Moreover, MATIS cannot take into account the behavior of companies devoted to avoid or evade taxes.

Qualitatively, the effects of these limitations can be statistically offset by the huge heterogeneity and by the large number of the cases analyzed, thus delivering adequate predictions of the amount of taxes effectively paid by companies. In what follows, we present specific econometric tests to assess for the forecasting ability of MATIS historical simulations (over the period 1982-1999). The test-regression is:

$$T^a(j)_{it} = \alpha + \beta\, T^p(j)_{it} + \varepsilon^p(j)_{it} \qquad (6)$$

where: T is the amount of j^{th} type of tax paid by the i^{th} firm at time t; a and p mean respectively actual (balance-sheet) and predicted (by MATIS microsimulations) data; α and β are parameters. Finally, $\varepsilon^p(j)_{it}$ are the prediction errors, supposed to be random variables with zero mean, and $\sigma^2(j)_i$ variance that varies by type of tax j and by firm i. The hypothesis of prediction errors heteroskedasticity is due to the largely different amounts paid by each firm for each type of tax because of very different firm sizes and tax relevance.

The predictions $T^p(j)_{it}$ are obtained by model microsimulations, stylized as the *MATIS[.]* function:

$$T^p(j)_{it} = MATIS\,[\,\tau(j)_{code,t}\,;\, IMP(j)_{it}\,;\, u(j)_{it}] \qquad (7)$$

where: $\tau(j)_{code,t}$ are the statutory rates of the j^{th} tax (varying over time); and $IMP(j)_{it}$ are the tax bases, specific by tax type, firm, and time. The tax code is modeled by the structure of MATIS model with possible errors of measurement and approximations summarized by the $u(j)_{it}$ term in the equation (7). The presence of $u(j)_{it}$ in $T^p(j)$ implies that the explanatory

variable of equation (6) is correlated with the error term $\varepsilon^{p}(j)$, *i.e.* the equation (6) is a classical case of regression with errors-in-variables.

The MATIS predictions are unbiased if $\alpha = 0$ and $\beta = 1$; these two hypotheses can be adequately tested only if consistent estimates of the parameters (and the corresponding standard errors) of equation (6) are obtained. Thus, we use the instrumental variables (IV) estimator, which delivers consistent parameter estimates in presence of regressors correlated with the error term (provided that valid instruments are used). In order to be valid in the equation (6) case, instrumental variables must be: *a)* relevant, *i.e.* related with the components of $T^{p}(j)$ different to the errors $u(j)_{it}$; *b)* exogenous, *i.e.* unrelated with the prediction error $\varepsilon^{p}(j)_{it}$. The statutory tax rates $\tau(j)_{code}$ at time *t*, and one-period-lags of the MATIS predictions and of the principal components of the tax base are the natural candidates for instrumenting $T^{p}(j)_{it}$.

All inference problems due to the heteroskedasticity of the errors in the equation (6) are tackled by using consistent estimators of the $\varepsilon^{p}(j)_{it}$ variance that allows for different error variability by firm and by type of taxation.

A battery of different tests is available for corroborating our specification hypotheses. The weak exogeneity test (see Hausman, 1978) checks if we have to use the IV instead of the OLS estimator by testing for the exogeneity of MATIS predictions in equation (6). The weak instruments test (see Stock, Wright and Yogo, 2002), and the *J* test for the overidentifying restrictions (see Hansen, 1982) assess the relevance and the exogeneity of the instruments in heteroskedastic regressions.[4]

The predictive ability of MATIS model is tested for two types of taxation: *1)* the tax on income TI (by summing the corporate tax, Irpeg, the local tax, Ilor, and, since 1997, the

[4] For a survey of these issues and the Stata implementation of specific procedures see Baum, Schaffer and Stillman (2003), whose efforts greatly simplified our work.

dual income tax, Dit);[5] and *2)* the net wealth tax TW (since 1992). Results are presented in Table 2: the upper part is devoted to the TI case; the lower part to the TW case.

Table 2 here

Of the 225,333 MATIS predictions Table 2 focuses on non-zero cases only; other observations are lost because of the IV estimation approach, of missing accounting tax data (mainly in the TW case), and of the different length of the period in which each tax was in force.[6]

Along the different columns of Table 2, the equation (6) is estimated in different samples. In particular: the first column reports the results obtained for the whole sample; columns 2-4 split the whole period in three sub-samples corresponding to the main "vintages" of the Italian tax code; finally, the last three columns assess MATIS predictive ability in the sub-samples used for the simulation experiments described in Section 6.

As far as TI is concerned, statistical results reported along the different rows suggest the very good ability of MATIS predictions to explain the variability of actual data (despite the high number of observations, about the 87-91% of the tax payments variability is explained by MATIS simulations). Specification tests suggest, with few exceptions, that IV is the more appropriate estimation method for the parameters in the equation (6), and that the

[5] The availability of accounting data on Irap payments is very scarce (1213 cases in 1998, and 1440 cases in 1999). In fact, the Irap balance-sheet item was introduced in CADS dataset very recently; moreover, the last two years of the sample are affected by low updating coverage. Thus, we preferred to exclude Irap tax from the TI MATIS formal evaluation by equation (6), and to make a qualitative assessment, conditional to the small available sample of data. Overall, the good predictive ability of MATIS is evident (further results are available upon request).

[6] Over the whole sample period, the zero-TI cases are on average the 12.7% of the total; MATIS correctly predicted the 64.3% of these zeros. In the TW-case the same kind of analysis is prevented by the low representative sample available for this kind of tax.

instruments we used are valid (both relevant and exogenous).[7] Finally the 95% confidence intervals of the α and β estimates are reported. The forecasting unbiasedness hypothesis requires that $\alpha = 0$ and $\beta = 1$. The α intervals contain zero in the whole sample case, and in four (out of six) sub-samples. Parameter β estimates are not statistically different from 1 in two sub-samples, and, even when they are[8], their upper bounds estimates are very close to 1. Therefore, we can suppose that the overall MATIS forecasting ability is acknowledged. The slight overestimation could be due the presence of overall negative changes imputed to accounting profits, in order to determine the tax base, which cannot be properly measured without information from tax return data. These changes might also include tax planning and tax avoidance activities operated by firms in order to lower the tax burden.

As far as the TW-case is concerned, we obtained similar results, with the only exception that MATIS predictions seem to slightly underestimate the actual tax payments.[9] This result is due to the fact that the net-wealth-tax accounting item sometimes includes other non-income-taxes, such as local taxes on buildings.

4. Two alternative tax reforms

As mentioned in Section 2, the corporate tax code in Italy has undergone several changes in recent years. The most important changes have been: on the one hand the introduction of the Dual Income Tax system (Dit) in 1997 and, on the other, the abolition of

[7] The instruments we used are: the one-period lagged MATIS predictions, the statutory Irpeg tax rates, and one-year-lags of both pre-tax income and non-debt-tax-shields.

[8] The statistical significance of parameter estimates is a natural consequence of the huge number of observations that permits a great precision in estimating.

[9] In the TW case, the instruments are: the MATIS predictions in the previous year, the statutory net wealth tax rates, and one-year-lags of paid-up share capital, of reserves, and of retained profits.

Ilor, the net wealth tax, social contributions for health expenditure and their substitution with Irap in 1998.

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 capitalization of Italian firms (Bordignon, Giannini and Panteghini, 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 from 37% to 35%, in 2003, was envisaged.

Prior to its full implementation, this reform was substantially reversed by the new government following the 2001 election. Italy's new government soon abolished the Dit system for new equity financing, and progressively restricted the effect of the equity benefit also on past equity financed investment up to the complete abolition of the Dual system in 2004. The new system enacted by the government marks a return to a flat corporate tax rate, reduced to 33% in 2004. In addition, the Irap tax is planned to be gradually abolished. The first objective was fairly easily achieved without detrimental effects on tax revenue: the reduction in the statutory rate was compensated by an increase in the tax base and particularly the abolition of the Dit allowance. This is not the case, however, with the abolition of Irap, which provides more than 30 billion euros of revenue, an amount higher than the corporate tax revenue. According to the law on fiscal reform approved by the Parliament in April 2003 (law 80/2003), 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. A first step should have been the reduction of the labor cost

component of the tax base, envisaged as a 20% deduction in the first presentation of the reform. However, no concrete step has yet been made in this direction.

