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The determination of optimal value of the firm in the short and long run by fine tuning the debt ratio and payout ratio under the new Dutch income tax code

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Abstract
The optimal value of the firm under the new Dutch income tax reform act in 2002, is reconsidered in this discussion paper. Tax shield of debt-financing and the aggregate tax payments of its joint investors are simultaneously considered. A more-period model is presented for making integrated decisions about the optimal capital structure and dividend policy. By considering the three parties involved: corporation, all individual investors and the Inland Revenue, the financing decision can be solved as a zero sum game. By simultaneously fine-tuning the debt and payout ratio, the model gives the conditions for maximizing firm's value.

Keywords: capital structure; debt ratio and payout ratio; Dutch income tax; firm value.

JEL classification: G32, G35

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The theoretical setting of this article.

In their pioneering article about the optimal capital structure of the firm F. Modigliani and M.H. Miller stated in their original propositions the irrelevance of the capital structure and dividend policy for the firm value. In this original view no credit was given to tax considerations.
In later articles corporate tax was taken into account and debt financing was favored due to the tax deductibility of interest payments by the firm (a theorem known as M&M II). This created a tax shield increasing firm value and a lower cost of capital. However, increasing debt financing also creates a higher risk of default for the firm. And risk of default generates costs. So there is a trade off between incremental debt financing and the additional costs of default, which lead to an optimum between debt and equity.
Later on, when personal taxation was also considered in de the financing decision the tax status of the private investors affected the optimal capital structure (Miller 1977). Dividend policy also affected firm value, due to the different taxation of capital gains and dividend income at the personal level, which shifts the optimal capital structure to a new equilibrium, at least considered at the aggregate level.
Successive articles introduced, among others, agency costs and asymmetrical information (moral hazard) between debt holders, equity holders and the management to explain existing capital structures of companies. Agency problems give rise to monitoring costs, which induce shifts in the optimal capital structure. All these factors affect the cost of capital of the firm. An important insight was the application of option theory on the market valuation of debt and equity claims. The founding articles about the optimal capital structure are based on the US tax system, which gives a different treatment to debt income and equity income, the latter either as dividend income or capital gains. In this article the model will be adapted to the Dutch tax rules of the corporate tax, and the income tax reform act 2001 for personal investors.

The fundamentals of the Dutch income tax code 2001.

In order to deduce the optimal firm value, first a summary of the fundamentals of the new income tax system in the Netherlands is presented. In this paper the focus is on individuals investing in a corporation. Historically the Dutch tax system was build as a classical system, where dividends paid to individuals were taxed at the individual level without taking into account the tax levied at the corporate level, which created a double tax burden. This system was partly reformed in 1997 with the introduction of the "*substantial participation holder*". The Dutch tax code was drastically reformed again in 2001 and as a consequence the specific tax rules affect the optimal capital structure for a firm.
The new income tax code is built around three forms of income (referred to as "boxes") and every form of income is calculated using a different set of rules. The total amount of tax payable is the summation of the tax due in each box. At present there are three boxes. Box **1** encompasses income from personal dwelling house, income from employment, business gains and a number of other less important sources of income. Individuals holding a large participation in a company are taxed in box **2**. All kinds of capital not belonging to business capital or substantial participation is taxed in box **3**.
This category refers to personal investors who either hold less than 5 percent equity capital or other securities in a firm. Capital income of this group is taxed in box 3.

