TAX ARBITRAGE IN THE NETHERLANDS

EVALUATION OF THE CAPITAL INCOME TAX REFORM OF JANUARY 1, 2001

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Tax Arbitrage in the Netherlands
Evaluation of the Capital Income Tax Reform of January 1, 2001

Belastingarbitrage in Nederland
Evaluatie van de hervorming op 1 januari 2001 van de belastingen op kapitaalinkomen

Proefschrift

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Voorwoord

Dit proefschrift presenteert de studie van het belastingarbitrage gedrag van bedrijven en gezinnen ten gevolge van de Nederlandse belastingen op kapitaalinkomen, vóór en na de belastinghervorming van 1 januari 2001.
Tijdens het schrijven van het proefschrift, sta je er als onderzoeker vaak alleen voor. Gelukkig, dikwijls ook niet. Lang heb ik naar dit moment uitgekeken: een mooie gelegenheid om héél wat mensen te bedanken.

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Bert Brys
Beveren-Waas, oktober 2004

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Chapter 1
Introduction

1.1 Introduction

The tax authorities in the Netherlands introduced the new Income Tax Act 2001 (*Wet Inkomstenbelasting 2001*)[1], effective on January 1, 2001.

The most significant component of the Dutch tax reform is the change in the tax levied on income from savings and investments (Meussen (2000)). The actual return on personally held wealth, in the form of dividend, interest or rental payments, is no longer taxed. Instead, the progressive personal income tax on dividend, interest and rental payments has been replaced by a presumptive capital income tax on the value of the assets net of liabilities. The tax code assumes that all personally held assets – such as deposits, stocks, bonds and real estate (except owner-occupied property) – earn a return of 4%, which is taxed at a proportional tax rate of 30%. Actual income is therefore no longer relevant under the new capital-income-tax system and the presumptive capital income tax replaces the old net wealth tax. However, because of the assumed 4% yield on personal wealth, the presumptive capital income tax is in fact a *net* wealth tax of 1.2%.

The household's borrowed funds (except mortgage loans on owner-occupied property) are deductible from personal wealth that is taxed under the presumptive capital income tax. Another feature of the Dutch tax reform, then, is that the interest payments on these borrowed funds (except interest paid on home mortgage loans) are no longer deductible from (labour and capital) income at high marginal income-tax rates (Cnossen and Bovenberg (2001)).

The Dutch reform of capital income taxation might be seen as a response to the distortions that were prevalent in the capital-income-tax system in the Netherlands before the tax reform of January 1, 2001.

This thesis evaluates the reform of capital income taxation of January 1, 2001. The analysis explores whether the capital-income-tax reform reduced distortions and/or resulted in additional distortions.

Section 1.2 reviews the distortions created by the capital-income-tax system before the tax reform and analyses the Dutch tax reform on the basis of the general principles of tax policy. *Section 1.3* defines the main objectives of this thesis, together with the methods used by this study. Finally, *section 1.4* presents the outline of the thesis.

[1] Published in the Official Gazette (*Staatsblad*) of May 30, 2000, no. 215.

1.2 Tax-arbitrage behaviour and the Dutch tax reform

This section first reviews the distortions under the capital-income-tax system in the Netherlands before the tax reform. Such distortions actually caused the firms' and households' 'tax-arbitrage behaviour'. Afterwards, the general concept and the effects of 'tax-arbitrage behaviour' are analysed in terms of the general principles of sound tax policy: efficiency, horizontal equity, vertical equity, tax enforcement and the need to collect tax revenues. These principles are then applied to analyse the Dutch capital-income-tax system and the tax-arbitrage opportunities before the Dutch tax reform. This analysis will point out the need for tax reform. Finally, also the new Dutch capital-income-tax system of January 1, 2001 will be described in terms of the general tax principles.

- ***Distortions as a result of capital income taxation before the Dutch tax reform***

The Dutch capital-income-tax system before the reform taxed distributed corporate equity income twice and retained corporate equity income and interest payments only once. At the corporate level, earnings net of interest payments were taxed at the corporate tax rate. The distributed after-tax dividends and interest payments were subsequently taxed at the household's progressive personal income-tax rate. Capital gains, however, were not taxed at the household level.

Because of the differences in the tax treatment of interest payments, dividends and capital gains, the Dutch tax code before the reform distorted the choice between the investment's sources of finance (newly issued equity, retained earnings or debt). The tax code distorted also the choice between the uses of the investment's earnings. Corporate firms were able to choose between dividend distributions, reinvestment of retained earnings, share repurchases, interest payments or debt redemption (this choice also depended on whether a corporate firm preferred either debt or equity as the source of finance). The analysis in this thesis will demonstrate that the differences in tax treatment of interest payments, dividends and capital gains also affect the entry of new entrepreneurs and the dynamics of the market.

The closely held corporation presents a special case. A controlling shareholder of the closely held corporation owns a substantial amount of shares (at least 5%) of that corporation. The return on the controlling shareholder's equity-financed investment is taxed at the corporate tax rate. The dividends and realised capital gains are subsequently taxed at a special uniform rate, as opposed to the taxes on (publicly held) corporate equity. Interest payments on bonds of the closely held corporation purchased by the controlling shareholder can be deducted from taxable earnings at the business level, but are taxed at the controlling shareholder's progressive personal income-tax rate at the household level.

In contrast to the tax treatment of returns from the (publicly held) corporate firm and the closely held corporation, the return on equity-financed investment in the proprietorship is taxed only once at the income-tax rate of the proprietor. Interest payments in the proprietorship are not taxed at the proprietor's income-tax rate, but were taxed at the investor's marginal income-tax rate.

The Dutch tax code before the tax reform thus distorted the choice between the sources of finance of investments in the closely held corporation (newly issued equity, retained earnings or debt) and it distorted the choice between the sources of finance of investments in the

proprietorship (equity or debt). The Dutch tax code also distorted how these businesses chose to use the investment's earnings.
Because of the differences in the tax treatment of (publicly held) corporate firms, closely held corporations and proprietorships, the Dutch tax code before the tax reform distorted the choice of businesses regarding their legal form.

This situation was compounded by the existence of institutional investors. Households may save directly in corporate debt and equity (by buying bonds or shares of the corporate firm). However, households attempting to avoid the progressive marginal income-tax on interest payments and dividends under the old tax regime could save indirectly in corporate debt and equity through a mutual fund or a pension fund. The mutual fund's earnings, which are retained and reinvested, were therefore taxed at the fund's (low) tax rate. A household selling its participation in the fund realised the capital gains tax-free. Households may save for pensions through a pension fund. These pension savings can be deducted from taxable personal income. The pension, however, is taxed at the household's personal income-tax rate at retirement. The pension fund is not taxed on its investment income. Because of the low imputed rental values that are taxed under the income tax, investment in owner-occupied property is taxed favourably as well.
Because of the differences in the tax treatment of direct household savings, indirect household savings through a mutual fund or a pension fund and owner-occupied property, the Dutch tax code before the tax reform distorted considerably the choices that households could make regarding saving opportunities[2].

Households were able to borrow funds to finance investment instead of financing a particular investment with their own funds. Households might have preferred this saving strategy because the interest payments on the borrowed funds could be deducted from taxable income (which was not restricted only to capital income, but also included labour income) at high marginal income-tax rates.
Consequently, the Dutch tax code before the tax reform distorted the choice between debt-financed and equity-financed household investments.

- ***Tax-arbitrage behaviour***

Taxes on capital income induce agents to change their saving and investment strategies. The effects of tax rules, however, extend beyond the level of savings and investments. Because tax rules can differ across saving and investment opportunities, agents that attempt to minimise their tax liabilities will change the allocation of their savings and investments.

The Dutch capital-income-tax system before the reform distorted considerably the saving and investment decisions of agents. Before the tax reform, capital income taxes distorted the choice between the investment's sources of finance and uses of earnings, the businesses'

[2] The analysis in this thesis abstracts from some additional tax-favoured saving opportunities as, for instance, options, employee and premium savings schemes, life insurances and home-related endowment insurances (Meussen (2000)).

legal form, and the households' (either debt-financed or equity-financed) saving vehicles. Such distortions imply that agents that seek to minimise their tax liabilities will change the allocation of their savings and investments. These allocative changes are then referred to as the *tax-arbitrage behaviour* of households, firms or intermediaries (mutual funds and pension funds).

The next section analyses the general concept and effects of tax-arbitrage behaviour in terms of the general principles of sound tax policy.

- ***Tax-arbitrage behaviour and the principles of sound tax policy***

Besides the need to raise tax revenues, (capital income-) tax policy is shaped by considerations of efficiency, horizontal equity, vertical equity and enforceability.

Efficiency

The efficiency loss of a tax refers to the reduction in the taxpayers' welfare above the welfare loss as a result of the income reduction due to payment of the tax (Zee (1995a)).

Efficiency losses are caused by reductions in the (total amount of) savings and investments of households and firms, because some of these savings and investments are no longer profitable as a result of the taxes on capital.

Because capital income taxes alter rates of return on savings and investments, taxpayers are compelled to change their saving and investment choices in order to offset the impact of the capital income taxes. This tax-arbitrage behaviour suggests that taxpayers are making saving and investment decisions that, in the absence of taxes, would be considered inferior. These inferior taxpayer decisions also cause efficiency losses (excess burdens) of the capital income taxes (Watson (1999)).

If the main concern of tax policy is to minimise efficiency losses, then capital income taxes should not affect the saving and investment decisions of taxpayers. A neutral tax policy should therefore minimise the opportunities for tax-arbitrage behaviour.

Neutrality of the capital-income-tax system may be undesirable (OECD (2001)), however, if the tax code is used to correct market failure or to achieve equity goals, or if departures from the neutrality principle enhance the tax code's simplicity.

Horizontal equity

Under the horizontal equity principle, taxpayers in 'similar circumstances' should pay the same amount of taxes (OECD (2001)). Horizontal equity is a principal dimension of the ability-to-pay principle. Horizontal equity means that taxpayers with the same income have the same ability to bear the tax burden and should therefore pay the same amount of taxes (Zee (1995b)).

The tax code may offer taxpayers incentives to save through tax-favoured saving vehicles, which implies that agents will engage in tax-arbitrage behaviour. This tax-arbitrage behaviour arguably violates the horizontal equity principle because it produces differences in taxes paid, not on the basis of the taxpayers' ability to pay, but on the basis of their deliberate saving decisions (OECD (2001)).

However, the opportunity to engage in tax-arbitrage behaviour not necessarily violates the horizontal equity tax principle, as long as these opportunities are available to all taxpayers. Hagemann, Jones and Montador (1987) therefore argue that horizontal inequity arises only if the ability to choose tax-favoured saving vehicles is restricted ex-ante (for certain types of taxpayers or in particular situations), as opposed to the ex-post differences in tax treatment (which are not necessarily inequitable). Horizontal inequity then arises, for instance, if the tax burden is shifted to agents that engage less actively in tax-arbitrage behaviour: not because they decide to do so, but because they possess less knowledge about the legal tax-avoidance possibilities or because they possess fewer financial resources to pay for the legal and financial tax-avoidance assistance.

Vertical equity

Under the vertical equity principle, taxpayers in 'better circumstances' should bear more of the tax burden (Bradford (1986)). In this case, the ability-to-pay principle requires taxpayers with higher incomes to pay a higher proportion of their income as taxes (OECD (2001)). It can be argued that vertical equity, as evaluated by the taxpayers' ability-to-pay, then implies that capital income should be taxed together with labour income at progressive marginal income tax rates (Hagemann, Jones and Montador (1987)). (Although intuitively appealing at first sight, this assumption can be criticised on several grounds. For a detailed discussion: see Bradford (1986)).

Tax-arbitrage behaviour then violates vertical equity because it reduces the progressivity of the capital-income-tax system. For instance, the gains of tax-favoured saving opportunities and tax allowances (e.g., the mortgage interest rate deduction from taxable income) are often increasing at the marginal income-tax rate, which implies that tax-arbitrage behaviour is of greater benefit to more affluent taxpayers. Or, tax-favoured saving opportunities are beneficial just because they allow the taxpayer to circumvent the progressive income taxes. As a result of tax-arbitrage behaviour, progressive capital income taxes then turn out to be less progressive in effective terms.

Tax enforcement

Because individuals are reluctant to pay taxes, the government requires an efficient system of tax administration and tax enforcement (e.g., audits and penalties in case of non-compliance) for raising tax revenues (OECD (2001)). However, tax enforcement in a narrower sense implies that taxpayers find no opportunity to transform taxed into untaxed capital income (e.g., by transforming dividends into untaxed capital gains), to defer the moment of taxation or to save through untaxed saving vehicles (e.g., mutual funds) (Cnossen and Bovenberg (1999)).

Loopholes in the tax code provide taxpayers with an opportunity to engage in tax-arbitrage behaviour. In fact, tax-arbitrage behaviour makes use of legal opportunities and loopholes in the tax code to reduce tax liabilities. Tax enforcement in a narrow sense then implies capital-income-tax rules that leave no opportunity for tax-arbitrage behaviour. Neutrality of the capital-income-tax system is thus important not only with regard to efficiency and horizontal equity, but also from the point of view of tax enforcement.

Tax revenues

Tax authorities seek to raise revenues by taxing capital income. However, tax revenues decline as a result of tax-arbitrage behaviour. This might induce tax authorities to raise tax rates. This increases the incentives of households and firms to minimise the tax liabilities even further. In order to solve the problems due to tax-arbitrage behaviour, tax authorities may try to adjust the tax code. Small adjustments often increase the tax code's complexity, however, which then aggravates tax-arbitrage efforts. The presence of severe tax-arbitrage behaviour, thus, might call for profound changes in the capital-income-tax system.

- ***Why a tax reform in the Netherlands?***

Under the Dutch capital-income-tax system before the reform, the level of the taxpayer's labour income influenced the tax burden on capital income. Dividend, interest and rental payments were taxed together with labour income at progressive marginal income tax rates. Consequently, the vertical equity tax principle, as evaluated by the taxpayers' ability-to-pay, seemed to be at the centre of the Dutch capital-income-tax system before the reform of January 1, 2001.

However, the Dutch capital-income-tax system before the tax reform was not entirely in accordance with the taxpayers' ability-to-pay. First, corporate debt was taxed at lower rates than corporate equity because only interest payments were deductible from the firm's earnings that fall under the corporate tax. Second, only corporate equity income that was distributed as dividends was taxed at high rates, but retained earnings were taxed at the (lower) flat corporate tax rate (because of the absence of a capital gains tax). Moreover, because the Dutch tax authorities wanted to stimulate taxpayers to save for a pension and for an owner-occupied property, savings through a pension fund and investment in owner-occupied housing were (and continue to be) taxed favourably.

The capital-income-tax system before the Dutch tax reform thus only partly implemented the ability-to-pay principle. Taxpayers with corporate income in the form of capital gains, and who saved through tax-favoured saving vehicles, paid less taxes than taxpayers who possessed the same before-tax income but obtained it as dividends or (to a lesser extent) as interest payments. This partial implementation of the ability-to-pay principle undermined the tax system's vertical equity.

Taxpayers before the Dutch tax reform faced considerable incentives and opportunities to engage in tax-arbitrage behaviour (e.g., with respect to the investments' sources of finance and the uses of earnings, the businesses' legal form, and the households' debt-financed or equity-financed saving vehicles). In fact, some of these tax-arbitrage opportunities existed (or were so stringent) because the Dutch tax code implemented only partially the ability-to-pay tax principle.

Consequently, the attempt to implement vertical equity was not successful for two reasons. First, the tax code before the reform contained too many exceptions to the ability-to-pay tax rule. Second, the agents' engaged extensively in tax-arbitrage behaviour in order to profit from the tax-minimising opportunities.

As explained earlier, the agents' tax-arbitrage behaviour provoked efficiency losses, undermined the horizontal and vertical equity of the Dutch tax system and reduced the government's tax revenues. Under the old system, the household might, for instance, have chosen to save through a mutual fund (in order to transform highly taxed dividends into tax-free capital gains). This saving strategy would cause efficiency losses because taxpayers chose to save through mutual funds for tax reasons and not (for instance) because of the funds' high return on past investments. This saving strategy undermined horizontal equity, because only households that engaged less actively in tax-arbitrage behaviour continued to pay the high dividend taxes. This saving strategy also undermined vertical equity because it reduced the actual progressivity of the tax system. Finally, this saving strategy reduced the government's tax revenue because of the absence of a capital gains tax in the Dutch tax code.

To deal with these violations of the general tax principles of sound tax policy, the Dutch tax authorities then decided to change drastically the tax treatment of capital income. Starting from January 1, 2001, the capital-income-tax system no longer attempts to be in accordance with the vertical equity tax principle.

- ***The Dutch tax reform of January 1, 2001***

The Dutch tax reform of January 1, 2001, did not change the tax treatment of debt and equity at the (publicly held) corporate firm, the closely held corporation or the proprietorship (except for the decrease in the top marginal income-tax rates and some minor other changes). The Dutch tax code continues to favour pension savings and investments in owner-occupied property favourably.
Dividends and interest payments are, however, no longer taxed under the income tax, and the wealth tax has been abolished. (Imputed rental values of owner-occupied property and pensions continue to be taxed under the income tax.) At the household level, capital is then taxed only under the presumptive capital income tax, which is in fact a net wealth tax.

The Dutch tax authorities introduced the presumptive capital income tax as an attempt to halt the excessive tax-arbitrage behaviour of households (for instance, by saving through mutual funds).
This tax reform attempts to stem the efficiency losses of capital income taxation. By limiting the tax-arbitrage opportunities, the Dutch tax authorities have strengthened the tax code's horizontal equity, as households that engage less actively in tax-arbitrage behaviour no longer pay more taxes. The tax reform attempts to ensure that the Dutch government is able to raise revenues from taxing capital income at the household level (even though debt-financed investment in owner-occupied property and pension savings are still taxed favourably).

The Dutch tax reform of January 1, 2001, thus aims at improving efficiency and horizontal equity, and at ensuring government revenues; these aims, however, seem to be pursued at the expense of the tax code's vertical equity.

Violation of the vertical equity tax principle

The presumptive capital income tax violates the vertical equity principle, as evaluated by the taxpayers' ability-to-pay, because capital is taxed irrespective of taxpayer's labour income. Moreover, the presumptive return of 4% is taxed at a proportional rate of 30%, in contrast to the progressive income tax rates before the tax reform.

Moreover, the presumptive capital income tax violates the vertical equity principle because *actual* income is no longer taxed. On the one hand, the authorities tax a presumptive return of only 4%. The government thereby exempts the above normal returns of taxpayers possessing superior investment insight and information advantages (Cnossen and Bovenberg (2000)). On the other hand, a presumptive return as high as 4% is taxed, irrespective of whether the taxpayer has actually earned a return of 4% on his savings. The presumptive capital income tax also violates the ability-to-pay principle because the tax is levied irrespective of the good or bad luck of the investors on their investments (Cnossen and Bovenberg (2000)).

1.3 Aims and scope

This purely theoretical thesis explores the incentives provided by the Dutch capital-income-tax system to engage in tax-arbitrage behaviour. The analysis, which is restricted to a closed economy, discusses the tax-arbitrage behaviour of firms, households and intermediaries (mutual funds and pension funds) before and after the Dutch tax reform of January 1, 2001. The analysis explores whether the capital-income-tax reform reduced tax-arbitrage opportunities and/or created additional tax-arbitrage opportunities. Does the presumptive capital income tax better fulfil the general principles of sound tax policy (as opposed to the capital-income-tax system before the tax reform)? This thesis thus explores whether the tax reform mitigates the distortions that were prevalent in the capital-income-tax system before the Dutch tax reform of January 1, 2001.

At the firm level, tax-arbitrage behaviour is distinguished with respect to the following:

- type of investment project (buildings, machinery, equipment, means of transportation, and intangible assets),
- sources of finance (external or internal funds, debt or equity, provided by a household or an intermediary),
- uses of profits (retentions, dividend distributions, share repurchases, debt redemption),
- timing of the investment decision, and
- the business's legal form (the publicly held corporate firm, the closely held corporation, the proprietorship).

At the household level, tax-arbitrage behaviour is distinguished with respect to the following:

- type of saving vehicles (direct household saving, saving through an intermediary (mutual fund and pension fund) or investment in owner-occupied housing), and
- sources of finance (own funds or borrowed funds, including mortgage debt).

Tax-arbitrage behaviour can be studied in several ways. The tax burden on saving and investment can be derived without taking into account the agents' optimal response to the capital-income-tax system. The agents' incentives for tax-arbitrage behaviour can then be derived from the comparison of the tax burden across saving and investment opportunities.
The agents' behaviour depends not only on the tax rules defined in the capital-income-tax system, but also on other relevant characteristics, such as the availability of sources of finance, adjustment costs and financial imperfections. How these characteristics influence the agents' optimal tax-arbitrage behaviour may be studied as well.
In addition to the tax analysis, this thesis adjusts and extends the methods typically used to infer tax-arbitrage behaviour. In particular, the analysis extends the well-known method of King and Fullerton (1984) for deriving marginal effective tax rates. The analysis also extends the dynamic finance and investment model of the firm as introduced by Sinn (1991a) in order to derive the agents' optimal tax-arbitrage behaviour.

1.4 Outline of the book

In order to explore tax-arbitrage behaviour, the first part of this thesis (chapters 2, 3 and 4) studies the tax burden on saving and investment opportunities. The analysis in these chapters derives the agents' tax-arbitrage behaviour by extending the methods of King and Fullerton (1984) and Sinn (1991a).
The second part of the thesis (chapters 5 and 6) studies the tax-arbitrage behaviour of firms, households and intermediaries before and after the Dutch tax reform of January 1, 2001. In order to assess the Dutch tax reform, the analysis applies the methods that are studied in the first part of the thesis.

Chapter 2 determines the tax burden by deriving marginal effective tax rates, which measure the tax burden on marginal saving and investment opportunities. Marginal effective tax rates will depend on the type of investment project and the corresponding tax treatment of depreciation. Also the legal form of the business, the saving strategy, the source of finance (debt, newly issued equity and retained earnings) and the use of earnings (interest payments and dividends) play a role.
The analysis in chapter 2 extends the King and Fullerton (1984) method by explicitly modelling the stream of benefits and costs of the investment over time. The analysis carefully distinguishes between the investment's source of finance and the use of the investment's earnings. The method also includes the value of the firm's equity (Tobin's q).
The extended King – Fullerton method suffers from a number of shortcomings. The method fails to link the investment's cost of capital to the firm's capital accumulation. Instead of paying interest and dividends, the firm might prefer to retain earnings, to repurchase shares or to redeem its debt level. Moreover, not all sources of finance are always available to the firm.

In order to discuss the shortcomings of the extended King-Fullerton method, chapters 3 and 4 derive the agents' tax-arbitrage behaviour in a (partial equilibrium) dynamic framework of a young, newly founded firm that invests until it becomes a mature firm (Sinn (1991a)). The firm can finance investment with debt, newly issued equity or retained earnings. The firm's

earnings may be retained and reinvested, or used to repurchase shares or to redeem debt. This model allows for alternative household saving strategies and may incorporate adjustment costs and financial market imperfections.
Specifically, chapter 3 introduces debt financing in Sinn's (1991a) dynamic model. The analysis derives the cost of capital along the entire optimal path and determines the optimal source of finance and use of earnings.
Chapter 4 studies the effect of additional financial market imperfections on the firm's finance and investment decisions. The first part of chapter 4 surveys the literature. The second part integrates some of the financial market imperfections in the dynamic finance and investment model. The analysis focuses on adverse selection, and discusses the 'traditional' view of dividend taxation. It incorporates a minimum dividend constraint in the dynamic finance and investment model, and explains the difference between the 'traditional' and 'new' view of dividend taxation in relation to the underlying production process.

Chapter 5 presents the tax burden on marginal saving and investment opportunities, and discusses the firm's and household's tax-arbitrage behaviour in the Netherlands before the tax reform of January 1, 2001.
The chapter first presents the capital-income-tax system in the Netherlands before the tax reform. Afterwards, the analysis applies the extended King-Fullerton method, simulates Sinn's life-cycle model of the firm and presents the firm's optimal finance and investment path, and discusses tax-arbitrage behaviour in light of financial market imperfections.
Chapter 6 presents the tax burden on marginal saving and investment opportunities in the Netherlands after the tax reform of January 1, 2001. Applying the same methods as in chapter 5, the analysis in chapter 6 discusses the firm's and household's tax-arbitrage behaviour and evaluates the tax reform.

Chapter 7 contains the final conclusions with respect to tax-arbitrage behaviour before and after the Dutch tax reform, and presents the final evaluation of the reform of the Dutch capital-income-tax system of January 1, 2001. This chapter also describes some alternative tax reforms.

The glossary and the list of symbols of chapter 2 and chapters 3 and 4 can be found at the end of this thesis. The numerical values of the tax rates and parameters that are applied in chapters 5 and 6 are presented there as well.

Chapter 2
The King-Fullerton Method

2.1 Introduction

Non-uniform taxation of capital income creates tax-arbitrage opportunities. Economic agents, such as firms and households, face incentives to change their saving and investment behaviour in order to maximise the tax advantages offered by the tax authorities. Because agents are assumed to minimise their tax liabilities, they will save and invest in the opportunities characterised by the lowest tax burden. Consequently, a comparison of the tax burden across these saving and investment opportunities permits the inference of the agents' tax-arbitrage behaviour. In order to compare the tax burden, this chapter presents a method to derive marginal effective tax rates.

Marginal effective tax rates measure the tax burden on *marginal* saving and investment opportunities. These saving and investment opportunities yield a return that is just sufficient to persuade the agent (household, firm or intermediary) to undertake the investment. Hence, a marginal investment opportunity yields a return equal to the investor's opportunity cost, which is the return the agent could realise if he would invest in an alternative project.

The method presented in this chapter to derive marginal effective tax rates employs the method of King and Fullerton (1984). These authors focus on domestic corporate investment financed by savings of domestic households, who save directly or through intermediaries (tax-exempt pension funds and insurance companies). The firm can finance the investment with debt, newly issued equity or retained earnings. Earnings are distributed as interest payments or as dividends.
Bovenberg and ter Rele (1998) and the OECD (1994) extend the method of King and Fullerton in a number of ways. Bovenberg and ter Rele (1998) incorporate investments by the closely-held corporation and the proprietorship. They consider both traditional and innovative opportunity returns (see below), and model investments in owner-occupied housing. The OECD (1994) method models the after-tax returns on the household's savings explicitly over time. These extensions are incorporated in this chapter's method.

In order to derive the investment's after-tax return, this chapter's method explicitly models the stream of benefits and costs over time of an investment financed by the household. This approach features a number of advantages. First, it permits the detailed study of the effect of capital income taxes, particularly those that have to be paid only once (transaction tax, capital gains tax, etc.). In contrast to King and Fullerton, the analysis includes a wealth tax when it compares alternative returns. Second, this chapter's method clearly distinguishes

between the investment's source of finance and the use of the investment's earnings. Third, the increase in value of the firm's equity as a result of a marginal investment is derived endogenously. In case of retained earnings as the source of finance, for instance, the method demonstrates that dividend taxes are capitalised in share values. Fourth, the method permits the calculation of the return of savings that are reinvested for a number of periods. Finally, this chapter's method permits the derivation of expressions for the cost of capital if households face a tax incentive to borrow funds instead of financing investment out of their own funds.

2.2 Outline of the method

In order to study the agents' tax-arbitrage behaviour, marginal effective tax rates are compared across saving and investment opportunities, which consist of combinations of the characteristics outlined in *table 1*. The analysis focuses on corporations (owned by ordinary shareholders), closely-held corporations (owned by shareholders who hold a controlling amount of shares of the firm), proprietorships (the self-employed) and owner-occupied housing. The method allows for different sources of finance and different uses of earnings. The savings are controlled directly by households or indirectly by intermediaries.

Table 1: characteristics of saving and investment opportunities

Legal form:	corporation	closely-held corporation	proprietorship	owner-occupied housing
Source of finance:	debt	equity • newly issued equity • retained earnings		
Use of earnings:	interest payments	dividends		
Saving strategy:	direct household savings	indirect household savings • mutual fund • pension fund		

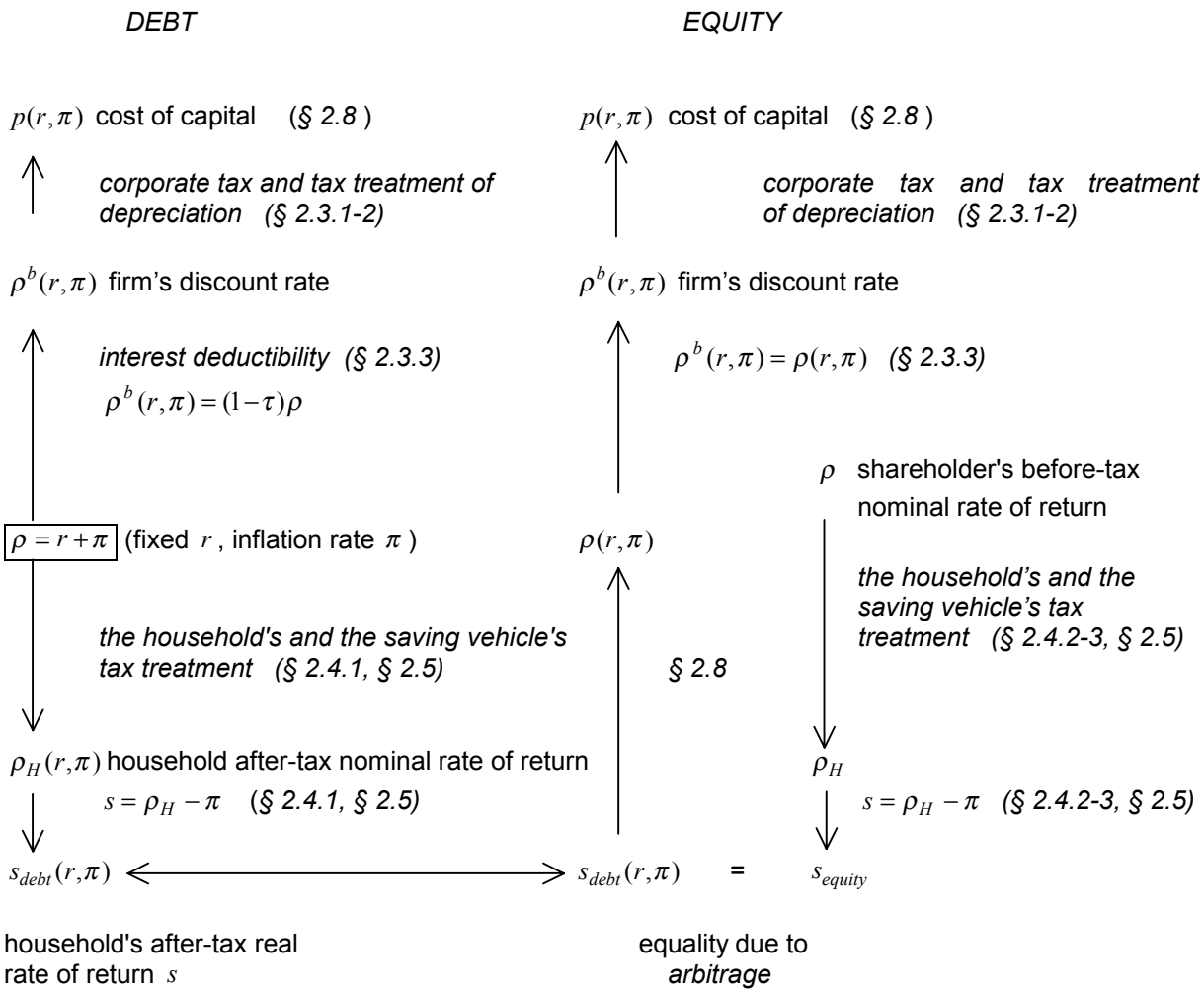
Table 2 presents the method to derive marginal effective tax rates on corporate investments. The marginal effective tax rates on investments in the closely-held corporation, the proprietorship and owner-occupied housing are derived similarly.

Debt-financed investment of corporations

The analysis, as illustrated in *table 2*, assumes an internationally fixed real interest rate r. Accordingly, firms can borrow at the nominal interest rate $r+\pi$ (π represents the exogenous inflation rate). Households can realise the before-tax gross rate of return $r+\pi$ on their savings in debt. A household's after-tax real rate of return s on savings in debt depends on r and π and on the household's and the saving vehicle's tax treatment (*section 2.4.1*

and *section 2.5*). The minimum required real rate of return (cost of capital p) that the debt-financed corporate investment must earn in order to be profitable depends on r, π, the corporate tax τ (*section 2.3.1*), the tax treatment of depreciation (*section 2.3.2*) and the interest deductibility (*section 2.3.3*).

Table 2: methodology for a given saving strategy and corporate business project



Equity-financed investment of corporations

The derivation of the cost of capital on equity-financed corporate investment is more complicated. First, it is assumed that an equity-financed investment at the household level yields a before-tax rate of return equal to ρ. The household's after-tax real rate of return s on savings in equity then depends on ρ and on the household's and the saving vehicle's tax treatment (*section 2.4.2, section 2.4.3* and *section 2.5*).

However, households put their savings in an asset only if it yields at least the same s as debt. Households require an after-tax real rate of return on the equity-financed investment

s_{equity} equal to the after-tax real opportunity return that could be earned if the investment would be financed with debt s_{debt}. This arbitrage behaviour permits the derivation of the cost of capital on equity-financed investment as a function of r (and possibly π). Moreover, the cost of capital depends on τ (*section 2.3.1*), on the tax treatment of depreciation (*section 2.3.2*), and on the household's and the saving vehicle's tax treatment (*section 2.4.2, section 2.4.3* and *section 2.5*).

Arbitrage strategies

For a given saving strategy, the household that invests in equity requires the after-tax real rate of return on debt. The household that directly invests in corporate equity requires the after-tax return on a direct investment in debt, which is referred to as the *traditional opportunity return*. In case of indirect household savings in equity through an intermediary (pension fund or mutual fund), the rate of return on an equity-financed investment is linked to the rate of return on a debt-financed investment through the same saving vehicle.

Households save for a pension through a pension fund. Contributions to the fund can be deducted from the household's taxable personal income. The pension, however, is taxed under the personal income tax. In order to avoid the personal income tax on direct household savings, the household may save through a mutual fund as well. Because the fund retains the earnings on corporate investments, the earnings are taxed at the mutual fund's tax rate, which is lower than the personal income tax rate. Consequently, an indirect investment in a pension fund or a mutual fund might save tax.

Saving through a mutual fund is an alternative to direct household savings, as opposed to saving for a pension that is received only at retirement. As a result, the investment in debt through a mutual fund is referred to as the *innovative opportunity return*.

The after-tax return on equity-financed investment in owner-occupied housing, in a closely-held corporation and in a proprietorship is linked to the traditional or to the innovative opportunity return.

Marginal effective tax rates

The tax wedge w is the difference between p and s. The marginal effective tax rate equals $t_e = \frac{p-s}{p}$ [1].

Structure of the chapter

The remainder of the chapter is structured as follows. Given the household's before-tax nominal rate of return, *section 2.3* focuses on the cost of capital on debt-financed and equity-financed investment in the corporate firm. *Sections 2.4* and *2.5* then determine the household's after-tax real rate of return on the corporate investment. Direct investment is

[1] The corporate marginal effective tax rate $t_c = \frac{p-(\rho-\pi)}{p}$ measures the tax burden at the firm level. Similarly, the marginal effective tax rate at the household level $t_h = \frac{(\rho-\pi)-s}{(\rho-\pi)}$ measures the tax burden at the household level. t_e satisfies $t_e = t_c + t_h(1-t_c)$.

financed with debt, newly issued equity or retained earnings in *section 2.4*. Households invest indirectly in the firm through a mutual fund or a pension fund in *section 2.5*.
Taxes on the closely-held corporation and the proprietorship deviate from the taxes on the corporate firm. *Section 2.6* discusses the controlling shareholder's after-tax real rate of return on the investment financed with newly issued equity or retained earnings. *Section 2.7* discusses the p and s on a debt and an equity-financed investment in the proprietorship.
Section 2.8 derives the cost of capital and the marginal effective tax rates in case of declining-balance economic depreciation at replacement costs. The analysis focuses on more general depreciation allowances as well.
Section 2.9 focuses on a debt-financed and an equity-financed investment in owner-occupied housing. An expression for the financial gain is derived if the household prefers to finance investment with borrowed funds.
Finally, *section 2.10* discusses the fixed-r assumption. The shortcomings of this chapter's method are analysed, which leads to suggestions for an alternative method.

2.3 Investment in the corporate firm

This section studies the cost of capital of debt-financed and equity-financed investments in a corporate firm. *Section 2.3.1* establishes the link between the firm's nominal discount rate ρ^b and the before-tax real rate of return p. *Section 2.3.2* discusses the tax treatment of depreciation. Given the deduction of interest payments from taxable earnings, *section 2.3.3* establishes the link between ρ^b and ρ.

2.3.1 The cost of capital

The net present value of the corporate firm's investment V amounts to

$$(2.1) \qquad V = -(1+B-A) + \int_{t=0}^{\infty} \left[(1-\tau)(p+\delta) - w_c\right] \cdot e^{-(\rho^b+\delta-\pi)t}\, dt \,.$$

In every period the firm earns a real return $p+\delta$, which is the sum of the investment's pre-tax real return p and a return to pay for the depreciation δ of the investment. The total return $p+\delta$ is taxed at the corporate tax rate τ. The firm pays a local property tax w_c on the value of the asset in every period. The value of the asset (and therefore the return the investment generates) increases at the rate of inflation π, drops in value at the rate of depreciation δ and is discounted at the rate ρ^b. τ, π and δ are assumed to be constant over time.

The cost of the project is unity, which equals the initial payment for the asset, net of the present discounted value of any grants and/or tax allowances A. Tax authorities levy a tax on the value of the newly attracted source of finance t_{sf}, and levy a transaction tax t_p when the firm buys real property. These taxes $B = t_{sf} + t_p$ increase the project's cost.

For any given discount rate ρ^b, the value of p that solves $V = 0$ is the pre-tax real rate of return (cost of capital) that the project must earn in order to be undertaken:

$$(2.2) \qquad p = \frac{(1+B-A)}{(1-\tau)}\left(\rho^b + \delta - \pi\right) + \frac{w_c}{(1-\tau)} - \delta \,.$$

The firm's discount rate can be expressed as a function of the cost of capital:

$$(2.3) \qquad \rho^b = \frac{(1-\tau)(p+\delta) - w_c}{(1+B-A)} - (\delta - \pi) \,.$$

The project generates a cash flow $p+\delta$, which is taxed at the corporate tax rate. After paying w_c, the investor realises the after-tax cash flow $(1-\tau)(p+\delta)-w_c$. In present value terms, the cost of the firm's project is $(1+B-A)$, which permits the calculation of the firm's after-tax cash flow per unit cost of investment. The term δ must be subtracted. π is added to obtain nominal returns. In the absence of taxes, the firm's discount rate amounts to $p+\pi$.

2.3.2 The tax treatment of depreciation

The depreciation rate δ, as part of the cash flow, is remuneration for the depreciation of the initial investment as a result of production. This remuneration can be viewed as a return to offset the cost of depreciation. However, δ is taxed under the corporate tax. To offset this tax, the government allows the firm to deduct the depreciation of the investment, computed in one way or another, from taxable earnings. This reduction in corporate taxes, together with possible investment subsidies, is represented (in present value terms) by A. Thus, A represents the present discounted value of grants and/or tax allowances given by the government: $A = f_1 A_d + f_2 \tau + f_3 g$.

1. $f_1 A_d$ represents the net present value of the reduction in corporate taxes due to depreciation allowances. f_1 denotes the proportion of the cost of an asset that is entitled to depreciation allowances. A_d represents the net present value of tax savings on a unit of investment[2].
2. $f_2 \tau$ represents the tax gain as a result of immediate expensing or free depreciation. f_2 denotes the proportion of the cost of the project qualifying for immediate expensing at the corporate tax rate τ.
3. $f_3 g$ represents the investment subsidies. f_3 denotes the proportion qualifying for investment subsidies and g stands for the rate of the investment subsidy.

[2] It is assumed that the firm's earnings are sufficiently large to take advantage of the depreciation allowances.

The net present value of depreciation allowances in case of straight-line depreciation equals $A_d = \int_{t=0}^{L} \tau \cdot \left(\frac{1}{L}\right) \cdot e^{-(\rho^b)t} dt = \frac{\tau \cdot (1 - e^{-\rho^b L})}{\rho^b L}$. The tax code specifies a lifetime L for the asset. The historical cost of the asset is written down for tax purposes during L years by $1/L$ per unit in each year.

The net present value of tax savings on a unit of investment as a result of declining-balance depreciation at historical cost at rate a equals $A_d = \int_{t=0}^{\infty} \tau \cdot a \cdot e^{-(a+\rho^b)t} dt = \frac{\tau \cdot a}{a + \rho^b}$ [3].

2.3.3 The deduction of interest payments from taxable earnings

With *equity financing*, the household's (intermediary's) nominal rate of return before personal taxes equals the firm's nominal rate of return after corporate taxes: $\rho = \rho^b$.

In case of *debt financing*, the firm can deduct the interest payments from its taxable earnings. Because no corporate taxes have to be paid on distributed interest payments, ρ can be expressed as

(2.4) $\rho = \rho^b + \tau\rho = \rho^b + \frac{\tau\rho^b}{(1-\tau)}$ *or* $\rho = \frac{\rho^b}{(1-\tau)}$.

Per percentage of ρ^b, the government implicitly pays the household or intermediary an extra $\tau/(1-\tau)$ percentage, as a result of the interest deductibility.

2.4 Direct household savings in the corporate firm

Given the nominal interest rate and the shareholder's before-tax nominal rate of return, this section derives the household's after-tax real rate of return of direct investment in the corporate firm. The household finances investment with debt in *section 2.4.1*. Investment is financed with newly issued equity in *section 2.4.2* and with retained earnings in *section 2.4.3*.

2.4.1 Debt

The net present value V of direct household investment in debt amounts to

(2.5) $V = -1 + \int_{n=0}^{\infty} \lambda e^{-\lambda n} \left[\int_{t=0}^{n} ((1-t_y)(r+\pi) - t_w) e^{-\rho_H t} dt + 1 e^{-\rho_H n} \right] dn$.

[3] If declining-balance depreciation allowances are computed at replacement cost, the net present value of tax savings on a unit of investment due to depreciation at rate a equals $A_d = \int_{t=0}^{\infty} \tau \cdot a \cdot e^{-(a+\rho^b-\pi)t} dt = \frac{\tau \cdot a}{a + \rho^b - \pi}$. The depreciation allowances increase with the inflation rate because replacing the asset becomes more expensive over time.

In the first period, the household buys a bond at the price of 1 euro. This investment yields in every period a return equal to the nominal interest rate $r+\pi$, which is taxed under the income tax. Consequently, in every period the household receives after-tax income equal to $(1-t_y)(r+\pi)$. The bond of 1 euro increases the wealth of the household. The household therefore pays every year a wealth tax t_w. After n periods, the household sells its bond (or the bond expires) and recovers the original investment[4]. The traditional household's s can be expressed as[5]

(2.6) $$s=(1-t_y)(r+\pi)-t_w-\pi\ .$$

The after-tax real rate of return is equal to the nominal interest rate after income tax, net of the wealth tax and the inflation rate.

2.4.2 Newly issued equity

The net present value V of investment financed with newly issued equity (the return of the investment is distributed as dividends) amounts to

(2.7) $$V=-1+\int_{n=0}^{\infty}\lambda e^{-\lambda n}\left[\int_{t=0}^{n}((1-t_y)\rho-t_w q)e^{-\rho_H t}dt+qe^{-\rho_H n}\right]dn\ .$$

The household initially buys a newly issued share of the corporate firm at the price of 1 euro[6]. In every period, the household earns dividends ρ, which are taxed under the personal income tax t_y. The 1 euro of newly issued equity increases the value of the firm's equity by q. The household has to pay a wealth tax t_w on the increase in value of the firm's equity. After n periods, the household sells its share and recovers its value q.

The increase in value of the firm's equity equals the present value of after-tax dividends net of the wealth tax on the increase in value of the firm's equity:

(2.8) $$q=\int_{t=0}^{\infty}\left[(1-t_y)\rho-t_w q\right]e^{-\rho_H t}dt\ .$$

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[4] It is assumed that the household's holding period of the asset follows an exponential distribution with parameter λ, where $1/\lambda$ represents the expected holding period.

[5] $V=0$ in (2.5) is solved for the household's after-tax nominal rate of return $\rho_H=(1-t_y)(r+\pi)-t_w$. Because $s=\rho_H-\pi$, (2.6) follows immediately.

[6] ρ_H can be interpreted as the (required) rate of return on an 'alternative' investment that makes the household indifferent between the firm's project and the alternative investment. Instead of buying newly issued equity, the household can invest its funds in the alternative investment. This opportunity investment yields a stream of benefits equal to $\int_{n=0}^{\infty}\lambda e^{-\lambda n}\left[\int_{t=0}^{n}\rho_H e^{-\rho_H t}dt+1\cdot e^{-\rho_H n}\right]dn$, which equals 1. The cost of the investment financed with newly issued equity thus equals 1 euro.

The household's after-tax real rate of return and the increase in value of the firm's equity are as follows:[7]

(2.9) $s = (1 - t_y)\rho - t_w - \pi \qquad and \qquad q = 1$.

Because the return of the investment is distributed as dividends, the household's after-tax dividends are equal to the before-tax return ρ that is taxed under the income tax, net of the wealth tax on the increase in value of the firm's equity. q equals 1 euro because the household buys newly issued equity at price 1 only if the value of the firm's equity increases by the same amount.

2.4.3 Retained earnings

The net present value V of investment financed with retained earnings (the return of the investment is distributed as dividends) amounts to

(2.10) $$V = -(1 - t_y) + \int_{n=0}^{\infty} \lambda e^{-\lambda n} \left[\int_{t=0}^{n} \left[(1 - t_y)\rho - t_w q \right] e^{-\rho_H t} dt + (1 - t_c) q e^{-\rho_H n} \right] dn .$$

Because the investment of 1 euro is financed with retained earnings, the investment costs the household only $(1 - t_y)$ euro[8]. The household receives $(1 - t_y)$ euro if the firm distributes the profits of 1 euro, because dividends are taxed under the personal income tax (dividend tax). If the firm reinvests the retained earnings, it realises in every period a return $(1 - t_y)\rho - t_w q$. After n periods, the household sells the asset and realises the capital gain q. Realised capital gains are taxed under the capital gains tax t_c.

The increase in value of the firm's equity q equals the present value of after-tax dividends generated by the 1 euro investment financed with retained earnings net of the wealth tax on the increase in value:

(2.11) $$q = \int_{t=0}^{\infty} \left[(1 - t_y)\rho - t_w q \right] e^{-\rho_H t} dt .$$

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[7] Calculate the integral of (2.8) and solve the result for q as a function of ρ_H: $q = \frac{(1 - t_y)\rho}{\rho_H + t_w}$. This result is used to solve (2.7) for ρ_H (solving $V = 0$): $\rho_H = (1 - t_y)\rho - t_w$, which implies that $q = 1$.

[8] The analysis of the cost of the investment is similar to the analysis presented in *footnote 6*. However, the household invests only $(1 - t_y)$ euro instead of 1 euro in case of investment financed with newly issued equity. Hence, the stream of benefits of the opportunity investment in *footnote 6* must be multiplied with the term $(1 - t_y)$.