Neither the V nor the T reform have been fully implemented. However, a comparison of the two envisaged systems is particularly interesting, above all with respect to their effect on companies' leverage. In fact, the V reform was enacted having, as a major purpose, to stimulate companies' capitalization. This was done by highly reducing the relative cost of equity versus debt. On the contrary, the abolition of the DIT, with the T reform, went in the opposite direction.

For a correct valuation of the two reforms it must be recognized that the relative cost of debt versus equity finance is not the only fiscal factor affecting leverage decisions.

According to previous work by the authors (Bontempi, Giannini and Golinelli, 2004), along with this fiscal factor, also changes in the actual tax burden might affect leverage decisions. The next section briefly illustrates the model used to estimate the effects of taxes on corporate financial choices. This is a MPO model that nesting the TO and PO theory include both a relative price and an income effect of taxes on corporate leverage.

5. The MPO model of leverage decisions

We measure leverage as the short- and long-term bank-borrowing over total net assets: this choice is discussed in Bontempi, Giannini and Golinelli (2004); short-term debt represents more than 80% of total bank-debt.

The MPO model explains the Italian companies' debt-ratios by nesting both trade-off (TO) and pecking-order (PO) leverage determinants in the same econometric specification. As a result, firms may modify their leverage position not only in order to readjust to their long–term target (TO-effects), but also because they need short-term external funding (PO-effects). The MPO empirical model for company *i* at time *t* can be written as follows:

$$\Delta d_{it} = c_1\, casha_{it} + c'\, fcf^*_{it} + a\, d_{it-1} + b_1\, ccnsitd_{it-1} + b'\, trade^*_{it-1} + u_{it} \qquad (8)$$

In the short run, the debt-ratio in first-differences (Δd_{it}) follows two sources of impulses. The first comes from PO proxy variables for the so-called "*free cash flow*" , i.e. internal funds in excess of investment opportunities and/or liquidity reserves scheduled. The PO determinants are net-of-taxes cash-flow ($casha_{it}$) and the vector of the other PO determinants fcf^*_{it}: profitable investment projects, both tangible and intangible; financial slack variables, such as cash, liquid assets and marketable securities. The second driving force of short-run movements is an equilibrium-correction mechanism of the actual debt-ratio towards the long-run target debt-ratio. The target debt-ratio is a function of the variables that measure the TO determinants: the relative cost of capital ($ccnsitd_{it-1}$) and the vector of the other TO determinants ($trade^*_{it-1}$): fiscal (except $ccnsitd_{it-1}$), failure, agency, and signalling variables. The error-term $u_{it} = \mu_i + \lambda_t + \varepsilon_{it}$ represents individual, time and random unobservable components. Vectors b and c , and scalars a, b_1 and c_1 are unknown parameters.

Cash flow *casha* (trough tax liabilities on the PO side) and the relative cost of capital *ccnsitd* (though effective tax rates on the TO side) are the direct transmission channels of tax policies on corporate borrowing modeled by a MPO behavior. In addition, the dynamics of the leverage responses to fiscal impulses is driven by the estimate of the a coefficient. Therefore, $casha_t$, $ccnsitd_{t-1}$, d_{t-1} are the "focus variables" and the corresponding c_1, b_1, a parameter estimates are the measures that translate the fiscal impulses, described in Section 6, in the financial responses discussed in Section 7.

6. The microsimulation of fiscal impulses

In order to assess the effect of the 1997-98 and 2001 reforms on MPO fiscal transmission channels $casha_t$, and $ccnsitd_{t-1}$, 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 130,000 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 cases analyzed 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:

$$T^{B} = T_{Irpeg37} + T_{Ilor} + CS + T_{Pat} \quad (9)$$

$$T^{V} = T_{Irpeg19\text{-}35} + T_{Irap} \quad (10)$$

$$T^{T} = T_{Irpeg33} + T_{Irapcl} \quad (11)$$

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% ($T_{Irpeg33}$), and that the Irap tax burden is reduced by subtracting 20% of labor costs from the tax base (T_{Irapcl}). As previously mentioned, the reduction, let alone the abolition, of Irap are still highly uncertain. 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.

As far as relative capital cost is concerned, we have the following formulas for the benchmark B, and the reforms V and T:

$$ccnsitd^B = \frac{1 - t_{sc}}{nsitd + (1 - nsitd)(1 + \frac{t_{spat}}{ieq})} \tag{12}$$

$$ccnsitd^V = \frac{1 - t_{sirpeg35}}{1 - agev} \tag{13}$$

$$ccnsitd^T = 1 - t_{sirpeg33} \tag{14}$$

In the denominator of equation (12) there is the tax on net company wealth (levied at the MATIS simulated rate t_{spat}) that increases the cost of marginal equity financing in the form of retained earnings, but not in the form of subscriptions of capital. Thus, equation (12) weights the two different sources of equity financing with *nsitd*, the percentage of financing by new share issues over the total financing by new equity. t_{spat} is discounted by the Treasury bills interest rate, *ieq*, in order to transform it into a corresponding rate on income, suitable for inclusion in the cost of capital formula.

In equation (12), $t_{sc} = t_{silor} + (1-\beta\ t_{silor})t_{sirpeg}$, 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.

In equations (13) and (14) $t_{sirpeg35}$ and $t_{sirpeg33}$ are the MATIS simulated Irpeg tax rates in the case of the V and T reforms, respectively. In equation (13), the ratio $agev = (0.35 - 0.19)\frac{IMP_{Dit}}{RO + RIP_{Dit}}$ accounts for the possibility of tax exhaustion, which might prevent the firm benefiting from Dit 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%): RO is the opportunity cost of shareholders' funds; RIP_{Dit} is the carry-forward of the fiscal allowance not utilized 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 16% - when firms can use the Dit advantage to the full.

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 (8) through the transmission channels *casha* and *ccnsitd*. They are defined as:[10]

$$\Delta casha^{ms}{}_{it} = -\frac{T_{it}^{ms} - T_{it}^{B}}{A_{it}}, ms = \text{V, T} \tag{15}$$

$$\Delta ccnsitd^{ms}{}_{it} = ccnsitd_{it}^{ms} - ccnsitd_{it}^{B}, \; ms = \text{V, T} \tag{16}$$

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 $ccnsitd_{it}^{B}$.

The company-year tax impulses $\Delta casha^{ms}{}_{it}$ and $\Delta ccnsitd^{ms}{}_{it}$ (ms = V, T) are then averaged out over time (from t that goes from t_1 to t_2) in order to neutralize specific-time effects in the cases belonging to the same company i:

[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 and MacKie-Mason (1990) takes ITC and tax loss carry-forwards as given.

$$\Delta casha_i^{ms} = \frac{1}{(t_2 - t_1 + 1)} \sum_{t=t_1}^{t_2} \Delta casha_{it}^{ms} \tag{17}$$

$$\Delta ccnsitd_i^{ms} = \frac{1}{(t_2 - t_1 + 1)} \sum_{t=t_1}^{t_2} \Delta ccnsitd_{it}^{ms} \tag{18}$$

In particular, we considered two sub-periods (both of six years) of the available time span for each firm[11]: t_1=1988, t_2=1993 and t_1=1994, t_2=1999, in order to control for the effects that different macroeconomic environments might exert on the average tax-impulses by firm.

Table 3 summarizes the main statistics of the changes by company in cash flow ($\Delta casha_i^{ms}$) and in the cost of capital ($\Delta ccnsitd_i^{ms}$) produced by the two reforms (*ms* = V, T) with respect to the benchmark 1996 legislation (B).

Table 3 here

On average, both V and T reforms entail a reduction of the tax burden, *i.e.* an increase in the ratio of cash flow to total assets. In fact, the share of companies with cash flow increases (tax burden reductions) is in the 68-76% range, depending on the reform and the sub-period considered. The distribution between companies of the changes in the tax burden is negatively skewed (*i.e.* the median increase in cash flow is about the half of the mean increase): in both the reforms, the larger portion of firms is concentrated around low and positive cash flow changes. If we compare the cash flow effects by reform, we have that the average cash flow increase is slightly greater under the T reform, while the variability between firms of cash flow changes is virtually the same.

Concerning the changes in the relative cost of debt versus equity, both V and T reforms entail increases (from 96% to 86% of the cases depending on the reform and the sub-period), with respect to the 1996 legislation (B case). However, the rise in the relative cost of capital induced by the V reform is always well above that induced by the T reform (the center

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

of the changes distribution with V reform is about twice than the center with T reform). The variability of the changes in question is bigger in the V case.