The "strange" element in this box 3 of the new tax system is that the tax payable is calculated on a deemed (i.e. preset and fixed) return on capital investment set at 4% of the average net value of the total belongings and ***not*** on actual income or actual returns on equity holdings. This category of taxpayers encompasses e.g. the majority of personal shareholders with small holdings in publicly held corporations (NV's). Their tax payable is calculated by first determining the *average* value of their investment holding during the tax year. From that average capital value a deemed return of **4** percent is taken and this amount is taxed at a flat rate of **30** percent with a fixed tax-exempt amount of € 18.800.
Dividend income and interest income falling in box 3 have the same effect on the tax payable of the individual. But the amount of retained earnings by the corporation ***does*** affect the average value of the equity capital values of the individual and thereby the tax due. The more a corporation retains of his earnings the higher the end-of-the-year capital value of the equity holder will be, and as a consequence the higher the calculated deemed return of 4 percent of the average capital value, expressed in euros.
A crucial assumption is that other things equal equity value on the balance sheet increases by the same amount as the retained earnings. Debt income is taxed on the same basis: again the real amount of rent income does not matter. Instead debt income falling in box 3 is taxed upon a deemed income as explained above.

The second category of income tax liable individuals refers to personal stockholders who are considered as a "*substantial participation holder*" of a corporation. Those stockholders hold at least 5 percent of the equity rights, or equivalent rights in a corporation.[1]
This group encompasses among others many personal stockholders of closed corporations (BV).
Their equity income is taxed at a flat rate of 25 percent in the so-called box 2 on the basis of received cash dividend. Possible capital gains on disposal of their equity are also taxed at a flat rate of 25 percent, but an increase in their capital value due to retained earnings is not taxed. Disposal of equity is taxed, because there a capital gains tax doen not exist in the Dutch tax system.

A *subgroup* of this category refers to substantial participation holders who not only hold more than 5 percent of the equity capital, but also hold ***simultaneously*** debt claims on the same corporation.
They are equity holder as well as debt holder. Their ***equity income*** is taxed in box 2 at 25 percent, while their ***debt income*** is taxed in box 1 according to a progressive four-bracket rate system, mounting to a maximum rate of 52 percent.
If however the investor holds less than 5 percent of equity rights and this individual is at the same time debt holder in the same corporation, then the two income sources, dividend and interest, are treated at equal footing in box **3**. This subgroup comprises a relatively large number of individuals, who have invested in small and medium sized firms. Debt income in box 3 does ***not*** generate additional income tax payments, but it does so when falling in box 1.

The following concise diagram summarizes the main features of the corporate and income tax code:

[1] There are other rules as well, but these will not be covered in this paper.

Who is taxed	What is taxed	Amount taxed	Tax rate 2002
Corporation: *corporate tax*	Earnings before tax	between 0 and € 22.689: from € 22.689 on:	29% 34,5%
dividend tax	Dividend paid out to investors	(withholding tax deducted from income tax investor)	25%
Individual investor: *Income tax*			
Equity holder < 5%	the average annual capital value*).	a fixed return of 4% starting at a threshold amount of € 18.800	30% (taxed in box 3)
Debt holder	the average annual debt value**).	a fixed return of 4% starting at a threshold amount of € 18.800	30% (taxed in box 3)
Equity holder ≥ 5% (*Substantial Participation Holder: SPH)*	Cash-dividend and realized capital gains		25% (taxed in box 2)
S.P.H. ***and*** debtholder in the same corporation	Cash-dividend: Debt income:	taxed according to a 4 bracket system***) with a highest rate of	25% (taxed in box 1) 52%

At the corporate level company profits are taxed at a flat corporate rate of (year 2002) 34,5 percent - beginning at a taxable income of € 22.689 and a rate of 29 percent below that amount -.[2]
Dividend, or income dependent payments to equity holders, is an after-tax payment, whereas interest payments are pre-tax payments (tax deductible). The traditional approach favoring debt financing due to the tax shield also holds under the Dutch corporate tax rules. The Dutch tax system also levies a dividend tax (25%), but this is a withholding tax by the corporation and is deducted from the final income tax payments by the personal stockholder and therefore does not affect the optimal capital structure, leaving aside some exceptional cases.

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2 *) The end-of-the-year equity holding at book value increases with the same amount as the retained earnings.

) As long as the face value of the debt claims of a debtholder does not change during the year when no principal - or part of it - is repaid to the debtholder, tax payments in box 3 are ***zero*!