The real after-tax rate of return and the increase in value of the firm's equity[9] (in the remainder of the text, $\frac{\lambda t_c}{\lambda + \rho_H}$ is represented by T_c) amount to

(2.12) $s = \left(1 - \frac{\lambda t_c}{\lambda + \rho_H}\right)\rho - t_w - \pi$ *and* $q = \frac{(1 - t_y)}{\left(1 - \frac{\lambda t_c}{\lambda + \rho_H}\right)}$ [10].

q and s are linked: s equals the after-tax real rate of return on the investment distributed as dividends, and q equals the present value of these after-tax dividends. At the margin, the household is indifferent between retaining 1 euro of profits and distributing that euro as dividends. In case of retention, the value of the equity increases by q, which results in an after-tax capital gain equal to $(1 - T_c)q$. If the profits are distributed, the household receives $(1 - t_y)$. Hence, dividend taxes do not affect the household's after-tax real rate of return, but are capitalised into the value of the firm's equity. $(1 - T_c)q = (1 - t_y)$ can be written as

(2.13) $(1 - T_c)[(1 - t_y)\rho - t_w q] = (1 - t_y)\rho_H$ [11].

The household is indifferent between the rate of return realised when the profits are retained and reinvested (left-hand side), and the rate of return realised when the after-tax dividends are invested in the alternative project (right-hand side). If the profits of 1 euro are distributed, the household will invest the $(1 - t_y)$ dividends in the alternative project, which yields a rate of return ρ_H. The investment project financed with retained earnings will yield a rate of return $(1 - t_y)\rho - t_w q$ (see (2.10)). Capital gains taxes are due on the increase in value of the firm's equity. However, a tax on capital gains in the last period at the rate t_c is equivalent to a tax on the return in every period at the rate T_c. Subtracting the inflation rate from the solution of (2.13) yields the household's after-tax real rate of return of condition (2.12).

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[9] Calculate the integral of (2.11) and solve the result for q as a function of ρ_H: $q = \frac{(1 - t_y)\rho}{\rho_H + t_w}$. This result is used to solve (2.10) for ρ_H (solving $V = 0$): $\rho_H = (1 - T_c)\rho - t_w$, which is used to calculate that $q = \frac{(1 - t_y)}{(1 - T_c)}$.

[10] If the average holding period drops to zero: $\left(1/\lambda\right) \to 0 \Leftrightarrow \lambda \to \infty$, the increase in the value of the firm's equity reduces to $q = \frac{(1 - t_y)}{(1 - t_c)}$. An average holding period that drops to zero implies that the household realises its capital gain almost immediately. This can be interpreted as if the capital gains tax is a tax on accrual, instead of a tax on realisation.

[11] From (2.11): $q = \frac{(1 - t_y)\rho - t_w q}{\rho_H}$. The substitution of q into $(1 - T_c)q = (1 - t_y)$ implies condition (2.13).

2.5 Indirect household savings in the corporate firm

This section derives the household's after-tax real rate of return s on indirect investment in the corporate firm. A mutual fund (*section 2.5.1*) or a pension fund (*section 2.5.2*)[12] controls the household savings in corporate debt or equity.

2.5.1 Mutual fund

A household buys a share of a mutual fund that invests in debt or equity. The fund's earnings are retained and reinvested and are therefore taxed at the mutual fund's tax rate. When the household sells its participation in the fund, the return is subject to the capital gains tax. The net present value V of investment through a mutual fund amounts to

$$(2.14)\quad V = -1 + \int_{n=0}^{\infty} \lambda e^{-\lambda n} \left[(1 \cdot e^{(1-\tau_{mf})\rho n} - 1)(1 - t_c) e^{-\rho_H n} + e^{-\rho_H n} - \int_{t=0}^{n} t_w (1 \cdot e^{(1-\tau_{mf})\rho t}) e^{-\rho_H t} dt \right] dn .$$

In the first period, the household buys a share of the mutual fund at the price of 1 euro. The mutual fund invests these funds in debt or equity. Investment in equity yields the nominal return ρ, and investment in debt yields $\rho = r + \pi$. The tax on the mutual fund τ_{mf} is due on the fund's earnings. Consequently, the fund will reinvest in every period the return $(1 - \tau_{mf})\rho$. After n periods, the household sells its share in the mutual fund. It realises the capital gain and recovers the original investment. The increase in value of the asset is taxed under the capital gains tax t_c. This is represented in the first term in the square brackets of condition (2.14). Moreover, in every period the tax authorities levy a wealth tax t_w on the value of the asset in that particular period, as shown in the last term. The household's real after-tax return is

$$(2.15)\quad s = \left(1 - \frac{\lambda t_c}{\lambda + \rho_H} \right) (1 - \tau_{mf})\rho - t_w - \pi .$$

Taxing the capital gains in the last period at the rate t_c is equivalent to taxing the return in every period at the rate $\frac{\lambda t_c}{\lambda + \rho_H}$. Consequently, the effect of the capital gains tax on s will be lower the longer is the holding period.

[12] It is assumed that the return of the intermediary's investment is taxed irrespective of whether the return is received as dividends, unrealised capital gains or interest payments. The intermediary's capital gains are taxed when they accrue and not when they are realised. It otherwise introduces a difference between the intermediary's investment financed with retained earnings and newly issued equity. This additional complexity is not studied here.

2.5.2 Pension fund

The net present value V of household investment in a pension fund amounts to

$$(2.16)\quad V = -(1-t_d) + \int_{n=0}^{\infty} \lambda e^{-\lambda n} \left[(1 \cdot e^{(1-\tau_{pf})\rho n})(1-t_y) e^{-\rho_H n} - \int_{t=0}^{n} t_w (1 \cdot e^{(1-\tau_{pf})\rho t}) e^{-\rho_H t} dt \right] dn .$$

The household has 1 euro (before income tax), which it saves for a pension through a pension fund. Even though the intermediary receives savings of 1 euro, the cost for the household equals only $(1-t_d)$ euro because pension savings can be deducted from taxable personal income. t_d is the household's marginal income tax rate at the time of saving. The pension fund invests in debt or equity. This investment yields in every period a return ρ ($\rho = r + \pi$ in case of debt), which is taxed at the pension fund's tax rate τ_{pf}. After n years, the total return, which equals the original contributions augmented with the return of the investment, is distributed and entirely taxed at the household's personal income tax rate t_y. It is assumed that wealth taxes are due yearly on the value of the pension savings in that particular year. The household's real after-tax rate of return amounts to

$$(2.17)\quad s = (1-\tau_{pf})\rho + \frac{\lambda(t_d - t_y)}{(1-t_d)} - \frac{t_w}{(1-t_d)} - \pi .$$

ρ in (2.17) is not taxed under the income tax. The household is indifferent between investing 1 euro for n years at the nominal return ρ (after which the entire sum is taxed at the rate t_y), and investing $(1-t_y)$ euro for n years at the nominal return ρ (no additional taxation after n years). Consequently, the investment in a pension fund is interpreted as if the household in (2.16) actually invests $(1-t_y)$ euro, which yields a return $(1-\tau_{pf})\rho$. This investment costs the household only $(1-t_d)$ euro. The difference between the cost and the actual investment equals $(t_d - t_y)$. This additional return $(t_d - t_y)$ per unit cost of investment $(1-t_d)$ is spread over the asset's expected holding period, which implies that the household realises an additional return in every period equal to $\frac{\lambda(t_d - t_y)}{(1-t_d)}$.

2.6 The closely-held corporation

Controlling shareholders of a closely-held corporation might transfer highly taxed labour income into lower taxed capital income. The tax authorities, in response, tax the return on the equity-financed investment in the closely-held corporation at special (higher) rates. Dividends and capital gains are taxed, respectively, at the rate t_y^c and t_c^c. Business wealth is taxed under the wealth tax t_w^c at the personal level.

The controlling shareholder can finance investment with newly issued equity or retained earnings (the return is distributed as dividends). The real after-tax rate of return and the increase in value of the equity are respectively (see *section 2.4.2 – 2.4.3*)

(2.18) $s = (1 - t_y^c)\rho - t_w^c - \pi$ *and* $q = 1$

(2.19) $s = \left(1 - \frac{\lambda t_c^c}{\lambda + \rho_H}\right)\rho - t_w^c - \pi$ *and* $q = \frac{(1 - t_y^c)}{\left(1 - \frac{\lambda t_c^c}{\lambda + \rho_H}\right)}$.

2.7 The proprietorship

This section derives the cost of capital and the after-tax real rate of return on investment in the proprietorship. In contrast to the corporation, the proprietorship is characterised by the absence of a legal entity that is taxed separately. Earnings are not taxed at the corporate tax rate, but are taxed at the income tax rate of the proprietor t_y^s. A in *section 2.3.2* is determined by replacing τ by t_y^s. B reduces to t_p. The cost of capital amounts to $p = \frac{(1 + B - A)}{(1 - t_y^s)}\left(\rho^b + \delta - \pi\right) + \frac{w_c}{(1 - t_y^s)} - \delta$. The proprietor can finance the investment out of own funds (equity) or with debt.

Debt-financed investment

$\rho = \frac{\rho^b}{(1 - t_y^s)}$ in case of debt financing because interest payments are deductible from the proprietorship's taxable earnings.

Equity-financed investment

The proprietor can finance investment with own funds. The net present value of an equity-financed investment (the return of the investment is distributed as dividends), amounts to

(2.20) $V = -1 + \int_{n=0}^{\infty} \lambda e^{-\lambda n}\left[\int_{t=0}^{n} (\rho - t_w^s q) e^{-\rho_H t} dt + q e^{-\rho_H n}\right] dn$.

The proprietor earns in every period the return ρ ($\rho = \rho^b$), but has to pay a wealth tax t_w^s on the value of the asset. The increase in value of the equity q as a result of the equity-financed investment equals

(2.21) $q = \int_{t=0}^{\infty} \left[\rho - t_w^s q\right] e^{-\rho_H t} dt$.

The after-tax real rate of return and increase in value of the equity amounts to

(2.22) $s = \rho - t_w^s - \pi \qquad and \qquad q = 1$.

2.8 Applying the method

This section applies the King-Fullerton method. It presents values for the cost of capital and marginal effective tax rates for declining-balance economic depreciation at replacement costs, and for more general depreciation allowances.

- *Declining-balance economic depreciation at replacement costs*

In case of declining-balance depreciation at the economic rate of depreciation based on replacement costs (and if $B = w_c = 0$), the firm's after-tax nominal rate of return amounts to $\rho^b = (1-\tau)p + \pi$. The depreciation allowance that can be deducted from taxable earnings equals the return the firm receives to pay for the depreciation of the asset. Consequently, only the pre-tax real return is taxed at the corporate tax rate.

Table 3 presents the expressions for the cost of capital and marginal effective tax rates if the investment is financed with debt.

Table 3: debt financing in case of economic depreciation at replacement costs

Corporate firm	$\rho = r + \pi$	$\rho^b = (1-\tau)(r+\pi)$	$p = r - \frac{\tau\pi}{(1-\tau)}$	$t_c = \frac{-\tau\pi}{(1-\tau)p}$	
• *Direct savings*		$t_e = t_y + \frac{(t_y - \tau)\pi}{(1-\tau)p} + \frac{t_w}{p}$			
• *Indirect savings:*	*mutual fund*	$t_e = \tau_{mf} + T_c(1-\tau_{mf}) + \frac{(\tau_{mf} + T_c(1-\tau_{mf}) - \tau)\pi}{(1-\tau)p} + \frac{t_w}{p}$			
	pension fund	$t_e = \tau_{pf} + \frac{(\tau_{pf} - \tau)\pi}{(1-\tau)p} - \frac{\lambda(t_d - t_y)}{(1-t_d)p} + \frac{t_w}{(1-t_d)p}$			
Proprietorship	$\rho = r + \pi$	$\rho^b = (1-t_y^s)(r+\pi)$	$p = r - \frac{t_y^s\pi}{(1-t_y^s)}$	$t_c = \frac{-t_y^s\pi}{(1-t_y^s)p}$	
• *Traditional opportunity return*		$t_e = t_y + \frac{(t_y - t_y^s)\pi}{(1-t_y^s)p} + \frac{t_w}{p}$			
• *Innovative opportunity return*		$t_e = \tau_{mf} + T_c(1-\tau_{mf}) + \frac{(\tau_{mf} + T_c(1-\tau_{mf}) - t_y^s)\pi}{(1-t_y^s)p} + \frac{t_w}{p}$			

Table 4 presents the expressions for the cost of capital and marginal effective tax rates if the marginal investment is financed with equity.

Table 4: equity financing in case of economic depreciation at replacement costs

Direct saving in equity of the corporate firm $\rho = \rho^b = (1-\tau)p + \pi \qquad t_c = \tau$

Newly issued equity $p = \dfrac{r}{(1-\tau)} \qquad t_e = \tau + t_y(1-\tau) + \dfrac{t_y\pi + t_w}{p}$

Retained earnings $p = \dfrac{(1-t_y)r}{(1-\tau)(1-T_c)} + \dfrac{(T_c - t_y)\pi}{(1-\tau)(1-T_c)} \qquad t_e = \tau + T_c(1-\tau) + \dfrac{T_c\pi + t_w}{p}$

Indirect saving in equity of the corporate firm $\rho = \rho^b = (1-\tau)p + \pi \qquad t_c = \tau$

$\rho = r + \pi \qquad p = \dfrac{r}{(1-\tau)}$

- *Mutual fund* $t_e = \tau + (1-\tau)[\tau_{mf} + T_c(1-\tau_{mf})] + \dfrac{(\tau_{mf} + T_c(1-\tau_{mf}))\pi + t_w}{p}$
- *Pension fund* $t_e = \tau + (1-\tau)\tau_{pf} + \dfrac{\tau_{pf}\pi}{p} - \dfrac{\lambda(t_d - t_y)}{(1-t_d)p} + \dfrac{t_w}{(1-t_d)p}$

Equity of the closely-held corporation $\rho = \rho^b = (1-\tau)p + \pi \qquad t_c = \tau$

- *Traditional controlling shareholder*

Newly issued equity

$$p = \frac{(1-t_y)(r+\pi) + (t_w^c - t_w)}{(1-t_y^c)(1-\tau)} - \frac{\pi}{(1-\tau)} \qquad t_e = \tau + (1-\tau)t_y^c + \frac{t_y^c\pi + t_w^c}{p}$$

Retained earnings

$$p = \frac{(1-t_y)(r+\pi) + (t_w^c - t_w)}{(1-T_c^c)(1-\tau)} - \frac{\pi}{(1-\tau)} \qquad t_e = \tau + (1-\tau)T_c^c + \frac{T_c^c\pi + t_w^c}{p}$$

- *Innovative controlling shareholder*

Newly issued equity

$$p = \frac{(1-T_c)(1-\tau_{mf})(r+\pi) + (t_w^c - t_w)}{(1-t_y^c)(1-\tau)} - \frac{\pi}{(1-\tau)} \qquad t_e = \tau + (1-\tau)t_y^c + \frac{t_y^c\pi + t_w^c}{p}$$

Retained earnings

$$p = \frac{(1-T_c)(1-\tau_{mf})(r+\pi) + (t_w^c - t_w)}{(1-T_c^c)(1-\tau)} - \frac{\pi}{(1-\tau)} \qquad t_e = \tau + (1-\tau)T_c^c + \frac{T_c^c\pi + t_w^c}{p}$$

Equity of the proprietorship $\rho = \rho^b = (1-t_y^s)p + \pi$

- *Traditional proprietor* $p = \dfrac{(1-t_y)(r+\pi) + (t_w^s - t_w) - \pi}{(1-t_y^s)} \qquad t_e = t_y^s + \dfrac{t_w^s}{p}$
- *Innovative proprietor* $p = \dfrac{(1-T_c)(1-\tau_{mf})(r+\pi) + (t_w^s - t_w) - \pi}{(1-t_y^s)} \qquad t_e = t_y^s + \dfrac{t_w^s}{p}$

- *General results*

Depreciation allowances A can be written as the sum of declining-balance depreciation allowances at the economic rate of depreciation based on replacement costs and an additional term $\overline{A}$. Hence, $\overline{A}$ is the difference between the cost of the investment in case of declining-balance economic depreciation based on replacement costs and the actual cost of the investment $1-A$. If $B = w_c = 0$, ρ^b amounts to

$$\text{(2.23)} \quad \rho^b = \frac{(1-\tau)p+\delta}{(1-\overline{A})} - (\delta - \pi).$$

The firm's cash flow, which is taxed under the corporate tax, consists of a return to pay for the cost of depreciation. To offset these taxes, the government allows the firm to deduct the depreciation of the investment from taxable earnings. This strategy is equivalent to the strategy that does not tax the return to pay for the cost of depreciation and gives a cost (tax) reduction in the initial period net of the present value of corporate taxes on the return to pay for the cost of depreciation. Consequently, the cost of the investment differs from unity in so far as the depreciation allowances differ from the allowances in case of declining-balance economic depreciation based on replacement costs. The cost of capital equals

$$\text{(2.24)} \quad p = \frac{(1-\overline{A})(\rho^b - \pi) - \overline{A}\delta}{(1-\tau)}.$$

If $\overline{A} = 0$, the return to pay for the cost of depreciation is sufficient to replace the decrease in value due to depreciation. Consequently, the cost of capital does not depend on δ. If $\overline{A} < 0$, the firm has to earn a higher p. In order to receive the return to pay for the cost of depreciation in every period tax-free, (2.24) can be interpreted as if the tax authorities levy initially an additional amount $-\overline{A} > 0$. The firm then actually invests $1-\overline{A} > 1$ units.

The general cost of capital $p|_{\overline{A}}$ in (2.24) is linked to the cost of capital in case $\overline{A} = 0$ ($p|_{\overline{A}=0}$)

$$\text{(2.25)} \quad p|_{\overline{A}} = (1-\overline{A})p|_{\overline{A}=0} - \frac{\overline{A}\delta}{(1-\tau)}.$$

The marginal effective tax rates in the general case amount to

$$\text{(2.26)} \quad t_e|_{\overline{A}} = \frac{p|_{\overline{A}=0}}{p|_{\overline{A}}}\left[t_e|_{\overline{A}=0} - \overline{A}\right] - \frac{\overline{A}\delta}{(1-\tau)p|_{\overline{A}}}.$$

Because $p|_{\overline{A}=0}$ and $t_e|_{\overline{A}=0}$ are described in *table 3* and *table 4*, the general expressions for the cost of capital and marginal effective tax rate can easily be derived from condition (2.26).

2.9 Owner-occupied housing

Instead of investing in the (closely-held) corporation or the proprietorship, the household can invest in owner-occupied housing. The household finances the investment with equity (own funds) in *section 2.9.1* and borrows funds in *section 2.9.2*. Given the household's opportunity return s, the analysis discusses the cost of capital. If the household prefers to finance investment with borrowed funds, the financial gain is derived as well.

2.9.1 Equity-financed investment

The net present value V of an equity-financed investment in owner-occupied housing equals

$$(2.27)\quad V = -(1+t_p) + \int_{n=0}^{\infty} \lambda e^{-\lambda n} \left[\int_{t=0}^{n} \left[(p+\delta) - irv \cdot t_y - w_c - t_w^h \right] \cdot e^{-(\rho_H + \delta - \pi)t} dt + 1 \cdot e^{-(\rho_H + \delta - \pi)n} \right] dn .$$

Equity-financed investment costs the household 1 euro augmented with a transaction tax (property transfer tax) t_p [13]. The investment yields a pre-tax real return p and a return to pay for the depreciation of the house δ. The value of the house is increasing at the inflation rate π and is decreasing at δ. Earnings are discounted at the nominal rate ρ_H. The imputed rental values (irv) are added to the household's income and are taxed under the personal income tax t_y. Moreover, the value of the asset is taxed under a local property tax w_c and is subject to the wealth tax t_w^h. After n years, the household sells the house and recovers the value (of 1 euro). The household's after-tax rate of return ρ_H equals

$$(2.28)\quad \rho_H = \frac{p + \delta - irv \cdot t_y - w_c - t_w^h - \lambda t_p}{1 + t_p} - (\delta - \pi) .$$

ρ_H consists of the cash-flow $p+\delta$ net of the capital taxes on owner-occupied housing, per unit cost of investment. The transaction tax t_p is spread over the expected holding period. The depreciation rate δ has to be subtracted. π is added to obtain nominal returns.

The investment's cost of capital is the minimum value of the housing services net of economic depreciation that the household would have to pay if it were to rent a similar house on the market in order to be indifferent between the investment opportunities. If the rental costs net of economic depreciation on the housing market are lower than the cost of capital, then the household has an incentive to rent a house and invest its funds alternatively.

A traditional household requires that savings yield at least the opportunity return of a direct investment in debt (condition (2.6)). The cost of capital amounts to

[13] Income- and household-dependent government subsidies of investment in owner-occupied housing are not studied.

(2.29) $p^T = (1+t_p)\{(1-t_y)(r+\pi)-t_w\} + irv \cdot t_y + w_c + t_w^h - (1+t_p)\pi + t_p(\delta+\lambda)$.

The household requires its traditional opportunity return[14] on the cost of the investment $(1+t_p)$. The capital taxes that are due (personal income tax, local property tax and wealth tax) increase the minimum required rate of return. The value of the $(1+t_p)$ euro of investment is increasing at π, which decreases p^T. $(1+t_p)\delta$ represents the depreciation of the $(1+t_p)$ units of investment. The household receives only δ as part of the cash flow. The difference $t_p\delta$ increases the cost of capital. Finally, the transaction tax is spread over the expected holding period, which increases the cost of capital by $t_p\lambda$. This cost of capital can be written as

(2.30) $p^T = (1+t_p)r + t_y\{irv - (1+t_p)(r+\pi)\} + w_c + \{t_w^h - (1+t_p)t_w\} + t_p(\delta+\lambda)$.

The first term represents the real interest rate on the invested amount $(1+t_p)$. r would be the required real rate of return in the absence of capital income taxes. If the imputed rental values are lower than the household's before-tax opportunity return (nominal interest rate) on the invested amount, then the household receives a subsidy on owner-occupied housing that increases with the income tax. A similar reasoning holds for the wealth tax. The local property tax and the term $t_p(\delta+\lambda)$ increase the cost of capital.

2.9.2 Debt-financed investment

The household might invest its own funds in an alternative investment while it borrows to finance the investment in owner-occupied housing[15]. The return on the alternative investment is used to pay for the borrowing costs. The present value V of a debt-financed investment in owner-occupied housing equals the gains net of the financing costs:

(2.31) $$V = -(1+t_p)\cdot\left[\int_{n=0}^{\infty}\lambda e^{-\lambda n}\left[\int_{t=0}^{n}\left[(1-t_y)(r+\pi)-t_w^d\right]\cdot e^{-\rho_H t}dt + 1\cdot e^{-\rho_H n}\right]dn\right] + \int_{n=0}^{\infty}\lambda e^{-\lambda n}\left[\int_{t=0}^{n}\left[(p+\delta)-irv\cdot t_y - w_c - t_w^h\right]\cdot e^{-(\rho_H+\delta-\pi)t}dt + 1\cdot e^{-(\rho_H+\delta-\pi)n}\right]dn$$.

[14] In case of an innovative investment in debt through a mutual fund, the cost of capital amounts to $p^I = (1+t_p)\{(1-T_c)(1-\tau_{mf})(r+\pi)-t_w\} + irv\cdot t_y + w_c + t_w^h - (1+t_p)\pi + t_p(\delta+\lambda)$, which can be written as $p^I = (1+t_p)r + \{irv\cdot t_y - (1+t_p)(\tau_{mf} + T_c(1-\tau_{mf}))(r+\pi)\} + w_c + \{t_w^h - (1+t_p)t_w\} + t_p(\delta+\lambda)$.

[15] This possible household preference of financing investment with borrowed funds is not limited to household investment in owner-occupied housing. It holds for all household savings.

The first term reflects the financing costs FC. The household borrows $(1+t_p)$ euro. Interest payments have to be paid, but are deductible from the household's taxable personal income. Moreover, the debt can be deducted from the household's taxable wealth, which reduces the yearly cost by t_w^d. After n years, the originally borrowed funds must be paid back. It is assumed that the holding period of the owner-occupied house and therefore of the loan follows an exponential distribution with parameter λ, where $1/\lambda$ represents the expected holding period.

The financing costs can be written as $FC = (1+t_p)(1-F)$ [16]. $F = \frac{\rho_H - ((1-t_y)(r+\pi) - t_w^d)}{\lambda + \rho_H}$ denotes the financing gains (or losses) and depends on the difference between the household's opportunity return ρ_H and the borrowing costs.

ρ_H represents the required rate of return on the alternative investment that equalises the benefits with the financing costs of an investment in owner-occupied housing[17]. This return, which makes the household indifferent between investing and not investing in owner-occupied housing financed with borrowed money, amounts to

$$\rho_H = \frac{p + \delta - irv \cdot t_y - w_c - t_w^h + \lambda(F - t_p(1-F))}{(1-F)(1+t_p)} - (\delta - \pi). \quad (2.32)$$

ρ_H consists of the cash-flow $p+\delta$ net of the capital taxes per unit cost of investment. The investment of 1 euro in owner-occupied housing costs the household $(1-F)(1+t_p)$ euro of own funds that must be invested in the alternative project in order to pay for the borrowing costs. After n years, the household sells the house and recovers the invested euro. The difference between the invested euro and the costs of the investment $(1-F)(1+t_p)$ is an additional gain (or loss) $(F - t_p(1-F))$, which is spread over the expected holding period. The term $(\delta - \pi)$ must be subtracted.

Traditional opportunity return

Because the traditional opportunity return equals the borrowing costs $(1-t_y)(r+\pi) - t_w^d$, the household that requires a traditional opportunity return does not realise a gain (or loss) when it borrows: $F = 0$. The financing costs reduce to $(1+t_p)$, which equals the cost in case of an equity-financed investment. Consequently, this household is indifferent between an equity-financed and a debt-financed investment in owner-occupied housing. The cost of capital is presented in condition (2.29).

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[16] ρ_H is the return that solves $V = 0$. The solution of (2.31) with respect to the financing costs amounts to $FC = (1+t_p)\left[\frac{\lambda + (1-t_y)(r+\pi) - t_w^d}{\lambda + \rho_H}\right]$, which simplifies to the condition presented above.

[17] The financing costs are written as $FC = (1+t_p)(1-F)$. The analysis assumes that $t_w^d = t_w$.

Innovative opportunity return

It is assumed that the innovative opportunity return of an investment in debt (condition (2.15)) exceeds the borrowing costs[18]. Instead of investing its own funds in the owner-occupied housing, the household has an incentive to invest its funds innovatively in market debt and to borrow in order to finance the investment. The additional gain reduces the cost of capital on the debt-financed investment below the cost of capital on an equity-financed investment. The finance gain F amounts to

$$F = \frac{[t_y - \tau_{mf} - T_c(1-\tau_{mf})](r+\pi)}{\lambda + (1-T_c)(1-\tau_{mf})(r+\pi) - t_w}. \quad (2.33)$$

F depends positively on the difference between the personal income tax t_y and the tax burden on an innovative investment in debt $\tau_{mf} + T_c(1-\tau_{mf})$. The cost of capital can be solved from (2.32) and equals

$$p^I = (1-F)(1+t_p)\{(1-T_c)(1-\tau_{mf})(r+\pi) - t_w\} + irv \cdot t_y + w_c + t_w^h - (1-F)(1+t_p)\pi - \{F - t_p(1-F)\}(\delta+\lambda). \quad (2.34)$$

The investment costs the household $(1-F)(1+t_p)$ euro, which implies that the household must invest $(1-F)(1+t_p)$ euro of its funds innovatively in market debt in order to pay for the debt-financed investment in owner-occupied housing. p^I in (2.34)[19] can be interpreted similarly as the cost of capital in (2.29).

2.10 Challenges and conclusions

In order to study the agents' tax-arbitrage behaviour, this chapter extends the King-Fullerton method. The net present value of the household savings depends explicitly on the costs and benefits of these savings over time.

As described in *table 2*, this chapter's method assumes a fixed real interest rate. By way of conclusion, this section criticises this fixed-*r* assumption. Alternative approaches (in particular the so-called fixed-*p* or fixed-*s* assumptions) also suffer from serious shortcomings. This section criticises the King-Fullerton method on several grounds. This criticism calls for a dynamic finance and investment model.

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[18] For simplicity, we do not insist that formula (2.14) (and therefore (2.15)) should be adjusted to incorporate the fact that, in every period, the household sells part of the innovative investment in debt in order to pay for the interest payments on the borrowed amount.

[19] Or: $p^I = (1+t_p)\{(1-t_y)(r+\pi) - t_w\} + irv \cdot t_y + w_c + t_w^h - (1+t_p)\pi + t_p(\delta+\lambda) - F(1+t_p)(\delta-\pi)$. The cost of capital covers the borrowing costs $(1+t_p)\{(1-t_y)(r+\pi) - t_w\}$ and the capital income taxes on owner-occupied housing. The inflation rate on the borrowed amount is subtracted from p^I because the inflation rate erodes the real value of the mortgage. The finance gain appears in the last term.

Fixed-s

The fixed-*r* assumption implies that different saving strategies feature different values of s. The household then invests only in the lower taxed saving opportunities yielding the highest s. Arbitrage at the household level then might lead to an equilibrium outcome where a particular saver requires the same s on all savings (fixed-*s* assumption).

In reality, however, households do not save only through the vehicles that offer the highest s up to the point where the after-tax rates of return are equalised. One reason is that the tax code often restricts the total amount of tax-favoured household savings. Another reason may be that these tax-favoured savings imply that the household must commit the savings for a longer period, which reduces liquidity. Furthermore, the saver may want to diversify savings in order to reduce risk.

Fixed-p

The fixed-*r* assumption results in a cost of capital that varies with the source of finance for a given saving strategy. This creates arbitrage opportunities for the firm. Competition may lead to an equilibrium outcome where the firm requires the same p on all sources of finance (fixed-*p* assumption).

Although firms have an incentive to finance the investment entirely with the cheapest source of finance, both debt and equity can be observed in reality because of financial market imperfections and the desire to reduce the risk of bankruptcy.

International capital market

Finally, the fixed-*r* assumption implies that the real interest rate is determined on the international capital market. In our formulas, therefore, the cost of capital in case of debt-financed investment does not depend on Dutch taxes at the household level. The cost of capital in case of equity-financed investment, in contrast, depends on the tax treatment of Dutch shareholders. A possible justification for this differential approach is that the capital market for equity is less internationally integrated than the market for debt. Indeed, equity-financed investment requires knowledge of the specific circumstances in a country.

Call for a dynamic model

The King-Fullerton method can be criticised on several grounds. First, the method described by King and Fullerton deals only with dividends and interest payments as uses of earnings, and abstracts from retentions as a possible use of the firm's earnings. A method that allows for retentions must model the investments financed with these earnings. This requires a dynamic model.

Second, firms do not always have sufficient retained earnings to finance investment. In particular, young (newly founded) firms must issue new equity or attract debt. If retained earnings are thus the preferred source of finance, young firms must finance the initial investment with more expensive sources of finance than older, mature firms with plenty of earnings on old capital. Afterwards, however, they can retain the earnings of the prior investment and finance additional investment with retained earnings. Again, modelling this interaction process requires a dynamic model.

Finally, the marginal effective tax rates reflect the firm's and household's incentives to change their saving and investment behaviour as a result of the capital income tax system. The optimal tax-arbitrage behaviour and the effects on the firm's capital accumulation are not explicitly derived, however. Again, analysing the impact of capital income taxes on actual investment behaviour requires a dynamic model of the firm's finance and investment decisions. This model will be introduced in the next chapter.

Chapter 3
Sinn’s Life-Cycle Model of the Firm

3.1 Introduction

Sinn (1990, 1991a, 1991b) studies a dynamic life-cycle model of the firm. If retained earnings are a cheaper source of finance than newly issued equity, a young firm according to Sinn issues only a nucleus of new equity. The return on the investment financed with newly issued equity is retained and reinvested. Afterwards, the return on the investment financed with retained earnings is retained and reinvested as well. The firm eventually stops investing and starts distributing dividends. Sinn's work not only shows the effect of the capital income tax system on the cost of capital, but also derives the effect of the differential tax treatment of newly issued equity and retained earnings on the length of the internal growth path.
Sinn shows that the cost of capital of newly issued equity, under some conditions, exceeds the cost of capital derived by King and Fullerton. The higher the amount of newly issued equity, the lower is the amount of investment that can be financed with the cheaper retained earnings. This opportunity cost of newly issued equity should be added to King and Fullerton's cost of capital on an investment financed with newly issued equity. Moreover, Sinn derives an expression for the cost of capital during the internal growth phase that is not derived by King and Fullerton. During the internal growth phase, the return on an investment financed with retained earnings is retained and reinvested and is not (as assumed by King and Fullerton) distributed as dividends. The cost of capital on an investment financed with retained earnings as derived by King and Fullerton is correct only when the firm reaches maturity and starts distributing dividends.

Instead of distributing highly taxed dividends, the firm might repurchase its shares. Sinn (1991c) studies the effect of share repurchases on the steady-state cost of capital and the steady-state value of the firm’s equity. Sinn demonstrates that the cost of capital on the marginal investment financed with retained earnings does not change if the tax code allows the firm to use a fixed and predetermined percentage of the earnings to repurchase shares. However, the steady-state marginal value of capital does increase because highly taxed dividends are transformed into lower taxed capital gains.

Also van Schijndel (1986, 1988) studies the impact of corporate and personal taxes on the firm’s financial, investment and dividend decisions in a dynamic setting. In contrast to Sinn (1991a), van Schijndel focuses on a finite horizon model and assumes that the firm owns an exogenous initial amount of equity and debt that is not endogenously determined (as it is in Sinn). Moreover, the firm is not allowed to issue new equity. Van Schijndel's dynamic model does, however, include debt financing. The analysis shows that if debt is more expensive

than retained earnings, the firm finances investment with debt and retained earnings until the marginal revenue of an investment equals the interest rate. Afterwards, the firm uses its earnings to redeem its entire debt. The firm subsequently finances investment only with retained earnings. When the optimal amount of capital is reached, the firm starts distributing dividends. Due to the model's finite horizon and the differential tax treatment of capital gains and dividends, the firm might find it optimal at the end of the time interval to stop distributing dividends and to retain the earnings.

The model presented in this chapter introduces debt and share repurchases in Sinn's dynamic life-cycle model of the firm. As in Sinn's model (1991a, 1991b), the model in this chapter derives the cost of capital along the entire optimal path and determines the optimal sources of finance (debt, newly issued equity or retained earnings) and the optimal use of the investment's earnings (dividends, retentions, share repurchases, interest payments or debt redemption) throughout the life cycle of the firm. Marginal effective tax rates are calculated along the entire optimal path. Moreover, the analysis focuses on direct household saving in the equity of the firm and on indirect household saving through a mutual fund.
The optimal path extends the results derived by van Schijndel (1986, 1988). The mature firm distributes dividends forever (because the model features an infinite horizon). Moreover, the firm endogenously determines the optimal amount of initial equity or debt-financed capital. The firm might issue new equity along the entire path. This extension is essential in order to study the effects of the capital income tax system. Moreover, the model analyses the effect of taxes on the increase in value of the firm's equity, interprets the results in terms of the cost of capital, and studies the influence of share repurchases.

The firm issues new equity and debt during the initial period. On the one hand, the firm is discouraged from issuing new equity in order to take advantage of the cheaper retained earnings as a source of finance. This opportunity cost might increase the cost of capital on investment financed with newly issued equity above the value of King and Fullerton, as demonstrated by Sinn. On the other hand, the firm faces an incentive to issue a sufficiently large amount of new equity so that it can invest as quickly as possible. This gain of newly issued equity might reduce the cost of capital below the value of King and Fullerton.
These results are not carried over to debt financing. As long as the investment's return exceeds the interest rate, the firm wants to attract as much debt financing as possible. The possibility of financing initial investment with debt allows the firm to accumulate more rapidly earnings that can be distributed or retained and reinvested.
Share repurchases increase the cost of an additional unit of debt, which is a weighted average of the present value of foregone dividends and foregone share repurchases. The firm might even prefer newly issued equity to debt in the steady state. In the initial period, the firm continues to issue a nucleus of new equity. Because the cost of capital of newly issued equity decreases with the amount of share repurchases, the firm might decide completely against financing investment with debt. Moreover, an increase in the amount of share repurchases shortens the firm's internal growth phase.

Section 3.2 introduces the life cycle of the firm. The model's solution is then discussed when retained earnings are the least preferred source of finance (*section 3.3*). *Section 3.4* explores

the firm's finance and investment behaviour if retained earnings are preferred to debt and if newly issued equity is the least preferred source of finance. Instead of directly investing in the firm, the household can save indirectly through a mutual fund (*section 3.5*). *Section 3.6* includes share repurchases in the life-cycle model. *Section 3.7* concludes.

3.2 The life-cycle model of the firm

Section 3.2.1 introduces the life-cycle model of the firm. *Section 3.2.2* focuses on the steady-state cost of debt, and studies the firm's preferred sources of finance.

3.2.1 The model

As in Sinn (1991a)[1], the firm produces output with capital K as production factor, which is assumed not to depreciate. Commodity prices are constant and are normalised to unity. The firm's revenue and output are described by the function $f(K)$, which satisfies $f'(K)>0, f''(K)<0$ and $f(0)=f'(\infty)=0, f'(0)=\infty$. The firm finances the investment I with newly issued equity Q, with new debt S_f or with retained earnings. D_f is the firm's total debt. The model allows for a corporate tax on distributed profits τ_d and on retained profits τ_r. τ_p is the personal income tax on dividends and interest income. Capital gains are taxed on an accrual basis. The tax rate on realised capital gains is transformed into an equivalent tax rate τ_c on accrued capital gains[2].

As in Sinn (1991a), the firm's financial and investment decisions are determined by the (representative) shareholder who wants the firm to maximise the initial value of the shares net of the originally injected equity. The shareholder is a price-taker who looks through the corporate veil and perfectly foresees all variables in the model. The shareholder can lend at the exogenous interest rate r.

The market value of the shares M is implicitly determined by the arbitrage condition (3.1). The wealth-owners are indifferent between retaining shares at a value of M or exchanging these shares for bonds. This implies that the current net return on shares equals the potential net returns $\theta_p rM$ from holding bonds

$$\theta_p\theta_d\pi^d + \dot{m}z\theta_c + (\dot{z}m - Q)\theta_c = \theta_p rM \quad (3.1)$$

The left-hand side of (3.1) represents the net return on shares (m is the price of a share and z is the number of outstanding shares). It consists of three components: $\theta_p\theta_d\pi^d$ is the net dividend paid out to shareholders, $\dot{m}z\theta_c$ is the capital gain from the existing stock of shares

[1] The model's notation is borrowed from Sinn (1987). Optimal control theory is used to solve the model analytically. The solution procedure of van Loon (1983) is used (see *appendix B*), as applied in van Schijndel (1986, 1988), van Hilten et al (1993) and Kari (1999).

[2] $1-\tau_d$ is represented by θ_d. A similar notation applies to the taxes τ_r, τ_p and τ_c.

net of the capital gains tax, and $(\dot{z}m - Q)\theta_c$ represents the net-of-tax capital gain from issuing new shares at a price below the market value.

The gross dividends π^d in expression (3.2) consist of the firm's revenue net of the firm's interest payments plus the attracted newly issued debt and equity net of the firm's investment and the corporate tax on retained profits. It is assumed that the firm's taxable earnings are high enough such that interest payments are deductible from taxable corporate earnings.

(3.2) $$\pi^d = f(K) - rD_f + S_f + Q - I - \tau_r(f(K) - rD_f - \pi^d)$$

The firm's problem is condition (3.3) – (3.11)[3]. The objective function represents the firm's initial period's market value of the shares $M(t_1)$, net of the originally injected equity. This last term equals the first-period invested capital $K(t_1)$ minus the first-period debt $D_f(t_1)$. The capital stock K and the debt D_f are the state variables. The investment I, the newly issued equity Q and the newly issued debt S_f are the control variables.

(3.3) $$\underset{\{I,S_f,Q,K(t_1),D_f(t_1)\}}{Max} \quad M(t_1) - K(t_1) + D_f(t_1)$$

Sub to:

(3.4) $$M(t_1) = \int_{t_1}^{\infty}\left[\frac{\theta_p\theta_d\pi^d(v)}{\theta_c} - Q(v)\right].e^{-\int_{t_1}^{v}\frac{\theta_p}{\theta_c}r(s)ds}\,dv$$

(3.5) $$\pi^d = f(K) - rD_f + \frac{1}{\theta_r}\left[S_f + Q - I\right]$$

(3.6) $$q_K: \quad \dot{K} = I$$

(3.7) $$q_D: \quad \dot{D}_f = S_f$$

(3.8) $$S_f \le \alpha I, \quad \lambda \ge 0, \quad \lambda(\alpha I - S_f) = 0$$

(3.9) $$Q \ge 0, \quad \mu_Q \ge 0, \quad \mu_Q \cdot Q = 0$$

(3.10) $$\theta_p\theta_d\pi^d \ge 0, \quad \mu_\pi \ge 0, \quad \mu_\pi\theta_p\theta_d\pi^d = 0$$

(3.11) $$D_f(t_1) \le \alpha K(t_1), \quad \lambda \ge 0, \quad \lambda(\alpha K(t_1) - D_f(t_1)) = 0$$

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[3] Because $\dot{M} = \dot{m}z + \dot{z}m$, (3.1) amounts to $\dot{M} = -\frac{\theta_p\theta_d}{\theta_c}\pi^d + Q + \frac{\theta_p}{\theta_c}rM$. Integration of this differential equation yields the value of the firm's equity $M(t) = \int_{t}^{\infty}\left[\frac{\theta_p\theta_d\pi^d(v)}{\theta_c} - Q(v)\right]\cdot e^{-\int_{t}^{v}\frac{\theta_p}{\theta_c}r(s)ds}\,dv$. It is assumed that $\lim_{v\to\infty}\left\{\left[\frac{\theta_p\theta_d\pi^d(v)}{\theta_c} - Q(v)\right]\cdot e^{-\int_{t}^{v}\frac{\theta_p}{\theta_c}r(s)ds}\right\} = 0$ in order to satisfy the transversality condition.

The change in the capital stock equals the investment $\dot{K} = I$, and the change in the debt equals the newly issued debt $\dot{D}_f = S_f$. At most, $(\alpha \cdot 100)\%$ of the investment can be financed with newly issued debt $S_f \leq \alpha I$, where α is the maximum debt-capital ratio. The same condition holds during the initial period: $D_f(t_1) \leq \alpha K(t_1)$. These conditions imply that the debt will never exceed $\alpha\%$ of the capital stock. The amount of newly issued equity is non-negative: $Q \geq 0$. This condition prohibits the firm from repurchasing its shares. Moreover, $\theta_p \theta_d \pi^d \geq 0$ excludes negative after-tax dividends[4].

The model's solution will satisfy three additional conditions that are not explicitly considered. The first condition excludes a negative debt $D_f \geq 0$. Second, the amount of retained earnings should be non-negative: $S_f + Q \leq I$. Finally, $K(t_1) \geq K(t_0) = 0$, where $K(t_0)$ is the stock of capital available from the firm's past history, and $K(t_1)$ is the capital reached at t_1 after the initial issue of equity and debt.

3.2.2 Preferred sources of finance

This section determines the firm's steady-state preference relations with respect to the sources of finance. Because it is assumed that the firm possesses 1 euro of before-tax earnings, the firm can finance an additional unit of investment with debt, newly issued equity or retained earnings.

Retained earnings or newly issued equity

Given values for S_f and I, the firm prefers retained earnings (*RE*) to newly issued equity (*NE*) (or the other way around), if capital gains are taxed less than dividends:

$$\text{(3.12)} \quad NE \begin{matrix} \phi \\ \approx \\ \pi \end{matrix} RE \quad \Leftrightarrow \quad \theta_p \theta_d \begin{matrix} > \\ = \\ < \end{matrix} \theta_c \theta_r \ .$$

The firm prefers to reinvest the 1 euro of before-tax earnings (which yields $\theta_c \theta_r$ after taxes) if reinvestment is more profitable than distributing the earnings as dividends (which yields $\theta_p \theta_d$ after taxes) and financing additional investment with newly issued equity at unit cost. Hence, the firm prefers retained earnings to newly issued equity if $1 - \frac{\theta_p \theta_d}{\theta_c \theta_r} > 0$. (3.12) then follows.

Retained earnings or newly issued debt

Similarly, the firm chooses between retained earnings and newly issued debt. The steady-state cost of an additional unit of debt equals the present value of foregone dividends as a

[4] If the firm is allowed to finance the investment entirely with debt $\alpha = 1$, and if no shares are issued until that moment, the founder of the firm collects the firm's dividends.

result of the additional interest payments. Because the foregone after-tax dividends are discounted at the after-tax return on debt, the steady-state cost of debt amounts to $\frac{\theta_p \theta_d r}{\theta_p r} = \theta_d$ euro (see *appendix C*). The debtholder, in present value terms, is repaid the invested funds. As opposed to dividends, the interest payments are deductible from taxable earnings, which yields a gain equal to the corporate tax rate on distributed profits τ_d. Consequently, the decrease in value of the firm's equity as a result of the additional interest payments is equal to $1-\tau_d$ euro. The firm then prefers retained earnings (*RE*) to newly issued debt (*DF*) (or the other way around), given values for Q and I, if $\theta_d - \frac{\theta_p \theta_d}{\theta_c \theta_r} > 0$, which implies that capital gains are taxed less than interest payments,

$$(3.13) \quad DF \begin{matrix} \phi \\ \approx \\ \pi \end{matrix} RE \quad \Leftrightarrow \quad \theta_p \begin{matrix} > \\ = \\ < \end{matrix} \theta_c \theta_r \ .$$

Newly issued equity or debt

The firm in the steady state prefers newly issued debt (*DF*) to newly issued equity (*NE*) (or the other way around), given the amount of retained earnings and the investment I, if interest payments are taxed less than dividends

$$(3.14) \quad DF \begin{matrix} \phi \\ \approx \\ \pi \end{matrix} NE \quad \Leftrightarrow \quad \theta_p \begin{matrix} > \\ = \\ < \end{matrix} \theta_p \theta_d \ .$$

The firm maximises the value of the current shareholders' equity. If the firm finances additional investment with debt, shareholders can invest their private funds in their opportunity investment (market bonds). Shareholders earn not only their opportunity return on debt but also the investment's return above the interest rate, which must be paid as a reward for the debt financing. Whether the firm finances the investment with debt or with newly issued equity, the shareholder earns a similar before-tax return. Consequently, if the steady-state cost of debt is lower than the unit cost of newly issued equity, $\frac{\theta_p \theta_d}{\theta_p} < 1$, current shareholders prefer to finance steady-state investment with debt instead of newly issued equity. Condition (3.14) then follows.

3.3 The model's solution if $\theta_p \geq \theta_p \theta_d \geq \theta_c \theta_r$

In order to provide intuition that helps to understand the economics of this chapter, this section assumes that $\theta_p \geq \theta_p \theta_d \geq \theta_c \theta_r$. The firm has an incentive to distribute its before-tax earnings and to finance additional investment with external sources of finance. Moreover, debt is preferred to newly issued equity.

During the initial period the firm attracts immediately the optimal amount of debt and equity-financed capital and starts distributing dividends. The steady state is characterised by the steady-state marginal value of capital and cost of capital.