By looking now at the difference between the T and V fiscal impulses, it emerges that the former further increases cash flow but reduces the relative cost of debt capital. The first effect 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.

7. 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 firm-averages 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 in equation (8), the MATIS-simulated changes defined in equations (17) and (18) are the measures of 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 those fiscal impulses with the estimates of c_1 and b_1 MPO model parameters. The dynamic nature of the MPO also allows for the assessment of the timing of fiscal effects, depending on the estimate of a parameter in equation (8). In particular, we will assess the impact effect (at horizon zero) in the year of introduction of the reform, the effect after one year, and the long-run effect (when fiscal impulses have exerted their full effect on debt choices).

Given the relevance of the estimation topic in assessing firms' financial responses, Bontempi, Giannini and Golinelli (2004) conducted a wide sensitivity "extreme-bound"

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

analysis (EBA, cfr Leamer, 1985) of the c_1, b_1 and a parameter estimates to alterations of the control variables in the fcf^*_{it} and the $trade^*_{it-1}$ vectors in equation (8).[13] The application of EBA techniques to the MPO model implied the estimation of all the possible combinations of a huge number of alternative explanatory control variables, and produced 2,880 estimates of the three parameters of interest. 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 parameter estimates. In other words, we obtained 2,880 debt-ratio responses for each of the 24,796 firms in our sample.

Overall, the bulk of these responses constitute the thick representation (see Granger and Jeon, 2004) 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 by 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 behavior.

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 run; this effect is monotonically reinforced in the long run (more than 88%), when the relative cost of the capital transmission channel leads to the full utilization 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

[13] The estimation of the MPO model parameters is done by using the dynamic panel instrumental-variables method.

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 analyzed 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 4, the two reforms consecutively reduce the tax burden, albeit by different amounts. In the long run, however, the T reform gradually loses its initial debt-shrinking impetus, because the relative price effect comes into play and works against the initial stimulus of debt reduction. The final two columns of Table 4 disaggregate the percentage of firms reducing debt under the T reform, depending on their behavior 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 behavior.

The ranges of the firms' reducing-debt share (*i.e.* the uncertainty bounds of the thick representation) confirm the average results discussed above. Therefore, in these simulation experiments the results are not affected by the uncertainty about the econometric specification.

Table 5 illustrates the quantitative relevance of the V and T reforms in terms of debt-ratio variations. In order to disentangle the most relevant tax transmission channel, the total effect of the reforms has also been separated in order to distinguish between the effects of cash flow and those of the relative cost of capital.

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 over time.

The difference between the T and V effects enables us to compare the quantitative effects of the two reforms on debt ratios. 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, moreover, the sign is even reversed: the average change of the debt-ratio is positive (0.06%). Note that the uncertainty bounds of the debt-changes induced by V and T reforms are largely overlapping, suggesting the robustness of point (average changes) results to model specification.

As it is clear by focusing separately on the effects of cash flow and the cost of capital, the T reform further reduces the debt ratio compared with the V reform, in so far as it increases cash flow. However, it also widens the gap in favor of debt, by reducing its relative cost. This latter effect gradually overcomes the former as time goes by. In addition, the significance of the difference between the relative cost of capital effects on debt in V and T reforms is further stressed by almost-not-overlapping uncertainty ranges in the last two columns of Table 5.

Figure 1 offers a picture of the long-run changes in the debt-ratio of all the 20,676 firms - with parameter estimates averaged over the 2,880 outcomes - induced by the shift from the T to the V reform. The figure summarizes 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 1 here

The results in Table 5, that refer to the whole sample of about 20,000 firms, are further detailed in Table 6, where the long run effects on debt-ratios of V and T reforms are summarized for a number of sub-samples (groups) by firms' size (measured by classes of employees) and geographical location (identified by grouping Italian regions in north-west, north-east, center, and south-islands).

Table 6 here

Overall, Table 6 delivers two main outcomes.

First, both the reforms are more effective to stimulate firms' capitalization in the larger companies of northern regions. However, this result is considerably less clear-cut if we account for largely overlapping uncertainty ranges: with both the reforms, only the firms belonging to southern regions group show significantly lower deviations than those in the rest of Italy. In addition, the southern regions case is the only where, in the V reform, the relative cost of capital effect significantly overcomes the cash flow effect. Despite the overlapping-ranges *caveat*, it is worth noting that, with both V and T reform, cash flow impulse towards capitalization grows with firms size, while the relative cost of capital stimulus from the V reform is slightly decreasing with firms size, and is quite constant in the T reform.

Second, the two transmission channels of both reforms act by group in the same way as for the whole sample. In fact, with the southern-firms exception, the cash flow channel is generally more effective than the relative cost of capital channel in inducing firms to reduce their debt-ratios. However, with the V reform, the gap between the two effects is very narrow (with partially overlapping ranges). This latter finding is mainly explained by the parameter poolability hypothesis in estimating our MPO model which, in turn, implies that all the firms have the same behavioral responses to the fiscal impulses (*i.e.* each of the 2,880 parameter estimates set is the same for all the companies). Therefore, the different effects on debt-ratios in the different sub-samples of Table 6 depend on the firm-specific fiscal impulses, and on how their components (cash-flow and cost of capital impulses) mix within each firm, also taking into account for the possibility of exhaustion.

8. Concluding remarks

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 behavior 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 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 average 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 characterized by equal cash flow), the increase in the debt-asset ratio would be much higher: approximately 0.38%.

In general, we can conclude that 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 behavior is widespread (see also Bontempi, Giannini and Golinelli, 2004). 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. 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.

In addition, financing effects in sub-samples can be further investigated by relaxing the poolability hypothesis of the parameters of the MPO model, and by allowing for heterogeneous behaviors of firms belonging to different groups. However, in order to avoid arbitrariness in the sub-samples definition, the split of the whole sample in groups must be validated by starting from disaggregated (firm-specific) parameter estimates, and then by testing for the poolability of the micro-parameters, in a sort of bottom-up approach. It is worth noting that the empirical implementation of such methodology requires time spans of firms data longer than whose actually used in the present study.

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Corporate tax reforms and financial choices: an empirical analysis

by

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Abstract

The aim of this paper is to assess the effect of different types of corporate tax reforms, recently implemented in Italy, on the debt choices of companies. To do so, we merge the information of a micro-simulation corporate tax-model (MATIS), with an empirical representation of the modified pecking order model, and we apply this analytical framework to a panel of Italian manufacturing companies. Main results suggest that: *(a)* the Italian fiscal code of the period 1982-1999 is well implemented by MATIS model, which delivers reliable predictions of fiscal account data for a sample of about 20,000 companies; *(b)* the reforms analyzed are able to induce similar reductions in firms' leverage, when compared with the situation prevailing before tax reforms. However, the routes through which the two reforms operate are different (mainly relative cost of capital in the first case, cash flow in the second), tracing some important differences in the overall evaluation of the two normative changes.

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1. Introduction[1]

There is a large agreement that forecasts and quantitative policy analyses are at the heart of the policymaking process. In fact, a large number of economic policy issues require a prediction, and the study of the impact of legislation relating to company taxes upon financial leverage choices is not an exception to the rule. However, the methods for making quantitative analyses often engender much less agreement.

In this paper we suggest an empirical framework able to shed some light on the effects of policy actions upon tax and financial behavior of companies. In Italy, a tax reform was introduced in 1997-98 with the main aim of reducing the tax advantage of debt, relative to equity, and of stimulating company capitalization. This reform was shortly reversed in 2001 by an alternative reform, thus eliminating the chance of undertaking a "natural experiment". However, given that the two reforms operate through different routes (mainly the relative cost of capital in the first case, and cash flow in the second), it can be of interest to disentangle the relevance of each route in driving companies' financing decisions.

In principle, this kind of analysis could be done in different ways: (*a*) by comparing *ex post* predictions 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 reforms: the reform introduced in 1997-98 was in fact abolished before its full implementation, and the new 2001 reform is still in progress. We decided therefore to adopt approach (*b*) by using alternative microsimulations to assess the impact of the two alternative

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reforms on the tax explanatory variables of a behavioral model of companies' borrowing choices.

