EMPIRICAL STUDIES ON "TAXATION AND CORPORATE CAPITAL STRUCTURE" AND THE DEANGELO/MASULIS MODEL

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O presente artigo aborda a análise estatística da influência da fiscalidade no financiamento das empresas. O modelo apresentado por DeAngelo e Masulis propõe como hipótese testável uma relação inversa entre as amortizações do imobilizado e o endividamento, baseado no efeito de substituição da poupança fiscal. O nosso propósito é o de discutir a adequação de tal modelo, a partir da explicitação das respectivas limitações. Após a referência a tais limitações, sugere-se uma forma mais adequada de medir o impacto das variáveis fiscais na estrutura de financiamento das empresas, baseando essa abordagem na análise das reformas fiscais, sobretudo em situações de alterações significativas do tratamento tributário dos rendimentos de capitais próprios e alheios.

This paper discusses the relationship between taxation and corporate capital structure. More specifically, we analyse the testable proposition proposed by DeAngelo and Masulis that argues for a substitution effect between depreciation and debt, given the tax deductibility of both in the corporate income tax.

We point out the limitations of empirical work based on that proposition and propose an alternative approach, based on the study of the impact on corporate capital structure of radical changes in equity and debt tax regimes, namely in the context of tax reforms.

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1-INTRODUCTION

Ever since the publication, in 1958, of the Modigliani and Miller -hereafter MM — paper on the irrelevance of capital structure[1] to the corporate cost of capital, a vast

(*) The author thanks C. Sinclair (Cambridge School) for a review of the paper. [1] Throughout this paper corporate capital structure means the *ratio* between equity and long term debt. Corporate value means the sum of market values of debt and equity.

number of theoretical studies have addressed the issue. And progress made at a conceptual level has been matched by an increasing body of empirical research on this contentious issue.

After the MM paper, the main line of investigation on corporate capital structure has focused on the study of the consequences of abandoning its hypothesis of perfect capital markets, no taxation, and to show the influence of some factors -taxation, bankruptcy costs, agency costs -on corporate value. One of the more influential papers in the taxation field was published, in 1980, by H. DeAngelo and R. Masulis -hereafter designated as DM.

Models on corporate taxation[2] developed before 1980 focused on tax rates. Some of them, exclusively on the corporate tax treatment of debt and equity income; others, on the interaction between corporate and personal taxation and the influence of this relationship on financial decisions of corporations.

The innovation introduced by DM was the proposal of a formal model where not only tax rates mattered. ln particular, at corporate level, a large number of tax deduc tions - e g, depreciation, investment tax credit (ITC) -can be used to minimise tax bills. That possibility renders the value of interest on debt as a tax shield somewhat lower than hypothesised in previous models. The authors postulated a substitution effect between debt and non debt tax shields, and established a proposition related to corporate financial choices that stated that firms with more non debt tax shields should, *ceteris paribus,* have lower levels of debt.

The purpose of this paper is the presentation of a critical analysis of this famous proposition's influence in some empirical work on the determinants of corporate capital structure. ln our view, the testable implications of DM paper have been somewhat overvalued. The authors carefully noted the conditions under the model applied and its limitations, but empirical work inspired in their proposition was, at times, less careful.

The results produced by most of these studies have ranged from claiming a sort of indifference — albeit to varying degrees – of corporate capital structure to taxation, to the finding of a relationship between capital structure and tax variables opposite to that proposed by DM. We shall argue that none of these conclusions can be derived from this empirical approach, and that the DM proposition should be properly evaluated before using it as a base for statistical studies in the determinants of corporate capital structure.

This paper is organised as follows: in section 2, a brief overview of theoretical developments on taxation and corporate capital structure is developed and the DM proposition is presented; in section 3, we point out the main limitations of the model as a base for empirical work; section 4 offers an alternative approach to statistical work on this subject; section 5 presents some concluding remarks.

[2] The main models were developed by MM (1958), MM (1963) and Miller (1977).

2 — TAXATION AND CORPORATE CAPITAL STRUCTURE: FROM MM TO DM

The MM (1958) paper is generally regarded as a watershed in corporate finance literature. It was the first attempt to derive normative rules on capital structure decisions based on economic reasoning embodied in a formal model. As is well known, the authors concluded with the irrelevance of capital structure to the cost of capital. (The paper also presented one of the great theoretical innovations in finance: the arbi traging behaviour of investors, which can be stated as "corporations can not do for investors something they can not do for themselves")[3].

Naturally, MM model rested on debatable assumptions. One of them — the absence of taxation -was corrected in their 1963 paper. But it was only a partial correction. ln this new model, they only allowed for corporate taxation, and concluded that, given the deductibility of interest and the non deductibility of dividends in the computation of the corporate tax bill[4], the use of debt by firms should minimise its cost of capital and, consequently, increase its value to investors.