- *The marginal value of capital*

The firm invests until the marginal increase in value of the firm's equity q_K as the result of a unit increase in the capital stock equals the cost of an additional unit of investment,

(3.15) $q_K = 1 - \tau_d \alpha$.

The firm prefers to finance the additional investment entirely with debt, which costs θ_d euro in the steady state. However, the firm is allowed to finance only $\alpha\%$ of the investment with debt. Consequently, the firm will have to finance the remaining $(1-\alpha)\%$ with newly issued equity at unit cost. The cost of the marginal investment is then a weighted-average of the costs of debt and newly issued equity. Condition (3.15) then follows. It can be written as

(3.16) $q_K = \alpha + [(1-\alpha) - \tau_d \alpha]$.

The firm invests until the benefit of the investment q_K equals the cost, which consists of two parts. In present-value terms, the debtholder has to receive back the originally invested α euro. The cost of issuing $(1-\alpha)$ euro of new equity is lower than the originally issued $(1-\alpha)$ euro, because the shareholder is entitled to the corporate tax savings due to the deductibility of the interest payments from taxable corporate earnings. These tax savings equal the corporate tax rate τ_d times the present value of interest payments paid to the debtholder α.

- *The cost of capital*

The firm invests until the after-tax return on a marginal investment is equal to the after-tax opportunity return on a direct investment in debt $\theta_p r$. Because the firm finances $\alpha\%$ of the investment with debt and $(1-\alpha)\%$ with newly issued equity, the investment's minimum required before-tax return (cost of capital) $f'(K)$ amounts to

(3.17) $f'(K) = \alpha r + (1-\alpha)\frac{r}{\theta_d}$.

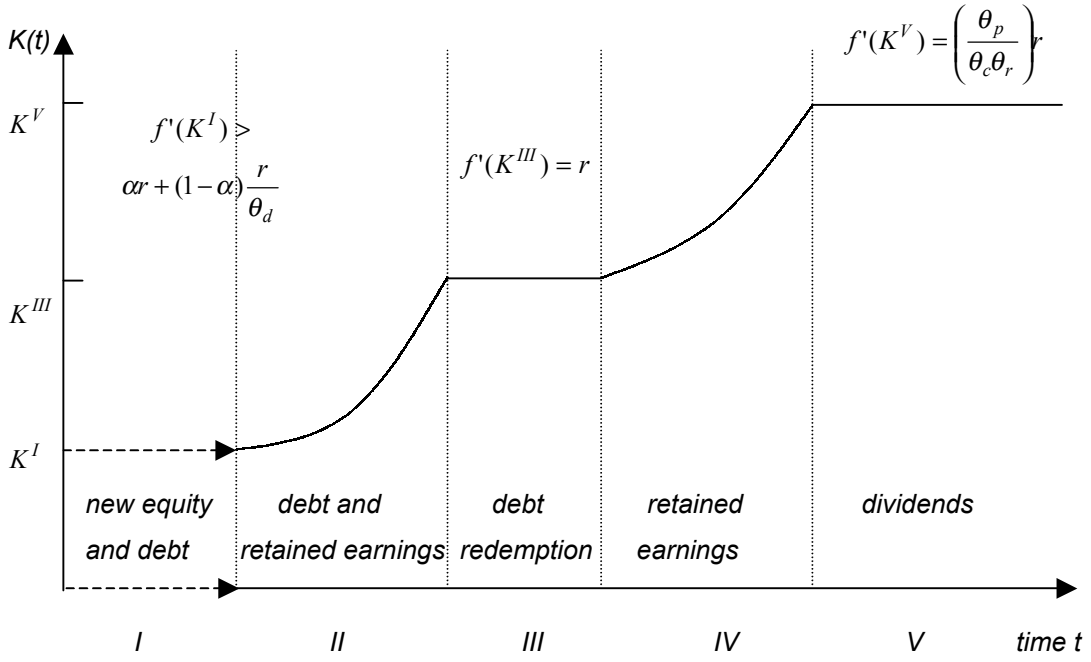
The marginal investment financed with newly issued equity yields a return $f'(K)$, which is distributed as dividends. This return is taxed under the corporate and income tax. Consequently, the household's after-tax income equals $\theta_p \theta_d f'(K)$. This investment has to yield a return equal to the household's opportunity return $\theta_p r$. The cost of capital on investment financed with newly issued equity then amounts to $f'(K) = \frac{r}{\theta_d}$. Similarly, a marginal debt-financed investment yields a return $f'(K)$, which is taxed under the income

tax. The household's after-tax interest payments $\theta_p f'(K)$ have to be equal to the opportunity return $\theta_p r$. The cost of capital on debt-financed investment then amounts to $f'(K) = r$. The weighted-average cost of capital on investment partly financed with debt and newly issued equity (condition (3.17)) then follows[5].

3.4 The model's solution if $\theta_c\theta_r > \theta_p > \theta_p\theta_d$

If $\theta_c\theta_r > \theta_p > \theta_p\theta_d$, the firm prefers retained earnings to debt and newly issued equity as a source of finance. In order to defer the dividend taxes $\tau_d + \tau_p(1-\tau_d)$, the firm prefers to retain and reinvest the profits instead of distributing them and then financing additional investment with newly issued equity or debt. If external sources of finance must be attracted, the firm prefers debt to newly issued equity. The solution of the problem consists of five successive phases. The capital stock along the optimal path over time is presented in *figure 1*.

Figure 1



[5] A similar steady state is reached if interest payments and dividends are no longer taxed under the personal income tax, and capital gains are not taxed under the capital gains tax. However, tax authorities levy a wealth tax t_w on the value of the equity and debt in every period (as under the tax reform discussed in chapter 6). The market value of the shares M is then implicitly determined by the arbitrage condition $\theta_d \pi^d + \dot{m}z + (\dot{z}m - Q) - t_w M = [r - t_w]M$. If $\tau_d = \tau_r$, the firm is indifferent between newly issued equity and retained earnings. Due to the deductibility of interest payments from taxable earnings, debt is the most preferred source of finance. The firm immediately attracts the optimal amount of capital, which is financed with debt and newly issued equity. The steady state is characterised by (3.15) and (3.17).

Because a newly founded firm does not yet possess retained earnings to finance investment, the firm has to attract external sources of finance during ***phase I***. The firm has an incentive to finance the initial investment with debt until the cost of capital $f'(K)$ equals the interest rate r. Because the firm is allowed to finance only $\alpha\%$ of the investment with debt, the firm will also have to issue new equity. The firm will issue only a nucleus of new equity in order to take advantage of the cheaper retained earnings as source of finance. *Section 3.4.1* demonstrates that the initial capital stock satisfies $f'(K(t_1)) > \alpha r + (1-\alpha)\frac{r}{\theta_d}$ if the relative share of total product accruing to capital in the (Cobb-Douglas) production function β is sufficiently small. During ***phase II*** (*section 3.4.2*), the firm finances additional investment with debt and retained earnings until $f'(K) = r$. At this point, it is no longer optimal to finance additional investment with debt. Subsequently, the firm redeems its entire debt (***phase III***, *section 3.4.3*) because the increase in value of the firm's equity as a result of the reduction in interest payments exceeds the gain of additional investment. In order to defer the taxes on distributed dividends, and because capital gains are taxed less than interest payments, the firm continues to finance the investment with retained earnings, even though the return on the investment is lower than the interest rate (***phase IV***, *section 3.4.4*). The shareholder realises a higher return if the firm retains and reinvests its earnings than if the firm distributes its earnings as dividends and the household invests the after-tax dividends in market bonds. The firm invests until the return on the investment is reduced to $f'(K) = \frac{\theta_p}{\theta_c \theta_r} r$. During ***phase V*** (*section 3.4.5*), the firm stops investing and starts distributing dividends because the shareholder prefers to invest the after-tax dividends in market bonds. *Section 3.4.6* discusses the optimal path over time. *Section 3.4.7* derives the marginal tax burden.

3.4.1 Phase I: starting the firm

The initial capital stock is financed partly with debt and partly with newly issued equity because the newly founded firm does not possess retained earnings and can finance only $\alpha\%$ of the investment with debt: $D_f(t_1) = \alpha K(t_1)$.

This section studies the marginal value of capital. The value of the cost of capital is discussed if $\alpha = 0$ and if $\alpha = 1$. The general cost of capital ($0 \le \alpha < 1$) then follows.

- *The marginal value of capital*

The firm invests until the marginal benefit, which is the marginal increase in value of the firm's equity $q_K(t_1)$, equals the marginal cost of the investment. The marginal investment is $(1-\alpha)\%$ financed with newly issued equity at unit cost and $\alpha\%$ with debt, which costs more than $1-\tau_d$. Consequently, the cost of the marginal investment is higher than $(1-\alpha) + \alpha(1-\tau_d) = 1 - \alpha\tau_d$. The optimal initial investment therefore satisfies

(3.18) $q_K(t_1) > 1 - \tau_d \alpha$.

If the firm faces additional profitable investment opportunities, the cost of debt is higher than the steady-state value derived in *section 3.2.2*. An additional unit of debt implies additional interest payments, which not only implies a reduction in the earnings that can be distributed as dividends, but also implies a reduction in the funds available for investment. The foregone gain of the additional investment should be added to the net present value of the reduction in distributed dividends, which implies that the cost of an additional unit of debt is higher than $1-\tau_d$. Put differently, the gain of an additional unit of debt given the level of investment is lower than τ_d.

- *The cost of capital if* $\alpha = 0$

This section studies the cost of capital on investment financed only with newly issued equity $\alpha = 0$. If dividends are taxed less than capital gains (see *section 3.3*), the firm issues new equity until $f'(K) = \frac{r}{\theta_d}$. If capital gains are taxed less than dividends, this result changes as a result of two opposite effects. According to the first effect (the 'internal versus external equity-cost' effect), the firm faces an incentive to issue initially less new equity in order to finance investment with the 'cheaper' retained earnings. According to the second effect (the 'time to maturity' effect), the firm issues initially more new equity in order to shorten the firm's internal growth phase. The remainder of this section discusses these two effects and introduces a condition that determines when the 'internal versus external equity-cost' effect dominates the 'time to maturity' effect.

The 'internal versus external equity-cost' effect

Because $\theta_c\theta_r > \theta_p\theta_d$, the firm prefers retained earnings to newly issued equity as a source of finance. Instead of financing investment directly with newly issued equity at unit cost, the firm faces an incentive to postpone the investment until it possesses earnings that can be retained. For instance, the firm might wait to invest until it has $\left(\frac{1}{\theta_c\theta_r}\right)$ of before-tax earnings. The additional unit of investment financed with retained earnings costs the household in terms of foregone dividends only $\left(\frac{\theta_p\theta_d}{\theta_c\theta_r}\right)$, which is lower than the unit cost of the investment financed immediately with newly issued equity. As a result of the difference in investment costs, the firm will issue initially less new equity in order to exploit the tax advantages.

As pointed out by Sinn (1991a), this preferential tax treatment of retained earnings as a source of finance increases the cost of initially issued new equity. An additional unit of investment financed with newly issued equity implies that the firm foregoes the opportunity to use the cheaper retained earnings as a source of finance. This opportunity cost must be added to the cost of capital in case of no-deferral (*section 3.3*). Consequently, the cost of capital on investment financed with newly issued equity might amount to $f'(K) > \frac{r}{\theta_d}$.

The 'time to maturity' effect

It takes more time to obtain a substantial amount of retained earnings if the firm issues initially less new equity. The firm then requires more time to become mature and to start distributing dividends. Consequently, the value of the firm's equity, which equals the present value of the after-tax dividends, declines if the firm issues initially too little new equity. This second effect explains not only why the firm does not issue an infinitesimally small amount of initial new equity, but also why the firm might issue a substantial amount of initial new equity such that the marginal return on the investment is lower than $\frac{r}{\theta_d}$.

The higher amount of new equity reduces the firm's internal growth phase. The gain of receiving dividends in an earlier stage is an opportunity return of newly issued equity, which might reduce the cost of capital below the conventional value $f'(K) < \frac{r}{\theta_d}$ [6].

General condition

As in Sinn (1991a), the pure profit implied by the concave production function $f(K)$ is the return to a hidden fixed factor of production. Moreover, output is assumed to be linearly homogeneous in capital and the hidden factor of production[7]. ω is the hidden factor's partial production elasticity, β is the partial production elasticity of capital and σ is the Hicksian elasticity of substitution between capital and the hidden production factor. A sufficient condition for the cost of capital of investment financed with newly issued equity to be higher than $\frac{r}{\theta_d}$ is $\left[1 - \frac{\theta_p \theta_d}{\theta_c \theta_r}\right] < \frac{\omega/\beta}{\sigma}$ [8].

Condition on β

This condition can be expressed as a requirement only on the relative share of total product accruing to capital β if output, in addition to the assumed linear homogeneity, is described by a constant-returns-to-scale Cobb-Douglas production function, which implies that $\sigma = 1$

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[6] Due to this second effect, it theoretically cannot be excluded that the cost of capital of initially issued new equity is lower than the interest rate. It would imply that the firm would not issue new debt. The firm would issue only new equity during the initial phase and jump immediately to *phase IV*, during which investment is financed only with retained earnings. However, simulation exercises provided no evidence that this actually would occur.

[7] Assume that the firm's production function $F(.)$ is linearly homogeneous in its two arguments, capital $\tilde{K}$ and another production factor N. The assumption of linear homogeneity allows working with the production function in intensive form. Consequently, $F(\frac{\tilde{K}}{N},1) = \frac{1}{N}F(\tilde{K},N)$. Moreover, $K = \frac{\tilde{K}}{N}$ and $f(K) = F(\frac{\tilde{K}}{N},1)$. Therefore, output/revenue per unit of hidden factor is written as a function of capital per unit of hidden production factor.

[8] The proof, which is similar to the proof in Sinn (1991a), is presented in *appendix D*.

and $\omega + \beta = 1$. The 'internal versus external equity-cost' effect dominates the 'time to maturity' effect, which implies a value of the cost of capital higher than r/θ_d, if β satisfies

(3.19) $$f'(K(t_1)) > \frac{r}{\theta_d} \quad \Leftrightarrow \quad \beta < \frac{1}{\left[1 - \frac{\theta_p \theta_d}{\theta_c \theta_r}\right] + 1} \quad .$$

The analysis in *appendix E* demonstrates that the length of the internal growth phase is increasing in β. For a given difference in investment costs $\left(1 - \frac{\theta_p \theta_d}{\theta_c \theta_r}\right)$, the length of the internal growth phase as a result of the value of the share of capital should not be too large in order for the 'internal versus external equity-cost' effect to dominate the 'time to maturity' effect. If $\beta < \frac{1}{\left[1 - \frac{\theta_p \theta_d}{\theta_c \theta_r}\right] + 1}$, the effect of the difference in investment costs is larger than the effect of the time needed to reach maturity. The cost of capital on investment financed with newly issued equity then satisfies $f'(K(t_1)) > \frac{r}{\theta_d}$ [9]. However, if it takes very long to reach the steady state as a result of the value of β, the firm offers the cost advantage of retained earnings in order to move more quickly to the steady state.

- *The cost of capital if* $\alpha = 1$

If $\alpha = 1$, the cost of capital on a marginal investment financed entirely with debt satisfies

(3.20) $$f'(K(t_1)) = r \quad .$$

As opposed to newly issued equity, debt does not compete with retained earnings. Even though retained earnings are the most preferred source of finance, the firm will issue debt as long as the investment's return is higher than the interest rate.
The firm does not want to wait to invest until it possesses retained earnings. In fact, once the firm has obtained retained earnings, they can be used to redeem the debt. In terms of foregone dividends, it makes no difference whether the firm uses the retained earnings as source of finance or as funds that are used to redeem the firm's debt. Moreover, both strategies imply that the firm will be entirely equity-financed once the debt is redeemed. However, immediate debt-financed investment shortens the time needed by the firm to reach the stage of maturity. Consequently, the firm has an incentive to issue new debt as long as the investment's return exceeds or equals the interest rate.

[9] Simulation exercises support this result, except for very high values of β.

- *The cost of capital if* $0 \leq \alpha < 1$

However, $\alpha\%$ of the marginal investment is financed with debt, and $(1-\alpha)\%$ is financed with newly issued equity. Given the condition on β, the cost of capital during the initial period satisfies

(3.21) $$f'(K(t_1)) > \alpha r + (1-\alpha)\frac{r}{\theta_d} > r \quad \Leftrightarrow \quad \beta < \frac{1}{\left[1-\frac{\theta_p \theta_d}{\theta_c \theta_r}\right]+1} \quad .$$

3.4.2 Phase II: internal growth phase (debt and retained earnings)

During *phase II*, the firm finances additional investment with debt and retained earnings. The firm continues to issue debt because the before-tax return on the investment exceeds the interest rate. Because $S_f = \alpha I$, the firm will attract $\frac{\alpha}{(1-\alpha)}$ units of debt for every euro of retained earnings. Because the firm owns $\theta_r(f(K) - rD_f)$ units of retained earnings, I and S_f are equal to $I = \frac{\theta_r(f(K) - rD_f)}{(1-\alpha)}$ and $S_f = \left(\frac{\alpha}{1-\alpha}\right)\theta_r(f(K) - rD_f)$. The firm's profits are retained and reinvested. The cost of capital amounts to

(3.22) $$f'(K) = \left[\frac{1}{1+\left(\frac{\alpha}{1-\alpha}\right)\left(\frac{q_K + q_D}{q_K}\right)}\right]\left[\frac{\theta_p}{\theta_c \theta_r} r - \frac{\dot{q}_K / q_K}{\theta_r}\right] \quad > \quad r \quad .$$

- *Cost of capital if* $\alpha = 0$

Every euro of retained and reinvested before-tax profits ($\theta_c \theta_r$ euro of after-tax profits) must yield the household's opportunity return $\theta_p r$. Because the capital gains can be realised and invested in market bonds, the household requires the return $\theta_c \theta_r r \theta_p$. However, if the firm reinvests the retained profits and the return on this investment is also retained, the household realises the return $\theta_c\left[\theta_r f'(K) + \frac{\dot{q}_K}{q_K}\right]$. The direct return on the investment is taxed at the level of the firm at the rate τ_r. However, the household realises a capital loss ($\dot{q}_K / q_K$ is negative) because the investment financed with the retention of the return on a prior investment yields a return lower than the originally retained return. The increase in the firm's market value is then taxed under the capital gains tax. The household's total return (because

only $\theta_c\theta_r$ euro are invested) amounts to $\theta_c\theta_r \cdot 1 \cdot \theta_c\left[\theta_r f'(K) + \frac{\dot{q}_K}{q_K}\right]$. Given the household's required opportunity return $\theta_c\theta_r r\theta_p$, the cost of capital amounts to

(3.23) $$f'(K) = \frac{\theta_p}{\theta_c\theta_r} r - \frac{\dot{q}_K / q_K}{\theta_r} \quad .$$

- *Cost of capital if* $0 \le \alpha < 1$

The firm faces an incentive to issue debt because the before-tax return on the investment exceeds the interest rate. Put differently, the gain of an additional unit of (debt-financed) capital exceeds the cost of an additional unit of debt $q_K > -q_D$, which yields an additional return $\frac{q_K + q_D}{q_K} > 0$ for debt-financed investment. The cost of capital in condition (3.22) takes into account this additional gain on the $\frac{\alpha}{(1-\alpha)}$ units of debt-financed investment. Compared to (3.23), this additional gain decreases the investment's required return that ensures that the household is indifferent between an investment in the firm's project and in an alternative investment in market debt. Moreover, an increase in α implies that the cost of capital converges faster to r, and that the gain of additional debt converges faster to zero.

3.4.3 Phase III: debt redemption

During *phase III*, the firm neither invests nor distributes dividends. The firm uses its earnings to redeem the debt $S_f = -\theta_r(f(K) - rD_f)$ until $D_f = 0$, which might take several periods.

The firm stops issuing new debt because the investment's return equals the interest rate $f'(K) = r$ and because $q_K = -q_D$. The increase in value of the firm's equity as a result of a unit increase in the capital stock q_K equals the decrease in value of the firm's equity as a result of an additional unit of debt q_D.

Moreover, it is optimal to redeem the entire debt[10]. If 1 euro of before-tax retained earnings (θ_r euro after corporate taxes) is employed for debt redemption, then the value of the firm's equity increases because the firm has to pay fewer interest payments. An additional unit of debt costs $q_D < 0$. Consequently, a unit decrease of the firm's debt increases the value of

[10] The co-state variable μ_π measures the increase in value of the firm's equity if the firm would redeem an additional unit of debt. It satisfies $\theta_c\mu_\pi = \frac{\theta_c\theta_r(-q_D) - \theta_p\theta_d}{\theta_p\theta_d} > 0$. Debt redemption is profitable if $\theta_c\theta_r(-q_D) - \theta_p\theta_d > 0$. This condition is satisfied because $q_D \le -\theta_d$ and $\theta_c\theta_r > \theta_p$.

the firm's equity by $-q_D > 0$. Because the household has to pay capital gains taxes on the increase in value of the firm's equity, the gains for the household due to a reduction in the firm's debt equal $\theta_c\theta_r(-q_D)$. The opportunity costs of debt redemption for the household are the postponed dividends that otherwise could have been distributed $\theta_p\theta_d$. The gains for the household when the debt is reduced $\theta_c\theta_r(-q_D)$ exceed the costs $\theta_p\theta_d$, as retained earnings are preferred over debt as a source of finance $\theta_c\theta_r > \theta_p$. Because the gains and costs are constant, the firm will redeem debt until D_f is reduced to zero.

3.4.4 Phase IV: internal growth phase (retained earnings)

During *phase IV*, the firm continues to invest. The investment $I = \theta_r f(K)$ is financed only with retained earnings. The profits of the investment are retained and reinvested. The cost of capital during this internal growth phase amounts to (see also *section 3.4.2*)

$$(3.24) \quad f'(K) = \frac{\theta_p}{\theta_c\theta_r} r - \frac{\dot{q}_K / q_K}{\theta_r} \qquad > \qquad \frac{\theta_p}{\theta_c\theta_r} r \quad .$$

In order to defer the taxes on distributed dividends and because capital gains are taxed less heavily than interest payments, the firm finances additional investment with retained earnings, even though the return on the investment is lower than the interest rate. The shareholder realises a higher return if the firm retains and reinvests the earnings than if the firm distributes the earnings as dividends and the household invests the after-tax dividends in market bonds.

3.4.5 Phase V: distribution of dividends

During *phase V*, the firm no longer invests and distributes the profits as dividends, which are equal to $\pi^d = f(K)$[11].

- *The marginal value of capital*

The firm invests until the marginal increase in value of the equity q_K equals the cost of the additional investment, which are the net dividends foregone:

$$(3.25) \quad q_K = \frac{\theta_p\theta_d}{\theta_c\theta_r} \qquad < \quad 1 \quad .$$

[11] In order to continue to defer dividend taxes, the firm can invest in financial capital (market bonds) instead of physical capital. Moreover, the firm faces an incentive to buy equity of another firm, even if the unit cost of the purchase of this other firm's share is higher than the increase in value of the firm's equity. In order to defer dividend taxes, the firm faces an incentive to acquire shares of another firm as long as the loss is lower than $1 - \frac{\theta_p\theta_d}{\theta_c\theta_r}$.

If the firm retains and reinvests an additional euro, the after-tax increase in value of the firm's equity equals $\theta_c\theta_r q_K$. If the firm distributes the additional euro, the household receives after-tax dividends $\theta_p\theta_d$. The firm invests until the household is indifferent between retaining and distributing the firm's earnings. Because capital gains are taxed at lower rates than distributed dividends, the increase in value of the equity is lower than 1.

- *The cost of capital*

During *phase V*, the cost of capital amounts to

(3.26) $$f'(K) = \frac{\theta_p}{\theta_c\theta_r} r \quad < \quad r \quad .$$

The household is indifferent between the after-tax return on the investment financed with retained earnings and the return that it realises if the earnings are distributed and invested in market debt. If the firm retains 1 euro of before-tax profits, it can reinvest $\theta_c\theta_r$ of after-tax retained earnings. This investment yields a return $f'(K)$, which is distributed as dividends. Consequently, the household's after-tax income equals $\theta_p\theta_d f'(K)$. Because the firm only invested $\theta_c\theta_r$, the household realises an after-tax return $\theta_c\theta_r f'(K)\theta_p\theta_d$. Instead, the firm can distribute the 1 euro as dividends. The household realises an after-tax opportunity return $\theta_p\theta_d r\theta_p$ if the dividends are invested in market bonds. The cost of capital, which is lower than the interest rate, then follows.

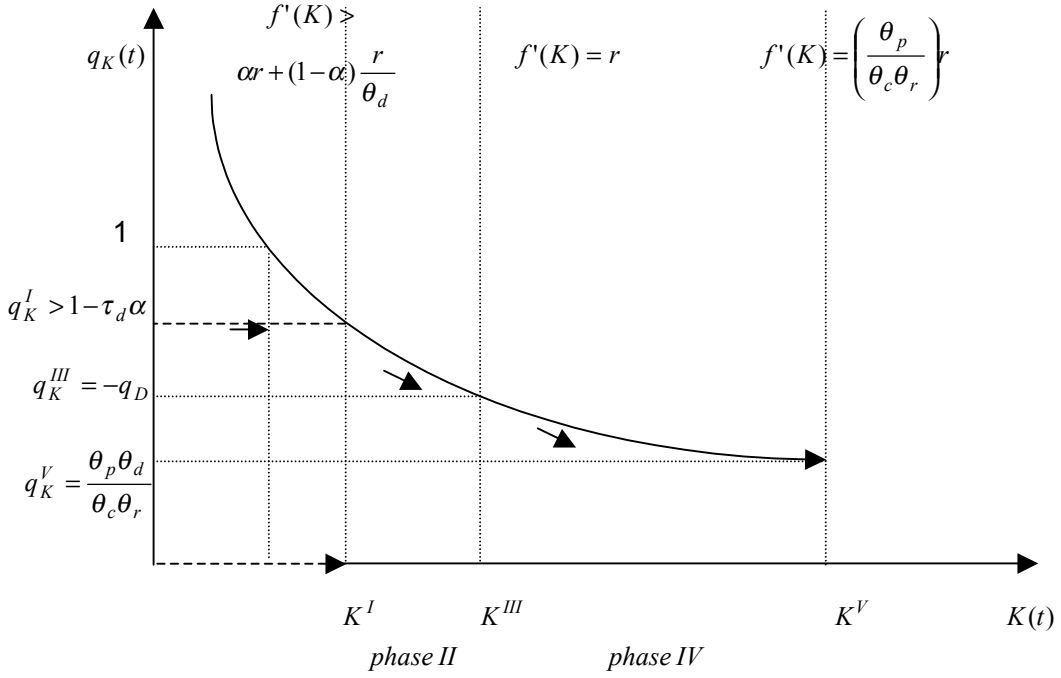
3.4.6 Optimal path over time

Figure 2 presents the change in q_K with the capital stock over time. During the initial phase, the firm immediately attracts K^I units of capital, which are $(1-\alpha)\%$ financed with newly issued equity and $\alpha\%$ financed with debt. The increase in value of the firm's equity satisfies $q_K^I > 1-\tau_d\alpha$. Afterwards, the firm enters an internal growth phase. Investment is financed with retained earnings and debt, and satisfies $q_K > -q_D$. At the end of this second phase, the firm has accumulated K^{III} units of capital. Moreover, $f'(K) = r$ and $q_K = -q_D$. During *phase III*, the firm redeems its entire debt. During the second internal growth phase, the firm finances investment only with retained earnings. The firm will accumulate K^V units of capital. When $q_K^V = \frac{\theta_p\theta_d}{\theta_c\theta_r} < 1$ (*phase V*), the firm stops investing and distributes all profits as dividends. The marginal productivity of capital is decreasing in K due to the concavity of the production function. Consequently, q_K is decreasing in K.

If $\alpha = 1$, the firm's initial capital stock is entirely financed with debt. The firm initially issues debt until $f'(K) = r$. In fact, the firm issues debt and jumps immediately towards *phase III.*

Hence, the firm will not issue new equity and will not pass through *phase II.* The firm does, however, pass through *phases IV* and *V*. If the firm is not allowed to attract debt financing $\alpha = 0$, then it issues new equity during the initial phase such that $q_K(t_1) = 1$. As discussed in Sinn (1991a), the firm enters an internal growth phase during which investment is financed with retained earnings (*phase IV*). The mature firm starts distributing dividends when it reaches *phase V*.

Figure 2:



The firm's optimal path depends on the value of the corporate tax on distributed earnings τ_d. If $\alpha = 0$, as derived in Sinn (1991a), an increase in τ_d decreases the final phase's value of q_K but does not change the final capital stock (because $f'(K) = \frac{\theta_p}{\theta_c\theta_r} r$ is not affected). Moreover, the accumulation process of capital, as presented by the downward-sloping curve in *figure 2*, is not affected and the initial condition $q_K(t_1) = 1$ does not change. An increase in τ_d consequently results in a lower initial capital stock $K(t_1)$, which increases the total amount of capital $K^V - K^I$ that must be accumulated over time. Hence, an increase in τ_d increases the time required by the firm to become mature. These results become less important if α increases, however. If the firm can finance the investment entirely with debt, for example, it will attract debt during the initial period such that $f'(K(t_1)) = r$ (K^{III} is not affected). The final capital stock K^V will not change and the optimal accumulation process of capital (slope of curve in *figure 2*) is not affected. Consequently, an increase in τ_d does not change the accumulation of capital if $\alpha = 1$. The length of the internal growth phase is thus entirely driven by the difference between $\theta_c\theta_r$ and θ_p.

3.4.7 The marginal tax burden

This section derives marginal effective tax rates along the optimal path of the dynamic finance and investment model. The cost of capital p equals $f'(K)$, and the household after-tax rate of return s equals $\theta_p r$. The marginal effective tax rate t_e amounts to

$$(3.27)\quad t_e = \frac{p-s}{p} = \frac{f'(K)-\theta_p r}{f'(K)} \quad .$$

Table 1 presents the marginal effective tax rates along the firm's optimal finance and investment path.

Table 1: marginal effective tax rates along the optimal finance and investment path

Phase I	$t_e^I \geq \left[\frac{1-\alpha}{1-\tau_d\alpha}\right](\tau_d + \tau_p(1-\tau_d)) + \left[\frac{\alpha(1-\tau_d)}{1-\tau_d\alpha}\right]\tau_p$	$\Leftrightarrow \quad \beta < \frac{1}{\left[1-\frac{\theta_p\theta_d}{\theta_c\theta_r}\right]+1}$
Phase II	$t_e^{II} = \tau_r + \tau_c(1-\tau_r) - \frac{(1-\tau_c)\dot{q}_K/q_K}{\left[\frac{\theta_p}{\theta_c\theta_r}r - \frac{\dot{q}_K/q_K}{\theta_r}\right]} - \left(\frac{\alpha}{1-\alpha}\right)\left(\frac{q_K+q_D}{q_K}\right)\frac{\theta_p r}{\left[\frac{\theta_p}{\theta_c\theta_r}r - \frac{\dot{q}_K/q_K}{\theta_r}\right]}$	
Phase III	$t_e^{III} = \tau_p$	
Phase IV	$t_e^{IV} = \tau_r + \tau_c(1-\tau_r) - \frac{(1-\tau_c)\dot{q}_K/q_K}{\left[\frac{\theta_p}{\theta_c\theta_r}r - \frac{\dot{q}_K/q_K}{\theta_r}\right]}$	
Phase V	$t_e^V = \tau_r + \tau_c(1-\tau_r)$	

The cost of capital of marginal investment in *Phase I* (condition (3.21)) exceeds the cost of capital in case of no-deferral (condition (3.17)) if the share of capital in the production function β is sufficiently small. In that case, the marginal effective tax rate on marginal investment in *Phase I* exceeds the marginal effective tax rate on investment financed with debt and newly issued equity in case of no-deferral. The no-deferral marginal effective tax rate is a weighted average of the marginal tax burden on newly issued equity $t_e = \tau_d + \tau_p(1-\tau_d)$ and debt $t_e = \tau_p$. The weight corresponding to the marginal effective tax rate on newly issued equity equals $(1-\alpha)\frac{1}{q_K}$, which represents the $(1-\alpha)$ units of capital

financed with newly issued equity at unit cost per unit of increase in value of the firm's equity q_K. The weight corresponding to the marginal effective tax rate on debt equals $\alpha \frac{(-q_D)}{q_K}$, which represents the α units of capital financed with debt at cost $-q_D = \theta_d$ per unit of increase in value of the firm's equity q_K (condition (3.15)).

The marginal effective tax rate during *phase II* consists of the taxes on capital gains augmented with a term arising as a result of the capital loss on the investment financed with retained earnings. The third term reflects the gain due to the permitted debt financing, which decreases the marginal effective tax rate.
The marginal effective tax rate on the marginal investment financed with retained earnings in *phase V* equals the taxes on capital gains.
Because the marginal product of capital decreases along the optimal path due to the concavity of the production function, the marginal effective tax rates are characterised by

(3.28) $t_e^I > t_e^{II} > t_e^{III} > t_e^{IV} > t_e^V$.

Link with King and Fullerton

King and Fullerton introduce a formula (3.29) to derive marginal effective tax rates if the firm is allowed to use a combination of different sources of finance. α_k is the exogenously determined weight of the k^{th} source of finance ('k' refers to newly issued equity, retained earnings or debt). p_k and t_k are, respectively, the cost of capital and the marginal effective tax rate of a marginal investment financed with k^{th} the source of finance, given that the returns of the investment are distributed as dividends. In case of a fixed interest rate, the marginal effective tax rate (according to King and Fullerton) amounts to

(3.29) $$\bar{t} = \frac{\sum_k \alpha_k p_k t_k}{\sum_k \alpha_k p_k}$$

This formula applies only to the marginal effective tax rate during the steady state of the life-cycle model when the firm distributes dividends. It cannot be applied to derive marginal effective tax rates along the optimal finance and investment path. Moreover, the weights α_k are determined endogenously in the dynamic finance and investment model. However, King and Fullerton fix the weights α_k exogenously. Sinn rightly observes that the firm in the King and Fullerton method does not minimise the cost of capital across sources of finance when the weights are chosen wrongly[12] [13].

[12] If $\theta_p > \theta_c \theta_r > \theta_p \theta_d$, the firm immediately issues debt until $f'(K) = r$, and then starts distributing dividends and interest payments. If only $\alpha\%$ of the investment can be financed with debt, the firm issues a nucleus of new equity and debt if the share of capital β is sufficiently small. During the

3.5 Indirect household saving through a mutual fund

Instead of directly buying equity or debt of the firm, the household can buy a share of a mutual fund that invests in equity or debt of the firm. This firm can distribute (to the fund) the return on the investment as dividends or interest payments or it can retain and reinvest the earnings such that the firm's equity, which is controlled by the fund, increases. The fund can distribute its earnings as dividends or it can retain its earnings. The household can sell its participation in the fund and realise the possible capital gains, which are taxed at the household level under the capital gains tax t_c. In order to avoid the household's income tax on dividends, mutual funds have an incentive to retain their earnings instead of distributing the fund's earnings as dividends. It is assumed that the mutual fund is taxed on the dividends and interest payments it receives at the corporate tax rate τ_{mf}. The fund's realised or unrealised capital gains are assumed to be untaxed at the level of the mutual fund.

Given that the firm anticipates that household savings are controlled by the fund, the firm determines its optimal finance and investment behaviour on behalf of the shareholder (household) that invests indirectly in the firm. The arbitrage condition amounts to

(3.30) $\theta_c\theta_{mf}(\theta_d\pi^d)+\theta_c(\dot{m}z+\dot{z}m-Q)=\theta_c\theta_{mf}rM$.

If it is assumed that $\tau_d=\tau_r=\tau_{mf}$, the firm is indifferent between retained earnings and debt as a source of finance. Newly issued equity is the least preferred source of finance. The firm's optimal finance and investment path then consists of three successive phases. Given

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internal growth phase, the firm finances investment with debt and retained earnings. The firm no longer invests when $f'(K)=\left[(1-\alpha)\frac{\theta_p}{\theta_c\theta_r}+\alpha\right]r \quad > r$ and $q_K=(1-\alpha)\frac{\theta_p\theta_d}{\theta_c\theta_r}+\alpha\theta_d$. The marginal effective tax rate on this steady-state marginal investment equals $t_e=\left[\frac{(1-\alpha)\frac{\theta_p\theta_d}{\theta_c\theta_r}}{(1-\alpha)\frac{\theta_p\theta_d}{\theta_c\theta_r}+\alpha\theta_d}\right](\tau_r+\tau_c(1-\tau_r))+\left[\frac{\alpha\theta_d}{(1-\alpha)\frac{\theta_p\theta_d}{\theta_c\theta_r}+\alpha\theta_d}\right]\tau_p$. The weights are determined by α, by the cost of the source of finance (in the numerator) and by the increase in value of the firm's equity q_K (in the denominator).

[13] The capital income tax system as described in *footnote 5* implies that the marginal effective tax rate $t_e=\frac{f'(K)-(r-t_w)}{f'(K)}$ in the steady state equals $t_e=\left[\frac{1-\alpha}{1-\tau_d\alpha}\right]\left(\tau_d+\frac{t_w}{\left(\frac{r}{1-\tau_d}\right)}\right)+\left[\frac{\alpha(1-\tau_d)}{1-\tau_d\alpha}\right]\left(\frac{t_w}{r}\right)$. The marginal effective tax rate of investment financed entirely with equity $\alpha=0$ amounts to the corporate tax rate in addition to the wealth tax rate per percentage of the cost of capital r/θ_d. If the investment is entirely financed with debt, then the marginal effective tax rate equals the wealth tax rate per percentage of the cost of capital r. The firm finances the investment partly with newly issued equity and partly with debt. The weights are explained in *footnote 12*.

the condition on β, the firm issues initially a nucleus of new equity and debt. The initial phase is characterised by

(3.31) $f'(K(t_1)) > \alpha r + (1-\alpha)\frac{r}{\theta_d} \quad \Leftrightarrow \quad \beta < \frac{1}{1+\tau_d} \quad$ and $\quad q_K(t_1)) > 1-\tau_d\alpha$.

Afterwards, the firm enters an internal growth phase during which investment is financed with debt and retained earnings. In *phase III*, the firm no longer invests, and uses its earnings as interest payments and as dividends. The equilibrium is characterised by $q_K^{SS} = \theta_d$ and $q_K^{SS} = -q_D^{SS}$. The steady-state cost of capital amounts to

(3.32) $f'(K^{SS}) = r$.

3.6 Share repurchases

This section introduces share repurchases, which are denoted by R, into the life-cycle model of the firm. The market value of shares M is implicitly determined by the arbitrage condition

(3.33) $\theta_p\theta_d\pi^d + \dot{m}z\theta_c + (\dot{z}m - Q + \theta_r R)\theta_c = \theta_p r M$.

The firm's gross profits $\pi^d + R$ amount to

(3.34) $\pi^d + R = f(K) - rD_f + S_f + Q - I - \tau_r(f(K) - rD_f - \pi^d - R)$.

The firm's dynamic finance and investment problem amounts to

(3.35) $\underset{\{I, S_f, Q, R, K(t_1), D_f(t_1)\}}{Max} \quad M(t_1) - K(t_1) + D_f(t_1)$

Sub to:

(3.36) $M(t_1) = \int_{t_1}^{\infty}\left[\frac{\theta_p\theta_d\pi^d(v)}{\theta_c} + \theta_r R(v) - Q(v)\right].e^{-\int_{t_1}^{v}\frac{\theta_p}{\theta_c}r(s)ds}\,dv$

(3.37) $\pi^d + R = f(K) - rD_f + \frac{1}{\theta_r}\left[S_f + Q - I\right]$

(3.38) $R \geq 0, \quad \mu_R \geq 0, \quad \mu_R R = 0$

(3.39) $R \leq \frac{\gamma}{\theta_r}\pi^d, \quad \mu_\pi \geq 0, \quad \mu_\pi\left(\frac{\gamma}{\theta_r}\pi^d - R\right) = 0$

+ (3.6), (3.7), (3.8), (3.9) and (3.11)

Condition (3.39) limits the amount of share repurchases. By assumption, capital gains are taxed less heavily than dividends, which implies that the firm prefers to repurchase as many

shares as possible. The steady-state dividends and share repurchases are then equal to $\pi^d = \left(\frac{\theta_r}{\theta_r + \gamma}\right) X$ and $\pi^d = \left(\frac{\gamma}{\theta_r + \gamma}\right) X$, where $X = f(K) - rD_f + \frac{1}{\theta_r}(S_f + Q - I)$.

- *Preferred sources of finance in the steady state*

As a result of interest payments, the household foregoes both dividends ($\left(\frac{\theta_r}{\theta_r + \gamma}\right)\%$) and share repurchases (capital gains) ($\left(\frac{\gamma}{\theta_r + \gamma}\right)\%$). Hence, the steady-state cost of debt equals the present value of foregone dividends and foregone share repurchases $q_D^{SS} = -\left[\frac{\theta_p \theta_d}{\theta_p}\left(\frac{\theta_r}{\theta_r + \gamma}\right) + \frac{\theta_c \theta_r}{\theta_p}\left(\frac{\gamma}{\theta_r + \gamma}\right)\right]$.

The firm in the steady state prefers retained earnings (*RE*) to newly issued equity/debt (*NE/DF*) if capital gains are taxed less than dividends/interest payments

$$(3.40)\quad NE \underset{\pi}{\overset{\phi}{\approx}} RE \quad \Leftrightarrow \quad \frac{\theta_p \theta_d}{\theta_c \theta_r}\left(\frac{\theta_r}{\theta_r + \gamma}\right) + \left(\frac{\gamma}{\theta_r + \gamma}\right) - 1 \underset{<}{\overset{>}{=}} 0 \quad \Leftrightarrow \quad \theta_p \theta_d \underset{<}{\overset{>}{=}} \theta_c \theta_r$$

$$(3.41)\quad DF \underset{\pi}{\overset{\phi}{\approx}} RE \quad \Leftrightarrow \quad \left[\frac{\theta_p \theta_d}{\theta_c \theta_r}\left(\frac{\theta_r}{\theta_r + \gamma}\right) + \left(\frac{\gamma}{\theta_r + \gamma}\right)\right] + q_D \underset{<}{\overset{>}{=}} 0 \quad \Leftrightarrow \quad \theta_p \underset{<}{\overset{>}{=}} \theta_c \theta_r \quad .$$

The firm in the steady state prefers debt (*DF*) to newly issued equity (*NE*) if the cost of an additional unit of debt is lower than the unit cost of newly issued equity

$$(3.42)\quad NE \underset{\pi}{\overset{\phi}{\approx}} DF \quad \Leftrightarrow \quad -1 - q_D \underset{<}{\overset{>}{=}} 0 \quad \Leftrightarrow \quad \theta_p \theta_d \left(\frac{\theta_r}{\theta_r + \gamma}\right) + \theta_c \theta_r \left(\frac{\gamma}{\theta_r + \gamma}\right) \underset{<}{\overset{>}{=}} \theta_p$$

$$\Leftrightarrow \quad \left(\frac{\theta_r}{\theta_r + \gamma}\right) \tau_d \theta_p \underset{>}{\overset{<}{=}} \left(\frac{\gamma}{\theta_r + \gamma}\right)(\theta_c \theta_r - \theta_p) \quad .$$

The firm prefers newly issued equity to debt if the tax cost as a result of the additional dividends compared to the interest payments $\theta_p - \theta_p \theta_d = \tau_d \theta_p$ is lower than the tax gain as a result of the additional share repurchases $\theta_c \theta_r - \theta_p$. Consequently, if $\theta_p > \theta_c \theta_r$, the firm always prefers debt to newly issued equity. However, if $\theta_c \theta_r > \theta_p$, the firm might prefer newly issued equity to debt for sufficiently large values of γ in the steady state:

$$(3.43)\quad \theta_c \theta_r > \theta_p \quad \Rightarrow \quad NE \underset{\pi}{\overset{\phi}{\approx}} DF \quad \Leftrightarrow \quad \gamma \underset{<}{\overset{>}{=}} \frac{\tau_d \theta_p \theta_r}{\theta_c \theta_r - \theta_p} \quad .$$

- *The model's solution if* $\theta_c\theta_r > \theta_p > \theta_p\theta_d$

Retained earnings are the preferred source of finance if $\theta_c\theta_r > \theta_p > \theta_p\theta_d$. It is assumed that the firm prefers to finance initial investment with debt instead of newly issued equity. The optimal path consists of five phases similar to the solution discussed in *section 3.4*. This analysis briefly focuses on the initial phase and the steady state.

Initial phase: starting the firm

In the initial phase, the firm invests until the benefit $q_K(t_1)$ equals the cost of the investment, which is financed partly with debt and partly with newly issued equity. The cost is higher than $(1-\alpha)\cdot 1+\alpha\cdot(-q_D^{SS})$, which implies

$$(3.44)\quad q_K(t_1) > \alpha + \left[(1-\alpha) - \tau_d\alpha\left(\frac{\theta_r}{\theta_r+\gamma}\right) + \alpha\left(\frac{\gamma}{\theta_r+\gamma}\right)\left[\frac{\theta_c\theta_r-\theta_p}{\theta_p}\right]\right] \quad .$$

The debtholder receives back the originally invested α euro. Because of the α units of debt, the cost of issuing $(1-\alpha)$ euro of new equity depends negatively on the corporate tax savings as a result of the foregone dividends, and depends positively on the additional taxes $\tau_p - \tau_r - \tau_c(1-\tau_r)$ as a result of the foregone share repurchases. The cost of capital satisfies

$$(3.45)\quad f'(K(t_1)) > \alpha r + \frac{(1-\alpha)\theta_p r}{\left[\left(\frac{\theta_r}{\theta_r+\gamma}\right)\theta_p\theta_d + \left(\frac{\gamma}{\theta_r+\gamma}\right)\theta_c\theta_r\right]} > r \quad \Leftrightarrow \quad \beta < \frac{1}{\left(\frac{\theta_r}{\theta_r+\gamma}\right)\left[1-\frac{\theta_p\theta_d}{\theta_c\theta_r}\right]+1}.$$

The cost of capital on debt-financed investment equals the interest rate. Because the firm foregoes the use of the cheaper retained earnings, the cost of capital on investment financed with newly issued equity might be higher than the cost of capital in case of no-deferral, as defined in $f'(K)\cdot\left[\left(\frac{\theta_r}{\theta_r+\gamma}\right)\theta_p\theta_d + \left(\frac{\gamma}{\theta_r+\gamma}\right)\theta_c\theta_r\right] = \theta_p r$. The difference between the unit cost of newly issued equity and the cost of retained earnings $\left(\frac{\theta_r}{\theta_r+\gamma}\right)\frac{\theta_p\theta_d}{\theta_c\theta_r} + \left(\frac{\gamma}{\theta_r+\gamma}\right)$, which represents the foregone dividends and foregone share repurchases, determines the first term in the denominator of the condition on β.

If $\gamma > \frac{\tau_d\theta_p\theta_r}{\theta_c\theta_r-\theta_p}$, the cost of capital on investment financed with newly issued equity in case of no-deferral is lower than r, which implies that the firm will prefer newly issued equity to debt in the steady state (condition (3.43)). However, given the condition on β, the cost of capital on initial investment financed with newly issued equity is higher than the value in case of no-deferral (the cost of capital includes the opportunity cost of the foregone retained

earnings as a source of finance). Consequently, even if $\gamma > \frac{\tau_d \theta_p \theta_r}{\theta_c \theta_r - \theta_p}$, the firm faces an incentive to issue debt during the initial phase as long as the cost of capital on investment financed with newly issued equity exceeds the cost of capital on debt-financed investment r.