By so doing we follow a partial approach that does not account for the feedback effects going from the firms' debt choices (modified by the fiscal reforms) to the macroeconomic scenario that, in turn, should modify firms taxation and financial choices of an amount that depends on their reactivity to macro impulses. However, a pure macroeconometric model, that would embody such feedback effects, lacks of micro-information about companies balance-sheets. Therefore, the macro (general-equilibrium) approach is not able to appropriately model the tax code language (unless very tight assumptions are made), and so to deliver satisfying answers to the policymaker questions about the firms capital structure effects of a corporate tax reform.[2]

The paper is set out as follows. Section 2 describes the main features of a microsimulation model (MATIS) capable of taking into account the complex interaction of the various aspects of tax law for a sample of about 20,000 Italian companies. Section 3 analyses the MATIS model ability in predicting the companies account data on tax payments over the period 1982-1999. Section 4 introduces the main features of the two reforms under scrutiny. In Section 5 companies' financial behavior is explained by an empirical representation of the modified pecking order (MPO) model, developed in a previous paper by the authors, see Bontempi, Giannini and Golinelli (2004). Section 6 presents several MATIS simulations scenarios designed to measure the effects on the companies' taxation of the two tax reforms under scrutiny, and in Section 7 the impact of each fiscal scenario on firms' debt choices is assessed through our MPO financial model. Section 8 concludes by summarizing our main findings and suggests possible developments for future research.

[2] For surveys about pros and cons of the micro and macro modeling approach see Golinelli and Mantovani (1992), and Higson and Holly (1990).

2. The MATIS micro-simulation model of corporate taxation

MATIS (Modello per l'Analisi della Tassazione e degli Incentivi delle Società) is a micro-simulation model for the calculation of the tax burden on companies in Italy. The data base is a wide unbalanced sample of about 24,796 companies' accounting balance sheets over the period 1982-99, extracted from CADS (Centrale dei Bilanci) data base. This data base contains very detailed information on individual companies' accounting items, which are used, along with the details from the tax code, to approximate the basis of the major taxes levied on companies and the consequent overall tax burden.

The model is recursive and not behavioral: the tax burden and its changes over time are computed without modeling reactions by companies which in turn would change the relevant items to compute the tax base, thus making the latter partly endogenous. To consider these effects one should include properly estimated behavioral equations, which is a plan for future research.

Table 1 summarizes the several changes occurred in the tax legislation of companies since the beginning of 1980s. After a period of progressive increase in the tax burden on companies, two major reforms were enacted, going in the opposite direction. To simplify we will label them the "V reform" introduced by the left-wing government in 1997-98 and the "T reform", subsequently enacted by the right-wing government since the second half of 2001. As we will see later on, neither of these reforms has been completed. The first one was progressively dismantled by the new government elected in 2001, and the second has not yet made any progress concerning the abolition of Irap.

Table 1 here

MATIS simulates the following taxes and contribution over the sample period 1982-99:

a) the corporation tax (Irpeg);
b) the local income tax (Ilor);

c) social security contributions for health expenditure;

d) the net wealth tax;

e) the regional tax on value added (Irap);

f) the Dual income tax (Dit).

For example, the corporate tax burden (T_{IRPEG}) is computed as follows:

$$T_{IRPEG} = \tau\, IMP_{IRPEG} - Cr \qquad (1)$$

where τ is the corporate tax rate, Cr are tax credits and the IMP_{IRPEG} is the corporate tax base:

$$IMP_{IRPEG} = [U(P)_{CE} + T_{IND} - Cr] + CrD - RIP_{IRPEG} \qquad (2)$$

As shown in expression (2), the corporate tax base is derived by firstly adding to accounting profits (losses) ($U(P)_{CE}$) non deductible taxes (T_{IND}) and subtracting tax credits (Cr). This before-tax income is further increased by considering the tax credit on dividends (CrD), included in the corporate tax base, and by allowing for the possibility of carrying forward tax losses for five years (RIP_{IRPEG}).

In the presence of the Dit system, the corporate tax burden is

$$T_{IRPEG} = \tau\,(IMP_{IRPEG} - IMP_{DIT}) + t_d\, IMP_{DIT} - Cr \qquad (3)$$

where: IMP_{DIT} is the share of the corporate tax base that is taxed with the lower rate t_d.

By considering all the aspects of the tax legislation, we have:

over the period 1997-2000:

$$IMP_{DIT} = min[RO + RIP_{DIT}\ ;\ 0.556\ IMP_{IRPEG}] \qquad (4)$$

and in 2001, when the minimum average tax rate of 27 per cent was abolished:

$$IMP_{DIT} = min[RO + RIP_{DIT}\ ;\ IMP_{IRPEG}] \qquad (5)$$

Thus, IMP_{DIT} is computed by taking into account the method adopted to obtain the ordinary return (RO)[3], the possibility of carrying forward for five years that part of ordinary

[3] The notional interest rate fixed by the tax authorities is applied to the definition of incremental equity, as contained in the tax legislation. The details of the data base allowed a fairly precise calculation of these increments in equity capital, considering also the most important limitation introduced in the legislation to prevent tax avoidance.

income which has not been able to benefit for the reduced rate (RIP_{DIT}), and, up to 2000, the constraint that set a floor for the average tax rate equal to 27%.

Along with the DIT tax, the introduction of regional tax Irap was the other major innovation of the V reform. The base of this tax is 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 one hand, and costs for intermediate goods and services and depreciation on the other. Neither labor costs nor interest payments are deductible from the Irap tax base.

In the MATIS model the tax base is computed by summing up 130 positive and negative items to obtain a definition of "value added" as close as possible to the one defined in the tax code.

Similar interaction of the information contained in the tax code and those made available by the balance sheets in our sample were used to compute the tax burden of the other taxes and contributions levied on companies in the period considered.

The dimension of the MATIS microsimulation model consists of about 7 Gb of basic balance-sheet data, transformed in about 800 Mb of MATIS input data, that are elaborated by a specific Stata program procedure for each of the six types of taxation listed above (a procedure consists of about 500 program lines).

The way in which the model computes the tax burden on companies allows: (a) to simulate the effects on each companies' balance sheet of the tax legislation actually in force each year (historical simulation); (b) to simulate the effects on companies' tax burden of alternative tax reforms hypotheses (counterfactual simulation). Moreover, MATIS provides effective tax rates that are used to construct a measure of the relative cost of capital which, in turn, is employed, along with variations of cash flow, to estimate the effects of taxes and of tax reforms on companies' leverage (see Bontempi, Giannini and Golinelli, 2004).

3. The predictive ability of the MATIS model

The MATIS model has, along with various advantages, also important limitations. In particular, it is well known that for properly estimating the individual company's tax burden one should have access to individual tax return data, which are unfortunately not available. Moreover, MATIS cannot take into account the behavior of companies devoted to avoid or evade taxes.

Qualitatively, the effects of these limitations can be statistically offset by the huge heterogeneity and by the large number of the cases analyzed, thus delivering adequate predictions of the amount of taxes effectively paid by companies. In what follows, we present specific econometric tests to assess for the forecasting ability of MATIS historical simulations (over the period 1982-1999). The test-regression is:

$$T^{a}(j)_{it} = \alpha + \beta\, T^{p}(j)_{it} + \varepsilon^{p}(j)_{it} \qquad (6)$$

where: T is the amount of j^{th} type of tax paid by the i^{th} firm at time t; a and p mean respectively actual (balance-sheet) and predicted (by MATIS microsimulations) data; α and β are parameters. Finally, $\varepsilon^{p}(j)_{it}$ are the prediction errors, supposed to be random variables with zero mean, and $\sigma^{2}(j)_{i}$ variance that varies by type of tax j and by firm i. The hypothesis of prediction errors heteroskedasticity is due to the largely different amounts paid by each firm for each type of tax because of very different firm sizes and tax relevance.

The predictions $T^{p}(j)_{it}$ are obtained by model microsimulations, stylized as the *MATIS[.]* function:

$$T^{p}(j)_{it} = MATIS\,[\ \tau(j)_{code,t}\ ;\ IMP(j)_{it}\ ;\ u(j)_{it}] \qquad (7)$$

where: $\tau(j)_{code,t}$ are the statutory rates of the j^{th} tax (varying over time); and $IMP(j)_{it}$ are the tax bases, specific by tax type, firm, and time. The tax code is modeled by the structure of MATIS model with possible errors of measurement and approximations summarized by the $u(j)_{it}$ term in the equation (7). The presence of $u(j)_{it}$ in $T^{p}(j)$ implies that the explanatory

variable of equation (6) is correlated with the error term $\varepsilon^{p}(j)$, *i.e.* the equation (6) is a classical case of regression with errors-in-variables.