***) The rationale for taxing debt income in box 1 of a SPH lies in the aggregate tax collections. Equity income is taxed at 35% at the corporate level, so 65% remains for the SPH. He pays 25% over 65% = 16,25%. Aggregate collection of the Inland Revenue is 35% + 16,25% = **51,25%.** If however the SPH switches to debt income in this firm, the firm does not pay corporate tax over debt payments and in order to receive more or less the same amount the Inland Revenue taxes the SPH in box 1 with a maximum rate of 52% (≈ 51,25%)

The one period model starting at the corporate level with a basic income statement.

Differences with the US tax-based view about optimal capital structure arise, when personal taxation is taken into account in the optimal capital structure decision of the firm. In this article a purely technical analysis on the effects of changes in capital structure and dividend policy is presented based on the Dutch tax rules. Behavioral impacts of adjustments in capital structure on management decisions, risk of default, and the reactions of investors and other stakeholders, like agency problems and asymmetric information, are left aside. The starting situation is a ***fully equity-financed*** project.
Two cases are separately considered:

1. All stockholders have less than 5% of equity, so that all equity income is taxed in box 3.
Changes in the capital structure are implemented by issuing new debt and the repurchase of outstanding shares at book value with the new debt claims. In this way the capital value of the two claims of the investor together remain constant. Ebit – which is *constant* and independent of the capital structure, is calculated on the forecasted cash flows of the project itself - is distributed as net income among equity holders, who after a repurchase are now also partly debtholder by the acquisition of the new debt claims. Income from both holdings is taxed according the rules of box 3. The added value to the project resulting from this shift in capital structure is calculated as the changes in corporate tax due by the firm and income tax payments for the individual investors.
2. All stockholders are "substantial participation holders". A repurchase of shares by the company implies that the SPH holds after the transaction simultaneously two claims in the ***same*** corporation. Equity income is only taxed, when paid out as dividend at 25% in box 2, while debt income is taxed in box 1 according to the 4-bracket system.

In both cases after the adjustment in capital structure the optimal choice the second step in the model regards the choice between dividend and retained earnings (optimal dividend policy).
The model is two tiered: first the impact on changes in corporate tax payments by the firm are considered by a repurchase. This calculation generates an output (net income and debt payments), which becomes the input for the tax calculation of the personal investor in the second step.
The equity input comes in a mixed form: dividend and retained earnings, depending on the choice of the payout ratio. Both affect the income tax payments of the individual investor.
In the one-period model the focus is on how much value is added (or lost) to the project value, as a result of adjustments in the capital structure and the dividend policy (the two side effects under consideration). By fine-tuning these two ratios the maximum value-adding capital structure and dividend policy can be found for a project with a given Ebit.

The major assumptions in the model.

The whole model centers on optimizing two ratio's: debt ratio [d] and payout ratio [a]. A *marginal* analysis is applied and not a total analysis. All the cash flows, which do not depend on these two ratios are not included and fall under the "other conditions equal clause" (ceteris paribus) of the Ebit.
Retained earnings cause the increase in the average capital value of the investor equal to half of the retained earnings. The book value of debt is assumed to remain constant and repayment of the principal occurs at maturity. Changes in debt payments to personal investors, who are tax liable in box 3, do not cause changes in tax payments since there is no increase in its average capital value.
The amount of the investment is fixed at the start of the project at € X and in case of (partial) debt refinancing the borrowing rate is fixed during the indenture term. The value of the project itself is considered as exogenous and based on the forecasted cash flows discounted at its appropriate rate for projects in the same risk class.

Table 1.

Income statement of a project with an investment € X in a project. Debt ratio: d percent of the investment amount X. Long term borrowing rate of the firm is r_D, which is independent of the amount borrowed. Earnings before tax and interest (Ebit) are fixed and based on the forecasted firm or project cash flows. Payout ratio is given as a% of net income.