Steady state: dividends and share repurchases

As discussed in Sinn (1991c), the firm finances investment with retained earnings until the after-tax increase in value of the firm's equity equals the opportunity cost of foregone dividends and share repurchases

(3.46) $$q_K = \left(\frac{\theta_r}{\theta_r + \gamma}\right)\frac{\theta_p \theta_d}{\theta_c \theta_r} + \left(\frac{\gamma}{\theta_r + \gamma}\right) \quad .$$

At the margin, the household is indifferent between the return on an investment financed with retained earnings that is partly distributed as dividends and partly used to repurchase shares, and the opportunity return on an investment in market bonds:

(3.47) $$\theta_c \theta_r f'(K)\left[\left(\frac{\theta_r}{\theta_r + \gamma}\right)\theta_p \theta_d + \left(\frac{\gamma}{\theta_r + \gamma}\right)\theta_c \theta_r\right] = \left[\left(\frac{\theta_r}{\theta_r + \gamma}\right)\theta_p \theta_d + \left(\frac{\gamma}{\theta_r + \gamma}\right)\theta_c \theta_r\right]\theta_p r \quad .$$

The cost of capital on marginal investment financed with retained earnings then equals

(3.48) $$f'(K) = \frac{\theta_p}{\theta_c \theta_r} r < r \quad .$$

Sensitivity analysis with respect to γ

The cost of capital on investment financed with newly issued equity thus includes the opportunity cost resulting from the foregone retained earnings as a source of finance. Because highly taxed dividends are replaced by lower taxed capital gains, the possibility of repurchasing shares decreases this opportunity cost. Consequently, an increase in γ decreases the cost of capital on investment financed with newly issued equity. The cost of capital on marginal investment financed with retained earnings does not change, however. The firm will thus not accumulate more capital as a result of an increase in γ. Given the increase in the initially attracted capital and the constant steady-state capital stock, the length of the internal growth phase decreases with γ.

If $\theta_c \theta_r > \theta_p \theta_d$, and if the firm may use all its profits to repurchase shares ($\gamma \to \infty$), the firm is indifferent between newly issued equity and retained earnings as a source of finance.

Because the steady-state cost of debt amounts to $q_D^{SS} = -\frac{\theta_c \theta_r}{\theta_p}$, the firm prefers equity to debt if $\theta_c \theta_r > \theta_p$. Under these assumptions, the firm immediately attracts the optimal amount of capital, which is entirely financed with newly issued equity. The firm will not finance investment with debt. In fact, the firm directly jumps towards the steady state that is characterised by $q_K = 1$ and $f'(K) = \frac{\theta_p}{\theta_c \theta_r} r < r$.

If $\theta_c \theta_r > \theta_p \theta_d$, an increase in γ decreases the cost of capital on investment financed with newly issued equity. Moreover, if γ becomes very large and if $\theta_c \theta_r > \theta_p > \theta_p \theta_d$, then the cost of capital on investment entirely financed with newly issued equity converges to a value that is lower than the interest rate. Under these assumptions, the firm will not finance investment with debt during the entire life cycle.

3.7 Challenges and conclusions

This chapter introduces debt and share repurchases in Sinn's dynamic life-cycle model of the firm. The model derives the cost of capital along the entire optimal path and determines the firm's optimal sources of finance and the optimal use of the investment's earnings.

The firm faces an incentive to defer the dividend taxes if $\theta_c \theta_r > \theta_p \theta_d$. As a result, the firm issues only a nucleus of new equity. Moreover, the firm faces an incentive to retain and reinvest the earnings until $f'(K) = \frac{\theta_p}{\theta_c \theta_r} r$. The steady-state cost of capital might be lower or higher than the interest rate, which depends on $\theta_c \theta_r \gtrless \theta_p$. The incentive to defer dividend taxes does not change if the firm finances investment with debt. However, the firm faces an incentive to attract debt as quickly as possible until $f'(K) = r$. The different tax treatment of dividends and capital gains becomes less important if the firm can repurchase shares.

The model features a number of shortcomings. The firm's production is represented by a concave function. Capital is assumed to be homogeneous, investment is assumed to be continuous and reversible, and production is assumed to be deterministic. Moreover, the firm's equity is owned by one type of shareholder, and risk is not incorporated in the model.

The model can be extended in several ways. The model could allow for technology shocks, or could incorporate adjustment costs or financial market imperfections.

Technology shock

The model could allow for unexpected technology shocks. If an unanticipated technology shock enhances the firm's productivity, the firm might want to issue additional new equity or might want to employ its retained earnings to finance the new investment opportunities. If retained earnings are the preferred source of finance, then a mature firm will not issue new equity if its retained earnings are large enough to finance the new investment. In fact, the

firm will take into account not only this year's available earnings that can be retained, but also the earnings in years to come. The problem becomes even more complex if the technology shock occurs during the firm's internal growth phase. The firm might decide to wait until it becomes mature before financing the new investment opportunities. However, the firm optimally issues debt as long as the return on the additional investment opportunity exceeds the interest rate.

Adjustment costs

Another interesting extension of this chapter's dynamic finance and investment model is the introduction of convex adjustment costs as a result of the installation of new capital (convex in the investment). In the presence of adjustment costs, the nucleus theory of the firm allows for dividends to be paid during the initial part of the life cycle of the firm. Investing too many funds in the same period might be too costly, due to the adjustment costs. Consequently, the firm might find it optimal to use only part of its internal sources to finance investment; the remainder of the funds will be distributed as dividends. The steady state of the model corresponds to the steady state of this chapter's model even though dividends are distributed along the firm's optimal finance and investment path. The analysis shows that in addition to the feasible paths discussed in this chapter, the solution might consist of two additional feasible phases. First, the firm might pass through a phase of investment (financed with retained earnings) while it distributes dividends. Second, the firm may pass through a phase during which investment is financed with both newly issued equity and retained earnings. Due to adjustment costs, the firm might not issue the optimal amount of new equity initially, but instead spread out the issue of new equity over different phases.

Financial market imperfections

This chapter's life-cycle model of the firm assumed that the capital markets function perfectly. In reality, however, the firm's finance and investment behaviour and its distribution policy are influenced by financial market imperfections due to adverse selection and moral hazard problems in the debt and equity market. The effects of these financial market imperfections on the firm's tax-arbitrage behaviour will be studied in the next chapter.

Mathematical appendix

A. The Hamiltonian and the first-order conditions

The Lagrangian of the model (3.3) – (3.11) is

(A.1) $$H = \left(\frac{1}{\theta_c} + \mu_\pi\right)\left[\theta_p\theta_d\left[f(K) - rD_f + \frac{S_f}{\theta_r} + \frac{Q}{\theta_r} - \frac{I}{\theta_r}\right]\right] - (1-\mu_Q)Q + q_K I + q_D S_f + \lambda\left[\alpha I - S_f\right] \quad .$$

(A.2) – (A.17) + the constraints (3.5) – (3.10) are the problem's first-order conditions:

(A.2) $$\frac{\partial H}{\partial I} = 0 \quad : \quad q_K = \left(\frac{1}{\theta_c} + \mu_\pi\right)\frac{\theta_p\theta_d}{\theta_r} - \lambda\alpha$$

(A.3) $$\frac{\partial H}{\partial Q} = 0 \quad : \quad \left(\frac{1}{\theta_c} + \mu_\pi\right)\frac{\theta_p\theta_d}{\theta_r} = \left(1 - \mu_Q\right)$$

(A.4) $$\frac{\partial H}{\partial S_f} = 0 \quad : \quad q_D = \lambda - \left(\frac{1}{\theta_c} + \mu_\pi\right)\frac{\theta_p\theta_d}{\theta_r}$$

From (A.2) and (A.3): $q_K = 1 - \mu_Q - \lambda\alpha$ **(A.5)**. From (A.3) and (A.4): $q_D = \lambda + \mu_Q - 1$ **(A.6)**. Moreover, from (A.2) and (A.4): $q_K = -q_D + \lambda(1-\alpha)$ **(A.7)**.

(A.8) $$\dot{q}_K - \left(\frac{\theta_p}{\theta_c}r\right)q_K = -\frac{\partial H}{\partial K}$$

(A.9) $$\dot{q}_D - \left(\frac{\theta_p}{\theta_c}r\right)q_D = -\frac{\partial H}{\partial D_f}$$

(A.10) is the solution of (A.8). Given (A.2), this condition is written as (A.11)

(A.10) $$\dot{q}_K - \left(\frac{\theta_p}{\theta_c}r\right)q_K = -\left(\frac{1}{\theta_c} + \mu_\pi\right)\theta_p\theta_d f'(K)$$

(A.11) $$\dot{q}_K + q_K\left[\theta_r f'(K) - \frac{\theta_p}{\theta_c}r\right] = -\lambda\alpha\theta_r f'(K)$$

(A.12) is the solution of (A.9). Given (A.4), this condition is written as (A.13)

(A.12) $$\dot{q}_D - \left(\frac{\theta_p}{\theta_c}r\right)q_D = \left(\frac{1}{\theta_c} + \mu_\pi\right)\theta_p\theta_d r$$

(A.13) $$\dot{q}_D + rq_D\left(\frac{\theta_c\theta_r - \theta_p}{\theta_c}\right) = \lambda\theta_r r$$

The sum of (A.10) and (A.12), with (A.7) yields (A.14):

(A.14) $$\dot{\lambda} = \lambda\frac{\theta_p}{\theta_c}r - \frac{\left(\frac{1}{\theta_c} + \mu_\pi\right)\theta_p\theta_d\left(f'(K) - r\right)}{(1-\alpha)} = \lambda\frac{\theta_p}{\theta_c}r - \frac{\theta_r\left(q_K + \alpha\lambda\right)\left(f'(K) - r\right)}{(1-\alpha)}$$

The firm's initial conditions are

(A.15) $\frac{\partial M(t_1)}{\partial K(t_1)} - 1 + \lambda\alpha = 0$, which implies $q_K(t_1) = 1 - \lambda\alpha$ ($\frac{\partial M(t)}{\partial K(t)} \equiv q_K(t)$ holds by definition)

(A.16) $\frac{\partial M(t_1)}{\partial D_f(t_1)} + 1 - \lambda = 0$, which implies $q_D(t_1) = \lambda - 1$ ($\frac{\partial M(t)}{\partial D_f(t)} \equiv q_D(t)$ holds by definition) .

The transversality constraints are equal to

(A.17) $\lim_{v\to\infty} q_K(t)K(t)e^{-\int_t^v \frac{\theta_p}{\theta_c} r(s)ds} = 0$ and $\lim_{v\to\infty} q_D(t)D_f(t)e^{-\int_t^v \frac{\theta_p}{\theta_c} r(s)ds} = 0$.

B. The solution procedure of van Loon (1983)

This section briefly describes the solution procedure of van Loon (1983) (the actual derivations are available upon request). The first step determines the phases, which are characterised by the values of π^d, Q, I, S_f. Given the first-order conditions and (for instance) the assumption $\theta_c\theta_r > \theta_p > \theta_p\theta_d$, the second step determines the feasible phases. The third step of the procedure characterises the feasible phases, which implies that the values of the control variables, the state variables, the cost of capital and the co-state variables are determined (if possible). The next step determines the final phase(s), which have to satisfy the transversality conditions. The chain(s) of feasible phases are obtained if the LaGrange multipliers, the co-state variables and the state variables are continuous. The final step checks whether the first phase of the optimal solution satisfies the initial condition.

C. The steady-state value of q_D^{SS}

The derivative of $M(t)$ with respect to the firm's debt $D_f(t)$, given the value of $\pi^d(t)$, yields

(C.1) $q_D(t) = \frac{dM(t)}{dD_f(t)} = \int_t^\infty -\left(\frac{1}{\theta_c} + \mu_\pi\right)\theta_p\theta_d r(v)\cdot e^{-\int_t^v \frac{\theta_p}{\theta_c} r(s)ds} dv$.

The firm distributes dividends in the steady state, which implies $\mu_\pi = 0$. Thus,

(C.2) $q_D(t^{SS}) = \frac{dM(t^{SS})}{dD_f(t^{SS})} = \int_{t^{SS}}^\infty -\frac{\theta_p\theta_d r(v)}{\theta_c}\cdot e^{-\int_{t^{SS}}^v \frac{\theta_p}{\theta_c} r(s)ds} dv = \theta_d\left(\int_{t^{SS}}^\infty \frac{d\cdot e^{-\int_{t^{SS}}^v \frac{\theta_p}{\theta_c} r(s)ds}}{dv} dv\right) = -\theta_d$.

D. The initial cost of capital: $\theta_c\theta_r > \theta_p > \theta_p\theta_d \Rightarrow f'(K(t_1)) > \alpha r + (1-\alpha)\frac{r}{\theta_d}$

- $\alpha = 1$

If $\alpha = 1$, the firm finances the investment entirely with debt. Because λ is the gain of an additional unit of debt, the firm stops to issue debt when $\lambda = 0$. It can be derived that $\lambda(1-\alpha) = \int_t^\infty \left(\frac{1}{\theta_c} + \mu_\pi\right)\theta_p\theta_d(f'(K) - r(v))\cdot e^{-\int_t^v \frac{\theta_p}{\theta_c} r(s)ds} dv$. Consequently, the firm finances investment with debt until $f'(K) = r$.

- $\alpha = 0$

This section proves that the cost of capital of investment financed with newly issued equity is $f'(K(t_1)) > \frac{r}{\theta_d}$.

(D.1) $$q_K = q_2^{'} = \frac{\theta_p \theta_d}{\theta_c \theta_r} \qquad K = K_2^{'}$$

(D.2) $$f'(K) = \frac{\theta_p}{\theta_c \theta_r} r \qquad K = K_2^{'}$$

Moreover, it can be proven that

(D.3) $$\frac{dq_K}{dK} = \frac{q_K}{f(K)} \left[\frac{\theta_p}{\theta_c \theta_r} r - f'(K) \right] \qquad K_1^{'} \le K \le K_2^{'} \quad .$$

Let's define $s(K) = \frac{\theta_d f'(K)}{r}$. Hence,

(D.4) $$q_K(K_1^{'}) = s(K_1) = 1$$

(D.5) $$q_K(K_2^{'}) = s(K_2^{'}) = \frac{\theta_p \theta_d}{\theta_c \theta_r} = q_2^{'} \quad .$$

The remainder proves that $q_K(K_1) < 1$. The capital stock K_1 is characterised by $f'(K_1) = \frac{r}{\theta_d}$. If $q_K(K_1) < 1$ and given that $q_K(K_1^{'}) = 1$, the initial period's capital stock $K_1^{'}$ is characterised by $f'(K_1^{'}) > \frac{r}{\theta_d}$ (under the assumption of a concave production function and given that $\frac{dq_K}{dK} \le 0$).

Because of $-\infty < dq_K(K)/dK < 0$ for $0 < K < K_2^{'}$, (D.4) and (D.5), a sufficient condition for $q_K(K_1) < 1$ is $\frac{\partial q_K(K)/\partial K}{q_K(K)} > \frac{\partial s(K)/\partial K}{s(K)}$. Hence,

(D.6) $$\frac{\partial q_K(K)/\partial K}{q_K(K)} > \frac{\partial s(K)/\partial K}{s(K)} \quad \Leftrightarrow \quad \frac{1}{f(K)} \left[\frac{\theta_p}{\theta_c \theta_r} r - f'(K) \right] > \frac{f''(K)}{f'(K)} \quad \Leftrightarrow \quad 1 - \frac{\frac{\theta_p}{\theta_c \theta_r} r}{f'(K)} < \frac{\omega/\beta}{\sigma} .$$

(D.6) and $f'(K) < \frac{r}{\theta_d} \quad for\ K > K_1$ imply that a sufficient condition for $q_K(K_1) < 1$ is

(D.7) $$\left[1 - \frac{\theta_p \theta_d}{\theta_c \theta_r} \right] < \frac{\omega/\beta}{\sigma} .$$

- *Conclusion*

$\alpha = 1$ implies that $f'(K(t_1)) = r$. $\alpha = 0$ implies that $f'(K(t_1)) > \frac{r}{\theta_d}$. Because the investment is $\alpha\%$ financed with debt and $(1-\alpha)\%$ with newly issued equity, it follows that $f'(K(t_1)) > \alpha r + (1-\alpha)\frac{r}{\theta_d} \quad \Leftrightarrow \quad \left[1 - \frac{\theta_p \theta_d}{\theta_c \theta_r} \right] < \frac{\omega/\beta}{\sigma}$.

E. The length of the internal growth phase

Given that $f(K) = AK^{\beta}$, $f'(K^{SS}) = \frac{\theta_p}{\theta_c \theta_r} r$ (condition (3.26)), and under the assumption that the initial period's capital stock satisfies $f'(\tilde{K}^I) = \frac{r}{\theta_d}$, the steady-state capital stock and the initial period's capital stock amount to $K^{SS} = \left[\frac{\theta_p r \,/\, \theta_c \theta_r}{A\beta} \right]^{\frac{1}{\beta - 1}}$ and $\tilde{K}^I = \left[\frac{r \,/\, \theta_d}{A\beta} \right]^{\frac{1}{\beta - 1}}$.

If $\alpha = 0$, condition (3.5) simplifies to $\frac{dK}{dt} = \theta_r \cdot A \cdot K(t)^{\beta}$. Using $\tilde{K}^I$ as initial condition, the solution of the differential equation equals

(E.1) $$K(t) = \left[\frac{A\beta}{r \,/\, \theta_d} + (1-\beta)\theta_r A \cdot t \right]^{1/(1-\beta)}.$$

Given that $K^{SS} = K(t^{SS}) = \left[\frac{\theta_p r \,/\, \theta_c \theta_r}{A\beta} \right]^{\frac{1}{\beta - 1}}$, (E.1) can be solved for t^{SS}:

(E.2) $$t^{SS} = \frac{\beta}{(1-\beta) \cdot \theta_r \cdot r} \left[\frac{\theta_c \theta_r}{\theta_p} - \theta_d \right]$$

From (E.2), it can easily be derived that (if $\theta_c \theta_r > \theta_p \theta_d$)

(E.3) $$\frac{\partial t^{SS}}{\partial \beta} > 0 \quad .$$

This result proves that the length of the internal growth phase is increasing in β.

Chapter 4
Financial Market Imperfections

4.1 Introduction

The analysis in chapter 2 and chapter 3 assumes that capital markets function perfectly. In reality, however, the firm's finance and investment behaviour and distribution policy are influenced by financial market imperfections as a result of adverse selection and moral hazard. For instance, firms may be constrained in issuing new equity or attracting debt as a result of adverse selection. Firms may also want to distribute dividends in order to address adverse selection or moral hazard problems.

In order to study the agents' tax-arbitrage behaviour and evaluate different capital income tax systems, this chapter incorporates some financial market imperfections. The analysis thus studies simultaneously the effects of capital income taxes and financial market imperfections.
The first part of this chapter surveys various financial market imperfections and reviews their effects on the firm's finance and investment decisions and distribution policy. *Section 4.2* discusses tax-arbitrage models, static trade-off models, adverse selection and moral hazard models. The second part of the chapter integrates some of the financial market imperfections surveyed in *section 4.2* into Sinn's life-cycle model of the firm. *Section 4.3* studies adverse selection in the debt and equity markets. *Section 4.4* analyses the 'traditional' view of dividend taxation.

Adverse selection in the debt and equity markets gives rise to an implicit tax wedge between the cost of internal and external sources of finance, which implies a 'finance pecking order'. In the absence of explicit taxes, retained earnings are then preferred to debt, while newly issued equity is the least preferred source of finance. *Section 4.3* incorporates this 'finance pecking order' in Sinn's life-cycle model of the firm. This 'finance pecking order' may be similar to the agents' preference relations with respect to the sources of finance as a result of the capital income tax system. The 'finance pecking order' then strengthens the 'tax pecking order'. Hence, the firm will issue even less new equity and possibly attract less debt. Moreover, the length of the firm's internal growth phase will grow with the adverse selection.

The 'traditional view' in *section 4.4* assumes that dividends are valued higher than capital gains and that newly issued equity is the firm's marginal source of finance. The analysis studies the effect on the firm's steady-state investment behaviour. Moreover, a minimum dividend constraint is included in Sinn's model. This analysis demonstrates that newly issued

equity is the 'traditional' view's key assumption, while it implies an implicit assumption on the firm's available investment opportunities.

4.2 Financial market imperfections: literature review

This section reviews the literature of financial market imperfections[1]. *Section 4.2.1* (tax-arbitrage models) studies the interaction between different households/firms minimising their tax liability. In *section 4.2.2* (static trade-off models), the firm considers capital income taxes, tax losses and bankruptcy costs in determining optimal leverage. Agents in the imperfect information models have access to different amounts of information, which results in adverse selection (*section 4.2.3*) and moral hazard (*section 4.2.4*).

4.2.1 Tax-arbitrage models

Given the capital income tax system, tax-arbitrage models study saving and investment decisions of households and firms that seek to minimise their tax liability.

Progressive capital income taxes

Miller (1977) assumes a progressive personal income tax on interest payments, which are deductible from taxable corporate earnings. The return on equity is implicitly defined as a weighted average of the return on investment financed with newly issued equity and retained earnings, while the return is distributed as dividends or is retained. This return on equity is taxed under the corporate tax and under a proportionate household tax. Moreover, households can earn a fully tax-exempt return on government bonds. Tax-exempt households will want to invest in corporate bonds if the interest rate exceeds the return on government bonds. However, additional debt will have to be purchased by households with positive personal income tax rates. If firms issue more debt, then the interest rate will have to rise in order to compensate these households for the progressive income tax on debt. If the interest rate rises above the required return on equity, then the corporate sector will not find it worthwhile to issue more bonds and will start to finance additional investment with equity. Consequently, at the equilibrium interest rate some marginal investor is indifferent between holding equity or debt. The capital income taxes and the available funds of households in the different personal income tax brackets determine the equilibrium debt-equity ratio for the corporate sector as a whole, but not the optimal amount for a particular firm. In fact, there is no optimal debt-equity ratio for an individual firm. Because households seek to minimise their tax liability, firms with a low (high) degree of leverage will find a tax clientele among investors in high (low) personal income tax brackets. An increase in the corporate tax rate or an increase in the proportionate tax on equity will increase the corporate sector's debt-equity ratio. An increase in the progressive personal income tax will decrease the corporate sector's debt-equity ratio.

Black and Scholes (1974) construct a similar tax clientele effect for equity. Firms with a low (high) degree of profits that are distributed as dividends will find a tax clientele among investors in high (low) tax brackets on equity income. In equilibrium, there is no optimal dividend payout rate for an individual firm.

[1] See also Brealy and Myers (1991) and Harris and Raviv (1991).

Tax-exempt saving

Miller and Scholes (1978) argue that there are opportunities for investors to reduce (or even avoid) the tax penalty on dividends relative to capital gains. Interest payments that are due on the household's borrowed funds can be deducted from the household's taxable income. Taxes on dividends can be avoided if the interest payments offset the taxable dividend income and if the household invests the borrowed funds in tax-free saving opportunities that yield a return high enough to pay for the borrowed funds. Consequently, shareholders might prefer to receive dividends because the dividend tax can be neutralised. Along the same lines, Gordon and Slemrod (1988) demonstrate that tax-arbitrage opportunities strongly reduce government revenue from taxing capital income.

4.2.2 Static trade-off models

Static trade-off models suggest that firms in search of the cheapest source of finance trade off the relative benefits and costs of debt with respect to equity financing (Mintz (1995)). At the optimal leverage, the firm is indifferent between marginal debt and equity-financed investment. Besides focussing on the corporate tax advantage and the personal income tax disadvantage of debt, static trade-off models examine tax losses and bankruptcy costs.

Tax losses

Debt is preferred to equity as long as the corporate tax benefit is higher than the personal income tax cost of debt. However, the interest payments might not be entirely deductible from the corporate tax base, because the firm's earnings are low or because the firm possesses a large amount of tax shield substitutes for debt (such as investment grants and depreciation allowances). The corporate tax advantage of debt is then lost, and the personal tax cost discourages the firm from financing the investment with debt. Consequently, the optimal amount of debt financing decreases with the available non-debt tax shields (DeAngelo and Masulis (1980))[2]. Corporate tax shields are less likely to be lost in case of tax loss carrybacks or carryforwards.

Bankruptcy costs

A rise in the firm's leverage increases the probability that the firm goes bankrupt. Creditors are aware of the increased probability that they will have to pay the corresponding bankruptcy costs (Brealy and Myers). Direct bankruptcy costs are the legal, accounting and administrative costs as a result of the firm's bankruptcy. Indirect bankruptcy costs refer to the decrease in expected profits as a result of the increased probability of bankruptcy[3]. Additional debt will be supplied only if the interest rate (as the reward for the additional debt financing) increases. The firm finances additional investment with debt until the corporate tax benefit is balanced by the increased bankruptcy costs included in the interest rate.

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[2] See Dammon and Senbet (1988) for a similar model with an endogenous level of investment.

[3] Altman (1984) discusses indirect bankruptcy costs. He explores the higher cost of credit and the firm's costs as a result of its inability to obtain credit or issue securities. He also mentions costs due to lost sales because potential buyers perceive that default is likely. Suppliers of materials will deliver goods under cost increasing conditions (for instance, cash on delivery). Altman also discusses the costs due to management's preoccupation with staying alive and the replacement and reorganisation costs because some employees leave the firm.

4.2.3 Adverse selection

Managers may have private information about the characteristics of the firm's return stream and/or investment opportunities. This gives rise to adverse selection (Harris and Raviv (1991)). The market's perception of the value of the firm and/or its investment opportunities may deviate from the management's information. Managers may use the firm's capital structure in order to mitigate the inefficiencies in its investment decisions as a result of asymmetric information. The firm's capital structure and payout policy may also be used to signal the private information.

- *Capital structure mitigates inefficiencies*

Asymmetric information may distort the firm's optimal finance and investment decisions. Firms may adjust the way they finance investment, however, in order to minimise the efficiency losses due to asymmetric information. Distortions may result from adverse selection in either the credit market or the equity market[4].

External debt finance

Adverse selection occurs in the credit market if lenders are unable to discriminate between different types of borrowers. Since contracts that are optimal only if offered exclusively to high quality borrowers also attract lower quality borrowers, lenders will offer a contract that is profitable if all types of borrowers accept. Compared to the perfect information case, firms with good (bad) projects have to pay a higher (lower) interest rate in case of adverse selection in the credit market. In this way, asymmetric information might drive a wedge between the firm's costs of internal and external finance.

Jaffee and Russell (1976) and Stiglitz and Weiss (1981) show that asymmetric information may lead to under-investment because credit will be rationed. In Jaffee and Russell (1976), all borrowers receive a loan smaller than the one they had asked for, which implies that fewer borrowers default. Stiglitz and Weiss (1981) model asymmetric information about the risk of a project. The maximum interest rate on debt that a firm can afford to pay is lower for low-risk firms than for high-risk firms (it is assumed that high-risk firms are willing to borrow at high interest rates because their profits are increasing with the riskiness of the project). Banks have an incentive to increase the interest rate they ask for as long as the low-risk borrowers continue to participate. Because the supply of funds is an increasing function of the interest rate, it may well be that (at the maximum interest rate the bank wants to charge) the total demand for credit by the firms is higher than the households' supply of credit. The lender will thus deny loans to some borrowers without observing whether each borrower is a high- or low-risk type of firm. While Stiglitz and Weiss (1981) assume that different projects have the same expected return, De Meza and Webb (1987) assume that expected returns differ across projects. The authors show that adverse selection in the credit market might lead to over-investment because good projects draw in bad projects. The firm then prefers debt to newly issued equity as the source of finance. However, in case of asymmetric information about risk (which implies credit rationing, as in Stiglitz and Weiss), DeMeza and

[4] A discussion of adverse selection that occurs simultaneously in the credit and the equity markets goes beyond the scope of this survey (see Hellmann and Stiglitz (2000)).

Webb demonstrate that the firm prefers newly issued equity to debt, and that there will be neither credit nor equity rationing.

External equity finance

In adverse selection models of the equity market, investors who buy the firm's newly issued equity have less information than the firm's current shareholders. Investors in Myers and Majluf (1984) do not observe the quality of the firm. They therefore pay less for shares of good firms in order to compensate for the losses that arise when shares of bad firms have been purchased. If the true value of the new shares exceeds the price that new equityholders are prepared to pay, there is a wealth transfer from the old to the new shareholders. If this transfer is not compensated by the investment's return to which the old equityholders are entitled, then the old equityholders lose if the investment is financed with newly issued equity. Myers and Majluf show that old equityholders may thus prefer that a firm does not undertake investment projects with positive net present value. In fact, issuing new equity is a 'bad' signal that the firm's equity is over-valued, because high quality firms will prefer not to issue new equity.

The under-investment problem can be circumvented if the firm finances investment with internal funds or risk-free debt. Even (less) risky debt is preferable to newly issued equity. Myers (1984) refers to this as a '*pecking order*' theory of financing. Before issuing new equity, the firm should try to finance the investment first with retained earnings, second with risk-free debt and third with risky debt. Moreover, the firm faces an incentive to build up internal funds during periods in which investment requirements are modest, for instance, by distributing less dividends.

Krasker (1986) maintains that investors must interpret larger issues of new equity more negatively than smaller issues. He shows that the larger is the issue of new equity, the larger will be the decrease in the firm's stock price. Cooney and Kalay (1993) demonstrate that firms with growth opportunities are less likely to be equity-constrained. The market does not perceive the equity issue as a 'bad' signal, but anticipates a valuable new investment project. Greenwald, Stiglitz and Weiss (1984) focus on imperfect information in the equity market but perfect information in the credit market. Only low-quality firms will issue new equity rather than debt because additional interest payments could cause financial problems for the firm. The market, which realises that firms that issue new equity are of low quality, reacts by decreasing the market value of the shares.

Some authors cast doubt on the Myers and Majluf finance pecking order. Brennan and Kraus (1987), Constantinides and Grundy (1989) and Noe (1988) show that firms do not necessarily prefer to issue debt rather than equity, and that the under-investment problem can be resolved through signalling with a richer set of financing options (e.g. convertible bonds).

- *Signalling private information*

The firm might use its capital structure and dividend policy to signal private information to outsiders. This signal prevents low-value firms from mimicking high-value firms because signalling imposes higher costs on the lower value firms, which thus do not signal. The review focuses on signalling through the capital structure and the firm's distribution policy.

Signalling through the capital structure

In Ross (1977), managers' compensation depends positively on the market valuation of the firm. The managers are penalised in case of bankruptcy. The debt level is used as a signal of the firm's quality. Low-quality firms do not increase the debt level in order to imitate high-quality firms because the higher debt level heightens the probability of bankruptcy. Profitable firms are thus more likely to issue debt. In Leland and Pyle (1977), managers are risk-averse and therefore prefer to finance investment with newly issued equity. However, managers can signal the high quality of their project by financing part of the investment with own funds. The debt level may also signal project quality, because an increase in leverage allows managers to retain a larger proportion of the firm's equity. Kale and Noe (1991) study the firm's finance decision under asymmetric information regarding the quality of the firm's investment opportunities. The authors derive the required tax advantage of debt with respect to equity such that high-quality firms issue equity, and low-quality firms issue debt (as opposed to Myers' (1984) pecking order). Low-quality firms will not mimic high-quality firms because the tax advantages of debt are higher than the mispricing gains of issuing overvalued equity. High-quality firms will issue equity because the tax benefits of debt are lower than the cost of the increased interest rate (which is due if the low-quality firm is mimicked).

Signalling through the distribution policy

The firm's payout policy can signal the firm's quality. The firm in Bhattacharya (1979) commits to a certain amount of dividends, regardless of the realised profits. The dividend level thus provides a positive signal of profitability. Low-quality firms will not distribute the high-quality firm's large amount of dividends because the probability that the low-quality firm cannot distribute these dividends is too high. In Miller and Rock (1985), dividends reveal information about the firm's realised cash flow. A larger-than-expected dividend reveals a larger-than-expected cash flow. However, dividends in Miller and Rock (1985) are not optimal if dividend taxes are introduced (John and Williams (1985)).

In John and Williams (1985), shareholders might prefer to receive cash. The firm's earnings are private information. Given the possible under-valuation of the firm's shares, the model derives the firm's optimal source of finance (retained earnings or newly issued equity) and use of profits (dividends or share repurchases). No dividends are distributed if the firm's retained earnings are large enough to finance the investment and to provide the household with cash (through share repurchases). If the shareholders have no liquidity needs and the firm's retained earnings are too small to finance the investment, it is optimal to sell new equity only to the existing shareholders (again, no dividends are distributed). In these cases, the under-valuation of the firm's equity is not a problem. However, if the firm's retained earnings are too small (given the stockholders liquidity needs and the funds required for reinvestment), both the firm and the shareholders would sell under-valued equity. Shareholders and the firm both have an incentive to signal the firm's true earnings in order to increase the price of the firm's shares. Dividends will be used as a signal, although they are taxed unfavourably. The larger the under-valuation (and thus the larger the gain of a correct valuation of the firm's equity), the more dividends will be distributed, as it will be worthwhile to pay the cost of the dividend taxes. Dividends are thus distributed only if the shareholders' demand for cash on corporate and personal account is higher than the firm's retained

earnings. Thus, some firms distribute dividends while others do not. Moreover, some firms distribute dividends while they simultaneously issue new equity.

Other authors question the results of John and Williams. Bernheim (1991) argues that the model cannot explain why firms simultaneously pay dividends and issue new equity to 'incumbent' shareholders. If the firm's profits do not change over time, and once the firm has distributed dividends in order to signal its type, Allen, Bernardo and Welch (1999) argue that the firm does not continue to distribute costly dividends because it has already signalled its type. If the market obtains information about the firm's earnings, the potential under-valuation problem vanishes. Given the households' and the firm's need for cash, the firm will issue new equity and will use part of the proceeds to repurchase shares instead of distributing highly taxed dividends. If the firm's prospects change continuously, dividends will constantly change if they are used as signal of profitability. Ambarish, John and Williams (1987) demonstrate that, although the firm can signal its quality only with its investment level, it might be cheaper to signal with dividends and the investment level at the same time.

Bernheim (1991) proves that dividends might be distributed, even though share repurchases are taxed more favourably. A high quality firm signals its type at minimum cost with the amount of taxes it pays. The firm's manager controls the amount of taxes by adjusting the proportions of (highly taxed) dividends and (lower taxed) share repurchases. In fact, some firms will pay dividends and then retrieve a portion of these payments by issuing new equity.

Risk-averse managers in Ofer and Thakor (1987) face an incentive to signal with dividends instead of share repurchases, in order to avoid the increase in the manager's undiversified holding of his firm's stock. Dividends (share repurchases) are used if the firm is slightly (highly) under-valued. The results remain intact in case of different taxes on dividends and capital gains. In Kumar (1988), managers face no incentive to reveal fully their private information about the firm's productivity (this would induce outside shareholders to invest too much, from the manager's point of view). Managers do have an incentive, however, to partly reveal their private information using the amount of distributed dividends. Different types of firms, within an interval of productivity, will cluster at a corresponding dividend level (which implies smooth dividends over time and over firms of similar productivity).

4.2.4 Moral hazard

The firm's decisions are influenced by agency costs (i.e. costs due to conflicts of interest). This section discusses shareholder-bondholder conflicts, shareholder-management conflicts and shareholder-shareholder conflicts.

- *Shareholder-bondholder conflicts*

Shareholders can undertake actions unobserved by the bondholders. This conflict arises especially when the firm faces financial problems. Because shareholders attempt to increase their wealth at the expense of bondholders, the latter will demand a higher return on their bonds. As a result, shareholders may have an incentive to mitigate the conflict with the

bondholders. This section examines three types of shareholder-bondholder conflicts: direct wealth transfers, asset substitution, and under-investment.

Direct wealth transfer

Wealth from bondholders is transferred to shareholders if an increase in the distributed dividends increases the probability that the firm cannot fulfil its debt repayments. In the extreme case, the firm distributes the entire value of the firm as dividends, such that the bondholders are left with an empty shell. As a result, bondholders require a limitation to the dividends that the firm is allowed to distribute. A direct wealth transfer also occurs if the firm issues debt with higher priority than the firm's existing debt level (Smith and Warner (1979)).

Asset substitution

If the firm is largely debt-financed, shareholders face an incentive to attract additional debt financing and to invest these funds in projects that are riskier than was agreed upon with the agents who provide the debt financing. Since bondholders are compensated according to the risk of the projects agreed upon by the agents, the asset substitution may transfer wealth from bondholders to shareholders (Jensen and Meckling (1976)). If the high-risk investment turns out well, shareholders capture almost all the gains. If the investment sours, creditors bear almost all of the costs. However, if debtholders realise that the firm will invest the funds in riskier projects, they will pay less for the firm's debt (in order to pay for the additional monitoring costs). The costs of the asset-substitution effect are consequently paid by the firm's equityholders. The firm's borrowing costs will decrease, however, if the firm builds a reputation of investing only in low-risk projects. In Diamond's (1989) model, the firm improves its reputation the longer it does not default on its debt. Mature firms invest only in safe projects because they want to avoid losing their valuable reputation (which might occur if they engage in asset substitution). Younger firms have built up less reputation and are thus more likely to choose risky projects. These firms will have to pay a higher borrowing rate. If they survive without default, these firms will eventually switch to safe projects. Diamond's results also imply that younger firms have lower leverage. Hirshleifer and Thakor (1992) focus on a manager who cares about his personal reputation of being successful. This manager will invest in a safe project if it increases his chances of being considered a successful manager even though the riskier project might maximise the equityholders' return. The manager's conservative behaviour might therefore reduce the agency (asset substitution) costs of debt financing.

Under-investment problem

If shareholders take investment decisions before debtholders have to be paid, leverage can cause firms to under-invest because the gains from the investment must be shared with the firm's existing debtholders (Myers (1977)). If the return is higher than the cost of the investment, but lower than the sum of the cost of the investment and the sum that must be paid back to the debtholders, then equityholders will forego a profitable investment opportunity. Debtholders will clearly foresee this agency conflict and will demand a higher return, which will make debt a less attractive source of finance. Again, the firm may attempt to build a reputation of taking all future investment opportunities with positive net present value. This may result in lower borrowing costs.

- *Shareholder-management conflicts*

Jensen and Meckling (1976) discuss the potential conflicts that arise between shareholders and managers as a result of the separation of ownership and control. Managers have an incentive to transfer firm resources for their personal benefit, for instance, by consuming "perquisites". Managers pay only part of the costs, while they receive the entire gain of these fringe benefits. Managers may consequently over-invest in non-pecuniary benefits. Jensen (1986) states that firms have an incentive to over-invest (causing their firms to grow beyond the optimal size) in order to increase the manager's power. The larger the firm's free cash flow is, and the smaller the growth opportunities are, the larger the over-investment problem will be. The shareholder-management conflict can be resolved if the firm distributes its excess cash flow. Financing additional investment with debt obliges the manager to pay interest, which restricts the amount of free cash flow.

In Stulz (1990), the cash flow and investment opportunities become private information of the firm's manager after the initial issue of new equity and debt. The opportunities for deviation of funds into (highly preferred) fringe benefits increase with the amount of investment. As a result, managers will want to invest as much as possible. If the firm's cash flow turns out to be high, the firm will therefore over-invest instead of distributing the excess cash. If the firm's cash flow is low, the managers will not be able to convince the shareholders that the cash flow is insufficient, and the firm will under-invest. Additional initially issued new equity may resolve the under-investment problem, but will aggravate the over-investment problem. Additional new debt may resolve the over-investment problem, but may also aggravate the under-investment problem. This yields an optimal debt-equity ratio.
Harris and Raviv (1990) assume that managers prefer to continue the firm's operations, even though the firm's investors might prefer liquidation of the firm. Debt financing may again resolve this agency conflict.

If the firm is a take-over target, the manager (in Zwiebel (1996)'s model) voluntarily chooses debt financing because it credibly prevents him from investing in bad ('empire building') projects. The amount of debt financing and dividends is determined such that the firm goes bankrupt if the manager invests in a bad project. A raider will thus find it less worthwhile to purchase the firm. The manager voluntarily chooses to distribute dividends and attract debt in order to keep control of the firm (take-over defence). Moreover, the better (worse) the manager's investment opportunities are (and therefore the lower (higher) the take-over threat), the lower (higher) the firm's debt level and distributed dividends will be. When future control benefits in the absence of bankruptcy are very large, a small amount of debt (and the resulting increase in the probability of bankruptcy) is sufficient to prevent the manager from investing in a bad project. The debt and dividend level are thus a decreasing function of the future control benefits. Managers from growing firms stand to lose more gains if they lose control than do managers of declining firms. As a result, growing firms will have a lower debt and dividend level than declining firms. The model uses the optimal path of 'net' debt (debt net of retained earnings) over time to explain why firms choose to distribute earnings through regular dividends instead of *irregular* share repurchases (regular share repurchases are assumed to be taxed as dividends).

- *Shareholder-shareholder conflicts*

In Brennan and Thakor (1990), some shareholders are better informed than others about the firm's prospects (and therefore the firm's 'true' share price). Because uninformed shareholders do not know when or when not to sell (part of) their shares, nonproportionate share repurchases may result in a wealth transfer from uninformed to informed shareholders. Given fixed costs of collecting information, larger shareholders find it more worthwhile to obtain information than do smaller shareholders. As a result, wealth is most likely transferred from small to large shareholders. Uninformed shareholders prefer to receive highly taxed dividends. Informed shareholders prefer share repurchases. The method of disbursement chosen by the firm will be determined by a majority vote of the shareholders.

4.3 Adverse selection in Sinn's life-cycle model of the firm

In case of adverse selection, new investors may be imperfectly informed about the value of the firm and its investment opportunities. The firm might have to sell under-valued new equity, or it might have to pay a higher interest rate if it attracts debt. The cost of the external sources of finance may therefore exceed the cost of internal funds. As in Myers (1984), adverse selection in the debt and equity markets then implies a 'finance pecking order'. Retained earnings are preferred to debt, and newly issued equity is the least preferred source of finance.

Fazzari, Hubbard and Petersen (1988a, 1988b) incorporate adverse selection in the equity market in an investment model of the firm. In the presence of taxes, the authors demonstrate that the lemons premium Ω demanded by new equity investors increases the wedge between the cost of retained earnings and the cost of newly issued equity. Firms will finance investment with external funds only if the investment's q is sufficiently high. Otherwise, the firm's investment will be restrained by the available internal funds.

In the absence of adverse selection, but in the presence of capital income taxes, *section 3.4* studied the effects of the 'tax pecking order', which is similar to the 'finance pecking order'. Retained earnings are tax-preferred to debt, and newly issued equity is the least tax-preferred source of finance if capital gains are taxed at lower rates than interest payments are and at the same time dividends are taxed at the highest rates: $\theta_c\theta_r > \theta_p > \theta_p\theta_d$.

In order to study the firm's and household's tax-arbitrage behaviour in more detail, this section introduces adverse selection in Sinn's life-cycle model of the firm. The firm's finance and investment behaviour is studied in the presence of the 'finance pecking order' and the 'tax pecking order'.

Adverse selection in the debt and equity markets further increases the wedge between the cost of internal and external funds. The newly founded firm will consequently issue even less new equity and debt. However, the firm's steady-state capital stock and cost of capital are not affected by adverse selection. This implies that the length of the firm's internal growth phase is increasing in the lemons premium on equity and debt.

The firm will immediately attract the optimal amount of capital if the personal income tax and the capital gains tax are replaced by a wealth tax. However, in the presence of adverse selection, the firm issues only a nucleus of new equity and passes again through an internal growth phase.

Section 4.3.1 derives the lemons premia on debt and newly issued equity. *Section 4.3.2* uses these premia to extend Sinn's model and studies the firm's optimal finance and investment behaviour.

4.3.1 Adverse selection in the equity and debt markets

This section introduces adverse selection: first, in the equity market and, second, in the debt market. This leads to a finance pecking order (Myers (1984)).

- *Adverse selection in the equity market*

Initial (incumbent) shareholders no longer want to invest in the firm. New shares are therefore sold to others, who are imperfectly informed about the value of the firm. Consequently, the market (new investors) has to form expectations about the correct market price of the firm's equity. The over- or under-valuation of the firm's equity is temporary because private information becomes common knowledge after the issue of new equity.

Before the issue of new equity, m denotes the correct market value of the firm's shares. Due to imperfect information in the equity market, the firm issues new equity at the expected price per share $\overline{m}$, which can be higher or lower than m. Afterwards, the private information becomes common knowledge, and shares are traded at their correct (possibly adjusted) market value. If the firm issues under-valued equity to new shareholders $\overline{m} < m$, the initial shareholders' shares drop in value. In order to compensate for this capital loss, initial shareholders pay for the difference between the correct market value and the value paid by the new investors $(m-\overline{m})\dot{z} > 0$ (z reflects the total amount of shares and $\dot{z}$ the amount of newly issued shares). The return for initial shareholders consists of not only dividends and capital gains, but also the capital loss due to the issue of under-valued new equity to others. Similarly, if the firm issues over-valued new equity $\overline{m} > m$, initial shareholders realise a capital gain $(m-\overline{m})\dot{z} < 0$.

The market value of the initial shareholders' equity M (see *section 3.2.1*) is implicitly determined by the arbitrage condition (4.1), which incorporates the additional cost (gain) for the initial shareholders of selling under-valued (over-valued) new equity:

$$\theta_p\theta_d\pi^d + \dot{m}z\theta_c + \left(\dot{z}m - (1+\Omega^e)Q\right)\theta_c = \theta_p r M \qquad (4.1)$$

The new investors pay $Q = \bar{m}\dot{z}$ for the newly issued equity. The actual cost for the initial shareholders is $(1+\Omega^e)Q = m\dot{z}$. The premium Ω^e then amounts to

$$(4.2) \quad \Omega^e = \frac{correct\ market\ value/share \quad - \quad expected\ value/share}{expected\ value/share} = \frac{m-\bar{m}}{\bar{m}} \quad \begin{matrix} > \\ = \\ < \end{matrix} \quad 0 \quad .$$

$\Omega^e > 0$ implies that initial shareholders sell under-valued new equity ($m > \bar{m}$). The possible gain for initial shareholders of selling over-valued new equity is studied if $\Omega^e < 0$ ($m < \bar{m}$).

According to Akerlof's (1970) lemons principle, low quality firms drive good quality firms out of the market. If the firm possesses debt or retained earnings as sources of finance, high quality firms will not issue new equity in order to avoid the costs of selling under-valued equity. The market, which anticipates this mechanism, adjusts downwards the expected value per share $\bar{m}$. More firms will therefore be under-valued and will not issue new equity. Consequently, only low-quality firms will want to issue new equity. $\bar{m}$ then reflects the value of the lowest quality firms, which rules out the case that firms issue over-valued new equity.

Newly founded firms do not possess retained earnings as source of finance, however. The firm's retained earnings may be insufficient, for example, to finance additional investment opportunities that arise as a result of a productivity shock. Consequently, high quality firms may have to issue new equity in order to finance investment, despite the under-valuation of the equity (the reasoning abstracts from the possibility of financing investment with debt). This cost of selling under-valued equity $\Omega^e > 0$ can be seen as an 'implicit' tax on the issue of new equity for the current shareholders. Hence, newly issued equity may not only have a 'direct' tax disadvantage (if dividends are taxed more than accrued capital gains), but may also offer an 'implicit' tax disadvantage compared to retained earnings.