(3) Briefly stated, the MM proposition and its arbitrage support runs as follows:

-let us suppose two corporations (A and B) have exactly the same characteristics, except that they have different capital structures. Corporation A has only equity capital, while B has a mix of debt and equity. lf B has a greater value than A, investors buy shares of B. The acquisition of, say, 10% of those shares originates the financial flows shown in table 1.

Table 1

Investment	Income
$0.1\ E_B = 0.1\ (V_B - D_B)$	0.1 (Profit - Interest)

E_B V_B D_B represent, respectively, equity, total value and debt of corporation B.

But any investor can buy 10% of shares of firm A, and ask for a personal loan equal to $0.1\ D_B$. Financial flows related to this strategy are shown in table 2.

Tablc 2

Investment		Income	
Loan	$-0.1\ D_B$		-0.1 lnterest
Purchase of A shares	$0.1\ V_A$		0.1 Profit
Total	$0.1\ (VA-D_B)$	Total 0.1	(Profit. -lnterest)

Both options have equal net income. Then, in perfect capital markets, if $0.1\ (V_A - D_B) = 0.1\ (V_B - D_B)$, then VA-VB. [This illustration of MM arbitrage procedure is taken from Martins (1997)].

(4) MM models reflected the "classical" tax system. In this system, dividend income suffers a double economic taxation – first at the corporate and then at the personal level – that is not mitigated by any integrating mechanism, like tax credit, tax reduction, or other. A description of systems of dividend taxation can be seen in Cadilhe (1991).

Miller (1977) developed a model where personal taxation was also considered. ln this model, which admitted, like previous ones, only tax rate variables, there could be some situations where personal debt was more advantageous than corporate indebtedness. Miller assumed that capital gains arising from share sales were tax exempt. Then, the relevant variables were the corporate tax rate *(tc)* and the personal tax on bond income *(tp).* If *tc* > *tp,* there was still an advantage to corporate indebtedness, because a dollar of paid corporate interest produced a greater tax saving than a dollar of personal paid interest. But, if *tp* > *tc,* the opposite was true. Thus, the financing of corporations should produce a kind of "tax clienteles"; in which highly taxed people preferred bonds and lowly taxed people preferred shares of indebted companies.

One of the criticisms made to Miller's paper regarded its assumption that the corporate tax saving resulting from one dollar of debt was always equal to *rtc,* where *r* is the interest rate. But, in some situations -vg, if a corporation has low or negative operational income — interest on debt is partially or totally lost as a tax saving mechanism, and we can not study corporate financial policy without introducing other tax minimising devices that can be used as an alternative to indebtedness.

This was the crux of the DM paper. They called these other devices "non debt tax shields", and used depreciation and investment tax credit as examples. They developed a rather sophisticated model[5] and showed that, in equilibrium, there would be a substitution effect between debt and non debt tax shields. That is, the decision of issuing debt by a corporation depends not only on the tax rates (corporate and personal) but also on the probability of losing other tax shields as a result of the increasing available amounts of tax deductible interest. The prescription was obvious: firms with more non debt tax shields should have less debt in their capital structure.

Because it is crucial to the argument developed in section 3. it is useful to state some important assumptions made by DM. First, as is usual in the theoretical treatment of the matter, they postulated a given investment policy; which means that the effect of corporate financial choices should be studied with the left hand side of the balance sheet unchanged. Second, they postulated perfect capital markets.

3 -EMPIRICAL WORK ANO DM HYPOTHESIS

DM paper has been a major source of inspiration for empirical work on the determinants of corporate capital structure. We venture two main reasons for this fact. First, the testable implication of the model is clear and, in the realm of the model assumptions, intuitive. Second, it is so easy way of putting aside problems arising from the empirical construction of a variable representing corporate effective tax rates. Some empirical results arising from testable hypothesis based on the DM proposition

[5] The model can be seen in detail in De Angelo and Masulis (1980). A resumed description of the model formal characteristics can be seen in Martins (1997)

conclude the irrelevance of taxation as a determinant of capital structure[6]. Others[7], present results that contradict the DM propositions. To this line of empirical treatment four main criticisms can be directed.

Firstly, and in our point of view the most important, is the fact that depreciation is, by nature, associated with corporate investment policy; so it is an inappropriate variable to test a proposition based on the *ceteris paribus* assumption.