Earnings before interest and taxes (this amount is determined by the forecasted cash-flows of the project and assumed ***constant***)	**Ebit**	
Less: interest payment on debt (Debt = d*X and r_D is the interest on the debt)	**r_D*d*X**	Cash-outflow to debt holders in box 3. Does not cause additional tax payments in box 3.
Earnings after interest and before tax (Ebt)	**Ebit – r_D*d*X**	
Less: corporate tax at a rate τ_c	**τ_c*(Ebit – r_D*d*X)**	Cash-outflow to the Inland Revenue
Income (for equity holders)	**(1 - τ_c)*(Ebit – r_D*d*X)**	
Payout ratio a percent	**a*(1 - τ_c)*(Ebit –r_D*d*X)**	Cash-outflow to equity holders and taxed as income in box 3
Plowback ratio (1 – a) percent (retained earnings)	**(1– a)*(1 - τ_c)* (Ebit–r_D*d*X)**	Retained earnings increase equity on the balance sheet with the same amount and increase the average capital value of the equity holder.

Retained earnings can be invested in current assets (like marketable securities) and appear on the balance sheet of the corporation. By turning these current assets into cash the corporation can make additional dividend payment to existing shareholders. In case of retention of the earnings in current assets of the corporation, once paid out they become cash flows to the stockholders. The output from the corporate income statement becomes the input for the calculations of the personal investor. The model shows, that maximizing firm's value is equivalent to minimizing tax payments.

Table 2.

Taxation at the personal level with a payout ratio of a% and an increase of corporate equity equal to the retained earnings. Mutations of taxation in box 3 as a consequence of the mutation in the capital structure of the corporation at a predetermined return of 4 percent on the average capital gain. Output values of Table 1 are the input values for the personal investor in this Table.

	Calculations of due income tax.	
Mutations of average capital gain due to retained earnings (c.p)	**½*(1 – a)*(1 - τ_c) * (Ebit –r_D*d*X)**	
Deemed return of **4 percent** on increase of average capital value.	**0,04*½*(1 – a)*(1 - τ_c) * (Ebit – r_D*d*X)**	
Mutations in income tax (rate of 30 percent)	**0,006*(1 – a)*(1 - τ_c) * (Ebit – r_D*d*X)**	Cash-outflow to Inland Revenue after deduction of withheld dividend tax.
Mutations in after tax income of the aggregate group of personal investors.	**r_D*d*X (interest debt holder) + (1 - τ_c)*(Ebit – r_D*d*X) (**Retained and paid out earnings after tax accrue to shareholder's wealth**)** **- 0,006*(1 – a)*(1 - τ_c) * (Ebit – r_D*d*X)** (income tax payments equity holders)	

The consistency check for zero sum of all the claims on the cash flows implies that all cash inflows and outflows must add up to **Ebit**, the original sum allocated among the three stakeholders; personal investors (debt and equity holders), corporation and Inland Revenue[3].

[3] Those claims present the following distribution pattern:

Claims by the Inland Revenue:

Corporate tax (cash inflow) (+) τ_c*(Ebit – r_D*d*X) [1]

Personal income tax receivable (cash inflow) (+) 0,006*(1 – a)*(1 - τ_c)*(Ebit – r_D*d*X) [2]

Claims by personal investors + corporation:

Income to debt holders (+) r_{D*}d*X [3]

Income to stockholders (retained & paid out earnings) (+) (1-τ_c)*(Ebit – r_D*d*X) [4]

Personal income tax payable (cash outflow) (-) 0,006*(1 – a)*(1 - τ_c)*(Ebit – r_D*d*X) [5]

The objective of maximizing first year after tax cash flows to ***all investors*** (firm value) is choosing simultaneously the two variables, debt ratio [d] and the payout ratio [a] and is formulated as:

Maximize

$$\mathbf{V = r_D*d*X + (1 - \tau_c)*(Ebit - r_D*d*X) - 0{,}006*(1-a)*(1 - \tau_c)*(Ebit - r_D*d*X)}$$

Subject to: $a \leq 1$ and $d \leq 1$. **[I]**

This is a nonlinear optimization problem with inequality constraints. Solving it this optimization problem by a standard technique applying Kuhn-Tucker conditions gives the solution: **a = 1** and **d = 1**.