Because high-quality firms might decide to issue new equity, the market's expected value per share $\bar{m}$ can be higher than the value of the lowest quality firm (the market's expectations are not explicitly modelled). This might give low-quality firms the opportunity to issue over-valued new equity $\Omega^e < 0$. However, the remainder of the analysis focuses only on the case of under-valued newly issued equity $\Omega^e > 0$.

- *Adverse selection in the debt market*

In the absence of imperfect information, high-quality firms may borrow at the risk-free interest rate r. Low-quality firms, however, will be charged a higher interest rate $r^* > r$. In case of asymmetric information in the credit market, lenders will have to form expectations about the quality of the firm. Given these expectations, they will charge the same interest rate to both

types of firms. Again, according to Akerlof's lemons principle, this interest rate will drive the high-quality firms out of the credit market. Lenders, who therefore anticipate that only low-quality firms enter the credit market, demand the corresponding interest rate r^*.

Due to the preferential tax treatment of debt compared to newly issued equity, however, some high-quality firms do enter the credit market. These high-quality firms will have to pay the interest rate $(1+\Omega^d)r$; r is the risk-free interest rate, and Ω^d is the premium due to the adverse selection in the credit market. This premium can be interpreted as an 'implicit' tax on debt financing.

- *Finance pecking order*

The cost for the initial shareholders of a marginal investment financed with retained earnings, newly issued equity or debt is (respectively) 1, $1+\Omega^e$ and $1+\Omega^d$ euro. Because $\Omega^e, \Omega^d > 0$, the firm prefers to finance the investment with retained earnings. Moreover, it is assumed that adverse selection in the debt market is less severe than in the equity market $\Omega^d < \Omega^e$ (for instance, because of the monitoring capacity of banks). Consequently, if the firm has to attract external sources of finance, it prefers debt to newly issued equity.

As in Myers (1984), adverse selection in the equity and debt markets then yield a finance pecking order $1 < 1+\Omega^d < 1+\Omega^e$; retained earnings are preferred to debt, and newly issued equity is the least preferred source of finance.

4.3.2 Adverse selection and the life-cycle model of the firm

Given adverse selection in the equity and the debt markets, this section extends the firm's finance and investment problem, as introduced in chapter 3.

- *The model*

The firm maximises the initial period's market value of the shares $M(t_1)$ net of the originally injected equity. The new investors pay $K(t_1) - D_f(t_1)$ for the newly issued equity. The cost for the initial shareholders[5], however, amounts to $(1+\Omega^e)(K(t_1) - D_f(t_1))$. The value of $M(t_1)$, which is solved from the arbitrage condition (4.1), represents the present value of the after-tax dividends net of the cost to the initial shareholders of the newly issued equity. The interest rate $(1+\Omega^d)r$ on the firm's debt decreases the firm's gross dividends in condition (4.5). The firm's problem amounts to condition (4.3) – (4.11):

[5] Until now, the 'initial' shareholders have referred to the founders of the firm. From this point on, 'initial' refers to the firm's shareholders just before the new equity is issued.

(4.3) $$\underset{\{I,S_f,Q,K(t_1),D_f(t_1)\}}{Max} \quad M(t_1)-(1+\Omega^e)\left[K(t_1)-D_f(t_1)\right]$$

Sub to:

(4.4) $$M(t_1)=\int_{t_1}^{\infty}\left[\frac{\theta_p\theta_d\pi^d(v)}{\theta_c}-(1+\Omega^e)Q(v)\right].e^{-\int_{t_1}^{v}\frac{\theta_p}{\theta_c}r(s)ds}\,dv$$

(4.5) $$\pi^d=f(K)-(1+\Omega^d)rD_f+\frac{1}{\theta_r}\left[S_f+Q-I\right]$$

(4.6) $$q_K:\ \dot{K}=I$$

(4.7) $$q_D:\ \dot{D}_f=S_f$$

(4.8) $$S_f\le\alpha I,\quad \lambda\ge 0,\quad \lambda(\alpha I-S_f)=0$$

(4.9) $$Q\ge 0,\quad \mu_Q\ge 0,\quad \mu_Q Q=0$$

(4.10) $$\theta_p\theta_d\pi^d\ge 0,\quad \mu_\pi\ge 0,\quad \mu_\pi\theta_p\theta_d\pi^d=0$$

(4.11) $$D_f(t_1)\le\alpha K(t_1),\quad \lambda\ge 0,\quad \lambda(\alpha K(t_1)-D_f(t_1))=0\ .$$

- *Preferred sources of finance*

The firm prefers to reinvest 1 euro of before-tax earnings ($\theta_c\theta_r$ after taxes) if such reinvestment is more profitable than distributing the earnings as dividends ($\theta_p\theta_d$ after taxes) and financing additional investment with newly issued equity, which costs the initial shareholders $1+\Omega^e$:

(4.12) $$NE\ \underset{\pi}{\overset{\phi}{\approx}}\ RE \quad\Leftrightarrow\quad \frac{\theta_p\theta_d}{1+\Omega^e}\ \underset{<}{\overset{>}{=}}\ \theta_c\theta_r\ .$$

In the steady state, debt is preferred to retained earnings if the after-tax dividends per unit cost of debt[6] are higher than the after-tax capital gains:

(4.13) $$DF\ \underset{\pi}{\overset{\phi}{\approx}}\ RE \quad\Leftrightarrow\quad \frac{\theta_p\theta_d}{\theta_d(1+\Omega^d)}\ \underset{<}{\overset{>}{=}}\ \theta_c\theta_r \quad\Leftrightarrow\quad \frac{\theta_p}{1+\Omega^d}\ \underset{<}{\overset{>}{=}}\ \theta_c\theta_r\ .$$

Debt is preferred to newly issued equity if the lemons premium on equity Ω^e is higher than the premium on debt Ω^d net of the corporate tax savings on the debt-financed investment:

(4.14) $$DF\ \underset{\pi}{\overset{\phi}{\approx}}\ NE \quad\Leftrightarrow\quad \Omega^e\ \underset{<}{\overset{>}{=}}\ \Omega^d-\tau_d(1+\Omega^d)\ .$$

[6] The steady-state cost of debt equals $q_D(t^{SS})=-\left(\theta_p\theta_d(1+\Omega^d)r/\theta_p r\right)=-(1+\Omega^d)\theta_d$.

- *The model's solution if* $\theta_c\theta_r > \theta_p > \theta_p\theta_d$ *and if* $1 < 1+\Omega^d < 1+\Omega^e$

This section presents the solution of the firm's problem (4.3) – (4.11) if $\theta_c\theta_r > \theta_p > \theta_p\theta_d$ and if $1 < 1+\Omega^d < 1+\Omega^e$. These assumptions imply that retained earnings are preferred to debt and newly issued equity. If the firm must attract external sources of finance, it will prefer debt to newly issued equity in the steady state[7].

The solution strongly resembles the optimal path if $\Omega^e = \Omega^d = 0$ (see *section 3.4*). As summarised in *table 1*, the firm finances initial investment partly with newly issued equity and partly with debt. During *phase II*, the firm finances investment with debt and retained earnings. When it is no longer optimal to attract debt, the firm redeems its entire debt. During *phase IV*, the firm finances investment only with retained earnings. The firm's profits are distributed as dividends during *phase V*.

Table 1: the optimal finance and investment path

Phase I:	start-up of the firm	*NE – DF / retentions – interest payments* $q_K(t_1) > (1-\alpha)\cdot\left(1+\Omega^e\right)+\alpha\cdot\left(\theta_d(1+\Omega^d)\right)$
Phase II:	internal growth phase I	*RE – DF / retentions – interest payments* $f'(K)$ *: see condition (3.22)*
Phase III:	debt redemption	$f'(K) = (1+\Omega^d)r > r$
Phase IV:	internal growth phase II	*RE / retentions* $f'(K)$ *: see condition (3.24)*
Phase V:	steady state	*RE / dividends* $f'(K^{SS}) = \frac{\theta_p}{\theta_c\theta_r}r$ $\quad q_K^{SS} = \frac{\theta_p\theta_d}{\theta_c\theta_r}$

The firm invests until the marginal benefit q_K equals the marginal cost of the investment. The marginal cost for the initial shareholders of newly issued equity is $1+\Omega^e$. If $\alpha = 0$, the optimal investment financed with newly issued equity satisfies

(4.15) $q_K = 1+\Omega^e \quad > \quad 1$.

[7] The analysis also assumes that during the initial phase the cost of capital on investment financed with debt is lower than the cost of capital on investment financed with newly issued equity.

In the presence of adverse selection in the equity market, the firm issues less new equity compared to the perfect-information case $\Omega^e = 0$. The cost of initially attracted debt is higher than the steady-state cost of debt $\theta_d(1+\Omega^d)$ (see *section 3.4.1*). Because debt is preferred to newly issued equity, the firm finances initial investment partly with newly issued equity ($(1-\alpha)\%$) and partly ($\alpha\%$) with debt. The optimal initial investment is then a weighted-average of the cost of newly issued equity and the cost of debt:

(4.16) $q_K(t_1) > (1-\alpha)\cdot\left(1+\Omega^e\right)+\alpha\cdot\left(\theta_d(1+\Omega^d)\right)$ [8].

During *phase II*, the firm finances the investment with debt and retained earnings. The cost of capital is presented in condition (3.22). The firm redeems its entire debt if financing investment with debt is no longer optimal. The cost of capital on debt-financed investment equals

(4.17) $f'(K) = (1+\Omega^d)r \quad > \quad r$.

In the presence of adverse selection in the debt market, the cost of capital exceeds the interest rate. The firm attracts less debt, consequently, compared to the perfect information case. Moreover, the amount of debt financing is decreasing in the implicit tax on debt Ω^d.
Afterwards, the firm finances investment only with retained earnings. The cost of capital is presented in condition (3.24). The steady state is not affected by adverse selection in the equity and debt markets (conditions (3.25) – (3.26)).

- *Conclusion*

Retained earnings are the most tax-preferred source of finance if $\theta_c\theta_r > \theta_p > \theta_p\theta_d$. The lemons premium in the equity market Ω^e increases the cost of newly issued equity. The lemons premium in the debt market Ω^d increases the cost of debt. Since the cost of retained earnings is not affected, the difference between the cost of external and internal sources of finance increases as a result of adverse selection in the equity and debt markets. Retained earnings thus become an even more preferred source of finance.
Because the firm issues less new equity and debt, and because adverse selection does not affect the steady-state capital stock, the firm will finance a larger part of the capital stock with retained earnings. Moreover, the length of the firm's internal growth phase is increasing in Ω^e and Ω^d. In fact, the use of retained earnings resolves the under-investment as a result of the increased cost of newly issued equity and debt as sources of finance.

[8] This condition can be written as $q_K(t_1) > \alpha\left(1+\Omega^d\right)+\left((1-\alpha)(1+\Omega^e)-\tau_d\alpha(1+\Omega^d)\right)$. The debtholder must receive back the originally invested funds $\alpha(1+\Omega^d)$. The cost of newly issued equity is lower than $(1-\alpha)(1+\Omega^e)$ because the equityholder is entitled to the corporate tax savings due to the deductibility of the interest payments from taxable corporate earnings.

- *Wealth tax*

This section presents the solution of the firm's problem (4.3) – (4.11) if the personal income tax and the capital gains tax are replaced by a wealth tax on the household's savings in corporate debt and equity (as under the tax reform discussed in chapter 6). In the absence of adverse selection and if $\tau_d = \tau_r$, the firm is indifferent between newly issued equity and retained earnings. Debt is the most tax-preferred source of finance. The firm thus does not enter an internal growth phase, but immediately attracts the optimal amount of capital, which is financed with debt and newly issued equity. These results change in the presence of adverse selection in the equity and debt markets. The preference relations with respect to the sources of finance amount to

$$(4.18)\quad NE \begin{matrix} \phi \\ \approx \\ \pi \end{matrix} RE \quad \Leftrightarrow \quad \Omega^e \begin{matrix} < \\ = \\ > \end{matrix} 0$$

$$(4.19)\quad DF \begin{matrix} \phi \\ \approx \\ \pi \end{matrix} RE \quad \Leftrightarrow \quad \Omega^d \begin{matrix} < \\ = \\ > \end{matrix} \left(\frac{\tau_d}{1-\tau_d}\right) \quad \Leftrightarrow \quad \Omega^d \begin{matrix} < \\ = \\ > \end{matrix} \tau_d(1+\Omega^d)$$

$$(4.20)\quad DF \begin{matrix} \phi \\ \approx \\ \pi \end{matrix} NE \quad \Leftrightarrow \quad \Omega^d - \tau_d(1+\Omega^d) \begin{matrix} < \\ = \\ > \end{matrix} \Omega^e \quad .$$

Solution if $\Omega^e > \Omega^d > 0$

The lemons premium on newly issued equity $\Omega^e > 0$ again drives a wedge between the cost of newly issued equity and retained earnings.

If $\Omega^d < \frac{\tau_d}{1-\tau_d}$, then the lemons premium on debt is lower than the corporate tax advantage of debt, which implies that $DF \; \phi \; RE \; \phi \; NE$. The firm issues new equity and debt during the initial phase. Afterwards, the firm enters an internal growth phase, during which it finances investment with debt and retained earnings. The steady state is characterised by

$$(4.21)\quad f'(K^{SS}) = (1-\alpha)\frac{r}{\theta_d} + \alpha(1+\Omega^d)r \qquad q_K^{SS} = (1-\alpha) + \alpha\left(\theta_d(1+\Omega^d)\right) \quad .$$

If $\Omega^d > \frac{\tau_d}{1-\tau_d}$, then retained earnings are the preferred source of finance ($RE \; \phi \; DF \; \phi \; NE$). The firm issues new equity and debt during the initial phase, and enters an internal growth phase, during which it finances investment with debt and retained earnings. When the cost of capital amounts to $f'(K) = (1+\Omega^d)r$, the firm redeems its debt. Afterwards, it finances investment with retained earnings. The steady state equals

$$(4.22)\quad f'(K^{SS}) = \frac{r}{\theta_d} \qquad q_K^{SS} = 1 \quad .$$

4.4 The traditional versus the new view of dividend taxation

Because capital gains are taxed at lower rates than dividends are, steady-state investment in the life-cycle model of the firm is financed with retained earnings, and the return is entirely distributed as dividends. This steady state reflects the 'new' view of dividend taxation.

Exploring the alternative to the 'new' view, *section 4.4.1* studies tax-arbitrage behaviour under the 'traditional' view of dividend taxation. The 'traditional' view is based on the assumptions that shareholders value dividends higher than capital gains and that newly issued equity is the firm's marginal source of finance.
Section 4.4.2 introduces a minimum-dividend constraint in Sinn's life-cycle model of the firm. The analysis demonstrates that, even if dividends are valued higher than capital gains, the steady state of the model satisfies the 'new' view of dividend taxation.
Section 4.4.3 concludes that the results of the 'traditional' view are strongly determined by the assumption that newly issued equity is the firm's marginal source of finance. It implies an implicit assumption on the underlying production process and the available investment opportunities.

4.4.1 The traditional view of dividend taxation

In Sinn's life-cycle model of the firm, the firm issues a 'nucleus' of new equity, after which it finances investment with retained earnings. In the steady state, the firm's marginal investment is financed with retained earnings, and the return on the investment is distributed as dividends. According to this *'new' view of dividend taxation*, dividends are considered to be the 'residual' use of profits. Because the tax burden on dividends exceeds the tax burden on capital gains, dividends are distributed only if no profitable investment opportunities are available. However, the *'traditional' view of dividend taxation* (see Poterba and Summers (1983)) asserts that shareholders value dividends higher than capital gains (which is the first assumption underlying the 'traditional' view), despite the tax disadvantage of dividends[9]. The firm will distribute dividends on a regular basis. Because of the firm's high dividend payout rate, the firm's retained earnings are assumed to be insufficient to finance investment. Consequently, the 'traditional' view assumes that newly issued equity is the firm's marginal source of funds (which is the second assumption underlying the 'traditional' view).

Due to the 'intrinsic' value of the distributed dividends, the 'traditional' view implies that firms with a high payout rate have to pay a lower rate of return to shareholders (Zodrow (1991)). For instance, Sørensen (1995) [10] assumes that the risk premium on equity p is a convex function in the dividend payout rate ξ. The risk premium decreases with ξ at a decreasing rate $p = p(\xi), \quad p' < 0, \quad p'' > 0$. Given the assumptions of the 'traditional' view (the presented analysis follows closely Sørensen (1995)), the cost of capital $f'(K)$ is the solution of

[9] As noted in *section 4.2*, dividends may be used to signal private information in case of adverse-selection problems. Moreover, dividends may resolve the shareholder-management and shareholder-shareholder conflicts in case of moral hazard problems.
[10] See Poterba and Summers (1985) for a dynamic version of this analysis.

(4.23) $1 \cdot f'(K)\{\xi\theta_p^e\theta_d + (1-\xi)\theta_c\theta_r\} = \theta_p^d r + p(\xi)$.

The return $f'(K)$ on the marginal investment financed with newly issued equity is partly ($\xi\%$) distributed as dividends and partly ($(1-\xi)\%$) retained, which yields capital gains. The investment has to earn the shareholder's opportunity return, which equals the after-tax return on a risk-free investment in debt $\theta_p^d r$, augmented with the risk premium on equity $p(\xi)$. The cost of capital on a marginal investment financed with newly issued equity then equals

(4.24) $f'(K) = \dfrac{\theta_p^d r + p(\xi)}{\xi\theta_p^e\theta_d + (1-\xi)\theta_c\theta_r}$.

The firm determines ξ such that the cost of capital is minimised. The optimal payout rate satisfies

(4.25) $\dfrac{-p'(\xi)}{f'(K)} = \theta_c\theta_r - \theta_p^e\theta_d$.

The firm will distribute dividends until the benefit of a reduction in the risk premium equals the tax cost of additional dividends. At the margin, the firm is indifferent between distributing dividends and financing investment with newly issued equity and retaining and reinvesting the firm's earnings. At the firm's optimal payout rate (given that the firm possesses 1 euro of funds), the household is indifferent between newly issued equity and retained earnings as the source of finance. Moreover, because the firm's earnings are replaced with external equity, the firm will invest funds until the marginal increase in the value of the firm's equity amounts to

(4.26) $q_K = \int_0^\infty f'(K)\left[\xi\theta_p^e\theta_d + (1-\xi)\theta_c\theta_r\right] \cdot e^{-(\theta_p^d r + p(\xi))t}\, dt \;=\; 1$.

q_K equals the present value (discounted at the rate $\theta_p^d r + p(\xi)$) of the after-tax return $f'(K)$, which is partly distributed (taxed as dividends) and partly retained (taxed as capital gains). Because the marginal return $f'(K)$ is presented in condition (4.24), the firm invests until $q_K = 1$ [11].

[11] If the personal income tax is replaced with a wealth tax (as under the tax reform discussed in chapter 6) and if $\tau_d = \tau_r$, the cost of capital under the 'traditional' view on a marginal investment financed with newly issued equity amounts to $f'(K) = \dfrac{r + p(\xi)}{\theta_d}$. Because dividends and capital gains are taxed similarly, the 'traditional' view implies that the firm distributes all its profits as dividends ($\xi = 1$). Investment opportunities are then financed only with newly issued equity.

According to the 'new' view of dividend taxation, the personal income tax on distributed dividends (dividend tax) is capitalised in the value of the firm's equity. Moreover, dividend taxes do not affect the firm's incentive to invest. The opposite is true under the 'traditional' view of dividend taxation. The dividend tax is not capitalised in the value of the firm's equity, but does influence the firm's incentive to invest (condition (4.24)). An increase in the dividend tax increases the cost of capital on a marginal investment financed with newly issued equity and decreases the optimal payout rate (as a result of the increased tax penalty of dividends compared to capital gains).

Reconsidering the assumptions of the 'traditional view'
The firm determines the optimal payout rule (condition (4.25)) and distributes dividends. The remaining earnings are retained and reinvested. In order to replace the distributed earnings, the firm issues new equity as a marginal source of finance. Under the 'traditional' view, the gains of dividends are directly linked to newly issued equity as a marginal source of finance.

The above discussion implicitly assumes that the firm's profitable investment opportunities are larger than the firm's retained earnings, which are earnings optimally retained according to condition (4.25). In fact, the assumption that newly issued equity is the firm's marginal source of finance implies that the firm's available investment opportunities are assumed to be sufficiently large.

However, the assumption with respect to newly issued equity as the firm's marginal source of finance or, similarly, with respect to the available profitable investment opportunities, is not as straightforward as it might seem at first sight.
Given the firm's optimal payout decision (which depends on the risk premium and the tax differential, but not on the available investment opportunities), the firm's earnings might be too high with respect to the available investment opportunities. Moreover, the firm might face a limited number of investment opportunities over time. For instance, if the firm distributes dividends according to the optimal dividend payout rule, and if the firm's remaining retained earnings are high enough to finance the additional investment opportunities, the firm will reinvest the earnings and will not issue new equity. And even if it has too few retained earnings, the firm might find it profitable to postpone the investment until the next period.

The following sections provide additional intuition that the results of the 'traditional' view' are strongly determined by the implicit assumption with respect to the number of profitable investment opportunities available to the firm.

4.4.2 Minimum dividend constraint
Auerbach (2001) incorporates a minimum dividend constraint in a standard model of a representative firm that maximises the after-tax value of the firm's equity. The earnings of the firm's operations are exogenously given. Auerbach then derives the results of the 'traditional' view and the 'new' view of dividend taxation. The particular outcome depends on the level of the firm's investment opportunities and its cash flow. Auerbach demonstrates that the young firm issues new equity because its investment needs are very large with respect to its cash

flow. The cost of capital equals the value that reflects the 'traditional' view of dividend taxation. If the firm's investment needs are small with respect to its cash flow, the mature firm will use its retained earnings to finance investment. The cost of capital then supports the 'new' view of dividend taxation.

Similarly to Auerbach (2001), this section incorporates a minimum dividend constraint in chapter 3's dynamic life-cycle model of the firm. In every period, the firm distributes $\xi\%$ of its earnings as dividends in order to signal its quality or to resolve the moral hazard problems. The firm's managers may find it worthwhile to signal the firm's quality because such a signal enables the current shareholders to sell their shares at the correct market price and allows the managers to issue correctly valued new equity. Moreover, the firm's managers may distribute part of the firm's earnings as dividends in order to convince the shareholders that the firm is not investing in 'empire building' projects.

The analysis demonstrates that the cost of capital on a marginal investment financed with newly issued equity exceeds the value that reflects the 'traditional' view of dividend taxation. Given a concave production function, the firm will not find it optimal to keep on issuing new equity until the cost of capital amounts to $f'(K) = \dfrac{\theta_p r}{\xi\theta_p\theta_d + (1-\xi)\theta_c\theta_r}$, which is the value in case of the 'traditional' view. The firm will issue less new equity in order to take advantage of the cheaper retained earnings as a source of finance. Even though the firm distributes a minimum amount of dividends along the optimal path, the firm continues to converge to the 'new' view's steady-state capital stock.

- *The model*

The firm maximises the initial market value of the firm $M(t_1)$ net of the original injected equity, which equals the initial capital stock $K(t_1)$. The model abstracts from debt as a source of finance. In every period, the firm distributes $\xi\%$ of its profits, as presented in condition (4.32). The firm's problem then amounts to

(4.27) $\underset{\{I,Q,K(t_1)\}}{Max} \quad M(t_1) - K(t_1)$

Sub to:

(4.28) $M(t_1) = \int_{t_1}^{\infty} \left[\dfrac{\theta_p\theta_d\pi^d(v)}{\theta_c} - Q(v) \right] \cdot e^{-\int_{t_1}^{v} \frac{\theta_p}{\theta_c} r(s)ds} dv$

(4.29) $\pi^d = f(K) + \dfrac{1}{\theta_r}[Q - I]$

(4.30) $q_K: \quad \dot{K} = I$

(4.31) $Q \geq 0, \quad \mu_Q \geq 0, \quad \mu_Q Q = 0$

(4.32) $\pi^d \geq \xi f(K), \quad \mu_\pi \geq 0, \quad \mu_\pi(\pi^d - \xi f(K)) = 0$.

- *The model's solution if* $\theta_c\theta_r > \theta_p > \theta_p\theta_d$ [12]

This section presents the solution of the firm's problem if $\theta_c\theta_r > \theta_p > \theta_p\theta_d$. As summarised in *table 2*, the firm's optimal finance and investment path consists of three phases.

During the initial phase, the firm issues a nucleus of new equity (see also *section 3.4.1*). Because $\theta_c\theta_r > \theta_p > \theta_p\theta_d$, and given the condition presented in *table 2*, the cost of capital on investment financed with newly issued equity satisfies

(4.33) $$f'(K(t_1)) > \frac{\theta_p r}{\xi\theta_p\theta_d + (1-\xi)\theta_c\theta_r} \quad .$$

Table 2: the optimal finance and investment path

Phase I:	start-up of the firm	*NE / dividends - retentions* $f'(K(t_1)) > \frac{r}{\theta_d} \quad \Leftrightarrow \quad \beta < \frac{1}{\left[1-\frac{\theta_p\theta_d}{\theta_c\theta_r}\right]+1}$	$q_K = 1$
Phase II:	internal growth phase	*RE / dividends - retentions* $f'(K) = \frac{\frac{\theta_p}{\theta_c\theta_r}r - \frac{\dot{q}_K / q_K}{\theta_r}}{\left[(1-\xi)+\xi\frac{\theta_p\theta_d}{\theta_c\theta_r q_K}\right]}$	
Phase III:	steady state	*RE / dividends* $f'(K) = \frac{\theta_p}{\theta_c\theta_r}r$	$q_K = \frac{\theta_p\theta_d}{\theta_c\theta_r}$

During the internal growth phase, the firm finances investment with retained earnings. The cost of capital is the solution of

(4.34) $$\theta_c\theta_r \cdot 1 \cdot \left[f'(K)\left[(1-\xi)\theta_c\theta_r + \xi\frac{\theta_p\theta_d}{q_K}\right] + \theta_c \dot{q}_K / q_K \right] = \theta_c\theta_r \cdot \theta_p r \quad .$$

[12] The first-order conditions are presented in *appendix A*. The feasible phases are characterised in *appendix B*.

If the household realises its capital gains and invests them in the opportunity investment, it realises the after-tax return $\theta_c\theta_r\theta_p r$. If the household reinvests the capital gains $\theta_c\theta_r$, it realises the return as presented on the right-hand side of condition (4.34). $\xi\%$ of the investment's return is distributed as dividends, which yields $\xi f'(K)\frac{\theta_p\theta_d}{q_K}$ [13]. $(1-\xi)\%$ of the return is retained, which yields $(1-\xi)f'(K)\theta_c\theta_r$. The household realises the capital loss $\left(\dot{q}_K/q_K\right)<0$, because the investment financed with the retention of the return of a prior investment yields a return lower than the original retained return. This capital loss reduces the capital gains taxes that are due. Condition (4.34) can be written as

$$f'(K)\left[1-\xi\left(\frac{\theta_c\theta_r q_K-\theta_p\theta_d}{\theta_c\theta_r q_K}\right)\right]=\frac{\theta_p}{\theta_c\theta_r}r-\frac{\dot{q}_K/q_K}{\theta_r} \quad . \tag{4.35}$$

In the absence of a minimum-dividend constraint (see *section 3.4.4*), the cost of capital is equal to the right-hand side of (4.35). The cost of capital in (4.35) consists of an additional term. It takes into account that $\xi\%$ of the return is distributed as dividends, which are taxed at higher rates than capital gains. Moreover, along the internal growth phase, $\theta_c\theta_r q_K>\theta_p\theta_d$.

The payout rate ξ does not affect the firm's steady-state capital stock and the steady-state cost of capital (see *table 2*). However, the higher the amount of distributed dividends is, the lower are the retained earnings that are available for reinvestment and the longer it takes before the firm reaches the phase of maturity. The after-tax value of the firm is therefore decreasing in ξ.

4.4.3 The underlying production process

Newly issued equity is the firm's marginal source of finance under the 'traditional' view of dividend taxation. Retained earnings are the firm's marginal source of finance under the 'new' view. This section concludes that both theories are correct. The firm's underlying production process (and therefore the available investment opportunities) determines whether newly issued equity or retained earnings will be the firm's marginal source of finance (in the steady-state).

In the presence of a minimum-dividend constraint in the life-cycle model of the firm (*section 4.4.2*), the cost of capital on investment financed with newly issued equity exceeds the cost of capital under the 'traditional' view. The firm issues only a nucleus of new equity, after which it finances investment with retained earnings. As a result of the assumption with

[13] This return is weighted by the marginal increase in value of the firm's equity. The higher q_K is, the higher the incentive to reinvest the profits will be, and the lower the relative value of the dividends is.

respect to the production process (i.e. a 'concave' production function), issuing additional new equity is not a feasible solution. If the firm has a limited number of profitable investment opportunities (which is an implication of the concavity), it will issue only a nucleus of new equity in order to finance the remaining investment opportunities with the cheaper retained earnings. The firm then converges to the cost of capital on investment under the 'new' view of dividend taxation.

In fact, the firm under the 'traditional' view of dividend taxation converges to a different steady state. This steady state is driven by the assumption that newly issued equity is the firm's marginal source of finance. Similarly to the concavity under the 'new' view, this assumption also imposes a condition on the firm's cash flow and investment opportunities. The 'traditional' view implies that the firm, in every period, faces a number of profitable investment opportunities that demand resources beyond the available retained earnings[14]. The firm must consequently issue new equity to finance the additional investment opportunities.

This assumption on the available profitable investment opportunities is a necessary condition for the steady-state cost of capital to be equal to the value under the 'traditional' view. Clearly, a concave production function as assumed in the 'nucleus' theory of the firm does not satisfy this 'traditional' view's condition (because the concavity implies limited profitable investment opportunities). Auerbach (2001) is able to derive simultaneously the 'traditional' view and the 'new' view from the dynamic model based on a dividend constraint because he does not impose a specific production function.

This analysis implicitly validates the predictions of both the 'traditional' view and the 'new' view about the effects of a reduction in the dividend tax. The steady-state outcome depends on the underlying production function and the investment opportunities of the firm, the influence of which is typically not recognised.

4.5 Conclusion

The capital income tax system and financial imperfections simultaneously determine the firm's optimal finance and investment decisions.

This chapter focussed on adverse selection in the equity and debt markets. The lemons premium in the equity market increases the cost of newly issued equity. Similarly, the lemons premium on debt raises the cost of debt. Adverse selection consequently increases the cost of external sources of finance above the cost of internal sources of finance. The finance pecking order then strengthens the tax-arbitrage behaviour as a result of the tax pecking order (if $\theta_c\theta_r > \theta_p > \theta_p\theta_d$). Consequently, the newly founded firm will issue even less new equity and debt. Because the steady-state cost of capital and capital stock are not affected,

[14] Otherwise, if the firm is able to finance the investment opportunities with the available retained earnings, the firm has an incentive to issue only a nucleus of new equity in order to take advantage of the cheaper retained earnings as a source of finance.

the length of the firm's internal growth phase increases with the lemons premium on equity and debt. Moreover, if the personal income tax is replaced by a wealth tax on the household's savings in corporate debt and equity, then the firm will issue only a nucleus of new equity as a result of adverse selection in the equity market.

This chapter also studied tax-arbitrage behaviour under the 'traditional' view of dividend taxation. The analysis demonstrates that the personal income tax on dividends does affect the cost of capital on a marginal investment (in the steady state), as opposed to the results under the 'new' view. The dividend tax, however, is not capitalised in the value of the firm's equity.

The analysis, which incorporated a minimum dividend constraint in Sinn's life-cycle model of the firm, demonstrates that the results of the 'traditional' view are strongly determined by the assumption that newly issued equity is the firm's marginal source of finance. In fact, this assumption puts strong conditions on the firm's production function. In every period, the value of profitable investment opportunities must be larger than the available retained earnings. Otherwise, the firm has an incentive to issue only a nucleus of new equity in order to take advantage of the cheaper retained earnings as a source of finance. The predictions of both the 'traditional' view and the 'new' view about the effects of a reduction in the dividend tax are therefore correct. The outcome depends, however, on the underlying production function and available investment opportunities of the firm.

Mathematical appendix

A. The Hamiltonian and the first-order conditions of the model (4.27) – (4.32)

(A.1) presents the current-value Hamiltonian and (A.2) presents the Lagrangian corresponding to the model (4.27) – (4.32):

(A.1) $$H = \frac{\theta_p \theta_d}{\theta_c}\left[f(K) + \frac{1}{\theta_r}\left[Q - I\right]\right] - Q + q_K I$$

(A.2) $$L = H + \mu_Q Q + \mu_\pi (\pi^d - \xi f(K))$$

Consequently:

(A.3) $$L = \left(\frac{\theta_p \theta_d}{\theta_c} + \mu_\pi \right)\left[f(K) + \frac{1}{\theta_r}(Q - I) \right] - (1 - \mu_Q)Q + q_K I - \mu_\pi \xi f(K)$$

The first-order conditions:

(A.4) $$\frac{\partial H}{\partial I} = 0 \quad : \quad q_K = \frac{1}{\theta_r}\left(\frac{\theta_p \theta_d}{\theta_c} + \mu_\pi \right)$$

(A.5) $$\frac{\partial H}{\partial Q} = 0 \quad : \quad \left(\frac{\theta_p \theta_d}{\theta_c} + \mu_\pi \right)\frac{1}{\theta_r} = 1 - \mu_Q$$

(A.6) $$\dot{q}_K - \left(\frac{\theta_p}{\theta_c} r \right) q_K = -\frac{\partial L}{\partial K} \qquad or \qquad \dot{q}_K - \left(\frac{\theta_p}{\theta_c} r \right) q_K = -\left[\left(\frac{\theta_p \theta_d}{\theta_c} + \mu_\pi \right) f'(K) \right] + \mu_\pi \xi f'(K)$$

(A.7) $$\pi^d = f(K) + \frac{1}{\theta_r}\left[Q - I\right] \qquad or \qquad \dot{K} = I = Q + \theta_r (f(K) - \pi^d)$$

(A.8) $$\dot{K} = I$$

(A.9) $$Q \geq 0, \quad \mu_Q \geq 0, \quad \mu_Q \cdot Q = 0$$

(A.10) $$\pi^d \geq \xi f(K), \quad \mu_\pi \geq 0, \quad \mu_\pi (\pi^d - \xi f(K)) = 0$$

(A.11) is the firm's initial condition, and (A.12) is the transversality condition:

(A.11) $$\frac{\partial M(t_1)}{\partial K(t_1)} - 1 = 0$$, (which implies $\frac{\partial M(t)}{\partial K(t)} \equiv q_K(t)$ holds by definition): $q_K(t_1) = 1$

(A.12) $$\lim_{v \to \infty} q_K(t) K(t) e^{-\int_t^v \frac{\theta_p}{\theta_c} r(s) ds} = 0$$

From (A.4) and (A.5):

(A.13) $$q_K = 1 - \mu_Q$$

Rearranging (A.6) yields (A.14), using (A.4) yields (A.15):

(A.14) $$\dot{q}_K + \frac{\theta_p}{\theta_c}\left[\theta_d f'(K) - r q_K\right] = -(1 - \xi)\mu_\pi f'(K)$$

(A.15) $$\dot{q}_K + q_K \left[\theta_r f'(K) - \frac{\theta_p}{\theta_c} r \right] = \mu_\pi \xi f'(K)$$

B. Characterisation of the feasible phases of the model (4.27) – (4.32)

Phase I: initial issue of new equity: $q_K(t_1)=1$

Similar to the proof in *appendix D* of chapter 3, and under the assumption of a Cobb-Douglas production function, it can be demonstrated that $f'(K(t_1))>\frac{r}{\theta_d}$ if $\beta<\frac{1}{\left[1-\frac{\theta_p\theta_d}{\theta_c\theta_r}\right]+1}$. As a result of $\theta_c\theta_r>\theta_p\theta_d$, $f'(K(t_1))>\frac{r}{\theta_d}$ implies that $f'(K(t_1))>\frac{\theta_p r}{\xi\theta_p\theta_d+(1-\xi)\theta_c\theta_r}$.

Phase II: $(\pi^d=\xi f(K),\quad Q=0,\quad I>0)$

From (A.7): $\dot{K}=I=(1-\xi)\theta_r f(K)$.

Using μ_π from (A.4) and (A.15) yields: $\dot{q}_K+q_K\left[\theta_r(1-\xi)f'(K)-\frac{\theta_p}{\theta_c}r\right]=-\xi\frac{\theta_p\theta_d}{\theta_c}f'(K)$. This condition can be solved for the cost of capital $f'(K)=\frac{\frac{\theta_p}{\theta_c\theta_r}r-\frac{\dot{q}_K/q_K}{\theta_r}}{\left[(1-\xi)+\xi\frac{\theta_p\theta_d}{\theta_c\theta_r q_K}\right]}$.

From (A.4) and (A.5): $q_K=1-\mu_Q=\frac{1}{\theta_r}\left(\frac{\theta_p\theta_d}{\theta_c}+\mu_\pi\right)$. However, q_K has to be lower than one: $q_K=\left(\frac{\theta_p\theta_d}{\theta_c\theta_r}+\frac{\mu_\pi}{\theta_r}\right)<1 \quad\Leftrightarrow\quad \mu_\pi<\frac{\theta_c\theta_r-\theta_p\theta_d}{\theta_c}$, where ($\mu_\pi\geq 0$). A necessary condition such that this phase is feasible is $\theta_c\theta_r>\theta_p\theta_d$.

Phase III: $(\pi^d>\xi f(K),\quad Q=0,\quad I=0)$

Because $\mu_\pi=0$, (A.4) reduces to $q_K=\frac{\theta_p\theta_d}{\theta_c\theta_r}$. From (A.16): $\mu_Q=\frac{\theta_c\theta_r-\theta_p\theta_d}{\theta_c\theta_r}$, which is feasible if and only if capital gains are taxed less than dividends $\theta_c\theta_r>\theta_p\theta_d$. Because of the constant value of q_K, which implies that $\dot{q}_K=0$, (A.15) reduces to $f'(K)=\frac{\theta_p}{\theta_c\theta_r}r$.

Chapter 5
Tax-arbitrage Behaviour in the Netherlands before the Tax Reform

5.1 Introduction

This chapter presents the tax burden on marginal saving and investment opportunities and discusses the firm's and household's tax-arbitrage behaviour in the Netherlands before the tax reform of January 1, 2001.

The analysis applies the King-Fullerton method (introduced in chapter 2). This method focuses on direct and indirect household savings in debt and equity of the corporate firm, on debt and equity-financed investment in the closely held corporation and the proprietorship, and on investment in owner-occupied housing. The cost of capital, the tax treatment of depreciation, the after-tax real rates of return and the marginal effective tax rates are derived. A sensitivity analysis is presented as well.

The analysis simulates Sinn's life-cycle model of the firm and presents the firm's optimal finance and investment path (discussed in chapter 3). These simulations focus on direct household saving in the corporate firm. The dynamic finance and investment model is applied to analyse indirect household savings in the corporate firm.

In case of direct household saving in the corporate firm, tax-arbitrage behaviour in light of financial market imperfections (see chapter 4) is discussed as well.

The King-Fullerton method assumes that actual (physical) depreciation of investment projects is exponential at rate δ. The cost of capital is independent of δ if tax depreciation allowances amount to declining-balance depreciation allowances at the economic rate of depreciation based on replacement costs (economic depreciation allowances, $\overline{A} = 0$). However, the Dutch tax code prescribes straight-line depreciation, which implies that the historical cost of the asset can be depreciated for tax purposes during L years by $1/L$ per asset in each year.

The analysis considers investment projects that, by assumption, are characterised by different values for δ and L. This chapter studies investment in machinery, equipment and means of transportation ($\delta = 12.5\%, L = 9$), in buildings ($\delta = 4.1\%, L = 25$) and in intangible assets ($\delta = 12.5\%, L = 1$). Investment in intangible assets refers to investment in research and development, advertising and other marketing expenses, and company training.

The analysis derives the cost of capital for the three types of investment projects. The weighted average cost of capital then assigns weights (machinery: 47%, buildings: 31%,

intangible assets: 22%) that reflect the relative size of that particular investment project in the total amount of investment (as applied in Bovenberg and ter Rele (1998)).

Part of the investment is immediately deductible from the firm's taxable corporate earnings. The actual tax depreciation allowances then amount to straight-line depreciation allowances and immediate expensing allowances.
The degree of immediate expensing, which aims at enhancing small investments, is inversely related to the size of the investment in a particular year. It is assumed that an average investment in the corporation exceeds the size of an average investment in the closely held corporation. Average investments in these corporations exceed the average investment in the proprietorship. The degree of immediate expensing for these types of firms is 0.5%, 4% and 7%, respectively (see Bovenberg and ter Rele (1998)).

The analysis assumes a real interest rate r of 4% and an inflation rate π of 2.5% (Sinn's life-cycle model of the firm abstracts from inflation). The analysis studies the sensitivity of the results under the King-Fullerton method with respect to these parameter values.

Section 5.2 presents the capital-income-tax system in the Netherlands before the tax reform. *Section 5.3* focuses on direct household savings in the corporate firm under the King-Fullerton method (*section 5.3.1*), under Sinn's life-cycle model of the firm (*section 5.3.2*) and in light of financial market imperfections (*section 5.3.3*). *Section 5.4* studies indirect household savings in the corporate firm under the King-Fullerton method (*section 5.4.1*) and under Sinn's life-cycle model of the firm (*section 5.4.2*). The proprietorship and the closely held corporation are studied respectively in *sections 5.5* and *5.6*. *Section 5.7* focuses on owner-occupied housing, and *section 5.8* presents a sensitivity analysis. *Section 5.9* concludes.

5.2 Capital income taxes in the Netherlands before the tax reform

Section 5.2 presents the capital-income-tax system in the Netherlands before the tax reform of January 1, 2001.

Before the tax reform, distributed corporate equity income was taxed twice. At the corporate level, dividends were taxed at the corporate tax rate. Afterwards, the after-tax profits were taxed at the household's progressive personal income-tax rate. Interest payments were deductible from corporate earnings, but were taxed at the household level at the progressive personal income-tax rate. Retained earnings were taxed at the corporate tax rate as well. Capital gains, however, were not taxed at the household level.

Table 1 presents in more detail the capital-income-tax system before the tax reform. Although the characterisation in different boxes was introduced only in the new tax system, a similar terminology was used to introduce the capital-income-tax system before the tax reform.

Table 1: capital-income-tax system before the tax reform of January 1, 2001 (a) (b)

BOX	Type of income (c) (d)	Tax rates
BOX I (e)	- Labour income (f) - Pensions (g), capital insurances - Return on capital of proprietor - Presumptive rental value of owner-occupied housing - Distributed profits (dividends), interest and rental payments on invested personal wealth (h)	younger than 65 years: **33.9/37.95 – 50 – 60%** older than 65 years: **16/20.05 – 50 – 60%**
BOX II	Distributed profits (dividends) and realised capital gains on shares that form a 'substantial holding' (i)	**25%**
BOX III	Personal wealth (j) (k): the value of shares, savings deposits, bonds, immovable property (l), business wealth 68% or 100% (m) exempt from wealth taxes (n)	**0.7%**
BOX IV	Corporate profits (net of interest payments); profits realised by a mutual fund are taxed if not distributed	**35%** (o)
BOX V	- Capital income realised by pension funds, insurance companies - Tax-exempt capital insurances - Additional saving opportunities (income blocked on a savings account for four years, return on savings taxed in box I (p)) - Capital gains on personal wealth	**exempt** (not in box IV) **exempt** (not in box I) **exempt** (not in box I) **exempt** (not in box I)

a. This table is based on '*Taxation in the Netherlands 2001*' of the Dutch Ministry of Finance (2001), and on '*Fundamental Tax Reform in the Netherlands*' of S. Cnossen and L. Bovenberg (2001).
b. These tax rules are applicable for income and profits earned until 31/12/2000.
c. Income can be taxed in different boxes.
d. The tax code allows straight-line depreciation. In case of intangible assets, tax authorities allow free depreciation. Moreover, part of the investment can be expensed immediately. The Dutch tax system allows the deduction of current losses from future (carry forward) and past (carry backward) profits.
e. Personal allowance of NLG 8 950 (if one person of a married couple does not have an income: NLG 17 473). If the household borrows to invest in (owner-occupied) housing (mortgage debt), the interest payments are deductible from the tax base of box I.
f. Includes wages, salaries, (labour) income of the proprietors, presumptive wage income of the director-shareholder of a closely held corporation, social security benefits and other labour income.
g. 'Registered-asset expenditure tax' treatment: pension savings are deductible from taxable income in box I. When the individual receives the pension, it is taxed under the income tax of box I.
h. Tax-free amount of dividends (NLG 1 000, not applicable for dividends to the controlling shareholder) and interest payments (NLG 1 000, also applicable for interest payments on bonds purchased by the controlling shareholder of the closely held corporation)
i. A controlling shareholder holds a substantial amount (at least 5%) of shares of the closely held corporation.
j. Wealth exemption of NLG 200 000 (NLG 250 000 for married couples), additional old-age allowance up to NLG 205 000 (NLG 292 000 for married couples), wealth exemption in case total taxes due (wealth and income taxes) > 68% of taxable income
k. Debt can be deducted from the tax base in box III.
l. Only 60% of the value of the house (owner-occupied housing) added to the personal wealth in box III.
m. Business wealth is 100% exempt from wealth taxes in case < NLG 219 000.
n. If the taxpayer has a substantial holding in a corporation, the debt claims that he holds of that corporation are part of the substantial holding (business wealth).
o. Profits up to NLG 50 000 are taxed at 30%.
p. With respect to the return: additional tax-free interest payments (NLG 1 000) and dividends (NLG 1 000)

5.3 Direct household savings in the corporate firm

Households may save directly in debt and equity of the corporate firm. *Section 5.3* studies tax-arbitrage behaviour under the King-Fullerton method, under Sinn's life-cycle model of the firm and in light of financial market imperfections.

5.3.1 The King-Fullerton method

The household may finance investment in the corporate firm with debt, newly issued equity or retained earnings. This section determines the firm's tax-preferred sources of finance and investment projects.

- *Direct household savings in debt of the corporate firm*

Households may invest directly in debt of the corporate firm (*table 2*), which is referred to as the *traditional saving strategy*. By assumption, debt-financed investment yields a before-tax nominal rate of return equal to $r+\pi=6.5\%$. Interest payments are taxed under the progressive personal income tax. Consequently, the after-tax real rate of return s is decreasing and the effective tax rate at the household level t_h is increasing in the marginal income-tax rate t_y. Because *nominal* interest payments are taxed, and due to the wealth tax of 0.7%, s may even become negative if $t_y=60\%$.

Given the assumptions, the cost of capital on debt-financed investment is 3%, which is lower than the real interest rate of 4%. In case of economic depreciation allowances, and if $t_p=w_c=0$, the cost of capital equals $p=r-\frac{\tau\pi}{1-\tau}=2.65\%$, which is lower than the real interest rate (as a result of the deductibility of the *nominal* interest payments from taxable corporate earnings). Because the actual tax depreciation allowances (including the immediate expensing allowances) are less favourable than economic depreciation allowances, the cost of capital exceeds 2.65%.