The MATIS predictions are unbiased if $\alpha = 0$ and $\beta = 1$; these two hypotheses can be adequately tested only if consistent estimates of the parameters (and the corresponding standard errors) of equation (6) are obtained. Thus, we use the instrumental variables (IV) estimator, which delivers consistent parameter estimates in presence of regressors correlated with the error term (provided that valid instruments are used). In order to be valid in the equation (6) case, instrumental variables must be: *a)* relevant, *i.e.* related with the components of $T^{p}(j)$ different to the errors $u(j)_{it}$; *b)* exogenous, *i.e.* unrelated with the prediction error $\varepsilon^{p}(j)_{it}$. The statutory tax rates $\tau(j)_{code}$ at time *t*, and one-period-lags of the MATIS predictions and of the principal components of the tax base are the natural candidates for instrumenting $T^{p}(j)_{it}$.

All inference problems due to the heteroskedasticity of the errors in the equation (6) are tackled by using consistent estimators of the $\varepsilon^{p}(j)_{it}$ variance that allows for different error variability by firm and by type of taxation.

A battery of different tests is available for corroborating our specification hypotheses. The weak exogeneity test (see Hausman, 1978) checks if we have to use the IV instead of the OLS estimator by testing for the exogeneity of MATIS predictions in equation (6). The weak instruments test (see Stock, Wright and Yogo, 2002), and the *J* test for the overidentifying restrictions (see Hansen, 1982) assess the relevance and the exogeneity of the instruments in heteroskedastic regressions.[4]

The predictive ability of MATIS model is tested for two types of taxation: *1)* the tax on income TI (by summing the corporate tax, Irpeg, the local tax, Ilor, and, since 1997, the

[4] For a survey of these issues and the Stata implementation of specific procedures see Baum, Schaffer and Stillman (2003), whose efforts greatly simplified our work.

dual income tax, Dit);[5] and *2)* the net wealth tax TW (since 1992). Results are presented in Table 2: the upper part is devoted to the TI case; the lower part to the TW case.

Table 2 here

Of the 225,333 MATIS predictions Table 2 focuses on non-zero cases only; other observations are lost because of the IV estimation approach, of missing accounting tax data (mainly in the TW case), and of the different length of the period in which each tax was in force.[6]

Along the different columns of Table 2, the equation (6) is estimated in different samples. In particular: the first column reports the results obtained for the whole sample; columns 2-4 split the whole period in three sub-samples corresponding to the main "vintages" of the Italian tax code; finally, the last three columns assess MATIS predictive ability in the sub-samples used for the simulation experiments described in Section 6.

As far as TI is concerned, statistical results reported along the different rows suggest the very good ability of MATIS predictions to explain the variability of actual data (despite the high number of observations, about the 87-91% of the tax payments variability is explained by MATIS simulations). Specification tests suggest, with few exceptions, that IV is the more appropriate estimation method for the parameters in the equation (6), and that the

[5] The availability of accounting data on Irap payments is very scarce (1213 cases in 1998, and 1440 cases in 1999). In fact, the Irap balance-sheet item was introduced in CADS dataset very recently; moreover, the last two years of the sample are affected by low updating coverage. Thus, we preferred to exclude Irap tax from the TI MATIS formal evaluation by equation (6), and to make a qualitative assessment, conditional to the small available sample of data. Overall, the good predictive ability of MATIS is evident (further results are available upon request).

[6] Over the whole sample period, the zero-TI cases are on average the 12.7% of the total; MATIS correctly predicted the 64.3% of these zeros. In the TW-case the same kind of analysis is prevented by the low representative sample available for this kind of tax.

instruments we used are valid (both relevant and exogenous).[7] Finally the 95% confidence intervals of the α and β estimates are reported. The forecasting unbiasedness hypothesis requires that $\alpha = 0$ and $\beta = 1$. The α intervals contain zero in the whole sample case, and in four (out of six) sub-samples. Parameter β estimates are not statistically different from 1 in two sub-samples, and, even when they are[8], their upper bounds estimates are very close to 1. Therefore, we can suppose that the overall MATIS forecasting ability is acknowledged. The slight overestimation could be due the presence of overall negative changes imputed to accounting profits, in order to determine the tax base, which cannot be properly measured without information from tax return data. These changes might also include tax planning and tax avoidance activities operated by firms in order to lower the tax burden.

As far as the TW-case is concerned, we obtained similar results, with the only exception that MATIS predictions seem to slightly underestimate the actual tax payments.[9] This result is due to the fact that the net-wealth-tax accounting item sometimes includes other non-income-taxes, such as local taxes on buildings.

4. Two alternative tax reforms

As mentioned in Section 2, the corporate tax code in Italy has undergone several changes in recent years. The most important changes have been: on the one hand the introduction of the Dual Income Tax system (Dit) in 1997 and, on the other, the abolition of

[7] The instruments we used are: the one-period lagged MATIS predictions, the statutory Irpeg tax rates, and one-year-lags of both pre-tax income and non-debt-tax-shields.

[8] The statistical significance of parameter estimates is a natural consequence of the huge number of observations that permits a great precision in estimating.

[9] In the TW case, the instruments are: the MATIS predictions in the previous year, the statutory net wealth tax rates, and one-year-lags of paid-up share capital, of reserves, and of retained profits.

Ilor, the net wealth tax, social contributions for health expenditure and their substitution with Irap in 1998.

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 capitalization of Italian firms (Bordignon, Giannini and Panteghini, 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 from 37% to 35%, in 2003, was envisaged.

Prior to its full implementation, this reform was substantially reversed by the new government following the 2001 election. Italy's new government soon abolished the Dit system for new equity financing, and progressively restricted the effect of the equity benefit also on past equity financed investment up to the complete abolition of the Dual system in 2004. The new system enacted by the government marks a return to a flat corporate tax rate, reduced to 33% in 2004. In addition, the Irap tax is planned to be gradually abolished. The first objective was fairly easily achieved without detrimental effects on tax revenue: the reduction in the statutory rate was compensated by an increase in the tax base and particularly the abolition of the Dit allowance. This is not the case, however, with the abolition of Irap, which provides more than 30 billion euros of revenue, an amount higher than the corporate tax revenue. According to the law on fiscal reform approved by the Parliament in April 2003 (law 80/2003), 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. A first step should have been the reduction of the labor cost

component of the tax base, envisaged as a 20% deduction in the first presentation of the reform. However, no concrete step has yet been made in this direction.

Neither the V nor the T reform have been fully implemented. However, a comparison of the two envisaged systems is particularly interesting, above all with respect to their effect on companies' leverage. In fact, the V reform was enacted having, as a major purpose, to stimulate companies' capitalization. This was done by highly reducing the relative cost of equity versus debt. On the contrary, the abolition of the DIT, with the T reform, went in the opposite direction.

For a correct valuation of the two reforms it must be recognized that the relative cost of debt versus equity finance is not the only fiscal factor affecting leverage decisions.

According to previous work by the authors (Bontempi, Giannini and Golinelli, 2004), along with this fiscal factor, also changes in the actual tax burden might affect leverage decisions. The next section briefly illustrates the model used to estimate the effects of taxes on corporate financial choices. This is a MPO model that nesting the TO and PO theory include both a relative price and an income effect of taxes on corporate leverage.

5. The MPO model of leverage decisions

We measure leverage as the short- and long-term bank-borrowing over total net assets: this choice is discussed in Bontempi, Giannini and Golinelli (2004); short-term debt represents more than 80% of total bank-debt.

The MPO model explains the Italian companies' debt-ratios by nesting both trade-off (TO) and pecking-order (PO) leverage determinants in the same econometric specification. As a result, firms may modify their leverage position not only in order to readjust to their long–term target (TO-effects), but also because they need short-term external funding (PO-effects). The MPO empirical model for company *i* at time *t* can be written as follows:

$$\Delta d_{it} = c_1\, casha_{it} + c'\, fcf^*_{it} + a\, d_{it-1} + b_1\, ccnsitd_{it-1} + b'\, trade^*_{it-1} + u_{it} \qquad (8)$$

In the short run, the debt-ratio in first-differences (Δd_{it}) follows two sources of impulses. The first comes from PO proxy variables for the so-called "*free cash flow*" , i.e. internal funds in excess of investment opportunities and/or liquidity reserves scheduled. The PO determinants are net-of-taxes cash-flow ($casha_{it}$) and the vector of the other PO determinants fcf^*_{it}: profitable investment projects, both tangible and intangible; financial slack variables, such as cash, liquid assets and marketable securities. The second driving force of short-run movements is an equilibrium-correction mechanism of the actual debt-ratio towards the long-run target debt-ratio. The target debt-ratio is a function of the variables that measure the TO determinants: the relative cost of capital ($ccnsitd_{it-1}$) and the vector of the other TO determinants ($trade^*_{it-1}$): fiscal (except $ccnsitd_{it-1}$), failure, agency, and signalling variables. The error-term $u_{it} = \mu_i + \lambda_t + \varepsilon_{it}$ represents individual, time and random unobservable components. Vectors b and c , and scalars a, b_1 and c_1 are unknown parameters.