Due to the zero sum character of this allocation problem, maximizing firm value is equivalent to transforming the problem in minimizing the sum of the tax payments:

Minimize

$$\mathbf{T = \tau_c*(Ebit - r_D*d*X) + 0{,}006*(1 - a)*(1 - \tau_c)*(Ebit - r_D*d*X)}$$

Subject to: $a \leq 1$ and $d \leq 1$. **[II]**

This has the same solution: **a = 1** and **d = 1**. Although a 100 percent long term debt refinancing at a fixed interest rate r_D does not seem plausible, if debt payments are guaranteed either by a holding corporation or a public agency, the risk of default on the project can be substantially reduced.
Also in the case that the expected Ebit of the project with a low volatility, are significantly higher than the fixed annual debt payments, a 100 percent (or high) debt ratio does not imply a concomitant significant higher risk of default.

The impact of tax-exempt amounts on firm value.

Tax exempt amounts, like the € 18.800 threshold value of box 3, accrue to the private investor and increase firm value. In order to calculate the impact of tax-exempt amounts, one needs to know the ***number*** of tax liable private investors holding securities in the firm, falling in box 3 of their income tax. If we set this number on N, the ***maximum*** amount added to the firm value is € 18.800*N. Any investor i with a income tax payable $X_i \leq$ € 18.800 does not pay income tax and firm value increases with € X_i. The aggegate contribution of all tax-exempt amounts to firm value equals $\Sigma_{i=1}^{N} X_i$ and this value must be added to the outcome of the firm value resulting form the maximization problem [I]. The decrease in the aggregate cash flows to the Inland Revenue is of course the same[4].
Because $\Sigma_{i=1}^{N} X_i$ is an exogeneous factor, it does not influence the optimal payout ratio **a** and debt ratio **d** of [I] and is therefore left out.

Cash flows [2] and [5] cancel out. Cash flows [1] and [4] add up to [Ebit – r_D*d*X] and by adding [3] the outcome is the expected **Ebit**!! This zero sum character evidently always holds, whatever the choice of **d** (debt ratio) and **a** (payout ratio) would be.

[4] A practical consequence is, that a private investor with tax payable in box 3 exceeding substantially the threshold value of € 18.800 creates added firm value by selling part of his securities to existing or new investors with a tax payable below the threshold value. Negotiating a good deal of his securities, he can cash-in part of the tax savings of the buying investors.

Only in the case that as a consequence of a change in the debt and payout ratio of the firm, the tax payable of a private investor leaps from below the tax-exempt amount to above the threshold value, the threshold value influences the optimal debt and pay-out ratio and becomes endogenous.

The case of an personal investor as a substantial participation holder (SPH) taxed in box 2.

In case the personal investor is a substantial participation holder, his capital income is taxed in box 2 at a flat rate of 25 percent. Changes in capital value do not influence his tax payable, which is only determined by cash dividend and by possibly realized capital gains by the investor. The output of the income statement of the corporations becomes the input of the tax calculation of the SPH.
After a partial repurchase of stock the stockholder is now also debt holder. His debt income is taxed in box 1 according a four-bracket system. We set the tax rate of box 1 at **b**, which can take four values depending on the tax status of the equity holder. His after-tax debt income is $(1 - b)* r_D*d*X$.
This corporate output (dividend) was already calculated as **$a*(1 - \tau_c)*(Ebit - r_D*d*X)$.**
The cash flow after tax payment to the SPH is $0{,}75*a*(1 - \tau_c)*(Ebit - r_D*d*X)$.
The value-maximizing problem of the firm is rewritten to:

Maximize
$$\mathbf{V=(1-b)*r_D*d*X + (1-\tau_c)*(Ebit - r_D*d*X) - 0{,}25*a*(1 - \tau_c)*(Ebit - r_D*d*X)}$$
$$\mathbf{Subject\ to:\ a \leq 1}$$
$$\mathbf{d \leq 1}.$$

Rearranging terms gives:

Maximize
$$\mathbf{V = (1 - b)*r_D*d*X + (1 - 0{,}25*a)*(1 - \tau_c)*(Ebit - r_D*d*X)}$$
$$\mathbf{Subject\ to:\ a \leq 1}$$
$$\mathbf{d \leq 1}.$$

The solution depends on the tax rate **b** in box 1. Under the assumption that the majority of the SPH's are taxed in the highest bracket of box 1 at b = 52% then the solution of this problem is:
a = 0 and d = 0. In words: stay fully equity financed and don't pay out any dividend. The two-tiered construction of the model gives a simple explanation of this result. 0% debt implies that there is no tax deductible interest for the firm at 35%. However the debt holder would pay 52% for every euro interest received, so there is net loss with debt financing. A payout ratio of 0 implies a zero cash income for individual SPH's, so their income tax payments are minimized[5].

[5] In case the company has two groups of personal investors, some of them tax liable in box 3, while others are tax liable in box 2 as SPH, agency problems can arise between the two groups. There would be consensus with the management about a 100 percent debt financing, but consensus about the payout ratio would result in conflicting views by the two groups of investors. A game theoretical approach would be necessary to find an equilibrium solution. We omit the case that the SPH sells his newly acquired debt claims to third parties, whose debt income falls in box 3. In that case the minimization problem is formulated in the same way with the exception, that b=0 and equity holders and debt holders are now two separated groups of claimholders in the firm.

The equivalent problem of minimizing tax payments yields the same result.

An attempt to extend to a multiperiod model with a constant growth factor for personal investors, whose capital income falls in box 3.

After having discussed the allocation of the claims on the cash flows for the first year to the three groups of stakeholders: personal investors - debt and equity holders -, corporation and Inland Revenue, although strictly spoken there are only two, because changes in corporate equity accrues to stockholders wealth, we will now focus on the long run for investment projects covering more than one year. Annual project earnings (first year Ebit) are assumed constant over the project life.

In a more-period model growth is introduced by the reinvestment of the retained earnings either in securities, or new projects. The annual cash flows of these reinvestments are added to the constant Ebit of the project itself. As long as the capital structure is fixed the annual debt payments (d*rD*X) remain also constant, so growth in Ebit accrues to equity holders and increases annual increasing tax payments. A complication arises because of non-uniform and time depending growth rates. If Ebit grows at an annual rate of g, than annual corporate tax payments as well as after-tax corporate income grow at another rate due to the deduction of constant debt payments. One way to bypass this problem of non-uniform growth rates would be to apply a rigorous PV-calculation, where every future nominal cash flow (annual equity payments as well as tax payments) is accurately computed and plugged into the PV-formula.
However to simplify calculations an adjusted constant growth rate ğ for "*Earnings **after** interest and **before** tax"* (Ebt) is introduced, which on its turn depends directly on the plowback ratio (1-a): ğ = ğ(a). This growth rate implies that corporate tax and after-tax income for equity holders will grow at the same rate ğ
If the initially chosen debt ratio [d] and dividend policy [a] are kept constant during project life, the added value of all cash flows can be estimated by perpetuities. All the cash flows are discounted at an appropriate rate corresponding to their risk class with debt payments having a lower risk than equity payments and hence a lower discount rate. A reasonable choice of the relevant discount rate is the risk free market interest rate r_f, under the following conditions: the borrowing rate for the project r_D, as well as the corporate [τ_c] and personal tax rates remain constant during the project life.