Table 2: direct household savings in debt of the corporate firm before the tax reform (a)

	t_e	t_h	t_c	p	s
Low income-tax rate (+65): 20.05%	10.8%	32.6%	-32.3%	3%	2.7%
Low income-tax rate (-65): 37.95%	49.3%	61.7%	-32.3%	3%	1.5%
Average income-tax rate: 50%					
- No wealth taxes	75.2%	81.2%	-32.3%	3%	0.75%
- Wealth tax: 0.7%	98.3%	98.7%	-32.3%	3%	0.05%
High income-tax rate: 60%	120%	115% (b)	-32.3%	3%	-0.6%

a. By assumption, households with high (low) marginal income-tax rates do (not) have to pay wealth taxes. Both cases are studied for households with an average marginal income-tax rate.

b. The total marginal effective tax rate t_e is higher than the tax rate at the household level t_h, even though the corporate effective tax rate t_c is negative. This peculiar result is due to the negative value of s.

Table 3 derives the cost of capital for different types of debt-financed investment projects. In case of investment in machinery, equipment and means of transportation, the cost of capital exceeds 2.65% (due to unfavourable tax depreciation). In case of investment in buildings, the unfavourable tax treatment of depreciation in addition to the transaction tax of 6% and the local property tax of 0.3% almost compensates for the deductibility of the inflation rate from taxable corporate earnings. The favourable tax treatment of (accelerated) depreciation in case of investment in intangible assets reduces the cost of capital even below 2.65%. The weighted average cost of capital corresponds to the value of *table 2*.

Table 3: depreciation allowances and cost of capital on debt-financed investment

	actual tax depreciation allowances (a)		economic depreciation allowances (b)	p	t_c
Machinery, equipment and means of transportation	29.3%	<	30.7%	2.97%	-34.5%
Buildings	21.8%	<	24.6%	3.91%	-2.3%
Intangible assets	34.3%	>	30.7%	1.88%	-112%
Weighted average (c)	28.1%	<	28.8%	3%	-32.3%

a. Includes the tax gain as a result of immediate expensing.
b. Declining-balance depreciation at the economic rate of depreciation, based on replacement costs.
c. Weights used to calculate the average cost of capital: machinery 47%, buildings 31%, and intangible assets 22% (source: Bovenberg and ter Rele (1998)).

- *Direct household savings in equity of the corporate firm*

Table 4 presents the tax burden on direct household investment financed with newly issued equity or retained earnings.

Newly issued equity

Corporate firms may finance investment with newly issued equity. By assumption, the return on the investment is distributed as dividends, which are taxed under the progressive personal income tax. On the investment financed with newly issued equity, households require an after-tax real rate of return equal to the after-tax real (traditional) opportunity return that could be earned if the investment would be financed with debt. The arbitrage implies that the cost of capital on investment financed with newly issued equity is independent of t_y.

Compared to interest payments, which are taxed under the progressive personal income tax, the firm's return on equity-financed investment is taxed at the corporate tax rate of 35%. The distributed dividends are taxed later at the progressive personal income-tax rate (up to 60%). The double taxation of dividends thus results in a high tax burden on investment financed with newly issued equity. In case of a marginal income-tax rate of 60%, the tax wedge even exceeds the cost of capital.

Table 4: direct household savings in equity of the corporate firm before the tax reform (a)

		newly issued equity	retained earnings
Low marginal income-tax rate (+65): 20.05%	p	6.3%	4.3%
	w	3.6%	1.6%
	t_c	36.5%	37.7%
	t_h	32.6%	0%
	t_e	57.2%	37.7%
	q	1	0.7795
Low marginal income-tax rate (-65): 37.95%	p	6.3%	2.76%
	w	4.8%	1.26%
	t_c	36.5%	44.6%
	t_h	61.7%	0%
	t_e	75.7%	44.6%
	q	1	0.6205
Average marginal income-tax rate: 50%	p	6.3%	1.7%
- No wealth taxes	w	5.55%	0.95%
	t_c	36.5%	56.8%
	t_h	81.2%	0%
	t_e	88.1%	56.8%
	q	1	0.5
- Wealth tax: 0.7% (b)	p	6.3%	1.7%
	w	6.25%	1.65%
	t_c	36.5%	56.8%
	t_h	98.7%	93%
	t_e	99.2%	97.1%
	q	1	0.5
High marginal income-tax rate: 60% (c)	p	6.3%	0.89%
	w	6.9%	1.49%
	t_c	36.5%	88.8%
	t_h	115%	700%
	t_e	109.5%	167%
	q	1	0.4

a. *By assumption, households that face a high (low) marginal income tax do (not) have to pay wealth taxes. Both cases are studied for households that face an average marginal income tax.*

b. t_e *on investment financed with newly issued equity or retained earnings do not differ much, even though the difference between* p *is large. This result follows from the fact that* s *is close to zero.*

c. t_e *on investment financed with newly issued equity is lower than on investment financed with retained earnings (the opposite of what we expect from* p*), which follows from the negative* s*.*

Table 5 presents the depreciation allowances and the cost of capital for different types of investment projects financed with newly issued equity. The weighted average cost of capital equals 6.3%. If actual depreciation allowances amount to economic depreciation allowances, and if no additional taxes are levied, p equals $\frac{r}{(1-\tau)}$ = 6.15%.

Table 5: depreciation allowances and cost of capital on investment financed with newly issued equity

	actual tax depreciation allowances (a)		economic depreciation allowances (b)	p	t_c
Machinery, equipment and means of transportation	26.7%	>	26.5%	6.34%	36.93%
Buildings	17.5%	<	17.7%	7.5%	46.71%
Intangible assets	33.9%	>	26.5%	4.5%	11.33%
Weighted average (c)	25.4%	>	23.8%	6.3%	36.5%

a. Includes the tax gain as a result of immediate expensing.
b. Declining-balance depreciation at the economic rate of depreciation, based on replacement costs.
c. Weights used to calculate the average cost of capital: machinery 47%, buildings 31%, and intangible assets 22% (source: Bovenberg and ter Rele (1998)).

Straight-line and declining-balance depreciation allowances decrease with the firm's discount rate ρ^b (see *section 2.3.2*). ρ^b in case of debt is $(1-\tau)(r+\pi)=4.2\%$. ρ^b in case of newly issued equity is $r+\pi=6.5\%$. Consequently, the depreciation allowances in *table 5* (newly issued equity) are lower than the depreciation allowances in *table 3* (debt). The sensitivity to ρ^b also influences whether or not the tax code permits accelerated depreciation (whether actual depreciation allowances are higher or lower than economic depreciation allowances).

The tax code permits accelerated depreciation in case of investment in machinery and intangible assets. In case of investment in machinery, the tax on the value of the newly issued equity of 0.9% compensates for the accelerated depreciation. This does not occur in case of investment in intangible assets because actual depreciation allowances are too favourable. In case of investment in buildings, the cost of capital exceeds 6.15% as a result of the unfavourable tax treatment of depreciation and the additional taxes (the transaction tax of 6%, the local property tax of 0.3% and the tax on the value of the newly issued equity of 0.9%).

Retained earnings

Instead of distributing the firm's profits as dividends and issuing new equity or debt to finance the investment, the firm may defer the dividend taxes by retaining and reinvesting its profits (second column of *table 4*). In fact, the firm's profits are locked in the firm because if they are distributed, the dividend tax is levied. Because the household avoids the dividend tax if the firm retains and reinvests the profits, the dividend tax reduces the cost of investment financed with retained earnings. By assumption, the return on the investment financed with retained earnings is again distributed as dividends. As explained in *section 2.4.3*, the dividend tax is capitalised into the value of the equity. The higher the dividend tax is, the lower the increase in the value of the firm's equity q. Moreover, the household's after-tax

real rate of return on investment financed with retained earnings is independent of the dividend tax. Because of the absence of a capital gains tax in the Netherlands, the effective tax rate of investment financed with retained earnings amounts to the corporate tax rate plus the wealth tax per unit of cost of capital. Because the household's opportunity return of an investment in debt is taxed under the progressive personal income tax, the investment financed with retained earnings has to earn a low real rate of return. The higher the income tax on the household's opportunity return, the lower the cost of capital. This low cost of capital also implies that the increase in value of the firm's equity (Tobin's q) is lower than unity. The cost of capital lies between 4.3% and 0.89%.

- *Tax-arbitrage behaviour*

The cost of investment financed with retained earnings equals the dividends foregone (because of the absence of a capital gains tax), the amount of which is lower than the unit cost of investment financed with newly issued equity. Retained earnings are therefore a tax-preferred source of finance over newly issued equity.

The firm prefers to finance the investment with retained earnings instead of debt if the marginal income-tax rate t_y on the opportunity return exceeds the corporate tax rate τ of 35%. (It is assumed that the household is a shareholder of the corporate firm in which he finances investment with debt). If $t_y > \tau$, the opportunity investment in debt is taxed at a higher rate than the investment financed with retained earnings. In fact, the income tax on the opportunity return on a direct investment in debt more than compensates for the corporate tax rate on the profits of the investment financed with retained earnings. (By retaining earnings within the firm, the household effectively reduces the tax burden on its savings from t_y to τ). As a result, the investment financed with retained earnings has to yield a lower minimum required rate of return than the direct investment in debt. This condition is satisfied except for households older than 65 with a low marginal income-tax rate. Thus:

Shareholders that directly invest in the corporate firm prefer:

- *Income-tax rate = 20.05%:* $D \phi RE \phi NE$
- *Income-tax rate = 37.95%-50%-60%:* $RE \phi D \phi NE$

Investment projects

Because of the tax treatment of depreciation (which deviates from declining-balance depreciation at the economic rate of depreciation based on replacement costs), the transaction tax and the local property tax on buildings, the cost of capital depends on the type of investment project. Whether the firm finances the investment with newly issued equity or retained earnings, the tax code favours equity-financed investment in intangible assets over equity-financed investment in machinery, equipment and means of transportation. The latter investment opportunities, in turn, are tax-favoured compared to investment in buildings. The same results hold for debt as a source of finance.

5.3.2 Sinn's life-cycle model of the firm

This section simulates Sinn's life-cycle model of the firm and presents the firm's finance and investment decisions along the optimal path (*table 6*). Sinn's dynamic framework takes into account that the newly founded firm has to attract external sources of finance because it does not possess earnings that can be retained and reinvested.

The analysis assumes a concave production function $f(K) = K^{\beta}$, where $\beta = 0.3$. Moreover, the maximum debt-capital ratio α is equal to 60%. The real interest rate equals 4%, and the model abstracts from inflation. One period in the model is equal to one year. The models are simulated in discrete time with Gams.

Because dividends are taxed at the highest rate and interest payments are taxed at a higher rate than capital gains (except for taxpayers older than 65 that face the lowest marginal income-tax rate of 20.05%), the firm prefers retained earnings over debt as a source of finance. Newly issued equity is the firm's least tax-preferred source of finance.
The simulation analysis (*table 6*) confirms the tax-arbitrage results of the 'nucleus' theory of the firm as derived theoretically in *section 3.4*. Initially, the firm issues new equity and debt. The firm then enters an internal growth phase, during which it finances investment with debt and retained earnings. The firm redeems its entire debt in *phase III*. Subsequently, the firm enters an internal growth phase, during which it finances investment with retained earnings. The firm no longer invests in *phase V*, and distributes all of its profits as dividends.
The higher the household's personal income tax, the larger the difference is between the cost of newly issued equity and retained earnings, and the stronger the firm's incentive is to finance investment with retained earnings. An increase in the personal income tax then implies a decrease in the initially issued new equity (and therefore a decrease in the issued debt). Moreover, it implies an increase in the cost of capital on investment financed with newly issued equity. *Table 6* presents the initial period's cost of capital, which is higher than the cost of capital on investment financed with newly issued equity (according to King and Fullerton). An increase in the personal income tax then implies that the amount of capital, which is financed with retained earnings during the second internal growth phase, increases as well.
During *phase III*, the firm redeems its entire debt (10.67 units). At this point, the cost of capital equals the interest rate of 4%.
Retained earnings are the investment's source of finance during *phase IV*. The higher the personal income tax, the lower the household's after-tax opportunity return is, and the stronger the incentive is to accumulate additional funds within the firm. The steady-state cost of capital is thus decreasing, and the steady-state capital stock is increasing in the personal income tax. Thus, also the length of the internal growth phase is increasing in the personal income tax.
During *phase V*, the firm distributes dividends. Given the assumptions, the cost of capital on marginal investment financed with retained earnings amounts to 3.82%, 3.08% or 2.46% (if the income-tax rate is 37.95%, 50% or 60%, respectively). The higher the steady-state capital stock, the more dividends that the firm will distribute.

Table 6: the life-cycle model of the firm before the tax reform

	marginal income-tax rate		
	37.95%	50%	60%
Phase I: newly issued equity & debt			
Year	0	0	0
Initial newly issued equity	0.79	0.55	0.39
Initial newly issued debt	1.19	0.82	0.59
Initial investment	1.98	1.37	0.98
$f'(K)$	18.6%	24%	30.4%
t_e	86.6%	91.7%	94.7%
Phase II: debt & retained earnings			
Year	$1 \rightarrow 7$	$1 \rightarrow 7$	$1 \rightarrow 7$
Newly issued equity	0	0	0
Debt level	$1.19 \rightarrow 10.67$	$0.82 \rightarrow 10.67$	$0.59 \rightarrow 10.67$
Capital stock	$1.98 \rightarrow 17.79$	$1.37 \rightarrow 17.79$	$0.98 \rightarrow 17.79$
$f'(K)$	$18.6\% \rightarrow 4\%$	$24\% \rightarrow 4\%$	$30.4\% \rightarrow 4\%$
Phase III: debt redemption			
Year	$7 \rightarrow 14$	$7 \rightarrow 15$	$7 \rightarrow 15$
Debt level	$10.67 \rightarrow 0$	$10.67 \rightarrow 0$	$10.67 \rightarrow 0$
Capital stock	17.79	17.79	17.79
$f'(K)$	4%	4%	4%
t_e	37.95%	50%	60%
Phase IV: retained earnings			
Year	$14 \rightarrow 15$	$15 \rightarrow 20$	$15 \rightarrow 25$
Debt level	0	0	0
Capital stock	$17.79 \rightarrow 19.01$	$17.79 \rightarrow 25.9$	$17.79 \rightarrow 35.6$
$f'(K)$	$4\% \rightarrow 3.82\%$	$4\% \rightarrow 3.08\%$	$4\% \rightarrow 2.46\%$
Phase V: dividends			
Year	$15 \rightarrow \infty$	$20 \rightarrow \infty$	$25 \rightarrow \infty$
Investment	0	0	0
Dividends	2.42	2.65	2.92
Steady-state capital stock	19.01	25.9	35.6
$f'(K)$	3.82%	3.08%	2.46%
s	2.48%	2%	1.6%
t_e	35%	35%	35%

This favourable tax treatment of retained earnings implies an advantage for mature firms that generate sufficient retained earnings to finance investment (compared to new firms). Young (newly founded) firms, which have not yet generated retained earnings, need to issue new equity as a source of finance. Investment financed by young firms must therefore yield a higher return than investment by mature firms. Consequently, the tax code offers mature firms a tax-induced competitive advantage compared to young firms. Shareholders will thus finance projects that earn a lower return with retained earnings instead of distributing the

profits and financing projects that earn a higher return with newly issued equity. The favourable tax treatment of retained earnings makes it more difficult for young firms to attract new capital. This hampers the dynamics on the equity market, misallocates resources and inhibits the entry of new firms. Young firms can try to limit this tax-induced competitive disadvantage by relying more on debt as a source of finance instead of newly issued equity.

5.3.3 Financial market imperfections

The capital-income-tax system and the financial market imperfections simultaneously determine the agents' saving and investment decisions. This section discusses tax-arbitrage behaviour in light of adverse selection in the debt and equity markets and in the presence of a minimum dividend constraint.

- *Adverse selection in the debt and equity markets*

In case of adverse selection, new investors may be imperfectly informed about the value of the firm and its investment opportunities. The firm might have to sell under-valued new equity in order to finance investment. If the firm attracts debt, it might have to pay a higher interest rate.

The lemons premium in the equity market increases the cost of newly issued equity. The lemons premium in the debt market increases the cost of debt. However, the cost of retained earnings is not affected. The adverse selection in the debt and equity markets therefore increases the difference between the cost of external and internal sources of finance. Thus, retained earnings become an even more preferred source of finance.

The firm will issue less new equity and debt and will finance a larger part of the capital stock with retained earnings. The steady-state cost of capital on investment financed with retained earnings and the capital stock remain unchanged. However, the length of the internal growth phase increases with the adverse selection.

Adverse selection therefore increases the advantage for mature firms that generate sufficient retained earnings to finance investment (compared to young, newly founded, firms).

- *Minimum dividend constraint*

In every period, the firm may distribute part of its earnings in order to signal its quality or to resolve the moral hazard problems. The firm, however, continues to issue a nucleus of new equity during the initial period. The payout rate does not affect the firm's steady-state capital stock and cost of capital on investment financed with retained earnings. However, the length of the internal growth phase increases with the payout rate. Mature firms that may finance investment with retained earnings thus face an even stronger competitive advantage, compared to young firms.

5.4 Indirect household savings in the corporate firm

Instead of saving directly in the corporate firm, the household might save indirectly in debt and equity of the corporate firm through an intermediary. This section analyses indirect household saving under the King-Fullerton method (*section 5.4.1*) and under Sinn's life-cycle model of the firm (*section 5.4.2*).

5.4.1 The King-Fullerton method

In this section, the household saves indirectly in debt and equity of the corporate firm through a mutual fund and a pension fund (*table 7*).

Table 7: indirect household savings in the corporate firm before the tax reform

	debt		equity	
	t_e	s	t_e	s
Cost of capital on investment through an intermediary	p^{debt} = 3%		p^{equity} = 6.1%	
Mutual fund				
• *Low income-tax rate (+65): 20.05%*	42.9%	1.7%	71.8%	1.7%
• *Low income-tax rate (-65): 37.95%*	42.9%	1.7%	71.8%	1.7%
• *Average income-tax rate: 50%*				
- No wealth taxes	42.9%	1.7%	71.8%	1.7%
- Wealth tax: 0.7%	66.1%	1%	83.2%	1%
• *High income-tax rate: 60%*	66.1%	1%	83.2%	1%
Pensions (a) (b)				
• *Low (65-): 37.95% → low (65+): 20.05%*	-95.8%	5.9%	3%	5.9%
• *Average: 50% → low (65+): 20.05%*	-164.3%	8%	-30.8%	8%
• *Average: 50% → average: 50%*	-32.3%	4%	34.5%	4%
• *High: 60% → average: 50%*	-87.4%	5.7%	7.2%	5.7%
• *High: 60% → high: 60%*	-32.3%	4%	34.5%	4%

a. The tax rates in front of the arrows are the marginal income-tax rates at which contributions to the pension fund can be deducted. The tax rates after the arrow reflect the marginal tax rates at which the pension is taxed.

b. By assumption, the expected time until retirement is 15 years.

The intermediary may finance corporate investment with debt. The cost of capital on debt-financed investment equals 3% (similar to the result with direct household saving in corporate debt). The intermediary may finance corporate investment with equity as well. The intermediary's return on the debt or equity-financed corporate investment is assumed to be taxed irrespective of how the intermediary receives the return – as interest payments, dividends or unrealised capital gains[1]. Because it is assumed that the intermediary's capital gains on the corporate firm's equity are taxed when they accrue (and not when they are realised), and because the tax on the value of the newly issued equity is not considered, newly issued equity and retained earnings are taxed similarly. The cost of capital on the equity-financed investment amounts to 6.1%.

Instead of directly buying debt and equity, the household may buy a share of a mutual fund that invests in debt and equity of the corporate firm. This firm can distribute (to the fund) the return on the investment as dividends or interest payments, or it can retain and reinvest the earnings such that the firm's equity, which is controlled by the fund, increases. In order to circumvent the income tax on dividends for the household, the mutual fund retains its

[1] This assumption is explained in *footnote 12*, chapter 2.

earnings instead of distributing them (to the household) as dividends. As a result, the mutual fund's earnings are taxed at a corporate tax rate of 35%. No additional taxes are levied when the household sells its participation in the fund. Because of the absence of a capital gains tax in the Netherlands, the household realises its capital gains tax-free. The differences in s are due to the wealth tax at the household level on the value of the savings. This *innovative* saving strategy[2] yields a higher s than direct household savings in corporate debt and equity if the household's marginal income-tax rate exceeds the mutual fund's corporate tax rate.
Pension savings are exempt from wealth taxes, and pension funds are not taxed on their earnings. Consequently, the household's after-tax real rate of return on savings for a pension amounts to the real interest rate of 4%. The household realises an additional gain, however, if the household's marginal income-tax rate (at which the pension is taxed) is lower than the rate at which contributions have been deducted. The higher this difference is, the higher is s and the lower is t_e.

Tax-arbitrage behaviour
Households that maximise the after-tax real rate of return on their savings face incentives to save through a mutual fund instead of controlling the savings themselves. However, households that face a marginal income-tax rate that is lower than the corporate tax rate on the fund's return prefer direct household saving over saving through a mutual fund. The pension fund is the household's most tax-preferred saving vehicle. The pension fund and the mutual fund face an incentive to invest in debt instead of equity of the corporate firm. Thus:

Shareholders that invest in the corporate firm through an intermediary prefer:
$$debt \quad \phi \quad equity$$

5.4.2 Sinn's life-cycle model of the firm
The King – Fullerton framework studies mutual funds whose earnings are taxed at the mutual fund's corporate tax rate. However, this corporate tax is not levied if the fund immediately distributes the dividends and interest payments it receives from the firm. The mutual fund's capital gains on the corporate firm's equity are not taxed, either. However, the firm's distributed dividends and interest payments, which are immediately distributed by the mutual fund, are taxed at the household level under the progressive income tax. The household thus obtains no tax advantage from saving through this type of mutual fund.
Households face an incentive to invest in the mutual fund whose return is taxed at the fund's corporate tax rate if the household wants to invest (through the mutual fund) in debt or in mature firms that distribute dividends. This saving strategy reduces the tax burden from the household's income-tax rate to the mutual fund's corporate tax rate. Households face an incentive to invest in the mutual fund whose return is not taxed if the household wants to invest in young firms with large investment opportunities, as capital gains are not taxed at the level of this fund.

[2] The household's *innovative opportunity return* refers to the return on the indirect investment in debt of the corporate firm through a mutual fund.

Section 3.5 analyses tax-arbitrage behaviour if the firm that distributes dividends and interest payments is controlled by a mutual fund that does not distribute the corporate investment's return. This return is therefore taxed at the mutual fund's corporate tax rate. The analysis also assumes that any firm that finances investment with retained earnings is controlled by a mutual fund that would immediately distribute the dividends and interest payments. The capital gains are therefore not taxed at the level of the mutual fund.
The firm then determines its optimal finance and investment behaviour on behalf of the household that invests indirectly in the firm through a mutual fund. The firm is indifferent between retained earnings and debt. Newly issued equity is the least tax-preferred source of finance.
If the debt-capital ratio is less than unity, the firm's life cycle consists of three successive phases. First, the firm issues a nucleus of new equity and debt. The firm then enters an internal growth phase, during which investment is financed with debt and retained earnings. The firm stops investing when the cost of capital equals the interest rate of 4%. If the firm can finance the entire investment with debt, then it immediately issues the optimal debt-financed capital stock. The steady-state cost of capital equals the interest rate of 4%.

The favourable tax treatment of retained earnings implies a tax-induced advantage for mature firms compared to young firms. Even if the firm's equity is controlled by a mutual fund, investment financed by young firms must yield a higher return than investment by mature firms. Young firms can resolve this tax-induced competitive disadvantage by relying on debt as a source of finance.

5.5 The proprietorship

Section 5.5 studies the tax burden on debt and equity-financed investment in the proprietorship, and discusses the traditional and innovative proprietor's tax-arbitrage behaviour.

- *Debt-financed investment in the proprietorship*

The proprietor may finance the investment in the proprietorship with borrowed money. By assumption, the proprietor borrows money from another household that requires the nominal interest rate on its investment. This lender realises a traditional or innovative return on its investment in debt. The proprietor then invests its personal wealth in corporate debt, which yields the traditional or innovative opportunity return as well. The analysis differentiates between the marginal income-tax rate on the proprietor's business income and the marginal income-tax rate on the income of the household that lends money (in case of a traditional saving strategy).

If the proprietor's marginal income-tax rate equals 50% (60%), then debt-financed investment in the proprietorship must yield a before-tax real rate of return of 1.9% (1.3%), which is lower than the cost of capital on debt-financed investment in the corporate firm. The household that provides the debt earns the traditional or innovative after-tax real rate of return (*table 2* and *table 7*). Consequently, the marginal effective tax rates on debt-financed investment in the proprietorship (*table 8*) are lower than on debt-financed investment in the corporate firm.

Table 8: debt-financed investment in the proprietorship before the tax reform (a)

		marginal income tax on the proprietor's business income 50%		60%	
	p	1.9%	(1.9%)	1.3%	(1.3%)
The lender's marginal income tax:					
• *Low marginal income-tax rate: 37.95%*	t_e	20.3%	(10.4%)	-17.7%	(-32.4%)
• *Average marginal income-tax rate: 50%*					
- No wealth taxes	t_e	61%	(10.4%)	42.4%	(-32.4%)
- Wealth tax: 0.7%	t_e	97.4%	(46.7%)	96.1%	(21.3%)
• *High marginal income-tax rate: 60%*	t_e	131%	(46.7%)	146%	(21.3%)

a. The table presents the results for the lender's traditional saving strategy. The results presented in parentheses indicate the lender who follows an innovative saving strategy.

In case of economic depreciation allowances, and if no additional taxes are levied, p equals $r - \frac{t_y^s \pi}{1 - t_y^s}$. The cost of capital equals the real interest rate net of the gain of the deduction of the inflation rate from taxable earnings. This implicit subsidy increases with the rate at which interest payments can be deducted. Consequently, the cost of capital on debt-financed investment in the proprietorship (deduction at 50% or 60%) is lower than the cost of capital on debt-financed investment in the corporate firm (deduction at 35%).

Table 9: depreciation allowances/cost of capital on debt-financed investment in the proprietorship (a)

	actual tax depreciation allowances (b) (d)		economic depreciation allowances (c) (d)	p
Machinery, equipment and means of transportation	46.85% (57.7%)	< (<)	47.2% (59.5%)	1.58% (0.82%)
Buildings	37.7% (48.3%)	< (<)	42.3% (58.6%)	3.12% (2.7%)
Intangible assets	49.2% (59.2%)	> (<)	47.2% (59.5%)	0.96% (0.34%)
***Weighted average** (e)*	44.5% (55.13%)	< (<)	45.6% (59.23%)	1.9% (1.3%)

a. The proprietor's marginal income-tax rate t_y^s equals 50% (the results when the proprietor's marginal income-tax rate is 60% are presented in parentheses).

b. Includes the tax gain as a result of immediate expensing, which (by assumption) exceeds the tax gain in case of a corporate firm.

c. Declining-balance depreciation at the economic rate of depreciation, based on replacement costs.

d. Actual and economic depreciation allowances are increasing in t_y^s.

e. Weights used to calculate the average cost of capital: machinery 47%, buildings 31%, and intangible assets 22% (source: Bovenberg and ter Rele (1998)).

Table 9 presents the depreciation allowances and cost of capital for different types of debt-financed investment projects. The tax code permits accelerated depreciation only in case of investment in intangible assets (and if $t_y^s = 50\%$). The local property tax, the transaction tax (in case of investment in buildings) and the unfavourable depreciation allowances then increase the investment's cost of capital (above p if $\overline{A} = 0$).

- *Equity-financed investment in the proprietorship*

This section discusses the tax burden on equity-financed investment in the proprietorship. Profits are taxed only once under the proprietor's personal income tax, which implies that newly issued equity and retained earnings are taxed similarly. The proprietor may invest his personal wealth traditionally or innovatively in debt.

Traditional proprietor

If the proprietor requires a traditional after-tax real rate of return, then the equity-financed investment must yield a low minimum required real rate of return, as presented in *table 10*. The cost of capital equals $\frac{(1-t_y)r - t_y\pi - t_w + t_w^s}{(1-t_y^s)}$ if $\overline{A} = B = 0$. p decreases with the proprietor's income tax on the traditional opportunity return, but increases with the proprietor's marginal income tax on business income. The inflation rate is not taxed in the proprietorship, but is taxed as part of the opportunity return, which lowers the cost of capital. Moreover, p decreases with the wealth tax on personal wealth, but increases with the wealth tax on business wealth. *Table 11* presents the depreciation allowances and the cost of capital for different types of investment projects.

Table 10: equity-financed investment in the proprietorship before the tax reform (a), (b)

	w	t_e	*p*
Low marginal income-tax rate (-65): 37.95%	1.08% (1.1%)	40.5% (39.2%)	2.58% (2.8%)
Average marginal income-tax rate: 50%			
- No wealth taxes	1.15% (1.7%)	61% (49.5%)	1.9% (3.4%)
- Wealth tax 0.7%			
• *business wealth 100% tax-exempt*	0.83% (1.3%)	94.3% (56.2%)	0.88% (2.3%)
• *business wealth 68% tax-exempt*	1.15% (1.7%)	95.9% (61.8%)	1.2% (2.7%)
High marginal income-tax rate: 60%			
Wealth tax 0.7%			
• *business wealth 100% tax-exempt*	0.74% (1.9%)	524% (64.7%)	0.14% (2.9%)
• *business wealth 68% tax-exempt*	1.1% (2.3%)	218% (68.9%)	0.5% (3.3%)

a. The proprietor's marginal income tax on personal income equals the marginal income tax on business income.

b. The table presents the results in case of a traditional opportunity return. The results in case of an innovative opportunity return are presented in parentheses.

Innovative proprietor

Table 10 presents in parentheses the tax burden if the proprietor requires an innovative opportunity return. As a result of this higher opportunity return, the cost of capital[3] and the tax wedge exceed the values obtained in case of a traditional opportunity return. *Table 11* studies the depreciation allowances and cost of capital for different types of investment projects.

Table 11: depreciation allowances and cost of capital on equity-financed investment in the proprietorship (a)

	actual tax depreciation allowances (b)		economic depreciation allowances (c)	p
Machinery, equipment and means of transportation	48.2% (46.3%)	< (>)	49.8% (46.2%)	0.51% (2%)
Buildings	40.5% (36.7%)	< (<)	49.4% (40%)	1.94% (3.6%)
Intangible assets	49.4% (49.1%)	< (>)	49.8% (46.2%)	0.21% (1.3%)
Weighted average (d)	46.8% (43.98%)	< (<)	49.7% (44.3%)	0.88% (2.3%)

a. *Proprietor's business income taxed at 50%, wealth taxes due on personal wealth but not on business wealth. Proprietor's personal income taxed at a marginal income-tax rate of 50% in case of traditional opportunity return, and taxed at the corporate tax rate of 35% in case of an innovative opportunity return (the latter results are presented in parentheses).*
b. *Includes the tax gain as a result of immediate expensing, which, by assumption, exceeds the tax gain in case of a corporate firm.*
c. *Declining-balance depreciation at the economic rate of depreciation, based on replacement costs.*
d. *Weights used to calculate the average cost of capital: machinery 47%, buildings 31%, and intangible assets 22% (source: Bovenberg and ter Rele (1998)).*

- *Traditional proprietor's tax-arbitrage behaviour*

If the wealth tax on personal wealth is 0%, the proprietor that requires a traditional opportunity return is indifferent between debt and equity (newly issued equity and retained earnings are taxed similarly). If the wealth tax on personal wealth is positive (and because business wealth is (partly) exempt from wealth taxes), then the proprietor prefers equity over debt as a source of finance.

In case of debt financing, the nominal interest payments are deducted from the proprietorship's taxable earnings. However, nominal interest payments are taxed at the household level (both the proprietor and the household that lends the funds realise the traditional opportunity return). Given that $t_y = t_y^s$, the marginal effective rate on debt-financed investment in the proprietorship then depends only on the taxes at the household level:

[3] If $\overline{A} = 0$ and $B = 0$, the cost of capital amounts to $p = \dfrac{(1-\tau^{mf})r - \tau^{mf}\pi - t_w + t_w^s}{(1-t_y^s)}$.

$t_e = t_y + \frac{t_w}{p}$. If the proprietor finances investment with equity, then his business profits are taxed only at the proprietor's marginal income-tax rate. t_e then amounts to t_y^s plus the wealth tax on the proprietor's business wealth per unit cost of capital: $t_e = t_y^s + \frac{t_w^s}{p}$. Thus:

The proprietor that requires a traditional opportunity return prefers:

- *Wealth tax = 0%* $equity \sim debt$
- *Wealth tax = 0.7%, business wealth 68% or 100% tax exempt* $equity \phi debt$

Investment projects

The tax code favours the proprietor's debt and equity-financed investment in intangible assets more than investment in machinery, equipment and means of transportation. These investments are more attractive, from a tax point of view, than investment in buildings.

Investment in the proprietorship versus personal savings in the corporate firm

In order for the proprietor to earn the traditional after-tax real rate of return, the equity-financed investment in the proprietorship has to yield a minimum required real rate of return that is lower than the cost of capital on corporate investment in debt and newly issued equity. Consequently, the proprietor faces a tax incentive to accumulate his funds within the proprietorship instead of saving in newly issued equity and debt of the corporate firm.

In fact, the proprietor even prefers that the corporate firm distributes its retained earnings such that he can invest these earnings as equity in the proprietorship. Except under an average marginal income-tax rate and no wealth tax, the cost of capital on equity-financed investment in the proprietorship is lower than the cost of capital on corporate investment financed with retained earnings.

- *Innovative proprietor's tax-arbitrage behaviour*

The proprietor that requires an innovative opportunity return prefers debt over equity as a source of finance (as can be concluded from the cost of capital in *table 8* and *table 10*). The proprietor's personal funds will be invested in a mutual fund that invests in corporate debt. Hence, the innovative proprietor does not face a tax incentive to invest his funds within the proprietorship. Thus:

The proprietor that requires an innovative opportunity return prefers:

$$debt \ \phi \ equity$$

5.6 The closely held corporation

Section 5.6 studies the tax burden on debt and equity-financed investment in the closely held corporation and discusses the controlling shareholder's tax-arbitrage behaviour.

- *Debt-financed investment in the closely held corporation*

Investment in the closely held corporation may be financed with debt. By assumption, the controlling shareholder provides the debt (directly or indirectly through a mutual fund). For simplicity's sake, we ignore the fact that the controlling shareholder's debt claims on his closely held corporation are part of his substantial holding (business wealth) and are therefore (partly) exempt from wealth taxes. Because the size of the investment in the closely held corporation is lower than in the corporate firm, the degree of immediate expensing is assumed to be 4%. The cost of capital on the debt-financed investment then equals 2.86%.

- *Equity-financed investment in the closely held corporation*

This section discusses the tax burden on equity-financed investment (newly issued equity and retained earnings as the source of finance) in the closely held corporation. The return on the equity-financed investment is distributed as dividends, which are not taxed at the progressive personal income-tax rate, but at a special rate of 25%. Realised capital gains are also taxed at 25%. The controlling shareholder requires either the traditional or the innovative opportunity return. The results are presented in *table 12*.

'Traditional' controlling shareholder

The controlling shareholder's traditional opportunity return is taxed under the progressive income tax. The cost of capital on investment financed with newly issued equity or retained earnings is then decreasing in the marginal income tax. The household's personal wealth is taxed under the wealth tax. However, the controlling shareholder's business wealth (which is the value of his substantial amount of shares in the closely held corporation) may be (partly) exempt from wealth taxes. The higher the exemption of business wealth from wealth taxes, the lower is the cost of capital.

Because dividends are taxed at a rate of only 25%, the cost of capital on investment financed with newly issued equity in the closely held corporation is lower than in the publicly held corporate firm.

Because the capital gains tax of 25% is levied only if the capital gains are realised, the cost of capital on investment financed with retained earnings is lower than on investment financed with newly issued equity. Because of this capital gains tax, the cost of capital on investment financed with retained earnings in the closely held corporation exceeds the corresponding cost of capital in the publicly held corporate firm. However, the opposite occurs if the controlling shareholder's business wealth is entirely exempt from wealth taxes.

'Innovative' controlling shareholder

In case of an innovative controlling shareholder, the wealth tax and the exemption of business wealth from wealth taxes explain the differences in the cost of capital and the tax wedge for a particular source of finance. Because the capital gains tax is levied only if the capital gains are realised, the cost of capital on investment financed with retained earnings is lower than on investment financed with newly issued equity.

Table 12: equity-financed investment in the closely held corporation before the tax reform (a) (b)

		newly issued equity		retained earnings	
Low marginal income-tax rate (-65): 37.95%					
	p	4.6%	(4.9%)	3.9%	(4.3%)
	w	3.1%	(3.2%)	2.4%	(2.6%)
	t_e	66.5%	(64.9%)	61.3%	(59.5%)
	q	1	(1)	0.939	(0.937)
Average marginal income-tax rate: 50%					
- No wealth taxes	p	3.2%	(4.9%)	2.7%	(4.3%)
	w	2.45%	(3.2%)	1.95%	(2.6%)
	t_e	76.3%	(64.9%)	72.3%	(59.5%)
	q	1	(1)	0.948	(0.937)
- Wealth tax: 0.7% business wealth 100% tax-exempt	p	1.9%	(3.7%)	1.6%	(3.1%)
	w	1.85%	(2.7%)	1.55%	(2.1%)
	t_e	97.4%	(72%)	96.9%	(67.5%)
	q	1	(1)	0.957	(0.945)
- Wealth tax: 0.7% business wealth 68% tax-exempt	p	2.3%	(4.1%)	2%	(3.5%)
	w	2.25%	(3.1%)	1.95%	(2.5%)
	t_e	97.8%	(74.8%)	97.5%	(70.9%)
	q	1	(1)	0.957	(0.945)
High marginal income-tax rate: 60% (c)					
- Wealth tax: 0.7% business wealth 100% tax-exempt	p	0.81%	(3.7%)	0.57%	(3.1%)
	w	1.41%	(2.7%)	1.17%	(2.1%)
	t_e	174%	(72%)	205%	(67.5%)
	q	1	(1)	0.967	(0.945)
- Wealth tax: 0.7% business wealth 68% tax-exempt	p	1.2%	(4.1%)	0.9%	(3.5%)
	w	1.8%	(3.1%)	1.5%	(2.5%)
	t_e	150%	(74.8%)	164%	(70.9%)
	q	1	(1)	0.967	(0.945)

a. By assumption, households that face a high (low) marginal income-tax rate do (not) have to pay wealth taxes. Both cases are studied for households that face an average marginal income-tax rate.

b. The table presents the results in case of a traditional opportunity return. The results in case of an innovative opportunity return are presented in parentheses.

c. t_e under newly issued equity is lower than under retained earnings (the opposite from what we expect from p), which follows from the negative s.

- *Traditional controlling shareholder's tax-arbitrage behaviour*

This section studies the tax-arbitrage behaviour of the controlling shareholder who requires a traditional opportunity return on his investment in the closely held corporation.

Retained earnings are tax-preferred over newly issued equity because the capital gains tax is levied only if the capital gains are realised. However, the capital gains tax reduces the incentives to finance investment with retained earnings.

Debt is the most tax-preferred source of finance for the controlling shareholder who faces a marginal income-tax rate of 37.95% on personal income. The gain as a result of the deduction of the interest payments from the firm's taxable earnings compensates for the personal income tax on the interest payments, which is only a little higher than the tax on business income of 25%. Moreover, the wealth tax is zero for low-income households (by assumption), which implies that the advantage of business wealth being partly exempt from wealth taxes (as opposed to personal wealth) is absent. In case of a marginal income-tax rate of 50% (and if the controlling shareholder's personal and business wealth is not taxed under the wealth tax), retained earnings are preferred over debt, and newly issued equity is the least tax-preferred source of finance. In the other cases, debt is the least tax-preferred source of finance (as a result of the high income tax on the interest payments and the wealth tax on the personal wealth). Thus:

The controlling shareholder who requires a traditional opportunity return prefers:

- *Income-tax rate = 37.95%:* $D \phi RE \phi NE$
- *Income-tax rate = 50%, wealth tax = 0%:* $RE \phi D \phi NE$
- *Income-tax rate = 50% or 60%, wealth tax = 0.7%:* $RE \phi NE \phi D$
  business wealth 68% or 100% exempt from wealth taxes)

Investment in the closely held corporation or personal savings in the corporate firm

Retained earnings are the closely held corporation's most tax-preferred source of finance (except in case of a controlling shareholder who faces a marginal personal income-tax rate of 37.95%). The controlling shareholder prefers the earnings to be retained and reinvested instead of distributed, such that he can invest these earnings in debt or newly issued equity of the corporate firm. The controlling shareholder therefore faces a tax incentive, which is increasing in the personal income-tax rate, to accumulate his funds in the closely held corporation instead of saving in newly issued equity (under the assumption that the return on this investment is distributed as dividends) or debt of the corporate firm. However, the controlling shareholder does not face a tax incentive to accumulate his funds in the closely held corporation if they can be invested in the equity of a growing firm or in a mutual fund.

Investment in the closely held corporation or in the proprietorship

The closely held corporation is tax-preferred over the proprietorship because the closely held corporation offers the opportunity to transform highly taxed labour income into lower taxed capital income.

However, on the basis of the capital income taxes as discussed in this dissertation, and because it is assumed that the controlling shareholder realises its capital gains already after 6 years, the tax code favours the proprietorship over the closely held corporation. The cost of capital on equity-financed investment in the proprietorship is lower than the cost of capital on equity-financed investment (newly issued equity and retained earnings as a source of finance) in the closely held corporation. The cost of capital on debt-financed investment in the proprietorship is lower than in the closely held corporation as well.

However, the closely held corporation is tax-preferred over the proprietorship if it takes more than 6 years before the controlling shareholder realises the capital gains on his shares.

Sinn's life-cycle model of the closely held corporation
Because retained earnings are tax-preferred over newly issued equity, Sinn's dynamic life-cycle model of the firm implies that the closely held corporation issues only a nucleus of new equity. Afterwards, the closely held corporation finances investment with retained earnings until the corporation reaches the phase of maturity. If no more profitable investment opportunities are available, the corporation starts to distribute dividends.

- *Innovative controlling shareholder's tax-arbitrage behaviour*

This section studies the tax-arbitrage behaviour of the controlling shareholder that requires an innovative opportunity return on its investment in the closely held corporation. Again, retained earnings are tax-preferred over newly issued equity. Debt, however, is the most tax-preferred source of finance. Thus:

The controlling shareholder that requires an innovative opportunity return prefers:

$$D \phi\ RE \phi\ NE$$

Investment in the closely held corporation or personal savings in the corporate firm
The controlling shareholder faces a tax incentive to invest indirectly in debt of the closely held corporation. However, if not the controlling shareholder but another household finances the investment with debt, the controlling shareholder faces a tax incentive to invest his funds indirectly in corporate debt, which yields the innovative opportunity return, and not to invest the funds in the closely held corporation.

Investment in the closely held corporation or in the proprietorship
In case of an innovative saving strategy, the capital-income-tax system favours the proprietorship over the closely held corporation (similarly to the outcome in case of a traditional opportunity return). Equity-financed investment in the proprietorship is preferred over investment financed with newly issued equity and retained earnings in the closely held corporation. Again, this result reverses if it takes more than 6 years before the controlling shareholder realises the capital gains on his shares (of the closely held corporation).

5.7 Owner-occupied housing

This section studies investment in owner-occupied housing. The household may require a traditional opportunity return. Part of the value of the investment (1.25%) is added to the household's taxable income. However, the imputed rental value is lower than the household's before-tax opportunity return (nominal interest rate of 6.5%) on the invested funds (transaction tax inclusive). Both returns are taxed under the marginal income tax. Hence, the household receives a subsidy on owner-occupied housing that is increasing in t_y. As presented in *table 13*, the cost of capital is then decreasing in t_y. The value of the opportunity investment is taxed under the wealth tax. However, only 60% of the value of the owner-occupied housing is taxed under the wealth tax. The cost of capital in the presence of

the wealth taxes is consequently lower than in the absence of the wealth taxes. As explained in *section 2.9*, the traditional household is indifferent between a debt-financed and an equity-financed investment in owner-occupied housing.

The household may require an innovative opportunity return on the funds invested in owner-occupied housing. The cost of capital on an equity-financed investment in owner-occupied housing increases if the household requires the innovative instead of the traditional opportunity return on the invested funds. However, instead of investing its funds in owner-occupied housing, the household has an incentive to invest its funds innovatively in market debt and to borrow in order to finance the investment in housing. This strategy yields a finance gain, which is increasing in the marginal income tax.

Table 13: owner-occupied housing before the tax reform: traditional and innovative opportunity return

	traditional opportunity return		*innovative opportunity return*				
	equity / debt		equity		debt		
	t_e	p	t_e	p	F	t_e	p
Low income-tax rate: 37.95%							
- No wealth taxes	45.1%	2.8%	42.5%	3%	2.8%	37.2%	2.7%
- Wealth tax: 0.7%	66.3%	2.5%	61.7%	2.7%	3.2%	57.6%	2.4%
Average income-tax rate: 50%							
- No wealth taxes	64.6%	2.1%	45.2%	3.1%	14.5%	7.8%	1.9%
- Wealth tax: 0.7%	97.2%	1.8%	63.7%	2.8%	16.2%	32.5%	1.5%
High income-tax rate: 60%							
- No wealth taxes	93.6%	1.5%	47.3%	3.3%	24.2%	-51%	1.1%
- Wealth tax: 0.7%	148.8%	1.2%	65.3%	2.9%	27%	-32.7%	0.8%

Tax-arbitrage behaviour

The tax code favours investment in owner-occupied housing. The traditional household prefers a debt or an equity-financed investment in owner-occupied housing over investment in the corporate firm financed with debt or newly issued equity. However, the traditional shareholder prefers corporate investment financed with retained earnings over investment in owner-occupied housing.

The household that requires an innovative opportunity return prefers debt-financed investment in owner-occupied housing over investment in debt and equity of the corporate firm through a mutual fund.

5.8 Sensitivity analysis

The numerical results of the King-Fullerton type of analysis are determined by the value of the interest rate and the inflation rate. Thus far, the analysis has assumed a real interest rate of 4% and an inflation rate of 2.5%. This section performs a sensitivity analysis and studies

the effects of a change in r and π on corporate investment financed with newly issued equity, retained earnings or debt. The analysis focuses on the effects on p, $\overline{A}$, s and t_e.

If $\overline{A}=0$, the cost of capital on a debt-financed corporate investment $p|_{\overline{A}=0}=r-\frac{\tau\pi}{1-\tau}$ amounts to the real interest rate net of the tax gain as a result of the deduction of nominal interest payments from taxable corporate earnings. This implicit subsidy is increasing in π. Consequently, $p|_{\overline{A}=0}$ is decreasing in the inflation rate (see *table 14*). If $\overline{A}=0$, then the cost of capital on a corporate investment financed with newly issued equity ('traditional' shareholder) $p|_{\overline{A}=0}=\frac{r}{1-\tau}$ increases with the real interest rate, and is independent of the inflation rate. If $\overline{A}=0$, then the cost of capital on a corporate investment financed with retained earnings ('traditional' shareholder) amounts to $p|_{\overline{A}=0}=\frac{(1-t_y)r-t_y\pi}{(1-\tau)}$. The rate of return on an investment financed with retained earnings is not taxed at the household level (because there is no capital gains tax). However, the *nominal* opportunity rate of return on a direct investment in debt is taxed under the household's marginal income tax. The cost of capital consequently decreases with the inflation rate, as presented in *table 14*.