Cash flow *casha* (trough tax liabilities on the PO side) and the relative cost of capital *ccnsitd* (though effective tax rates on the TO side) are the direct transmission channels of tax policies on corporate borrowing modeled by a MPO behavior. In addition, the dynamics of the leverage responses to fiscal impulses is driven by the estimate of the a coefficient. Therefore, $casha_t$, $ccnsitd_{t-1}$, d_{t-1} are the "focus variables" and the corresponding c_1, b_1, a parameter estimates are the measures that translate the fiscal impulses, described in Section 6, in the financial responses discussed in Section 7.

6. The microsimulation of fiscal impulses

In order to assess the effect of the 1997-98 and 2001 reforms on MPO fiscal transmission channels $casha_t$, and $ccnsitd_{t-1}$, 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 130,000 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 cases analyzed 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:

$$T^{B} = T_{Irpeg37} + T_{Ilor} + CS + T_{Pat} \quad (9)$$

$$T^{V} = T_{Irpeg19\text{-}35} + T_{Irap} \quad (10)$$

$$T^{T} = T_{Irpeg33} + T_{Irapcl} \quad (11)$$

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% ($T_{Irpeg33}$), and that the Irap tax burden is reduced by subtracting 20% of labor costs from the tax base (T_{Irapcl}). As previously mentioned, the reduction, let alone the abolition, of Irap are still highly uncertain. 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.

As far as relative capital cost is concerned, we have the following formulas for the benchmark B, and the reforms V and T:

$$ccnsitd^B = \frac{1 - t_{sc}}{nsitd + (1 - nsitd)(1 + \frac{t_{spat}}{ieq})} \tag{12}$$

$$ccnsitd^V = \frac{1 - t_{sirpeg35}}{1 - agev} \tag{13}$$

$$ccnsitd^T = 1 - t_{sirpeg33} \tag{14}$$

In the denominator of equation (12) there is the tax on net company wealth (levied at the MATIS simulated rate t_{spat}) that increases the cost of marginal equity financing in the form of retained earnings, but not in the form of subscriptions of capital. Thus, equation (12) weights the two different sources of equity financing with *nsitd*, the percentage of financing by new share issues over the total financing by new equity. t_{spat} is discounted by the Treasury bills interest rate, *ieq*, in order to transform it into a corresponding rate on income, suitable for inclusion in the cost of capital formula.

In equation (12), $t_{sc} = t_{silor} + (1-\beta\, t_{silor})t_{sirpeg}$, 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.

In equations (13) and (14) $t_{sirpeg35}$ and $t_{sirpeg33}$ are the MATIS simulated Irpeg tax rates in the case of the V and T reforms, respectively. In equation (13), the ratio $agev = (0.35 - 0.19)\frac{IMP_{Dit}}{RO + RIP_{Dit}}$ accounts for the possibility of tax exhaustion, which might prevent the firm benefiting from Dit 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%): *RO* is the opportunity cost of shareholders' funds; RIP_{Dit} is the carry-forward of the fiscal allowance not utilized 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 16% - when firms can use the Dit advantage to the full.

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 (8) through the transmission channels *casha* and *ccnsitd*. They are defined as:[10]

$$\Delta casha^{ms}{}_{it} = -\frac{T_{it}^{ms} - T_{it}^{B}}{A_{it}}, ms = \text{V, T} \tag{15}$$

$$\Delta ccnsitd^{ms}{}_{it} = ccnsitd_{it}^{ms} - ccnsitd_{it}^{B}, \; ms = \text{V, T} \tag{16}$$

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 $ccnsitd_{it}^{B}$.

The company-year tax impulses $\Delta casha^{ms}{}_{it}$ and $\Delta ccnsitd^{ms}{}_{it}$ (*ms* = V, T) are then averaged out over time (from *t* that goes from t_1 to t_2) in order to neutralize specific-time effects in the cases belonging to the same company *i*:

[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 and MacKie-Mason (1990) takes ITC and tax loss carry-forwards as given.

$$\Delta casha_i^{ms} = \frac{1}{(t_2 - t_1 + 1)} \sum_{t=t_1}^{t_2} \Delta casha_{it}^{ms} \tag{17}$$

$$\Delta ccnsitd_i^{ms} = \frac{1}{(t_2 - t_1 + 1)} \sum_{t=t_1}^{t_2} \Delta ccnsitd_{it}^{ms} \tag{18}$$

In particular, we considered two sub-periods (both of six years) of the available time span for each firm[11]: t_1=1988, t_2=1993 and t_1=1994, t_2=1999, in order to control for the effects that different macroeconomic environments might exert on the average tax-impulses by firm.

Table 3 summarizes the main statistics of the changes by company in cash flow ($\Delta casha_i^{ms}$) and in the cost of capital ($\Delta ccnsitd_i^{ms}$) produced by the two reforms (*ms* = V, T) with respect to the benchmark 1996 legislation (B).

Table 3 here

On average, both V and T reforms entail a reduction of the tax burden, *i.e.* an increase in the ratio of cash flow to total assets. In fact, the share of companies with cash flow increases (tax burden reductions) is in the 68-76% range, depending on the reform and the sub-period considered. The distribution between companies of the changes in the tax burden is negatively skewed (*i.e.* the median increase in cash flow is about the half of the mean increase): in both the reforms, the larger portion of firms is concentrated around low and positive cash flow changes. If we compare the cash flow effects by reform, we have that the average cash flow increase is slightly greater under the T reform, while the variability between firms of cash flow changes is virtually the same.

Concerning the changes in the relative cost of debt versus equity, both V and T reforms entail increases (from 96% to 86% of the cases depending on the reform and the sub-period), with respect to the 1996 legislation (B case). However, the rise in the relative cost of capital induced by the V reform is always well above that induced by the T reform (the center

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

of the changes distribution with V reform is about twice than the center with T reform). The variability of the changes in question is bigger in the V case.

By looking now at the difference between the T and V fiscal impulses, it emerges that the former further increases cash flow but reduces the relative cost of debt capital. The first effect 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.

7. 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 firm-averages 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 in equation (8), the MATIS-simulated changes defined in equations (17) and (18) are the measures of 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 those fiscal impulses with the estimates of c_1 and b_1 MPO model parameters. The dynamic nature of the MPO also allows for the assessment of the timing of fiscal effects, depending on the estimate of a parameter in equation (8). In particular, we will assess the impact effect (at horizon zero) in the year of introduction of the reform, the effect after one year, and the long-run effect (when fiscal impulses have exerted their full effect on debt choices).

Given the relevance of the estimation topic in assessing firms' financial responses, Bontempi, Giannini and Golinelli (2004) conducted a wide sensitivity "extreme-bound"

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

analysis (EBA, cfr Leamer, 1985) of the c_1, b_1 and a parameter estimates to alterations of the control variables in the fcf^*_{it} and the $trade^*_{it-1}$ vectors in equation (8).[13] The application of EBA techniques to the MPO model implied the estimation of all the possible combinations of a huge number of alternative explanatory control variables, and produced 2,880 estimates of the three parameters of interest. 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 parameter estimates. In other words, we obtained 2,880 debt-ratio responses for each of the 24,796 firms in our sample.

Overall, the bulk of these responses constitute the thick representation (see Granger and Jeon, 2004) 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 by 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 behavior.

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 run; this effect is monotonically reinforced in the long run (more than 88%), when the relative cost of the capital transmission channel leads to the full utilization 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

[13] The estimation of the MPO model parameters is done by using the dynamic panel instrumental-variables method.