Secondly, one must not forget that debt issuance can be related to the weight of fixed assets. When firms can present physical assets as collateral value to loan con tracts, potential lenders are more easily persuaded to lend. If this is the case, then corporations with more depreciation can also obtain funds more easily, which produces a conclusion contrary to the DM model – a direct relationship between debt and depreciation.

Thirdly, any firm's tax exhaustion status is not only -and perhaps not even mainly -associated with depreciation related tax savings. Other tax saving sources
-loss carryover rules, special benefits enacted by state budgets (tax reductions, tax credits) and others, can have a significantly stronger effect on tax bills, thus diminishing depreciation as a tax saving source.

Finally, the DM hypothesis could be validated empirically without the theoretical base being correct. If tax exhausted corporations have, in the past, produced regular losses and if there is a correlation between depreciation and tax exhaustion, the negative relation between depreciation and debt can be explained by the reluctance of investors to lend to financially distressed companies. Tests of DM hypothesis should then control this factor.

3.1 -Financial and investment policies: is there an independent relation?

Corporate financial policies are seldom decided independently of investment decisions. Values appearing on the right side of the balance sheet are influenced by decisions that affect the left side of it.

This has two effects that cast doubt on the soundness of using the DM proposition to test the relevance of taxation to corporate capital structure. First, it invalidates the ceteris paribus assumption, which means that what we are analysing is not the result of pure financial options but the result of a mix of policies. (We can argue that corporate capital structure can be influenced by the dividend policy, which renders this assumption even more unrealistic). Secondly, it produces another objection related to the meaning of tax variables based on depreciation.

This second aspect -studied by Damon and Senbet (1988) -is based on the following reasoning: an increasing of depreciation caused for an active investment policy can be related to an expected increasing of net income; if this is the case, then

[6] See, Titman e Wessels (1988), Augusto (1996).

[7] See Bradley, Kim and Jarrel (1984).

the addition of more debt is justified on the grounds that, in the future, the company will have a higher taxable income and a stronger cash flow. Then, debt and depreciation are positively related, which renders inappropriate the empirical study of taxation and capital structure based on DM proposition.

Damon and Senbet (1988) callthis relationship between investment, depreciation and increasing debt levels income effect. If it is stronger than the substitution effect postulated by DM, then we should observe a positive relationship between depreciation and debt.

3.2 -Debt and bank guaranties

The DM proposition as a base for the empirical test of taxation and corporate finance also suffers from a limitation, associated with creditor protective guaranties. Specifically when financing investment projects or even when backing pure capital structure changes, lenders ask for real guaranties. Firms with a large fixed asset base have thus easier access to borrowing.

ln this situation, and because large fixed assets also tend to produce greater depreciation, increasing debt levels can be positively associated with depreciation. Especially in countries where banks are the main providers of corporate debt, and bond issuance is a rarely considered financial option, this can be a major source of bias in testing the econometric consistency of DM propositions.

The best way to perform a statistical analysis of the influence of taxation on corporate capital structure decisions, would require the estimation of expected effective marginal tax rates for corporate and personal income related to debt and equity for a sample of corporations, and to investigate the relationship between these rates and debt and equity issuance policies.

Unfortunately, this would also require the knowledge of all factors that render effective tax rates quite different from statutory ones. Among these factors, at corporate level, we can highlight the following:

i) loss carryover rules, mainly the time length established in tax laws during which losses are deductible to any year's positive income;

ii) rules established in the corporate tax code on the subject of the determination of taxable income. Among the most important ones are depreciation allowances, the methods of calculation of cost of goods sold and provisions for debts or stocks;

iii) tax benefits policy -vg, ITC, tax reductions, special rules for capital gains;

iv) last, but not the least, to have some kind of clue to the main lines of future tax changes, and in what sense they would affect the tax treatment of debt and equity income.

At personal level, the issues are even more complex. Besides the questions related to tax rates, taxable income definition and tax benefits, and given the aggre-

gation of income for tax purposes in the tax systems of advanced countries, a lot of tax rules that apply to other areas of personal income taxation could influence the individual 's tax preference for debt or equity income. ln particular, the existence of ceilings for deductions related to personal debt is a very sensitive factor to the tax status of individuals.

33 -Depreciation as a proxy for effective corporate tax rate: is it adequate?

The theoretical underpinning for the use of depreciation in the test of the attract iveness of debt as a corporate financing choice is to use it as a proxy towards the tax status of a firm. That is, if a firm has a large amount of tax deductible depreciation, then its effective tax rate will be lower than the tax rate faced by firms with other things equal to those but with less depreciation.