Table 14: sensitivity analysis in case of a (weighted) corporate investment (a), (b)

		debt			newly issued equity			retained earnings		
r	π	$\overline{A}$	$p\|_{\overline{A}=0}$	p	$\overline{A}$	$p\|_{\overline{A}=0}$	p	$\overline{A}$	$p\|_{\overline{A}=0}$	p
r = 4%										
	0%	0.0375	4%	3.64%	0.046	6.15%	5.7%	0.032	3.1%	2.8%
	2.5%	-0.008	2.65%	3.02%	0.016	6.15%	6.3%	-0.026	1.15%	1.7%
	5%	-0.055	1.3%	2.3%	-0.007	6.15%	6.7%	-0.098	-0.77%	0.5%
	7.5%	-0.11	-0.04%	1.5%	-0.026	6.15%	7.1%	-0.21	-2.7%	-0.74%
r = 8%										
	0%	0.05	8%	7.22%	0.055	12.3%	11.4%	0.046	6.15%	5.5%
	2.5%	0.0185	6.65%	6.56%	0.035	12.3%	11.96%	0.005	4.23%	4.4%
	5%	-0.0126	5.3%	5.8%	0.019	12.3%	12.4%	-0.041	2.3%	3.2%
	7.5%	-0.0445	3.96%	4.99%	0.005	12.3%	12.8%	-0.097	0.38%	1.86%

a. The household requires a traditional opportunity return of a direct investment in debt. The marginal income tax equals 50%; the wealth tax is 0.7%.

b. Weights used to calculate the average cost of capital: machinery 47%, buildings 31%, and intangible assets 22% (source: Bovenberg and ter Rele (1998)).

Actual (straight-line) tax depreciation allowances are not indexed for inflation. Economic depreciation allowances, however, are adjusted for inflation. Even though actual tax depreciation allowances do not directly depend on the inflation rate, an increase in the inflation rate raises the firm's discount rate ρ^b, which decreases the straight-line depreciation allowances. A similar decrease occurs in case of the economic depreciation allowances. As a result of the increased inflation rate, however, this decrease does not exceed the direct increase. Economic depreciation allowances are thus not decreasing in π. Consequently, $\overline{A}$ decreases with π, as demonstrated in *table 14*.

Table 15: sensitivity analysis in case of a (weighted) corporate investment (a), (b)

	debt			newly issued equity			retained earnings		
	p	s	t_e	p	s	t_e	p	s	t_e
r π									
r = 4%									
0%	3.64%	1.3%	64.3%	5.7%	1.3%	77.2%	2.8%	1.3%	53.6%
2.5%	3.02%	0.05%	98.3%	6.3%	0.05%	99.2%	1.7%	0.05%	97.1%
5%	2.3%	-1.2%	152%	6.7%	-1.2%	118%	0.5%	-1.2%	340%
7.5%	1.5%	-2.45%	263%	7.1%	-2.45%	134%	-0.74%	-2.45%	-
r = 8%									
0%	7.22%	3.3%	54.3%	11.4%	3.3%	71.1%	5.5%	3.3%	40%
2.5%	6.56%	2.05%	68.7%	11.96%	2.05%	82.9%	4.4%	2.05%	53.4%
5%	5.8%	0.8%	86.2%	12.4%	0.8%	93.5%	3.2%	0.8%	75%
7.5%	4.99%	-0.45%	109%	12.8%	-0.45%	103%	1.86%	-0.45%	124%

a. *The household requires a traditional opportunity return of a direct investment in debt. The marginal income tax equals 50%; the wealth tax equals 0.7%.*
b. *Weights used to calculate the average cost of capital: machinery 47%, buildings 31%, and intangible assets 22% (source: Bovenberg and ter Rele (1998)).*

As discussed in *section 2.8*, a decrease in $\overline{A}$ (for instance, as a result of an increase in π) increases p (*ceteris paribus*). *Table 14* demonstrates this result for corporate investment financed with newly issued equity. However, in case of debt and retained earnings as a source of finance, p decreases with π. In these cases, the effect of an increase in the inflation rate through $\overline{A}$ is lower than the effect as a result of the direct deduction of the

inflation rate from the cost of capital (deduction at the corporate tax rate in case of debt and at the marginal income-tax rate in case of retained earnings).
As derived in *section 2.8*, p is lower than $p|_{\overline{A}=0}$ if $\overline{A} > 0$. However, this result is based on the assumption that $B = w_c = 0$. If the additional taxes are positive, p may exceed $p|_{\overline{A}=0}$ even if actual depreciation allowances are more favourable than economic depreciation allowances, as demonstrated in *table 14*.

The household's after-tax real rate of return $s = (1 - t_y)(r + \pi) - t_w - \pi$ is decreasing in the inflation rate and is increasing in the real interest rate. *Table 15* presents a sensitivity analysis with respect to the after-tax real rate of return and the marginal effective tax rate.

5.9 Conclusion

This chapter discussed the tax burden and the household's and firm's tax-arbitrage behaviour before the tax reform of January 1, 2001.
Shareholders that directly invest in the corporate firm prefer retained earnings over debt (if $t_y > 35\%$), while newly issued equity is the least tax-preferred source of finance. This favourable tax treatment of retained earnings implies a tax-induced advantage for mature firms, which generate sufficient retained earnings to finance investment (compared to new firms). Financial market imperfections increase the mature firm's competitive advantage even further. Young firms can try to limit this competitive disadvantage by relying more on debt as the source of finance instead of newly issued equity. Even if the firm's equity is controlled by a mutual fund, investment financed by young firms must yield a higher return than investment by mature firms.
Households face incentives to save through a mutual fund instead of controlling the savings themselves. The pension fund is the household's most tax-preferred saving vehicle.
As result of the tax treatment of depreciation, the Dutch capital-income-tax system favours investment in intangible assets over investment in machinery, equipment and means of transportation. The latter investment opportunities, in turn, are tax-favoured compared to investment in buildings.
If the wealth tax on personal wealth is positive, then the traditional proprietor prefers equity over debt as the source of finance. Newly issued equity and retained earnings are taxed similarly because profits are taxed only once under the proprietor's personal income tax. The traditional proprietor faces a tax incentive to accumulate funds inside the proprietorship instead of saving in the equity or debt of the corporate firm. The innovative proprietor, in contrast, prefers debt over equity as the source of finance.
Controlling shareholders that require a traditional opportunity return prefer to finance investment with retained earnings instead of newly issued equity. In most cases, debt is the least tax-preferred source of finance. This controlling shareholder faces a tax incentive to accumulate his funds in the closely held corporation instead of saving in newly issued equity or debt of the corporate firm. The proprietorship is tax-preferred over the closely held corporation if the controlling shareholder realises its capital gains rather quickly. Otherwise, the opposite is true. The innovative controlling shareholder prefers debt over retained

earnings. Newly issued equity is the least tax-preferred source of finance. Whether the proprietorship is tax-preferred over the closely held corporation depends again on how quickly the controlling shareholder realises the capital gains on his shares.
The Dutch tax code taxes investment in owner-occupied housing favourably. Households that require a traditional opportunity return are indifferent between debt and equity-financed investment. However, innovative households face an incentive to borrow in order to finance the investment in owner-occupied housing.

Chapter 6
Tax-arbitrage Behaviour in the Netherlands after the Tax Reform

6.1 Introduction

Chapter 6 presents the tax burden on marginal saving and investment opportunities in the Netherlands after the tax reform of January 1, 2001. The analysis discusses the firm's and household's tax-arbitrage behaviour and evaluates the tax reform. This chapter applies the King-Fullerton method, simulates Sinn's dynamic life-cycle model of the firm, and focuses on financial market imperfections.

Similarly to chapter 5, the analysis considers investment projects that, by assumption, are characterised by different values for the depreciation rate δ and the asset's tax lifetime L (investment in machinery, equipment and means of transportation $(\delta = 12.5\%, L = 9)$, in buildings $(\delta = 4.1\%, L = 25)$ and in intangible assets $(\delta = 12.5\%, L = 1)$). The analysis derives the cost of capital for the three types of investment projects. The weighted average cost of capital then applies the following weights: machinery 47%, buildings 31%, and intangible assets 22%. The degree of immediate expensing is 0.5% (corporate firm), 4% (closely held corporation) and 7% (proprietorship), as applied in Bovenberg and ter Rele (1998). The analysis assumes a real interest rate of 4% and an inflation rate of 2.5% (Sinn's life-cycle model of the firm abstracts from inflation).

Section 6.2 presents the capital-income-tax system in the Netherlands after the tax reform. *Section 6.3* focuses on direct household savings in the corporate firm under the King-Fullerton method (*section 6.3.1*), under Sinn's life-cycle model of the firm (*section 6.3.2*) and in light of financial market imperfections (*section 6.3.3*). *Section 6.4* studies indirect household savings in the corporate firm. The proprietorship and the closely held corporation are studied respectively in *sections 6.5* and *6.6*. *Section 6.7* focuses on owner-occupied housing, and *section 6.8* presents a sensitivity analysis. *Section 6.9* concludes.

6.2 Capital income taxes in the Netherlands after the tax reform

The main characteristic of the capital-income-tax system in the Netherlands after the tax reform of January 1, 2001 is that the actual return on personal wealth no longer falls under the personal income tax, and that the old wealth tax is abolished. These capital income taxes have been replaced by a presumptive capital income tax. All personal wealth, except owner-

occupied property, is assumed to earn a return of 4%, which is taxed at a proportional tax rate of 30%. Thus, the presumptive capital income tax is in fact a wealth tax of 1.2%. More details of the new capital-income-tax system are presented in *table 1*.

Table 1: capital-income-tax system after the tax reform of January 1, 2001 (a) (b)

BOX	Type of income (c) (d)	Tax rates
BOX I (e)	- Labour income (f) - Pensions (g) - Return on capital of proprietor - Interest, rental income and capital gains on assets put at the disposal of closely held companies by controlling shareholders - Net presumptive rental value of owner-occupied housing (minus interest)	younger than 65 years: **32.35/37.6-42-52%** older than 65 years: **14.45/19.7-42-52%**
BOX II	Distributed profits (dividends) and realised capital gains on shares that belong to a 'substantial holding' (h)	**25%**
BOX III	Personal wealth (i) (j): 4% presumptive return on the value of shares, savings deposits, bonds, immovable property (k) and (not tax-exempt) capital insurances	**30%**
BOX IV	Corporate profits (net of interest payments)	**35%** (l)
BOX V	- Capital income realised by pension funds, insurance companies - Tax-exempt capital insurances (linked to owner-occupied housing) - Additional saving opportunities (income blocked on a savings account for four years, return on savings taxed in box III)	**exempt** (not in box IV) **exempt** (not in box III) **exempt** (not in box I)

a. This table is based on '*Taxation in the Netherlands 2001*' of the Dutch Ministry of Finance (2001), and on '*Fundamental Tax Reform in the Netherlands*' of S. Cnossen and L. Bovenberg (2001).
b. These tax rules are applicable for income and profits earned after 01/01/2001.
c. Income can be taxed in different boxes.
d. The tax treatment of depreciation does not change. The tax code allows straight-line depreciation. In case of intangible assets, tax authorities allow free depreciation. Moreover, part of the investment can immediately be expensed. The Dutch tax system allows the deduction of current losses from future (carry forward) and past (carry backward) profits.
e. General tax credit of euro 1 576. Plus maximum labour income tax credit of euro 920. Additional tax credits for children, singles and elderly
f. Includes wages, salaries, (labour) income of proprietors, presumptive wage income of the director-shareholder of a closely held corporation, social security benefits and other labour income
g. 'Registered-asset expenditure tax' treatment: pension savings are deductible from taxable income in box I. When the individual receives the pension, it is taxed under the income tax of box I.
h. A controlling shareholder holds at least 5% of the shares of a (closely held) corporation.
i. Personal wealth exemption of euro 17 600 (euro 35 200 for married couples); debt exceeding euro 2 500 is deductible from the tax base in box III.
j. Mortgage loans on owner-occupied property are not deductible from the tax base in box III. (Only) the interest paid on home mortgage loans is deductible in box I.
k. The value of the owner-occupied house is not added to the tax base in box III.
l. Profits up to euro 22 686 are taxed at 30%.

6.3 Direct household savings in the corporate firm

Households may save directly in the debt and equity of the corporate firm. *Section 6.3* studies tax-arbitrage behaviour under the King-Fullerton method, under Sinn's life-cycle model of the firm, and in light of financial market imperfections.

6.3.1 The King-Fullerton method

The household may finance investment in the corporate firm with debt, newly issued equity or retained earnings. This section determines the firm's tax-preferred sources of finance and investment projects and evaluates the tax reform.

- *Direct household savings in debt of the corporate firm*

The tax reform replaces the personal income tax with the presumptive capital income tax on personal wealth t_w. The household realises an after-tax real rate of return $s = 4\% - t_w$ on direct investment in the corporate firm. s is independent of the inflation rate.

The tax reform increases the after-tax real rate of return on direct investment in the corporate firm. As a result, the required yields on other investment opportunities increase as well. Wealthy traditional households that have high incomes from capital gain the most.

Table 2: direct household savings in debt of the corporate firm after the tax reform (a) (b)

	t_e	t_h	t_c	p	s
• *Low income-tax rate (+65): 19.7%*	-32.3 %	0%	-32.3%	3%	4%
• *Low income-tax rate (-65): 37.6%*	-32.3 %	0%	-32.3%	3%	4%
• *Average income-tax rate: 42%*					
- No wealth taxes	-32.3 %	0%	-32.3%	3%	4%
- Wealth tax: 1.2%	7.4 %	30%	-32.3%	3%	2.8%
• *High income-tax rate: 52%*	7.4 %	30%	-32.3%	3%	2.8%

a. By assumption, households that face a high (low) marginal income tax (do not) possess a substantial amount of wealth, which implies that their wealth is (not) taxed under the presumptive capital income tax. Both cases are studied for households with an average marginal income tax.

b. The tax reform strongly reduces the personal wealth exemption. As a result, more individuals will be taxed under the 'wealth' tax.

The tax reform does not change the tax treatment at the firm level. As a result of the nominal deductibility of interest payments from taxable earnings, the cost of capital on debt-financed investment continues to be lower than the real interest rate. The depreciation allowances are presented in *table 3* of chapter 5. The increase in s strongly reduces the marginal effective tax rates on debt-financed investment (*table 2*) compared to the tax burden before the tax reform (see *table 2* of chapter 5).

- *Direct household savings in equity of the corporate firm*

This section discusses the tax burden on direct household investment financed with newly issued equity or retained earnings, as presented in *table 3*.

Newly issued equity

By assumption, the return on the investment financed with newly issued equity is distributed as dividends, which are no longer taxed under the progressive personal income tax. At the household level, equity is taxed under the presumptive capital income tax.

At the firm level, the tax reform affects only the tax on the value of the newly issued equity, which decreases from 0.9% to 0.55%. The tax reform does not change the value of the depreciation allowances (see *table 5*, chapter 5). As a result, the cost of capital decreases only slightly (from 6.3% to 6.2%)[1].

Table 3: direct household savings in equity of the corporate firm after the tax reform

		newly issued equity	retained earnings
Low marginal income-tax rate (+65): 19.7%	p	6.2%	6.1%
	w	2.2%	2.1%
	t_c	35.7%	34.5%
	t_h	0%	0%
	t_e	35.7%	34.5%
	q	1	1
Low marginal income-tax rate (-65): 37.6%	p	6.2%	6.1%
	w	2.2%	2.1%
	t_c	35.7%	34.5%
	t_h	0%	0%
	t_e	35.7%	34.5%
	q	1	1
Average marginal income-tax rate: 42%	p	6.2%	6.1%
- No wealth taxes	w	2.2%	2.1%
	t_c	35.7%	34.5%
	t_h	0%	0%
	t_e	35.7%	34.5%
	q	1	1
- Wealth tax: 1.2%	p	6.2%	6.1%
	w	3.4%	3.3%
	t_c	35.7%	34.5%
	t_h	30%	30%
	t_e	55%	54.1%
	q	1	1
High marginal income-tax rate: 52%	p	6.2%	6.1%
	w	3.4%	3.3%
	t_c	35.7%	34.5%
	t_h	30%	30%
	t_e	55%	54.1%
	q	1	1

a. *By assumption, households that face a high (low) marginal income-tax rate (do not) possess a substantial amount of wealth, which implies that their wealth is (not) taxed under the presumptive capital income tax. Both cases are studied for households with an average marginal income-tax rate.*

[1] The household realises an after-tax real rate of return $s = \rho - t_w - \pi$. Because the household requires the opportunity return on a direct investment in corporate debt, the equity-financed investment has to yield a nominal rate of return before household taxes ρ equal to the nominal interest rate of 6.5%. The arbitrage implies that the cost of capital is independent of t_w.

Retained earnings

Because the equity-financed investment is taxed under the presumptive capital income tax, investment financed with newly issued equity or with retained earnings is taxed similarly. The difference between newly issued equity and retained earnings in *table 3* is attributable only to the tax on the value of the newly issued equity, which is not due if the investment is financed with retained earnings.

The corporate tax discrimination of equity at the firm level (in contrast to debt, because interest payments are deductible from taxable earnings) is no longer compensated by a tax advantage of capital gains at the household level (the absence of a capital gains tax in contrast to the personal income tax on interest payments before the tax reform). Similarly to newly issued equity, the investment financed with retained earnings is taxed twice. Profits are taxed at the corporate tax rate, and the investment is taxed under the presumptive capital income tax.

The required return on investment financed with retained earnings no longer depends on the labour income of the investor and on the taxes at the household level. As a result, the cost of capital strongly increases. By implication, the increase in the value of the firm's equity, as a result of the investment financed with retained earnings, is no longer below unity.

- *Tax-arbitrage behaviour*

Because equity-financed and debt-financed investment are taxed under the presumptive capital income tax, and because only interest payments are deductible from taxable corporate earnings, debt is the tax-preferred source of finance. The tax code thus induces firms to finance investment with debt. A slight difference exists between newly issued equity and retained earnings, which is attributable to the tax on the value of the newly issued equity. This difference, however, is negligible. Thus:

Shareholders that directly invest in the corporate firm prefer:

$$D \phi\ RE \sim NE$$

Although the household is indifferent between newly issued equity and retained earnings as a source of finance, and dividends and capital gains as use of profits, the household prefers to receive dividends instead of capital gains (for a given amount of investment opportunities) such that these funds can be invested in corporate debt.

Investment projects

Due to the unchanged tax treatment of depreciation, the Dutch capital-income-tax system continues to favour investment in intangible assets over investment in machinery, equipment and means of transportation. The latter investment opportunities are more attractive, from a tax point of view, than investment in buildings.

- *Evaluation of the tax reform*

The tax reform does not affect the cost of capital on investment financed with newly issued equity or on investment financed with debt. The most important effect of the tax reform is the

equal tax treatment of newly issued equity and retained earnings (ignoring the minor impact of the tax on the value of the newly issued equity). As a result, the cost of capital on investment financed with retained earnings strongly increases.

Before the tax reform, the firm preferred retained earnings over debt (if $t_y > 35\%$). In fact, the household that earned a substantial labour income faced a stronger incentive to reinvest the retained earnings instead of financing the investment with debt than did the household that earned a lower labour income. However, even though retained earnings were tax-preferred, the firm faced an incentive to attract debt as long as the investment's return was higher than the interest rate. After the tax reform, debt is unambiguously the tax-preferred source of finance. The tax reform thus results in an even stronger preference for debt as the source of finance. Moreover, the preference for these sources of finance no longer depends on the household's labour income.

The tax reform raises the marginal steady-state cost of capital. The cost of capital on debt-financed investment after the tax reform exceeds the cost of capital on investment financed with retained earnings before the tax reform. After the tax reform, firms are thus characterised by a lower steady-state capital stock.

Because the cost of capital on investment financed with retained earnings increases, equity-financed firms reduce their capital stock.

6.3.2 Sinn's life-cycle model of the firm

Abstracting from the tax on the value of the newly issued equity, we derived that retained earnings and newly issued equity are taxed similarly. Sinn's dynamic life-cycle model then demonstrates that the firm immediately attracts the optimal amount of capital, after which it starts distributing dividends and interest payments. The steady-state capital stock is financed partly with debt and partly with newly issued equity. (If the debt-capital ratio is not restricted, the firm finances the steady-state capital stock entirely with debt). The cost of capital on debt-financed investment equals the interest rate of 4%, which is lower than the cost of capital on equity-financed investment (which amounts to 6.1%). The steady-state cost of capital then equals 4.86%. The household realises an after-tax real rate of return of 2.8%. The marginal investment is characterised by a marginal effective tax rate of 42.4%.

Evaluation of the tax reform

The tax burden on external equity no longer exceeds that on internal equity. Consequently, it no longer is attractive to defer dividend taxes for tax purposes. The corporate firm thus does not pass through an internal growth phase, but immediately attracts the optimal amount of steady-state capital. Consequently, the tax code no longer offers mature firms (which possess earnings that can be retained and reinvested) a tax-induced competitive advantage compared to young, newly founded firms.

The tax reform removes the tax barrier on the transfer of equity capital, which enhances the dynamics on the equity market. Resources are no longer misallocated, and the tax code no longer discourages the entry of new firms. However, because debt becomes the most tax-preferred source of finance, firms that cannot attract debt suffer a tax-induced competitive disadvantage compared to firms that face no borrowing constraints.

6.3.3 Financial market imperfections

This section discusses the agents' tax-arbitrage behaviour and evaluates the tax reform in light of adverse selection in the debt and equity markets and in the presence of a minimum dividend constraint.

- *Adverse selection in the debt and equity markets*

In light of adverse selection in the equity market, the lemons premium on newly issued equity drives again a wedge between the cost of newly issued equity and the cost of retained earnings. Because retained earnings become a cheaper source of finance, the firm will issue only a nucleus of new equity.

Adverse selection in the debt market increases the cost of debt-financed investment. If the lemons premium on debt Ω^d is lower than the corporate tax advantage of debt, the firm prefers debt over retained earnings. The firm then issues new equity and debt during the initial phase. The firm then enters an internal growth phase during which it finances investment with debt and retained earnings. In the steady state, the firm finances investment partly with debt (cost of capital equals $(1+\Omega^d)\cdot 4\%$) and partly with retained earnings (cost of capital equals 6.1%). If the debt-capital ratio is not restricted, the firm finances the steady-state capital stock entirely (and immediately) with debt.

If the lemons premium on debt exceeds the corporate tax advantage of debt, the firm prefers retained earnings over debt. The firm issues new equity and debt during the initial phase. Afterwards, the firm enters an internal growth phase during which it finances investment with debt and retained earnings. When the cost of capital equals $(1+\Omega^d)\cdot 4\%$, the firm redeems its debt. Additional investment is financed only with retained earnings. The steady-state cost of capital on investment financed with retained earnings equals 6.1%.

Evaluation of the tax reform

The tax reform eliminates the tax differential between newly issued equity and retained earnings. In light of adverse selection in the equity market, however, the cost of newly issued equity exceeds the cost of retained earnings. The firm thus continues to issue only a nucleus of new equity and, as before the tax reform, the firm passes through an internal growth phase.

The capital-income-tax system after the tax reform yields a strong incentive to finance investment with debt. However, in case of adverse selection in the debt market, this strong preference for debt might be tempered or even reversed. As before the tax reform, retained earnings might become the firm's preferred source of finance.

In the presence of severe adverse selection after the tax reform, firms that must attract external sources of finance face a competitive disadvantage compared to mature firms. This conclusion is similar to the outcome before the tax reform. The competitive disadvantage of these firms increases even further if they are restricted in the amount of debt financing.

- *Minimum dividend constraint*

Before the tax reform, the minimum dividend constraint increased the tax-induced competitive advantage of mature firms compared to young firms. Sinn's dynamic model

demonstrates that after the tax reform the firm (in the absence of adverse selection) immediately attracts the steady-state capital stock, after which it begins to distribute dividends and interest payments. Consequently, the incentive to distribute dividends in every period (in order to signal the firm's quality or to resolve the moral hazard problems) no longer affects the firm's finance and investment decisions.

6.4 Indirect household savings in the corporate firm

The household might save indirectly in the debt and equity of the corporate firm through an intermediary. *Table 4* focuses on savings through a pension fund and a mutual fund.
The cost of capital on the debt-financed investment equals 3%. Because the tax on the value of the newly issued equity is not considered, newly issued equity and retained earnings are taxed similarly. The cost of capital on the equity-financed investment equals 6.1%.

Table 4: indirect household savings in the corporate firm after the tax reform

	debt		equity	
	t_e	s	t_e	s
Cost of capital on investment through an intermediary	$p^{debt} = 3\%$		$p^{equity} = 6.1\%$	
Pensions				
• *Low (65-): 37.6% → low (65+): 19.7%*	-95.5%	5.9%	3.2%	5.9%
• *Average: 42% → low (65+): 19.7%*	-117 %	6.6%	-7.5%	6.6%
• *Average: 42% → average: 42%*	-32.3%	4%	34.5%	4%
• *High: 52% → average: 42%*	-78.2%	5.4%	11.8%	5.4%
• *High: 52% → high: 52%*	-32.3%	4%	34.5%	4%
Mutual fund (earnings are NOT distributed)				
• *No wealth taxes*	42.5%	1.7%	71.7%	1.7%
• *Wealth tax: 1.2%*	82.5%	0.5%	91.4%	0.5%
Mutual fund (earnings are distributed)				
• *No wealth taxes*	-32.3%	4%	34.5%	4%
• *Wealth tax: 1.2%*	7.4%	2.8%	54.1%	2.8%

Except for the changes in the statutory marginal income-tax rates, the tax reform does not change the favourable tax treatment of pensions.
The household may buy a share of a mutual fund. If this mutual fund retains its earnings instead of distributing them (to the household) as dividends, the fund's earnings are taxed at a corporate tax rate of 35%. At the household level, the savings are taxed at the presumptive capital income-tax rate as well. These savings yield an after-tax real rate of return that is lower than the s on direct savings in the corporate firm. If the mutual fund distributes its earnings, they are not taxed at the tax rate of 35%. These household savings are taxed, however, under the presumptive capital income tax.

Tax-arbitrage behaviour

Households face an incentive to save for a pension through a pension fund. Saving through a mutual fund that does not distribute its earnings becomes a less attractive saving strategy than direct household savings. The household gains no tax advantage from saving through a mutual fund that distributes its earnings. The mutual fund after the tax reform is thus no longer a tax-favoured saving vehicle. The pension fund and the mutual fund face an incentive to invest in the debt rather than the equity of the corporate firm. Thus:

Shareholders that invest in the corporate firm through an intermediary prefer:

$$debt \quad \phi \quad equity$$

Evaluation of the tax reform

The innovative strategy of a debt or equity-financed investment in the corporate firm through a mutual fund is no longer a more attractive saving strategy than direct household savings. The tax reform therefore reduces the tax-arbitrage opportunities at the household level, thereby levelling the playing field. Less 'active' households no longer pay more taxes than households who know how to minimise their tax liabilities. As a result of the increase in the after-tax real rate of return on direct savings in corporate debt, direct household saving is no longer less attractive than saving through (certain types of) intermediaries. The tax treatment of pension savings, however, remains very attractive.

If the household borrows funds after the tax reform, the interest payments are not deductible from taxable income in box I. The household no longer faces a tax-incentive to borrow funds and use them to buy (directly or indirectly) shares of the corporate firm. These tax-arbitrage transactions no longer erode the tax base as well.

6.5 The proprietorship

This section studies the tax burden on investment in the proprietorship. The analysis explores the proprietor's tax-arbitrage behaviour and evaluates the tax reform.

- *Debt-financed investment in the proprietorship*

The proprietor may finance investment in the proprietorship with borrowed money. By assumption, the proprietor borrows money from another household. The proprietor invests his personal wealth in corporate debt.

If the proprietor's marginal income-tax rate equals 42% (52%), then debt-financed investment in the proprietorship must yield a before-tax real rate of return of 2.4% (1.8%). As a result of the nominal interest deductibility at the marginal income-tax rate, the cost of capital is lower than the real interest rate. The required return rises slightly (compared to the cost of capital before the tax reform), due to the lower personal income tax rates. The lender's investment is taxed under the presumptive capital income tax (see *table 2*). Because p is lower than s, the marginal tax burden on debt-financed investment in the proprietorship is negative, as presented in *table 5*.

Table 5: debt-financed investment in the proprietorship after the tax reform

	marginal income tax on the proprietor's business income			
	42%		52%	
	t_e	p	t_e	p
Taxes at household level (lender):				
- No wealth taxes	-68.9%	2.4%	-121.4%	1.8%
- Wealth tax: 1.2%	-18.2%	2.4%	-55%	1.8%

- *Equity-financed investment in the proprietorship*

Table 6 presents the tax burden on equity-financed investment in the proprietorship. Profits are taxed only once under the proprietor's personal income tax. This implies that newly issued equity and retained earnings are taxed similarly.

If actual depreciation allowances are equal to economic depreciation allowances, and if no additional taxes are levied, the cost of capital equals $p = \frac{r - t_w}{(1 - t_y^s)}$. p decreases with the presumptive capital income tax on the opportunity investment in corporate debt, and increases with the proprietor's marginal income tax on business income. p is independent of the inflation rate.

Table 6: equity-financed investment in the proprietorship after the tax reform

	w	t_e	p
Low marginal income-tax rate (-65): 37.6%	1.9 %	32.5 %	5.9 %
Average marginal income-tax rate: 42%			
- No wealth taxes	2.3 %	36.2 %	6.3 %
- Wealth tax: 1.2% on opportunity return	1.7 %	38.2 %	4.5 %
High marginal income-tax rate: 52%			
- Wealth tax: 1.2% on opportunity return	2.5 %	47 %	5.3 %

- *Tax-arbitrage behaviour*

Nominal interest payments are tax deductible, but the lender's investment in the debt of the proprietorship and the proprietor's investment in corporate debt are taxed under the presumptive capital income tax. The return on the equity-financed investment is taxed under the proprietor's marginal business income tax. The results in *table 5* and *table 6* then demonstrate that the tax burden on equity-financed investment exceeds the tax burden on debt-financed investment. Thus:

The proprietor prefers: $debt \;\phi\; equity$

The proprietor faces no tax incentive to invest his funds inside of the proprietorship. Those proprietors who are subject to high marginal tax rates in box I face substantial tax incentives to finance their business with debt and to invest their personal wealth in assets assigned to box III (for instance, in corporate debt).

Investment projects
Similarly to the situation before the tax reform, the tax code favours the proprietor's debt and equity-financed investment in intangible assets more than investment in machinery, equipment and means of transportation. These investment opportunities are, from a tax point of view, more attractive than investment in buildings.

- *Evaluation of the tax reform*

Even though interest payments are deductible at the lower marginal business income-tax rates, the tax reform reduces the tax burden on debt-financed investment in the proprietorship because the personal income tax on the interest payments is replaced by the lower presumptive capital income tax. Since the return on equity-financed investment is taxed at the lower marginal business income-tax rates, and because business wealth is no longer taxed under the wealth tax, the tax reform also reduces the tax burden on equity-financed investment in the proprietorship.
Because of the greater opportunity return, the tax reform increases the cost of capital on equity-financed investment in the proprietorship (the increase exceeds the reduction in p, since business wealth is no longer taxed under the wealth tax and because the business income-tax rates are reduced). As a direct consequence, the traditional proprietor's tax-preferred source of finance changes from equity to debt. The proprietor thus has an incentive to withdraw his funds from the proprietorship. Moreover, the tax reform reduces the optimal steady-state capital stock. The reform has less influence on the innovative proprietor (except for the small increase in the cost of capital on debt-financed investment) because debt remains his most tax-preferred source of finance.

6.6 The closely held corporation

This section explores the tax burden on debt and equity-financed investment in the closely held corporation, discusses the controlling shareholder's tax-arbitrage behaviour and evaluates the tax reform.

- *Debt-financed investment in the closely held corporation*

Investment in the closely held corporation may be financed with debt. This analysis assumes that the controlling shareholder buys the debt of the closely held corporation. The controlling shareholder's debt-financed investment is not taxed under the presumptive capital income tax of box III. The interest payments are taxed under the income tax of box I. This anti-avoidance provision prevents the controlling shareholders from shifting their taxable income

out of box I into box III and, as such, prevents large differences in the tax burden on debt and equity-financed investment.
Because 4% of the cost of the investment in the closely held corporation is immediately expensed, the cost of capital reduces to 2.86%.

Table 7: the controlling shareholder's debt-financed investment in the closely held corporation after the tax reform

	t_e	p	s
• *Low income-tax rate (+65): 19.7%*	5%	2.86%	2.72%
• *Low income-tax rate (-65): 37.6%*	45.7%	2.86%	1.56%
• *Average income-tax rate: 42%*	55.7%	2.86%	1.27%
• *High income-tax rate: 52%*	78.4%	2.86%	0.62%

The interest payments are taxed under the income tax (box I), as is the case for interest payments before the tax reform. Hence, the investment yields a real after-tax rate of return that is decreasing in t_y. This after-tax rate of return is lower than the s of savings that are taxed under the presumptive capital income tax. Consequently, the marginal effective tax rates in *table 7* exceed the tax rates in *table 2*.

- *Equity-financed investment in the closely held corporation*

Investment in the closely held corporation may be financed with newly issued equity or retained earnings. Dividends and realised capital gains are taxed at a rate of 25%. Since the capital gains tax of 25% is levied if the capital gains are realised, and because dividends are directly taxed at 25%, the cost of capital on investment financed with retained earnings is lower than in case of newly issued equity as a source of finance.
The controlling shareholder requires an opportunity return of a direct investment in corporate debt. *Table 8* then demonstrates that the cost of capital is decreasing in the presumptive capital income tax.

- *Tax-arbitrage behaviour*

Internal equity (retained earnings) is tax-preferred over external equity (newly issued equity) because the capital gains tax can be delayed until the shares are sold, which hampers the dynamics on the equity market. Debt is the most tax-preferred source of finance because the tax burden on equity-financed investment exceeds the tax burden on debt-financed investment. The tax burden on equity-financed investment consists of the corporate tax and the tax on dividends or realised capital gains of 25%. The tax burden on debt-financed investment equals the taxes at the household level on the interest payments, minus the gain of the deductibility of the nominal interest payments from taxable corporate earnings.

Table 8: equity-financed investment in the closely held corporation after the tax reform

		newly issued equity	retained earnings
Low marginal income-tax rate (-65): 37.6%	p	9%	7.9%
No wealth taxes:	w	5%	3.9%
	t_e	55.7%	49.2%
	q	1	0.914
Average marginal income-tax rate: 42%			
- No wealth taxes	p	9%	7.9%
	w	5%	3.9%
	t_e	55.7%	49.2%
	q	1	0.914
- Wealth tax: 1.2% on opportunity return	p	6.8%	6%
	w	4%	3.2%
	t_e	58.9%	53.1%
	q	1	0.925
High marginal income-tax rate: 52%	p	6.8%	6%
Wealth tax: 1.2% on opportunity return	w	4%	3.2%
	t_e	58.9%	53.1%
	q	1	0.925

The controlling shareholder may buy debt of the closely held corporation. However, the after-tax real rate of return on the controlling shareholder's debt-financed investment in the closely held corporation (*table 7*) is lower than the s on debt-financed investment in the corporate firm (*table 2*). The controlling shareholder thus faces an incentive to invest his own funds in corporate debt (and does not face a tax incentive to invest his funds in the closely held corporation). Investment in the closely held corporation will be financed with funds that are borrowed from another household. Thus:

The controlling shareholder prefers: $D \phi\ RE \phi\ NE$

Investment in the closely held corporation or in the proprietorship

On the basis of the capital income taxes as discussed in this dissertation, and because it is assumed that the controlling shareholder realises the capital gains on his shares already after 6 years, the tax code favours the proprietorship over the closely held corporation. The cost of capital on equity-financed investment in the proprietorship is lower than the cost of capital on equity-financed investment (newly issued equity and retained earnings as the source of finance) in the closely held corporation. Moreover, the cost of capital on debt-financed investment in the proprietorship is lower than in the closely held corporation.

- *Evaluation of the tax reform*

Because of the greater opportunity return, the tax reform increases the cost of capital on investment in the closely held corporation financed with newly issued equity or retained earnings. As a direct consequence, the tax-preferred source of finance of the traditional controlling shareholder changes from equity to debt. This reduces the optimal steady-state capital stock. The tax reform has less impact on the innovative controlling shareholder because debt remains his most tax-preferred source of finance.

As a result of the tax reform, the controlling shareholder has an incentive to withdraw his funds from the closely held corporation and to invest these funds in corporate debt. The controlling shareholder no longer faces an incentive to invest his funds in the debt and equity of the closely held corporation. The debt of the closely held corporation will be bought by another household.

After the tax reform, the proprietorship might be tax-preferred over the closely held corporation. The difference in the cost of capital on debt-financed investment (which is the tax-preferred source of finance in the proprietorship and in the closely held corporation) is small. However, the tax reform reduces the tax burden on equity-financed investment in the proprietorship. The entrepreneur might therefore prefer the proprietorship over the closely held corporation as legal form. This might result in a renewed interest for the proprietorship, as pointed out by Cnossen and Bovenberg (1999). Moreover, in the presence of large inframarginal returns after the tax reform, the ordinary corporation is also tax-preferred over the closely held corporation as legal form.

6.7 Owner-occupied housing

Table 9 presents the tax burden on investment in owner-occupied housing. The tax code continues to subsidise investment in owner-occupied housing because the income tax on the imputed rental value is lower than the presumptive capital income tax on the household's invested funds (transaction tax inclusive). The imputed rental value decreases from 1.25% to 0.8%. After the tax reform, this implicit subsidy no longer depends on the marginal income-tax rate. In fact, p for equity-financed investment increases with t_y.

The value of the house is no longer taxed under the wealth tax. Of course, the elimination of personal wealth taxation implies that investment in owner-occupied housing no longer benefits from its favourable treatment under the wealth tax (only 60% of the value was taxed). However, p decreases with the presumptive capital income tax t_w on the opportunity investment.

The tax code taxes debt-financed investment in owner-occupied housing favourably, compared to other saving vehicles. The nominal interest costs remain deductible at the progressive personal income-tax rates (box I). However, the alternative investment of the household's personal funds in corporate debt is taxed under the presumptive capital income tax (box III). As a result, the household realises a financial gain[2] if the investment in owner-

[2] $F = \frac{t_y(r+\pi) - t_w}{\lambda + r + \pi - t_w}$ (See *section 2.9.2;* $t_w^d = 0$ because the wealth tax of the capital income-tax system

occupied housing is financed with debt. This 'finance gain' is increasing in the marginal income-tax rate at which the borrowing costs can be deducted from taxable income, and is decreasing in the presumptive capital income tax on the household's opportunity investment. The higher this 'finance gain', the lower is the cost of capital. Especially households with high labour income face an incentive to finance investments in owner-occupied housing with debt.

Table 9: owner-occupied housing after the tax reform

	debt			equity	
	F	t_e	p	t_e	p
Low marginal income-tax rate: 37.6%					
- No wealth tax on opportunity return	27.2%	-83%	2.2%	23.6%	5.24%
- Wealth tax on opportunity return: 1.2%	15.9%	-17.9%	2.4%	29.4%	3.96%
Average marginal income-tax rate: 42%					
- No wealth tax on opportunity return	30.3%	-114%	1.9%	24.1%	5.27%
- Wealth tax on opportunity return: 1.2%	19.6%	-36.9%	2%	30%	4%
High marginal income-tax rate: 52%					
- No wealth tax on opportunity return	37.6%	-253%	1.1%	25.3%	5.35%
- Wealth tax on opportunity return: 1.2%	27.9%	-116%	1.3%	31.4%	4.1%

Evaluation of the tax reform

Before and after the tax reform, a debt-financed owner-occupied property remains an attractive saving vehicle.

Before the tax reform, innovative households already realised a financial gain on their debt-financed investment in owner-occupied housing. Because of the increase in the 'finance gain', the tax reform makes it even more attractive to shift income from box I to box III.

On the one hand, the tax reform decreases the cost of capital on investment in owner-occupied housing as a result of the decrease in the income tax rates and the decrease in the imputed rental value, and because the value of the house is no longer taxed under the wealth tax. On the other hand, the tax reform increases the cost of capital as a result of the increase in the household's opportunity return.

Comparing the cost of capital before (*table 9*) and after the tax reform (*table 13* of chapter 5) then reveals an increase in the cost of capital on equity-financed investment in owner-occupied housing. In case of a positive presumptive capital income tax, the tax reform only slightly increases the cost of capital on debt-financed investment.

before the tax reform is no longer operational).

6.8 Sensitivity analysis

The King-Fullerton type of analysis assumed a real interest rate of 4% and an inflation rate of 2.5%. This section performs a sensitivity analysis and studies the effects of a change in r and π on corporate investment financed with debt, newly issued equity or retained earnings. The analysis focuses on the effects on p, s and t_e, as presented in *table 10.*

Table 10: sensitivity analysis in case of a (weighted) corporate investment (a) (b)

		debt			newly issued equity			retained earnings		
r	π	p	s	t_e	p	s	t_e	p	s	t_e
r = 4%										
	0%	3.64%	2.8%	23.1%	5.7%	2.8%	50.6%	5.55%	2.8%	49.6%
	2.5%	3.02%	2.8%	7.4%	6.2%	2.8%	55%	6.1%	2.8%	54.1%
	5%	2.3%	2.8%	-21.6%	6.7%	2.8%	58.1%	6.56%	2.8%	57.3%
	7.5%	1.5%	2.8%	-86.6%	7%	2.8%	60.3%	6.9%	2.8%	59.6%
r = 8%										
	0%	7.22%	6.8%	5.8%	11.3%	6.8%	40%	11.2%	6.8%	39.2%
	2.5%	6 .56%	6.8%	-3.8%	11.9%	6.8%	42.7%	11.7%	6.8%	41.9%
	5%	5.8%	6.8%	-17%	12.3%	6.8%	44.7%	12.16%	6.8%	44.1%
	7.5%	4.99%	6.8%	-36%	12.7%	6.8%	46.4%	12.5%	6.8%	45.7%

a. The presumptive capital income tax equals 1.2%.
b. Weights used to calculate the average cost of capital: machinery 47%, buildings 31%, intangible assets 22%, (source: Bovenberg and ter Rele (1998)).

As opposed to the situation before the tax reform, s is independent of π. The cost of capital on debt-financed investment is decreasing in π as a result of the deductibility of *nominal* interest payments. If π is high, this may even result in a negative value of t_e. The sensitivity analysis in *section 5.8* already pointed out that the cost of capital on investment financed with newly issued equity increases with π. The only difference between the cost of capital in case of newly issued equity and retained earnings is the tax on the value of the newly issued equity, which is absent in case of retained earnings. A higher inflation rate then increases the gap between the cost of capital on debt-financed investment and the cost of capital on equity-financed investment. As a result, the preference for debt over equity as a source of finance is increasing in the inflation rate.

6.9 Conclusion

The tax reform in the Netherlands of January 1, 2001 replaces the personal income tax and the wealth tax with the presumptive capital income tax. All personal wealth, except owner-occupied property, is assumed to earn a return of 4%, which is taxed at a rate of 30% in box III. The presumptive capital income tax is therefore in fact a wealth tax of 1.2%.

The tax reform increases the after-tax real rate of return on direct investment in corporate debt, which no longer depends on the household's labour income and marginal income-tax rate. As a result, the required yield on other investment opportunities also increases. Moreover, this increase in s implies that indirect household saving through a mutual fund is no longer an attractive saving vehicle. Pension savings, however, are still taxed favourably.

Because the equity-financed investment is taxed under the presumptive capital income tax, investment financed with newly issued equity or retained earnings is taxed similarly (in addition to the minor effect of the tax on the value of the newly issued equity). The tax reform strongly increases the cost of capital on investment financed with retained earnings. Moreover, p no longer depends on the personal income tax in box I.

Because the tax burden on external equity does not exceed that on internal equity, mature firms no longer face a tax-induced competitive advantage compared to young, newly founded firms. The tax reform removes the tax barrier on the transfer of equity capital and restores the dynamics on the equity market.

At the household level, corporate investment is taxed under the presumptive capital income tax, irrespective of whether the household receives the return as interest payments, dividends, or capital gains. Only interest payments, however, are deductible from the corporate firm's taxable earnings. Consequently, debt becomes unambiguously the most tax-preferred source of finance. Firms that cannot attract debt thus suffer a tax-induced competitive disadvantage, compared to firms that face no borrowing constraints.

In light of adverse selection in the equity market, the cost of newly issued equity exceeds the cost of retained earnings. After the tax reform, the strong preference for debt might be reversed in the presence of severe adverse selection in the debt market. Retained earnings might still be the most preferred source of finance. Similarly to the outcome before the tax reform, firms that have to attract external sources of finance then face a competitive disadvantage compared to mature firms.

The Dutch capital-income-tax system continues to favour investment in intangible assets over investment in machinery, equipment and means of transportation. The latter investment opportunities are more attractive, from a tax point of view, than investment in buildings.

The tax reform increases the cost of capital on equity-financed investment in the proprietorship. As a direct consequence, the traditional proprietor's tax-preferred source of finance changes from equity to debt. Debt remains the most attractive source of finance for the innovative proprietor. As a result, the proprietor no longer faces a tax incentive to accumulate his funds inside the proprietorship.

As result of the tax reform, the controlling shareholder faces the same incentives as the proprietor. Debt becomes the tax-preferred source of finance, which implies that the controlling shareholder faces no tax incentive to accumulate his funds inside the closely held corporation. Moreover, the entrepreneur might prefer the proprietorship over the closely held corporation as a result of the tax reform.

Except in the case of mortgage debt, the household's interest payments on borrowed funds are not deductible from taxable income in box I. As a result, the household faces no incentive to borrow and to invest the funds directly or indirectly in the corporate firm. However, similar to the innovative household before the tax reform, the household does face an incentive after the tax reform to finance investment in owner-occupied housing with borrowed funds. In fact, debt-financed investment in owner-occupied housing is taxed favourably, especially for households that face a high marginal income-tax rate (and therefore have a substantial amount of income in box I).

Evaluation of the tax reform in the presence of adjustment costs
In the presence of adjustment costs, the nucleus theory of the firm allows for dividends to be paid while the firm invests. Too great investment in the same period might be too costly (as a result of the adjustment costs). Moreover, the firm might not issue initially the optimal amount of new equity, but might rather spread out the issue of new equity over different phases (see *section 3.7*).
After the tax reform, the cost of external equity equals the cost of internal equity. As a result of the adjustment costs, however, young firms continue to issue only a nucleus of new equity. In the presence of adjustment costs, young firms suffer a competitive disadvantage compared to mature firms – even after the tax reform.

Evaluation of the tax reform and share repurchases
In order to prevent firms from transforming highly taxed dividends into lower taxed capital gains, the tax authorities before the tax reform treated and taxed share repurchases as dividends. Capital income, after the tax reform, is taxed under the presumptive capital income tax. The household is thus indifferent between dividends and share repurchases. A first glance would suggest that tax authorities no longer have to prevent firms from repurchasing their shares. If the Dutch tax authorities would allow for share repurchases, however, firms would strongly increase their debt-equity ratio. Share repurchases allow the firm to replace highly taxed equity (which the firm accumulated before the tax reform) with lower taxed debt. This tax-arbitrage behaviour might provide an incentive for the Dutch tax authorities to proceed carefully in allowing firms to repurchase shares, even after the tax reform.