The present value of the constant debt payments becomes: $[r_D*d*X] / r_f$. When the firm has access to risk free borrowing ($r_D = r_f$) and the yield curve is flat this reduces to a present value of D = **d*X**, the amount initially borrowed.[6] The present value of the annual corporate income accruing to equity holders is split in a *constant* dividend stream with a present value of $\mathbf{[a*(1-\tau_c)*(Ebit - r_D*d*X)]/(r- ğ)}$ and **r** the proper discount rate for the cash flows to equity holders. The annual retained earnings with a growth rate of ğ, approximated by perpetuity have a present value of $\mathbf{[(1-a)*(1-\tau_c)*(Ebit - r_D*d*X)]/(r - ğ).}$

[6] Comparing this situation with full equity financing (additional) debt financing generates a tax shield of τ_c*d*X accruing to the equity holders in accordance with the findings in the literature. If the annual Ebit is much higher than debt payments and also experiences a low volatility, the risk free rate could be a good benchmark for the discount rate. When the difference between Ebit and debt payments is small and expected Ebit's have a high volatility than the risk of default on debt increases. As a consequence debt ratings by financial agencies are downgraded and the firm has to pay higher borrowing rates. Offsetting this increasing default risk favors lower debt ratios.

Equity holders share the benefits of growth partly in a higher annual dividend income, partly in increased stock value. This increase in stock value can be considered as a Dutch tax-adjusted version of the in the literature commonly known "*Present Value of Growth Opportunities*".
The remaining cash flows are the tax payments of the firm and the personal investors.
Corporate tax payments have a present value of $\boldsymbol{\tau_c*(Ebit - r_D*d*X)/(r - ğ)}$, which accrues to the Inland Revenue. Income tax payments of the equity holders falling in box 3 have a present value of:

$$\boldsymbol{[0{,}006*(1 - a)*(1 - \tau_c)*(Ebit_1 - r_D*d*X)]/(r - ğ).}$$

Summary of allocation of the claims on firm value in the long run.

Present value of the claims by debt holders	$\boldsymbol{d*X}$
Present value of dividend claims by equity holders	$\boldsymbol{[a*(1-\tau_c)*(Ebit-r_D*d*X)]/(r-ğ)}$
Present value of stock value increase due to growth	$\boldsymbol{[(1-a)*(1-\tau_c)*(Ebit-r_D*d*X)]/(r - ğ)}$

Corresponding values for the Inland Revenue

Present value of the corporate tax payments	$\boldsymbol{\tau_c*(Ebit - r_D*d*X)/(r - ğ)}$
Present value of income tax payments	$\boldsymbol{[0{,}006*(1-a)*(1-\tau_c)*(Ebit_1-r_D*d*X)]/(r-ğ)}$

Finding the values of the debt ratio and payout ratio that maximize the long run claims on firm value of debt holders as well as equity holders, both tax liable in box 3, reduces to the constrained optimization problem:

$$\textbf{Maximize:}$$
$$\boldsymbol{V_{long} = d*X + [a*(1-\tau_c)*(Ebit - r_D*d*X)]/(r-ğ(a)) + [0{,}994*(1-a)*(1-\tau_c)*(Ebit - r_D*d*X)]/(r-ğ(a))}$$
$$\textbf{Subject to: } \boldsymbol{a \leq 1}$$
$$\boldsymbol{d \leq 1}$$

NB: the number 0,994 in the third term is the value of retained earnings after income tax deduction: (1 – 0,006).

This is a non-linear optimization problem with inequality constraints. The conditions for finding a solution are given in the mathematical appendix.
The impact of tax-exempt amount discussed at the end of the one-period model has to be adjusted to the multiperiod situation. Assuming the threshold value remains constant the tax saved depends not only on the individual investor, but also on the annual growth. The growth effect ensures that in the long run all private investors will once jump to a taxable amount in box 3 exceeding € 18.800. From than on the annual tax savings will remain € 18.800. Aggregating this for N investors result in annual tax savings of N*€ 18.800.