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 analyzed 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 4, the two reforms consecutively reduce the tax burden, albeit by different amounts. In the long run, however, the T reform gradually loses its initial debt-shrinking impetus, because the relative price effect comes into play and works against the initial stimulus of debt reduction. The final two columns of Table 4 disaggregate the percentage of firms reducing debt under the T reform, depending on their behavior 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 behavior.

The ranges of the firms' reducing-debt share (*i.e.* the uncertainty bounds of the thick representation) confirm the average results discussed above. Therefore, in these simulation experiments the results are not affected by the uncertainty about the econometric specification.

Table 5 illustrates the quantitative relevance of the V and T reforms in terms of debt-ratio variations. In order to disentangle the most relevant tax transmission channel, the total effect of the reforms has also been separated in order to distinguish between the effects of cash flow and those of the relative cost of capital.

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 over time.

The difference between the T and V effects enables us to compare the quantitative effects of the two reforms on debt ratios. 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, moreover, the sign is even reversed: the average change of the debt-ratio is positive (0.06%). Note that the uncertainty bounds of the debt-changes induced by V and T reforms are largely overlapping, suggesting the robustness of point (average changes) results to model specification.

As it is clear by focusing separately on the effects of cash flow and the cost of capital, the T reform further reduces the debt ratio compared with the V reform, in so far as it increases cash flow. However, it also widens the gap in favor of debt, by reducing its relative cost. This latter effect gradually overcomes the former as time goes by. In addition, the significance of the difference between the relative cost of capital effects on debt in V and T reforms is further stressed by almost-not-overlapping uncertainty ranges in the last two columns of Table 5.

Figure 1 offers a picture of the long-run changes in the debt-ratio of all the 20,676 firms - with parameter estimates averaged over the 2,880 outcomes - induced by the shift from the T to the V reform. The figure summarizes 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 1 here

The results in Table 5, that refer to the whole sample of about 20,000 firms, are further detailed in Table 6, where the long run effects on debt-ratios of V and T reforms are summarized for a number of sub-samples (groups) by firms' size (measured by classes of employees) and geographical location (identified by grouping Italian regions in north-west, north-east, center, and south-islands).

Table 6 here

Overall, Table 6 delivers two main outcomes.

First, both the reforms are more effective to stimulate firms' capitalization in the larger companies of northern regions. However, this result is considerably less clear-cut if we account for largely overlapping uncertainty ranges: with both the reforms, only the firms belonging to southern regions group show significantly lower deviations than those in the rest of Italy. In addition, the southern regions case is the only where, in the V reform, the relative cost of capital effect significantly overcomes the cash flow effect. Despite the overlapping-ranges *caveat*, it is worth noting that, with both V and T reform, cash flow impulse towards capitalization grows with firms size, while the relative cost of capital stimulus from the V reform is slightly decreasing with firms size, and is quite constant in the T reform.

Second, the two transmission channels of both reforms act by group in the same way as for the whole sample. In fact, with the southern-firms exception, the cash flow channel is generally more effective than the relative cost of capital channel in inducing firms to reduce their debt-ratios. However, with the V reform, the gap between the two effects is very narrow (with partially overlapping ranges). This latter finding is mainly explained by the parameter poolability hypothesis in estimating our MPO model which, in turn, implies that all the firms have the same behavioral responses to the fiscal impulses (*i.e.* each of the 2,880 parameter estimates set is the same for all the companies). Therefore, the different effects on debt-ratios in the different sub-samples of Table 6 depend on the firm-specific fiscal impulses, and on how their components (cash-flow and cost of capital impulses) mix within each firm, also taking into account for the possibility of exhaustion.

8. Concluding remarks

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 behavior 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 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 average 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 characterized by equal cash flow), the increase in the debt-asset ratio would be much higher: approximately 0.38%.

In general, we can conclude that 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 behavior is widespread (see also Bontempi, Giannini and Golinelli, 2004). 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. 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.

In addition, financing effects in sub-samples can be further investigated by relaxing the poolability hypothesis of the parameters of the MPO model, and by allowing for heterogeneous behaviors of firms belonging to different groups. However, in order to avoid arbitrariness in the sub-samples definition, the split of the whole sample in groups must be validated by starting from disaggregated (firm-specific) parameter estimates, and then by testing for the poolability of the micro-parameters, in a sort of bottom-up approach. It is worth noting that the empirical implementation of such methodology requires time spans of firms data longer than whose actually used in the present study.

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Tab. 1 - Major tax parameters and legislation changes in Italy since 1982

Year	*Major tax parameters and tax changes*
1982	The corporate tax rate was 27 per cent and in addition there was a local tax (Ilor) with a rate of 16.2 per cent. Ilor was deductible from the corporate tax base. The overall tax rate on corporate profit was 38.8 per cent.
1983	The corporate tax rate increased from 27 to 36 per cent.
1991	Ilor was made deductible from the corporate tax base only at 75%.
1992	Ilor was made entirely non deductible from the corporate tax base. A net wealth tax was introduced, with a tax rate of 0.75 per cent. Both retained earnings and subscription of new equity capital were included in the tax base.
1995	The corporate tax rate increased from 36 to 37 per cent.
1996	Subscription of new equity capital was made deductible from the tax base of the net wealth tax.
1997	A new dual income tax system was introduced according to which the opportunity cost of capital in case of new equity financing and retained earning (since 1996) was taxed with a preferential rate of 19 per cent. The average corporate tax rate could not be lower than 27%.
1998	Several taxes on companies were abolished, mostly important: the local income tax (Ilor), the net wealth tax and a social contribution specifically levied on labor income to finance health expenditure. A new regional tax (Irap), levied on a measure of value added of the net income type, was introduced, with a rate of 4.25 per cent. The overall (national and local) tax rate on profits dropped from 53.2 in 1996 to 41.25-31.25 per cent in 1998.
2000	A multiplier was introduced (equal to 1.2) to accelerate the transition from the incremental DIT to a dual system in which the opportunity cost of equity is related to the whole stock of shareholders' equity
2001	The corporate tax rate was decreased from 37% to 36%. The DIT multiplier was increased from 1.2 to 1.4. The minimum average tax rate of 27% was abolished. In the second half of 2001, the newly elected government froze the DIT benefit to the equity increments up to June 2001
2003	The corporate tax rate was further decreased to 34%
2004	The DIT system was completely abolished and the uniform corporate tax rate set at 33%

Tab. 2 – Analysis of MATIS forecasting ability of non-zero tax payments by type of taxation and by subperiods

Income tax	**1982-1999**	**1982-1991**	**1992-1995**	**1996-1999**	**1988-1993**	**1994-1999**	**1988-1999**
Observations	173,462	105,369	41,875	26,218	76,711	44,669	121,380
R^2	0.8829	0.8875	0.9144	0.8603	0.9120	0.8791	0.8896
Specification tests:							
- Hausman test[a]	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
- weak instruments[b] (#)[c]	803.8 (4)	435.5 (3)	251.8 (4)	233.7 (3)	87.22 (4)	492.2 (4)	671.6 (4)
- Hansen *J* test[d]	0.2516	0.3706	0.0010	0.0742	0.3980	0.0462	0.4199
α 95% confidence interval:							
- lower bound	-1.680	5.095	-77.62	22.09	-32.55	-12.78	-2.187
- upper bound	91.75	121.7	81.07	213.6	85.91	144.1	87.58
β 95% confidence interval:							
- lower bound	0.7977	0.6169	0.8566	0.8028	0.8054	0.8164	0.8392
- upper bound	0.9580	0.9103	1.0813	0.9647	1.0529	0.9636	0.9696
Net wealth tax	**1992-1999**		**1992-1995**	**1996-1999**	**1992-1993**	**1994-1999**	**1992-1999**
Observations	4,048		2,106	1,942	532	3,516	4,048
R^2	0.9144		0.9793	0.6289	0.9880	0.8833	0.9144
Specification tests:							
- Hausman test[a]	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
- weak instruments[b] (#)[c]	224.2 (4)		5979 (3)	31.25 (4)	11114 (3)	105.8 (4)	224.2 (4)
- Hansen *J* test[d]	0.0903		0.0810	0.1463	0.5747	0.1082	0.0903
α 95% confidence interval:							
- lower bound	9.122		8.719	-93.85	4.904	4.296	9.122
- upper bound	40.76		30.13	42.17	31.76	42.55	40.76
β 95% confidence interval:							
- lower bound	1.0519		1.0847	1.0296	1.0709	1.0433	1.0519
- upper bound	1.2406		1.1328	2.1164	1.1375	1.2951	1.2406

[a] P-value; under H_0 the regressor is weakly exogenous, *i.e.* the OLS estimator is preferable to IV. [b] F-statistic; 5% c.v. = 11.6 (2 instruments), 12.8 (3 instruments), 15.1 (5 instruments) tabulated in Stock *et al* (2002, p. 522); under H_0 the instruments are not relevant. [c] In brackets, the number of instruments. [d] P-value; under H_0 the instruments are uncorrelated with the error term.