This is highly unlikely. First, the accrual of debt at any moment is related to the tax status of the firm at any of the future periods when debt will have to pay interest. And the estimate of expected effective tax rates depend — much more than they depend on depreciation -on other variables that define the tax status of a corporation. The amount of tax losses, ITC, tax reduction s that apply to some economic activities and many others have a more powerful influence in managers minds when it comes to estimating future tax bills. And it should be stressed that some of this non debt tax shields -like ITC -are deductible to the tax bill, and not only to taxable income like depreciation is.

If statistical studies that use depreciation based variables like the ratio between "depreciation" and "earnings before interest and taxes" -as proxies for corporate tax status fail to show a consistent relationship between those variables and effective corporate tax rates, their results are somewhat ambiguous and open to misinterpretation.

34 -The control for financial distress

When testing the relationship between depreciation and debt levels, we must not forget that it can be rendered meaningless -as far as the DM proposition is con cerned -by the fact that firms with high depreciation can also have a history of big losses, and this can give the bank sector some reason to be cautious with loan policies towards those corporations. So, the test of DM hypothesis should be done while controlling for this effect. One way of doing it could be the breaking of the statistical sample used by the researcher in two sub-samples: one containing firms in good financial shape and the other including firms in financial distress[8]. The test should then be applied to the first sub-sample.

[8] Healthy firms could be selected by applying the following criteria based on financial reports:

i. Equity capital/Net total assets > 25%;
ii. Net working capital > 0;
iii. Operating income > 0.

4- TAXATION AND CORPORATE CAPITAL STRUCTURE: ALTER- NATIVE APPROACHES TO EMPIRICAL WORK

ln the light of the difficulties mentioned in section 3, some authors have turned to an empirical approach in the study of the taxation/corporate capital structure question that is considered better than the one based on the DM proposition. The main point of this approach is to investigate the reaction of firms to changes in the tax environment faced by individuals and corporations. The most appropriate situation to perform this research is in the context of tax reforms, particularly if they change the tax rules on corporate and personal income derived from debt and equity instruments.

The great advantage offered by this methodology, is that it is the best approximation to the *ceteris paribus* hypothesis. Given the importance of this assumption in theoretical models, the identification of a situation where it can be presumed to hold
-even approximately -is a strong point in favour of this approach.

ln countries where tax reforms have furnished a kind of " controlled environment" to assess this hypothesis, conclusions are mostly in accordance with the influence of taxation as a corporate capital structure determinant[9].

One of the problems that can be encountered in this method is the fact that, in most reforms, the net result of changes in tax law produces a situation where the previous relative advantage of debt over equity — or vice-versa — is not quite changed. However, the evolution of tax systems generally provides researchers with some events that can be fruitfully seized in order to study the impact of important changes in tax rules on corporate capital structure. We can choose an example from Portuguese income tax rules. As is well known, the first version of personal income tax code (CIRS) established a tax credit of 20% to be earned by individuals receiving dividend income[10].

This credit was increased to 35% in 1991, to 50% in 1992 and to 60% in 1994, where it stands now. If there are no concomitant changes in tax rules that affect the fiscal attractiveness of debt and equity, then this evolution offers an interesting opportunity to study the impact of this equity favouring policy in corporate capital structure.

5-CONCLUSION

The DM model is one of the most influential papers written in corporate finance on the relationship between taxation and corporate capital structure. A lot of empirical studies have been based on the proposition derived from that model which states that, *ceteris paribus,* firms with more non debt tax shields should have less

[9] See Givoly *et al* (1992) e Schulman *et al* (1996)

[10] Dividend income could also be taxed by a proportional rate. Tax credit was only granted to taxpayers that submitted dividend income to the progressive rates of the income tax.

debt on their capital structures.

But empirical results arising from the testable hypothesis based on the DM proposition are not unambiguous. Four reasons can be advanced to view with some scepticism statistical work based on the DM model.

First, is the fact that depreciation is associated with corporate investment policy; so it is an inappropriate variable to test a proposition based on the *ceteris paribus* assumption. Second, debt issuance can be related to the weight of fixed assets. If this is the case, then corporations with more depreciation can also obtain funds more easily, which produces a conclusion contrary to the DM model. Third, the fact that the tax status of firms firm is not only associated with depreciation related tax savings. Finally, if tax exhausted corporations have, in the past, produced consistent losses and if there is a correlation between depreciation and tax exhaustion, the negative relation between depreciation and debt can be explained by the reluctance of banks in lending to financially distressed companies.

Because of these difficulties some authors have turned to an empirical approach in the study of the taxation/corporate capital structure question that is considered better than the one based on the DM proposition. The main point of this approach is to investigate the reaction of firms to changes in the tax environment faced by individuals and corporations. Tax reforms are particularly suitable as "controlled experiments", and are now actively investigated by researchers of corporate financial policy.

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