The increase in firm value in the long run due to tax-exempt amounts can be approximated by a perpetuity whose cash-flows consist in all tax savings considered over an unrestricted period of time with a value equal to (N*€ 18.800)/r. This value is independent of **a** and **d** and has no impact on the solution of the long run maximization problem.

Conclusions

The model presented in this paper to determine the optimal capital structure and dividend policy is divided in a one-period version and a long run version. It focuses on a technical analysis of the new Dutch tax code for personal investors when a firm switches from a fully equity financed capital to a partial debt finance of its investment project. Two categories of personal investors are considered in the model: those falling in the so-called box 3 and those falling in box 2 (substantial participation holders) investors.
In the one-period version the model leads to a quite simple solution for the box 3 investors: 100 percent debt financing by the firm and full payout of corporate income. For the box 2 investors the optimal solutions depends on the tax rate of box 1. In the highest tax bracket of 52% the optimal policy is 0 percent debt and zero payout. The zero sum character guarantees that maximizing firm value is equivalent to minimizing aggregate tax payments.
For the long run an additional set of assumptions was made especially about the growth rate of the annual earnings *after* interest payments and *before* tax.
The present value of the cash flow to the different stakeholders was estimated as a perpetuity, whereby the personal investors are considered as a homogeneous tax liable group in box 3.
Maximizing the three present values to debt holders and equity holders derived the conditions for the debt ratio and the payout ratio to obtain maximal firm value in the long.

Mathematical appendix with the Kuhn-Tucker conditions for solving the long run maximalization of firm value.

The optimal **capital** structure for the long run was found by solving the following optimization problem:

Maximize

$$V_{long} = d*X + [a*(1-\tau_c)*(Ebit - r_D*d*X)]/(r - \check{g}(a)) + [0{,}994*(1-a)*(1-\tau_c)*(Ebit - r_D*d*X)]/(r - \check{g}(a))$$

Subject to: $a \leq 1$

$d \leq 1$

This problem is a non-linear optimisation problem with inequality constraints and can be solved by applying Kuhn-Tucker conditions.

Therefore the problem is reformulated as:

$$L(a, d, \lambda, \mu) = V_{long}(a, d) - \lambda*(a - 1) - \mu*(d - 1) \qquad [I]$$

The set of Kuhn-Tucker conditions that have to be satisfied for a solution are:

- $\partial L(a, d, \lambda, \mu)/\partial d = 0$ [I.1]
- $\partial L(a, d, \lambda, \mu)/\partial a = 0$ [I.2]
- $a \leq 1$ [I.3]
- $d \leq 1$ [I.4]
- $\lambda \geq 0$ [I.5]
- $\mu \geq 0$ [I.6]
- $\lambda*(1 - a) = 0$ [I.7]
- $\mu*(1 - d) = 0$ [I.8]

Working out condition [I.1] yields the following result:

$$\frac{\partial L}{\partial d} = 0 \rightarrow \left[X - \frac{a * (1 - \tau_c) * r_D * X}{(r - \breve{g}(a))} \right] - \frac{[0{,}994 * (1 - a) * (1 - \tau_c) * r_D * X]}{(r - \breve{g}(a))} = \mu$$

Working out condition [I.2] yields the following result:

$$\frac{\partial L}{\partial a} = 0 \rightarrow \frac{[(1 - \tau_c) * (Ebit - r_D * d * X] * (r - \breve{g}(a)) - [(\partial \breve{g} / \partial a) * [a * (1 - \tau_c) * (Ebit - r_D * d * X]]}{[(r - \breve{g}(a)]^2}$$

$$+$$

$$\left[\frac{0{,}994 * (1 - \tau_c) * (Ebit - r_D * d * X) * (r - \breve{g}(a)) + \left[\partial \breve{g} / \partial a * 0{,}994 * (1 - \tau_c) * (Ebit - r_D * d * X) \right]}{[r - \breve{g}(a)]^2} \right] = \lambda$$

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