Tab. 3 – Summary statistics of the microsimulated fiscal impulses by firm *i*

	$\Delta casha_i^{ms}$		$\Delta ccnsitd_i^{ms}$	
	ms = V	*ms* = T	*ms* = V	*ms* = T
1988-1993 period (20,676 firms):				
Number of positive changes	14,504 (70.1%)	15,688 (75.9%)	19,238 (93.0%)	18,591 (89.9%)
Number of negative/zero changes	6,172 (29.9%)	4,988 (24.1%)	1,438 (7.0%)	2,085 (10.1%)
Median	0.0021	0.0027	0.3171	0.1663
Mean	0.0044	0.0052	0.2901	0.1419
Standard deviation	0.0084	0.0085	1.5908	0.1023
1994-1999 period (14,545 firms):				
Number of positive changes	9,841 (67.7%)	10,774 (74.1%)	13,013 (89.5%)	12,556 (86.3%)
Number of negative/zero changes	4,704 (32.3%)	3,771 (25.9%)	1,532 (10.5%)	1,989 (13.7%)
Median	0.0021	0.0027	0.3486	0.1861
Mean	0.0046	0.0052	0.2870	0.1519
Standard deviation	0.0088	0.0089	0.4182	0.1011

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-run[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-run parameter estimates of the cash flow effect are negative, 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-run[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)

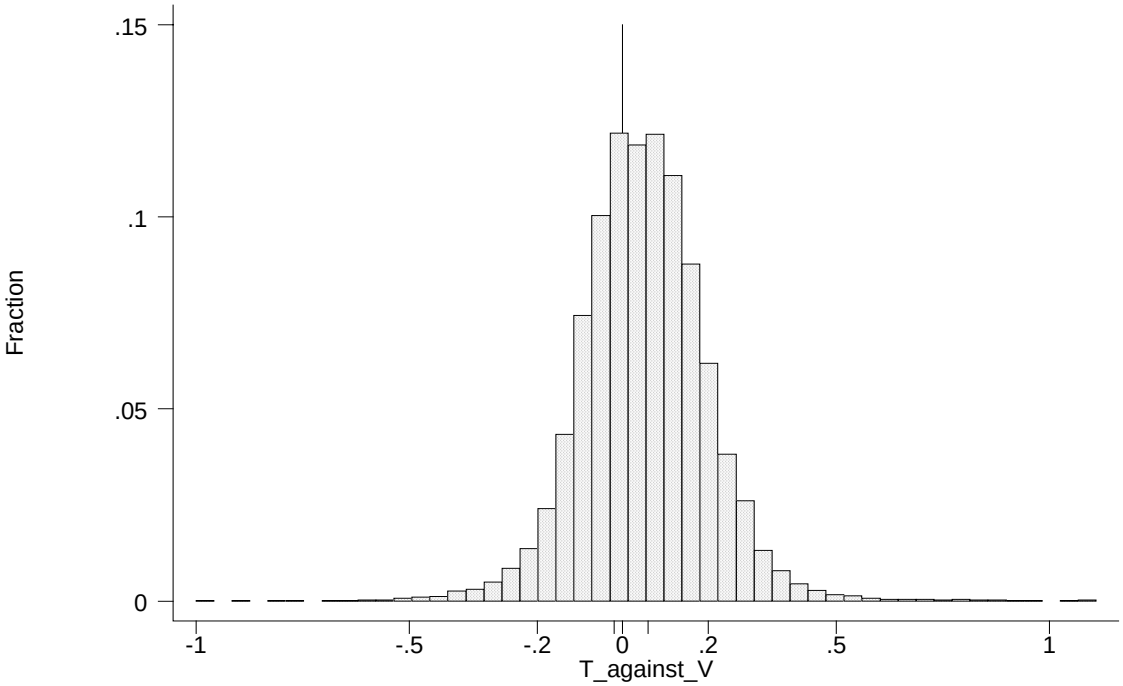
[a] Average debt-ratios changes covering the more than 20,000 firms in our sample, averaged out over the 2,880 outcomes.[b] The lowest and highest average deviations in the 2,880 outcomes. [c] Average of the 2,880 standard deviations, measuring company variability within the 2,880 simulation results.

Tab. 6 – Long-run deviations of debt-ratios from the benchmark in sub-samples

	Total effect		Cash flow effect		Relative cost of capital effect	
	V reform	T reform	V reform	T reform	V reform	T reform
groups by firm size (depending on the number of employees)						
1 - 19[a]	-0.47%	-0.37%	-0.24%	-0.27%	-0.23%	-0.10%
range[b]	*-0.67/ -0.31%*	*-0.53/ -0.26%*	*-0.35/ -0.18%*	*-0.39/ -0.21%*	*-0.34%/ -0.12%*	*-0.15/ -0.05%*
s.d.[c]	(2.44)	(0.53)	(0.49)	(0.50)	(2.37)	(0.07)
20 - 49[a]	-0.47%	-0.42%	-0.27%	-0.32%	-0.20%	-0.10%
range[b]	*-0.67/ -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]	(0.58)	(0.55)	(0.52)	(0.53)	(0.22)	(0.07)
50 - 249[a]	-0.48%	-0.43%	-0.28%	-0.33%	-0.20%	-0.10%
range[b]	*-0.68/ -0.32%*	*-0.62/ -0.31%*	*-0.40/ -0.21%*	*-0.48/ -0.26%*	*-0.29/ -0.11%*	*-0.15/ -0.05%*
s.d.[c]	(0.59)	(0.54)	(0.51)	(0.51)	(0.25)	(0.07)
250 - [a]	-0.51%	-0.47%	-0.33%	-0.38%	-0.19%	-0.09%
range[b]	*-0.73/ -0.35%*	*-0.67/ -0.34%*	*-0.47/ -0.25%*	*-0.55/ -0.29%*	*-0.27/ -0.10%*	*-0.13/ -0.05%*
s.d.[c]	(0.60)	(0.61)	(0.55)	(0.57)	(0.15)	(0.13)
groups by geographical location [d]						
N-W[a]	-0.50%	-0.46%	-0.30%	-0.35%	-0.20%	-0.11%
range[b]	*-0.71/ -0.34%*	*-0.66/ -0.33%*	*-0.43/ -0.23%*	*-0.51/ -0.27%*	*-0.30%/ -0.11%*	*-0.16/ -0.06%*
s.d.[c]	(0.58)	(0.56)	(0.52)	(0.54)	(0.19)	(0.07)
N-E[a]	-0.56%	-0.47%	-0.31%	-0.36%	-0.25%	-0.11%
range[b]	*-0.80/ -0.38%*	*-0.68/ -0.34%*	*-0.46/ -0.24%*	*-0.53/ -0.28%*	*-0.36/ -0.13%*	*-0.16/ -0.06%*
s.d.[c]	(2.20)	(0.56)	(0.53)	(0.54)	(2.11)	(0.07)
Ce[a]	-0.48%	-0.43%	-0.27%	-0.32%	-0.21%	-0.11%
range[b]	*-0.67/ -0.32%*	*-0.60/ -0.30%*	*-0.39/ -0.21%*	*-0.46/ -0.24%*	*-0.30/ -0.11%*	*-0.16/ -0.06%*
s.d.[c]	(0.55)	(0.53)	(0.51)	(0.51)	(0.16)	(0.07)
S-I [a]	-0.15%	-0.06%	-0.03%	-0.03%	-0.12%	-0.03%
range[b]	*-0.22/ -0.09%*	*-0.09/ -0.04%*	*-0.04/ -0.02%*	*-0.04/ -0.02%*	*-0.18/ -0.06%*	*-0.05/ -0.02%*
s.d.[c]	(0.49)	(0.27)	(0.30)	(0.26)	(0.36)	(0.05)
whole sample (from the last rows of Table 5)						
Italy[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%*	*-0.16/ -0.06%*
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. [d] N-W (north-western regions), N-E (north-eastern regions), Ce (central regions), and S-I (southern regions and islands).

Fig. 1 - 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.