Chapter 7
Conclusion

7.1 Introduction

Prior to the tax reform of January 1, 2001, taxpayers in the Netherlands faced considerable incentives and opportunities to engage in tax-arbitrage behaviour. In fact, these opportunities existed mainly because the Dutch tax code only partially implemented the fiscal-neutrality tax principle. Interest payments and dividends were taxed together with labour income at progressive marginal income-tax rates, which satisfied the ability-to-pay tax principle. Capital gains, however, were not taxed. Moreover, only the return on equity-financed investment was taxed under the corporate tax, and pensions, savings through a mutual fund and owner-occupied property were taxed favourably.

These tax-arbitrage opportunities caused efficiency losses because taxpayers were making saving and investment decisions which, in the absence of capital income taxes, would be considered inferior. Their tax-arbitrage behaviour also violated the horizontal equity tax principle, which states that agents who have the same ability to bear the tax burden should pay the same amount of taxes. Tax arbitrage then produced differences in taxes paid, not on the basis of the taxpayers' ability to pay, but because some taxpayers possessed less knowledge about the legal tax-avoidance possibilities or because they possessed fewer financial resources to pay for the legal and financial tax-avoidance assistance. As a result of the tax-arbitrage behaviour, higher incomes did not necessarily pay a higher proportion of their income as taxes (vertical equity tax principle). Tax-arbitrage behaviour thus undermined the progressivity of the Dutch capital-income-tax system. Tax-arbitrage behaviour hindered the enforcement ability of the Dutch tax authorities and limited the possibilities for the authorities to raise tax revenues.

Because the agents' tax-arbitrage behaviour before the Dutch tax reform strongly violated the general principles of sound tax policy, the Dutch tax authorities decided to change the tax treatment of (personal) capital income in a fundamental way.

Starting from January 1, 2001, all personally held assets, such as deposits, stocks, bonds and real estate (except owner-occupied property) are assumed to earn a return of 4%. This return is taxed at a proportional tax rate of 30%. The assets' actual income is therefore no longer relevant under the new capital-income-tax system. The presumptive capital income tax is then in fact a net wealth tax of 1.2%.

This thesis studied the incentives provided by the Dutch capital-income-tax system to engage in tax-arbitrage behaviour. The analysis discussed the tax-arbitrage behaviour of firms, households and intermediaries (mutual funds and pension funds) before and after the

Dutch tax reform of January 1, 2001. Did the capital-income-tax reform reduce distortions or did it create additional distortions? The conclusions of this analysis are presented in *section 7.3*, which evaluates the tax reform in terms of the general principles of sound tax policy.

In addition to carrying out the tax analysis, this thesis adjusted and extended the models that are typically used to study tax-arbitrage behaviour. Thus, the analysis extended the King – Fullerton (1984) method for deriving marginal effective tax rates. Sinn's (1991a) dynamic finance and investment model of the firm, which is used to derive the agents' optimal tax-arbitrage behaviour, was also extended. The main contributions with respect to these methods are summarised in *section 7.2*.

Section 7.4 presents alternative tax reforms. The analysis focuses on the consumption type of tax reform and the income type of tax reform. Finally, *section 7.5* presents ideas for further research.

7.2 Extending the methods to study tax-arbitrage behaviour

Tax-arbitrage behaviour can be studied by deriving the tax burden on savings and investments without taking into account the agents' optimal response to the capital-income-tax system. Agents, who are assumed to minimise their tax liabilities, will save and invest in the opportunities with the lowest tax burden. A comparison of the tax burdens across the saving and investment opportunities permits inference of the agents' tax-arbitrage behaviour. The King – Fullerton (1984) method determines the tax burden by deriving marginal effective tax rates, which measure the tax burdens on marginal saving and investment opportunities.

The analysis in chapter 2 extends the King – Fullerton (1984) method by explicitly modelling the stream of benefits and costs of the household's investments over time. This approach permits the detailed study of the effect of capital income taxes, particularly the taxes that have to be paid only once (e.g., the transaction tax and the capital gains tax). The extended method clearly distinguishes between the investment's source of finance and the use of the investment's earnings. Moreover, this approach permits the derivation of the increase in the value of the firm's equity (Tobin's q). In case of retained earnings as the source of finance, for instance, the extended method demonstrates that dividend taxes are capitalised in share values. This method also permits calculation of the return on savings that are reinvested for a number of periods. Finally, the method is used to derive expressions for the cost of capital if households face a tax incentive to borrow funds instead of financing investment out of their own funds.

The extended King – Fullerton method suffers from a number of shortcomings, however. The method deals only with dividends and interest payments as uses of the earnings. Moreover, firms do not always have sufficient retained earnings to finance investment. In particular, young (newly founded) firms have to either issue new equity or attract debt. Finally, the model does not explicitly derive the impact of capital income taxes on either the agents' saving and investment (tax-arbitrage) behaviour or the firm's capital accumulation. These shortcomings require a dynamic model.

In order to derive the agents' tax-arbitrage behaviour, the analysis in chapter 3 solves Sinn's (1991a) (partial equilibrium) dynamic framework of a young, newly founded firm that invests until it becomes a mature firm. In Sinn's model, investment is financed only with equity. Chapter 3 introduces debt financing and share repurchases in Sinn's dynamic life-cycle model of the firm. The firm can thus finance investment with debt, newly issued equity or retained earnings. The firm's earnings may be distributed as dividends or as interest payments, or they may be retained and reinvested or used to repurchase shares or redeem debt. The analysis in chapter 3 then determines the firm's optimal source of finance and use of earnings, and derives the cost of capital and the marginal effective tax rates along the entire optimal path.

The firm issues new equity and debt during the initial period. On the one hand, the firm is discouraged from issuing new equity by the prospect of using the cheaper retained earnings as the source of finance. This opportunity cost might increase the cost of capital on investment financed with newly issued equity above the value of King and Fullerton, as demonstrated by Sinn. On the other hand, the firm faces an incentive to issue a sufficiently large amount of new equity so that it can invest as quickly as possible. This gain of newly issued equity might reduce the cost of capital below the value of King and Fullerton.

These results do not extend to debt financing. As long as the investment's return exceeds the interest rate, the firm wants to attract as much debt financing as possible.

Share repurchases increase the cost of an additional unit of debt, which is a weighted average of the present value of foregone dividends and foregone share repurchases. The firm might even prefer newly issued equity to debt in the steady state. In the initial period, the firm continues to issue a nucleus of new equity. Because the cost of capital on newly issued equity is decreasing in the amount of share repurchases, the firm might prefer to forego entirely financing investment with debt. Moreover, an increase in the amount of share repurchases shortens the firm's internal growth phase.

In reality, capital markets do not function perfectly. The firm's finance and investment behaviour and its distribution policy are influenced by financial market imperfections as a result of adverse selection and moral hazard. In order to analyse the effects of financial market imperfections on the agents' tax-arbitrage behaviour, chapter 4 incorporates some of the financial market imperfections in Sinn's (extended) life-cycle model of the firm.

Adverse selection in the debt and equity markets gives rise to an implicit tax wedge between the cost of internal and external sources of finance, which implies a 'finance pecking order'. This finance pecking order then strengthens the tax-arbitrage behaviour as a result of the tax pecking order (if capital gains are taxed at lower rates than interest payments and dividends). The newly founded firm will thus issue even less new equity and will attract less debt. Because the steady-state cost of capital and capital stock are not affected, the firm's internal growth phase will lengthen with adverse selection.

Chapter 4 also analyses the 'traditional' view (as opposed to the 'new' view) of dividend taxation, and incorporates a minimum dividend constraint in Sinn's life-cycle model of the firm. The analysis demonstrates that the results of the traditional view are strongly determined by its assumption that newly issued equity is the firm's marginal source of finance. This imposes strong conditions on the firm's production function. The amount of profitable investment opportunities in every period must be larger than the available retained

earnings. Otherwise, the firm has an incentive to issue only a nucleus of new equity in order to take advantage of the cheaper retained earnings as the source of finance, which yields the new view of dividend taxation. Consequently, the predictions of both the traditional and the new view are correct regarding the effects of a reduction in the dividend tax. The outcome depends, however, on the underlying production function and the available investment opportunities of the firm.

7.3 Evaluating the Dutch tax reform

The most significant component of the Dutch tax reform of January 1, 2001 is the change in the tax levied on income from savings and investments. The household's actual return on personal wealth (except owner-occupied property), which is received as dividends or as interest payments, no longer falls under the progressive personal income tax. The old wealth tax is gone. These taxes have been replaced by the presumptive capital income tax.

- ***The effects of the tax reform***

The tax reform increases the after-tax real rate of return on direct corporate investment, which no longer depends on the household's labour income and marginal income-tax rate. As a result, also the required yield on other investment opportunities increases.

Internal versus external equity

Since equity-financed investment is taxed under the presumptive capital income tax, the tax reform strongly increases the cost of capital on corporate investment financed with retained earnings. In fact, the tax burden on external equity no longer exceeds the tax burden on internal equity. The firm's (retained) earnings are then no longer locked within the firm and invested in projects that yield a lower before-tax real rate of return than can be obtained elsewhere. Consequently, resources are no longer misallocated. The absence of tax-induced incentives to defer dividend taxes implies that the firm no longer passes through an internal growth phase. The firm will directly attract the optimal steady-state capital stock. The tax code then no longer inhibits the entry of new firms. The Dutch tax reform actually puts an end to the tax-induced competitive disadvantage of firms that do not possess enough earnings to finance the available investment opportunities (for instance young, newly founded firms).

Debt versus equity

After the tax reform, the corporate tax discrimination of equity at the firm level (in contrast to debt, because interest payments are deductible from taxable earnings) is no longer compensated by a tax advantage of capital gains at the household level (the absence of a capital gains tax in contrast to the progressive personal income tax on interest payments before the tax reform). Debt therefore becomes unambiguously the corporate firm's most tax-preferred source of finance.

Corporate firms that cannot attract debt thus suffer a tax-induced competitive disadvantage compared to corporate firms that face no borrowing costs. (Firms may find it difficult to borrow because, for instance, they lack a high credit rating, own firm-specific assets against

which it is difficult to borrow, or have insufficient taxable earnings to be able to deduct all interest (Cnossen (1996))). After the tax reform, young newly founded corporate firms that cannot attract debt thus continue to face a tax-induced competitive disadvantage.
The tax reform raises the corporate firm's marginal steady-state cost of capital. Corporate firms after the tax reform are thus characterised by a lower steady-state capital stock.

Adverse selection in the corporate debt and equity markets
In light of adverse selection in the equity market, the cost of newly issued equity exceeds the cost of retained earnings. After the tax reform, the presence of adverse selection in the debt market might reverse the strong preference for debt. Consequently, even after the tax reform, retained earnings might be the corporate firm's most preferred source of finance. Similarly to the outcome before the tax reform, corporate firms that have to attract external sources of finance then face a competitive disadvantage compared to mature firms with earnings from old capital.

Investment projects
As a result of the (unchanged) tax treatment of depreciation, the Dutch capital-income-tax system before and after the tax reform of January 1, 2001 favours investment in intangible assets over investment in machinery, equipment and means of transportation. The latter investment opportunities, in turn, are tax-favoured compared to investment in buildings.

Household saving strategies
Indirect household saving through a mutual fund is no longer an attractive saving vehicle. Pension savings are still taxed favourably, however. Moreover, the tax reform does not affect the incentive of intermediaries to invest in the debt instead of the equity of the corporate firm. Investment in owner-occupied property continues to be taxed favourably as well. In fact, after the tax reform, the household faces an even stronger incentive to finance investment in owner-occupied housing with borrowed funds.

The proprietorship
The Dutch tax reform has increased the cost of capital on equity-financed investment in the proprietorship. As a direct consequence, the tax-preferred source of finance for the traditional proprietor changes from equity to debt. Debt remains the most attractive source of finance for the innovative proprietor. As a result, proprietors no longer face a tax incentive to accumulate their funds inside the proprietorship. Instead, they borrow to finance the investment in the proprietorship. The proprietor's funds will then be invested as personal wealth in, for instance, corporate debt.

The closely held corporation
Debt becomes the controlling shareholder's most tax-preferred source of finance. Consequently, the controlling shareholder no longer faces a tax incentive to accumulate his funds inside the closely held corporation.
Because the tax reform reduces the tax burden on equity-financed investment in the proprietorship, the entrepreneur after the tax reform might prefer the proprietorship over the closely held corporation as legal form.

- ***Evaluating the tax reform in terms of the general principles of sound tax policy***

As a result of the Dutch tax reform of January 1, 2001, (publicly held) corporate firms have become indifferent between newly issued equity and retained earnings as the source of finance (ignoring both the minor impact of the tax on the value of the newly issued equity and the effects of adverse selection in the equity market). Moreover, households are now indifferent between dividends and capital gains as use of profits. Because households, under the new capital-income-tax system, have no longer an incentive to transform (highly taxed) dividends and interest payments into (untaxed) capital gains, saving through a mutual fund, for instance, is no longer a tax-favoured saving vehicle. The tax reform thus diminishes the tax-arbitrage opportunities at the household level, thereby strengthening the tax code's horizontal equity. The capital-income-tax reform levels the playing field. Households that engage less actively in tax-arbitrage behaviour no longer pay more taxes than households who actively attempt to minimise their tax liabilities.
By limiting the tax-arbitrage opportunities at the household level, the Dutch tax authorities ensure that the government raises more revenues from taxing capital income at the household level.

However, the tax reform has certain drawbacks. Because the presumptive capital income tax is levied irrespective of the savings' actual return, the capital-income-tax system after the reform is no longer able to implement (even only partly) the vertical equity tax principle. Moreover, even after the tax reform, the Dutch capital-income-tax system continues to cause substantial efficiency losses.

The tax code still distorts how businesses determine their sources of finance. Because only interest payments are deductible from a corporate firm's taxable earnings, debt has unambiguously become the corporate firm's most tax-preferred source of finance. The controlling shareholder and the proprietor, moreover, no longer face a tax incentive to accumulate their funds inside their business. They will rather finance investment with debt.
The Dutch tax code continues to distort how businesses choose their legal form and type of investment projects. The tax code also continues to distort the household's choices regarding saving vehicles. Pension savings and debt-financed investment in owner-occupied property are still taxed favourably.

- ***Fundamental tax reform: the next round***

The Dutch tax authorities opted for a tax reform that restores neutrality with respect to newly issued equity and retained earnings as the source of finance (in the absence of adverse selection in the equity market). Yet, after the tax reform, the firm's choice between debt and equity as the source of finance is even more distorted. It could therefore be argued that the Dutch tax authorities, when designing the tax reform, ignored to implement the required neutrality between debt and equity. They also seemed to have ignored neutrality between the businesses' legal forms. Consequently, this tax analysis of the Dutch tax reform of January 1, 2001 illustrates that fundamental tax reform is rarely successful if the distortions arising from the capital-income- tax system are solved only partly. The analysis in this thesis therefore suggests the need for a further reform of the Dutch capital-income-tax system.

Section 7.4 therefore presents alternative tax reforms. These would restore neutrality between the firm's sources of finance.

7.4 Alternative tax reforms

In attempting to deal with the distortions arising from the Dutch capital-income-tax system, the tax literature considers two approaches: the consumption-tax approach and the income-tax approach.

The consumption type of tax reform no longer taxes the normal return to capital (i.e. the inflation- and risk-adjusted market interest rate) (Cnossen (2001)). The income type of tax reform continues to tax the normal return to capital as well as the economic rents.

As opposed to the presumptive capital income tax, these tax reforms restore neutrality, not only between newly issued equity and retained earnings, but also between equity and debt.

- ***Consumption type of tax reform***

Bradford (1986) suggests that the tension in the capital-income-tax system could be resolved by placing the system on a consistent consumption basis. This type of tax reform might be considered in the Netherlands because saving vehicles such as pensions, life insurance policies (before the Dutch tax reform) and employee and premium saving schemes already fall under the consumption tax, as will be explained below.

This section briefly discusses the Cash-Flow Tax, the Allowance for Corporate Equity (ACE) tax system, the Flat Tax, and the Personal Expenditure Tax.

Cash-Flow Tax

Under the Cash-Flow Tax (which no longer taxes the normal return to capital) only economic rents and entrepreneurial risk premiums are taxed at the business level (Cnossen (2001)). Tax authorities allow no deduction of interest payments from taxable corporate earnings. Firms are allowed, however, an immediate write-off of the cost of business assets. Because of this immediate expensing, the marginal return that the firm realises on its funds is effectively not taxed under the corporate tax (Cnossen (1996)). Moreover, savings are not taxed at the household level under a full consumption tax. In that case, the marginal (corporate) effective tax rate is zero. The firm is then indifferent between debt, newly issued equity or retained earnings as the source of finance. The cost of capital (for all sources of finance) equals the real interest rate.

Allowance for Corporate Equity ACE

Under the Dutch capital-income-tax system (before and after the tax reform), interest payments are deductible from taxable corporate earnings. The return on equity-financed investment, however, is taxed under the corporate tax.

The ACE tax system (IFS Capital Tax Group (1991)) corrects for this differential tax treatment by providing a deductible allowance for corporate equity in computing taxable profits. This allowance equals the product of shareholders' funds and an appropriate nominal interest rate, and therefore approximates normal profits. The corporate tax is thus confined to

pure profits from inframarginal investments (Cnossen (2001)). Corporate equity in excess of the ACE remains subject to corporate tax. Savings are not taxed at the household level under a full consumption tax.
If the nominal interest rate that is applied to calculate the ACE equals the nominal interest rate that is paid as a reward for the debt, then the firm is indifferent between debt, newly issued equity or retained earnings as the marginal source of finance. In all cases, the cost of capital equals the real interest rate net of the gain because the inflation rate can be deducted from taxable corporate earnings as well (it is assumed that actual depreciation occurs at the economic rate of depreciation based on replacement costs (see *section 2.3.2*)).

Flat Tax
The Flat Tax, introduced by Hall and Rabushka, consists of a business tax and an individual compensation tax (Bradford (1986)). This tax (also referred to as the Two-Tiered Cash-Flow Tax) replaces both the individual and corporate income taxes.
In fact, the Cash-Flow Tax and the ACE tax system both form the business cash-flow component of the flat tax (Cnossen (2001)). The business tax is levied on value added (total revenues from sales less purchases of inputs from other firms and purchases of plant and equipment) (Hall and Rabushka (1996)), *less* payments to employees (wages, salaries and pensions) (Bradford (1986)). The business cash-flow is then taxed at a flat rate, without basic exemption.
The individual compensation tax is levied on wages, salaries and pensions (at retirement; pension contributions are not part of wages). Only those earnings above a personal or family allowance are taxed, which makes the tax system progressive (Hall and Rabushka (1995)).
Because the business tax does not tax the normal return to capital, and because households are not taxed on interest, dividends and capital gains, the marginal effective tax rates on the firm's marginal investments equal zero. The firm is then indifferent between debt, newly issued equity or retained earnings as the source of finance.

Personal Expenditure Tax
Under the Personal Expenditure Tax (or Personal Cash-Flow Tax), the household's net savings can be deducted from the household's taxable income (Escolano (1995)). In fact, the treatment of savings distinguishes this tax from the conventional income tax. The Personal Expenditure Tax makes no use at all of a company-level tax (Bradford (1986)).
The current Dutch tax treatment of pension savings is a good example of this consumption tax approach. Because households postpone their consumption, contributions to the pension fund are not taxed. Also the return on the fund's investments is not taxed. However, the retirement benefits (consisting of the original savings and the accumulated return on these savings) become available for consumption and are therefore included in the household's consumption-tax base.
In the absence of a corporate tax, and because the current tax treatment of pension savings is extended to all savings, the marginal effective tax rates on the firm's marginal investments are equal to zero (if the household's marginal income-tax rate at which savings can be deducted from taxable income equals the marginal income-tax rate at which savings, which become available for consumption, are taxed). Again, the firm is indifferent between debt, newly issued equity or retained earnings as the source of finance.

- ***Income type of tax reform***

The second type of tax reform treats the return of saving and investment opportunities as taxable income, but attempts to integrate capital income taxes at the firm and household level. The Comprehensive Business Income Tax (CBIT) and the Dual Income Tax (DIT) are two variants of such a tax system.

Comprehensive business income tax CBIT

The U.S. Treasury Department's (1992) Comprehensive Business Income Tax (CBIT) taxes the return to capital of businesses only once. Under the CBIT, which is a business-level tax (Hubbard (2002)), tax authorities allow no deduction of either interest payments or the return on equity from taxable corporate earnings. Interest payments, dividends and capital gains are no longer taxed at the household level.

Tax treatment of depreciation is similar to the tax treatment under the Dutch capital-income-tax system (before and after the tax reform of January 1, 2001). However, under the CBIT, depreciation allowances follow economic depreciation as closely as possible (Hubbard (2002)).

Under the CBIT, the marginal effective tax rate on investment financed with debt, newly issued equity or retained earnings is equal to the business tax rate. Firms are thus indifferent between debt, newly issued equity and retained earnings as the source of finance.

Dual income tax DIT

Under a Dual Income Tax (DIT), all income is separated into either capital income or labour income. Capital income is taxed at a (low) uniform rate, while labour income continues to be taxed at progressive rates. In fact, the proportional capital-income-tax rate is aligned with the basic marginal tax rate on labour income (Sørensen (2001)).

Under a DIT, the taxable earnings of businesses should correspond to true economic profits. This implies that depreciation allowances follow economic depreciation as closely as possible. Accelerated deprecation schemes and other special deductions from taxable earnings should thus be avoided (Sørensen (2001)).

The return on equity is taxed under the corporate tax, while interest payments are tax deductible. At the household level, interest and dividends are taxed under the capital income tax. Double taxation of distributed profits is prevented through a full imputation system (shareholders are permitted a tax credit against the capital income tax for the corporate tax that can be imputed to the dividends which they received (Cnossen (1993)). Alternatively, double taxation can be avoided by exempting dividend income at the shareholder level (Cnossen (2003)).

Double taxation of retained profits (under the corporate tax and the capital income tax on realised capital gains) is prevented as well. Shareholders are permitted to write up the basis of their shares by retained profits net of corporate tax. As a result, the capital income tax is levied only on capital gains in excess of retained profits that already have borne corporate tax (Sørensen (2001)). Similarly, the taxable basis is written down if the business incurs losses or if the business distributes dividends out of previously accumulated earnings (Cnossen (2003)).

Under a DIT in its most perfect form (and in the absence of inflation and in the presence of economic depreciation allowances based on replacement costs), the marginal effective tax

rate on investment financed with debt, newly issued equity or retained earnings is equal to the (proportional) capital income-tax rate. In this case, firms are indifferent between debt, newly issued equity and retained earnings as the source of finance.

7.5 Further research

This section presents some ideas for further research. It would be interesting to extend the tax analysis in order to measure the tax burden on savings and investments by foreign firms and foreign households. Moreover, the analysis might focus on the tax-induced incentives for Dutch firms and households to save and invest abroad. The tax analysis might be extended with taxes on labour income and social security contributions as well. This extension would permit a more detailed evaluation of the tax burden (after the tax reform) on the proprietorship and the closely held corporation.

Sinn's dynamic finance and investment model assumed a (continuous) concave production function. However, different investment processes (e.g., discrete investment decisions, irreversible investment processes, technology shocks) might be incorporated as well. Sinn's model might also be extended with uncertainty about the investment's return.

Finally, the literature has already studied profoundly the effects of the alternative tax reforms. Introduction of (one of) these tax reforms in the Netherlands, however, would require further research.

Glossary

Ability-to-pay principle: taxes should be the same for people in the same economic position (horizontal equity) and different for people in different economic positions (vertical equity).

Accelerated depreciation allowances: (actual tax) depreciation allowances that are more favourable than economic depreciation allowances.

Actual tax depreciation allowances: the deprecation allowances prescribed by the tax code. (The Dutch tax code prescribes straight-line tax depreciation).

Capital-income-tax system: the rules defined in the tax code concerning the tax treatment of capital income.

Closely held corporation: the corporate firm that is owned by controlling shareholders.

Controlling shareholder: a shareholder who holds a controlling amount of shares (at least 5%) of the corporate firm.

Corporation: the publicly held corporate firm that is owned by ordinary shareholders.

Cost of capital: the minimum required real rate of return an investment must earn in order to be profitable.

Declining-balance depreciation: if the cost of the asset is written down for tax purposes by an amount that declines exponentially over time.

Deferral of tax: a tax strategy whereby income may be deferred or postponed for some period of time.

Depreciation (tax depreciation) allowances: the gain that arises when the firm deducts the depreciation of the investment, computed in one way or another, from taxable earnings.

Direct household savings: savings that are controlled directly by the household.

Economic depreciation: the actual (physical) fall in value of the asset in a given period. (The analysis assumes that the value of the investment project declines exponentially over time).

Economic depreciation allowances: the depreciation allowances that compensate for the actual (physical) fall in value of the asset in a given period. (In the analysis: declining-balance depreciation at the economic rate of depreciation, based on replacement costs).

Efficiency: the principle that states that taxes should distort the agents' economic decisions as little as possible.

Excess burden (efficiency loss, deadweight loss) of a tax: the reduction in the taxpayers' welfare above the welfare loss as a result of the income reduction due to payment of the tax.

Horizontal equity: the principle that states that taxpayers in 'similar circumstances' should pay the same amount of taxes.

Immediate expensing (free depreciation): if the cost of the investment can immediately be deducted from taxable earnings.

Imputed income: income which is not in money form, such as the rental value of owner-occupied housing.

Indirect household savings: household savings that are controlled by intermediaries (mutual funds, pension funds).

Innovative opportunity return: the after-tax return on an indirect investment in corporate debt through a mutual fund.

Intangible assets: assets belonging to a business which are not material. Investment in intangible assets refers to investment in research and development, advertising and other marketing expenses, and company training.

Lock-in effects and capital gains taxation: because capital gains are taxed only when realised, the capital gains tax discourages the realisation of capital gains. Agents induced to hold appreciated assets because of capital gains tax when they otherwise would sell are said to be 'locked in'.

Marginal income tax rate: the additional income tax payable when income increases marginally divided by the marginal increase in income.

Marginal effective tax rate: the additional tax that has to be paid if the tax base increases marginally. Marginal effective tax rates measure the tax burden on marginal saving and investment opportunities.
The corporate marginal effective tax rate measures the tax burden on a marginal investment opportunity (only) at the corporate level.
The marginal effective tax rate at the household level measures the tax burden on a marginal saving opportunity (only) at the household level.

Marginal saving and investment opportunities: saving and investment opportunities that yield a return equal to the investor's opportunity cost, which is the return the agent could realise if he would invest in an alternative project.

Mutual fund: the intermediary that reinvests the household's savings for a number of periods.

Neutral taxes: taxes that have no excess burden.

Pension fund: the intermediary through which the household saves for a pension.

Presumptive capital income tax: a proportional tax levied on a predetermined return, irrespective of the savings' and investments' actual return.

Progressive income tax: a tax under which the average rate of tax increases with income.

Proportional income tax: a tax under which the average rate of tax is constant.

Proprietor: the self-employed individual.

Proprietorship: a firm owned and operated by a single individual or family.

Regressive income tax: a tax under which the average rate of tax decreases with income.

Straight-line depreciation: if the historical cost of the asset is written down for tax purposes by a fixed percentage per unit of investment in each year.

Tax-arbitrage behaviour: when economic agents change their saving and investment behaviour in order to minimise their tax liabilities (to maximise the tax advantages offered by the tax authorities).

Tax burden: the claim on consumption, income or wealth resulting from the imposition of a tax.

Tax compliance: the extent to which taxpayers comply with tax laws.

Tax enforcement: the extent to which tax authorities make sure that tax rules are obeyed.

Tobin's q: the (marginal) increase in value of the firm's equity as a result of a marginal unit of investment.

Traditional opportunity return: the after-tax return on a direct investment in corporate debt.

Vertical equity: the principle that states that taxpayers with 'the better circumstances' should bear more of the tax burden.

Chapter 2 list of symbols

General symbols

t_e	marginal effective tax rate
t_c	corporate marginal effective tax rate
t_h	marginal effective tax rate at the household level
V	net present value of a saving/ investment possibility
p	cost of capital/before-tax real rate of return
δ	economic rate of depreciation
r	real interest rate
s	after-tax real rate of return
w	$p-s$
π	inflation rate
t	time index
n	time index
$1/\lambda$	expected holding period of the savings

The household level

τ_{mf}	tax on the mutual fund
τ_{pf}	tax on the pension fund
ρ	household's before-tax nominal rate of return
ρ_H	household's after-tax nominal rate of return
t_y	personal income tax
t_d	personal income tax (at which contributions to pension fund can be deducted)
t_w	wealth tax (on the household's wealth)
t_c	capital gains tax
q	increase in the value of the firm's equity

$$T_c = \frac{\lambda t_c}{\lambda + \rho_H} \qquad T_y = \frac{\lambda t_y}{\lambda + \rho_H}$$

The firm level

ρ^b	nominal return after taxes at the firm level / the firm's discount rate
τ	corporate tax rate
w_c	local property tax on the value of the asset
A	present discounted value of grants and tax allowances
f_1	proportion of the cost of an asset entitled to depreciation allowances
f_2	proportion of the cost of the project qualifying for immediate expensing
f_3	proportion of the cost of the project qualifying for investment subsidies
g	rate of the investment subsidy
A_d	present value of tax savings as a result of depreciation allowances
L	lifetime tax of the asset
a	tax (fiscal) depreciation rate
B	additional taxes that increase the investment's cost
t_{sf}	tax on the value of the newly issued source of finance
t_p	transaction tax (property transfer tax)

Controlling shareholder/proprietor

t_y^c	controlling shareholder's personal income tax
t_c^c	controlling shareholder's capital gains tax
t_w^c	wealth tax on the controlling shareholder's business wealth
t_y^s	proprietor's income tax
t_w^s	wealth tax on the proprietor's business wealth

Owner-occupied housing

t_p	transaction tax (property transfer tax)
irv	imputed rental values
t_w^h	wealth tax on owner-occupied housing
w_c	local property tax
FC	financing costs
t_w^d	wealth tax on debt
F	finance gain (loss)

List of symbols
Chapter 3 – Chapter 4

General symbols

r	interest rate
t	time index
v	time index
t_1	initial period
t_e	marginal effective tax rate
SS	steady state

The firm level

K	capital
$f(K)$	production function
$f'(K)$	cost of capital
I	investment level
Q	newly issued equity
S_f	newly issued debt
D_f	total debt
τ_d	corporate tax on distributed profits
τ_r	corporate tax on retained profits
θ_d	$1-\tau_d$
θ_r	$1-\tau_r$
M	market value of the shares
m	correct value (price) per share
$\overline{m}$	expected value per share
z	number of outstanding shares
π^d	gross dividends
$q_K(t)$	$\frac{\partial M(t)}{\partial K(t)}$, the marginal increase in value of the firm's equity as a result of an additional unit of capital
$q_D(t)$	$\frac{\partial M(t)}{\partial D_f(t)}$, the marginal increase in value of the firm's equity as a result of an additional unit of debt
α	maximum debt-capital ratio
β	partial production elasticity of capital
ω	hidden factor's partial production elasticity
σ	Hicksian elasticity of substitution between capital and the hidden production factor
τ_{mf}	tax on the dividends and the interest payments that the mutual fund receives
R	share repurchases
X	$= f(K) - rD_f + \frac{1}{\theta_r}(S_f + Q - I)$
γ	restriction on the allowed share repurchases
Ω^e	lemons premium because of adverse selection in the equity market
Ω^d	lemons premium because of adverse selection in the credit market
p	risk premium on equity
ξ	dividend payout rate

The household level

τ_p	personal income tax on dividends and interest income
τ_p^e	personal income tax on dividends
τ_p^d	personal income tax on interest income
τ_c	capital gains tax (on accrual)
t_w	wealth tax
θ_p	$1-\tau_p$
θ_p^e	$1-\tau_p^e$
θ_p^d	$1-\tau_p^d$
θ_c	$1-\tau_c$

Chapter 5 – Chapter 6 tax rates and parameters

A. TAX RATES AND PARAMETERS BEFORE THE TAX REFORM of 01/01/2001

Opportunity return: traditional household: income taxed as personal income
innovative household: income taxed at: τ_{mf} = 35%

	personal income	**business income**	**personal wealth**	**business wealth**
	dividends, rents, labour income, pensions and imputed rental value		marginal wealth tax	
Low marginal income tax				
Ordinary shareholder				
- 65	37.95%	-	0%	-
+65	20.05%	-	0%	-
Proprietor	37.95%	debt 37.95%	0%	0%
		equity 37.95 %	0%	0%
Controlling shareholder	37.95%	debt 37.95%	0%	0%
		equity 25% (dividends and capital gains)	0%	0%
Average marginal income tax				
Ordinary shareholder	50%	-	0%	-
			0.7%	-
Proprietor	50%	debt 50%	0%	0%
			0.7%	0.7%
		equity 50%	0%	0%
			0.7%	$(1-100\%)\cdot 0.7\%$
			0.7%	$(1-68\%)\cdot 0.7\%$
Controlling shareholder	50%	debt 50%	0%	0%
			0.7%	0.7%
		equity 25% (dividends and capital gains)	0%	0%
			0.7%	$(1-100\%)\cdot 0.7\%$
			0.7%	$(1-68\%)\cdot 0.7\%$
High marginal income tax				
Ordinary shareholder	60%	-	0.7%	-
Proprietor	60%	debt 60%	0.7%	0.7%
		equity 60%	0.7%	$(1-100\%)\cdot 0.7\%$
			0.7%	$(1-68\%)\cdot 0.7\%$
Controlling shareholder	60%	debt 60%	0.7%	0.7%
		equity 25% (dividends and capital gains)	0.7%	$(1-100\%)\cdot 0.7\%$
			0.7%	$(1-68\%)\cdot 0.7\%$

Additional Taxes

Capital gains tax	t_c = 0%	Local property tax	$w_c = 0.3\%$
Tax on the pension fund	$\tau_{pf} = 0\%$	Wealth tax on owner-occupied housing	$60\% \cdot t_w$
Tax on the mutual fund	$\tau_{mf} = 35\%$	Property transfer (transaction) tax	$t_p = 6\%$
Tax on the value of the newly issued equity	$t_{sf} = 0.9\%$	Imputed rental values	$irv = 1.25\%$

B. TAX RATES AND PARAMETERS AFTER THE TAX REFORM of 01/01/2001

Opportunity return: investment in market debt taxed at the presumptive capital income tax t_w = 1.2%.

	personal income		**business income**	**personal wealth**	**business wealth**
	dividends/rents capital gains BOX III	labour pensions BOX I		marginal wealth tax	
Low marginal income tax					
Ordinary shareholder					
+ 65	0%	19.7%	-	0%	-
- 65	0%	37.6%	-	0%	-
Proprietor	0%		37.6%	0%	0%
Controlling shareholder	0%	37.6%	debt 37.6%	0%	0%
			equity 25% (dividends and capital gains)	0%	0%
Average marginal income tax					
Ordinary shareholder	0%	42%	-	0% 1.2%	- -
Proprietor	0%		42%	0% 1.2%	0% 0%
Controlling shareholder	0%	42%	debt 42%	0% 1.2%	0% 0%
			equity 25% (dividends and capital gains)	0% 1.2%	0% 0%
High marginal income tax					
Ordinary shareholder	0%	52%	-	1.2%	-
Proprietor	0%		52%	1.2%	0%
Controlling shareholder	0%	52%	debt 52%	1.2%	0%
			equity 25% (dividends and capital gains)	1.2%	0%

Additional Taxes

Capital gains tax	t_c = 0%,	Local property tax	$w_c = 0.3\%$
Tax on the pension fund	$\tau_{pf} = 0\%$	Imputed rental values	$irv = 0.8\%$
Property transfer (transaction) tax	$t_p = 6\%$	Tax on the value of newly issued equity	$t_{sf} = 0.55\%$
Wealth tax on owner-occupied housing	0%	Presumptive capital income tax	$t_w = 1.2\%$

C. TAXES AT THE FIRM LEVEL BEFORE AND AFTER THE TAX REFORM of 01/01/2001

Corporate tax rate τ	35%
f_1	1
λ owner-occupied housing	1/40
λ pensions	1/15
λ capital gains of the closely-held corporation	1/6

	type of asset		
	machinery	buildings	free depreciable assets
Tax (straight-line) depreciation in years L *Source: Bovenberg and ter Rele (1998)*	9	25	1
Economic depreciation δ *Source: Bovenberg and ter Rele (1998)*	12.5%	4.1%	12.5%
Transaction (property transfer) tax t_p	0	6%	0
Local property tax (wealth tax w_c on firms)	0	0.3%	0
Percentage immediate expensing f_2 *Source: Bovenberg and ter Rele (1998)*			
• ordinary shareholder	0.5%	0.5%	0
• controlling shareholder	4%	4%	0
• proprietor	7%	7%	0
Weights used to determine (average) cost of capital *Source: Bovenberg and ter Rele (1998)*	47%	31%	22%

Nederlandse Samenvatting (Summary in Dutch)

De spaar- en investeringsbeslissingen van gezinnen en bedrijven worden beïnvloed door de belastingen op kapitaalinkomen. Naast de invloed op de totale hoeveelheid hebben deze belastingen ook een invloed op de allocatie van de besparingen en de investeringen. Spaar- en investeringsmogelijkheden worden vaak gekenmerkt door een verschillende belastingdruk. Belastingbetalers die de door hen verschuldigde belastingen willen minimeren hebben daarom een prikkel om hun spaar- en investeringsgedrag aan deze verschillen in belastingdruk aan te passen. Deze belastingminimerende verschuivingen in besparingen en investeringen noemen we belastingarbitrage.

Dit proefschrift analyseert de prikkels tot belastingarbitrage voor gezinnen, bedrijven en intermediairs ten gevolge van de Nederlandse belastingen op kapitaalinkomen vóór en na de belastinghervorming van 1 januari 2001. De analyse bestudeert of deze belastinghervorming de prikkels tot belastingarbitrage heeft beperkt of versterkt.
Naast deze belastinganalyse past dit proefschrift de methodes aan die vaak worden toegepast in de analyse van het belastingarbitrage gedrag. De analyse breidt de King – Fullerton (1984) methode uit die wordt gebruikt bij het berekenen van marginale effectieve belastingvoeten. Ook Sinn's (1991a) dynamisch financierings- en investeringsmodel van het bedrijf, dat wordt gebruikt bij de afleiding van het optimale arbitrage gedrag, wordt in dit proefschrift uitgebreid.

Uitbreiding van de toegepaste methodes

Belastingbetalers, die worden verondersteld de door hen verschuldigde belastingen te minimeren, maken gebruik van de spaar- en investeringsmogelijkheden die onderworpen zijn aan de laagste belastingdruk. Het vergelijken van de belastingdruk op verschillende spaar- en investeringsmogelijkheden laat toe om het belastingarbitrage gedrag van belastingbetalers impliciet af te leiden. De King – Fullerton (1984) methode bepaalt de belastingdruk door het berekenen van marginale effectieve belastingvoeten die de belastingdruk meten op marginale spaar- en investeringsmogelijkheden.
Hoofdstuk 2 breidt de methode van King – Fullerton (1984) uit door de stroom van ontvangsten en investeringskosten expliciet te modelleren over de tijd. Deze aanpak laat een gedetailleerde analyse toe van de impact van alle belastingen, ook deze die slechts eenmaal moeten worden betaald zoals transactiebelastingen en vermogenswinstbelastingen. De uitbreiding maakt een duidelijk onderscheid tussen de financieringskosten van de investering en de investeringsopbrengsten. Bovendien kan de waardestijging in de aandelen van het

bedrijf worden berekend (Tobin's q). Zo wordt er bijvoorbeeld aangetoond dat, wanneer het bedrijf de investering financiert met ingehouden winsten, de dividendbelasting in de waarde van de aandelen gekapitaliseerd zit. De uitbreiding laat ook toe om de return op besparingen te berekenen die gedurende een aantal jaren worden geherinvesteerd. Tot slot kan deze extensie worden gebruikt bij het berekenen van de kapitaalkost wanneer een gezin een prikkel heeft om de investering te financieren met geleend geld in plaats van het eigen spaargeld aan te wenden.

De uitgebreide King – Fullerton (1984) methode heeft echter een aantal tekortkomingen. De methode focust enkel op dividenden en rentebetalingen als gebruik van de bedrijfsopbrengsten. In de King – Fullerton methode kunnen bedrijven investeringen financieren met schuld, nieuwe aandelen of ingehouden winsten. Bedrijven beschikken echter niet steeds over voldoende ingehouden winsten om de investeringen te financieren. Zo moeten, in het bijzonder, nieuw opgerichte bedrijven nieuwe aandelen uitgeven of schuld aantrekken. Bovendien leidt het model niet expliciet de impact van de belastingen af op het spaar- en investeringsgedrag van bedrijven en gezinnen en op de totale kapitaalaccumulatie van het bedrijf. Het tegemoetkomen aan deze tekortkomingen vereist een dynamisch model.

Hoofdstuk 3 analyseert daarom Sinn's (1991a) dynamisch partieelevenwichtsmodel waarin een jong, nieuw opgericht bedrijf investeert tot het bedrijf volwassen wordt. In Sinn's model worden investeringen echter enkel gefinancierd met aandelen. Hoofdstuk 3 introduceert daarom schuldfinanciering in Sinn's dynamisch levenscyclus model van het bedrijf en introduceert ook de inkoop van eigen aandelen. Het bedrijf kan investeringen dan financieren met schuld, nieuw uitgegeven aandelen of ingehouden winsten. De bedrijfsopbrengsten kunnen worden uitgekeerd als dividenden of rentebetalingen. De opbrengsten kunnen echter ook worden ingehouden voor de financiering van extra investeringen, om aandelen terug te kopen of om schuld af te lossen. De analyse in hoofdstuk 3 bepaalt de optimale financieringsbron voor investeringen en de wijze waarop de bedrijfsopbrengsten optimaal kunnen worden aangewend. De analyse leidt de kapitaalkost en de marginale effectieve belastingvoeten af over heel de levenscyclus van het bedrijf.
Indien vermogenswinsten minder zwaar worden belast dan rentebetalingen en indien dividenden het zwaarst worden belast (zoals vóór de belastinghervorming) zal de levenscyclus van het bedrijf bestaan uit vijf fases (indien er abstractie wordt gemaakt van de mogelijkheid tot inkoop van eigen aandelen). In de eerste fase geeft het bedrijf bij de oprichting nieuwe aandelen en schuld uit. Tijdens de tweede fase financiert het bedrijf de investeringen met schuld en ingehouden winsten. Tijdens de derde fase, wanneer de return op de extra investering gelijk is aan de interestvoet, lost het bedrijf al de uitstaande schuld af. Tijdens de vierde fase worden aanvullende investeringen enkel gefinancierd met ingehouden winsten. En ten slotte, tijdens de vijfde fase, stopt het bedrijf met investeren en keert het alle winsten uit in de vorm van dividenden.
Zoals reeds aangegeven, worden er nieuwe aandelen en schuld uitgegeven bij de oprichting van het bedrijf. Enerzijds heeft het bedrijf een prikkel om zo weinig mogelijk nieuwe aandelen uit te geven zodat het de investeringen kan financieren met goedkopere ingehouden winsten. Deze opportuniteitskost, zoals aangetoond door Sinn, kan leiden tot een kapitaalkost van investeringen gefinancierd met nieuwe aandelen die hoger is dan de waarde volgens King –

Fullerton. Anderzijds heeft het bedrijf een prikkel om een voldoende groot aantal nieuwe aandelen uit te geven zodat het onmiddellijk de investeringen kan financieren, en dus snel opbrengsten kan genereren en dividenden kan uitkeren. Dit voordeel van nieuwe aandelen kan resulteren in een kapitaalkost die lager is dan de waarde die werd afgeleid door King – Fullerton.
Een soortgelijke redenering geldt echter niet voor schuld als financieringsbron. Het bedrijf zal zoveel mogelijk schuld willen aantrekken zolang de return op de investering hoger is dan de interestvoet.
De inkoop van aandelen verhoogt de kost van schuldfinanciering. Deze kost is, ten gevolge van de te betalen interesten, gelijk aan het gewogen gemiddelde van de contante waarde van de niet uitgekeerde dividenden en van de niet ingekochte aandelen. In het evenwicht kan het bedrijf zelfs nieuwe aandelen verkiezen boven schuld. Bij de opstart van het bedrijf zal nog steeds een beperkt aantal aandelen en schuld worden uitgegeven. Het kan echter zelfs optimaal zijn om helemaal geen investeringen te financieren met schuld omdat de kapitaalkost van investeringen gefinancierd met nieuwe aandelen daalt met de mogelijkheid tot inkoop van de eigen aandelen. Een stijging in de mogelijkheid tot inkoop van eigen aandelen impliceert bovendien dat de duur van de interne groeifase van het bedrijf verkort.

In werkelijkheid zijn de kapitaalmarkten echter niet perfect. De financierings- en investeringsbeslissingen en de aanwending van de bedrijfsopbrengsten worden beïnvloed door financiële marktimperfecties ten gevolge van ‘adverse selection’ en ‘moral hazard’ problemen. Hoofdstuk 4 incorporeert een aantal van deze financiële marktimperfecties in Sinn’s levenscyclus model van het bedrijf. De uitbreiding analyseert de effecten van deze financiële marktimperfecties op het belastingarbitrage gedrag.
‘Adverse selection’ in de markten voor aandelen en voor schuld impliceert een impliciete belastingwig tussen de kost van interne en externe financieringsbronnen. Dit kostverschil geeft aanleiding tot een rangorde in de door het bedrijf geprefereerde financieringsbronnen. Deze rangorde versterkt het belastingarbitrage gedrag ten gevolge van de soortgelijke rangorde in de financieringsbronnen ten gevolge van de belastingen (indien vermogens-winsten minder worden belast dan rentebetalingen en dividenden het zwaarst worden belast). Het nieuw opgerichte bedrijf zal nog minder nieuwe aandelen uitgeven en zal minder schuld aantrekken. Omdat het lange termijn evenwicht niet wordt beïnvloed (lange termijn kapitaalkost en kapitaalstock blijven onveranderd) impliceren de ‘adverse selection’ problemen dat de duur van de interne groeifase van het bedrijf zal toenemen.
Hoofdstuk 4 analyseert ook de ‘traditionele’ visie op dividendbelastingen en voegt in Sinn’s levenscyclus model een extra randvoorwaarde in, die het bedrijf verplicht tot distributie van een minimum aantal dividenden in elke periode. De analyse toont aan dat de resultaten van de traditionele visie sterk worden bepaald door de onderliggende assumptie dat nieuw uitgegeven aandelen de marginale financieringsbron van het bedrijf zijn. Deze assumptie impliceert dat de winstgevende investeringsmogelijkheden in elke periode groter moeten zijn dan de ingehouden winsten. Anders heeft het bedrijf een prikkel om een beperkt aantal nieuwe aandelen uit te geven om zo gebruik te maken van de goedkopere ingehouden winsten als financieringsbron (deze strategie impliceert de ‘nieuwe’ visie op dividend-belastingen). Deze analyse impliceert dat de voorspellingen van zowel de traditionele visie als van de nieuwe visie met betrekking tot een daling van de dividendbelasting correct zijn.

De impact van de belastingdaling is echter afhankelijk van het aantal winstgevende investeringsopportuniteiten (in elke periode) voor het bedrijf.

Distorsies vóór de belastinghervorming van 1 januari 2001

Het Nederlandse belastingstelsel vóór de hervorming van 1 januari 2001 belastte bedrijfsopbrengsten min rentebetalingen onder de vennootschapsbelasting. Dividenden en rentebetalingen werden op gezinsniveau belast onder de progressieve inkomensbelasting. Gerealiseerde vermogenswinsten werden op gezinsniveau niet extra belast.
Door deze verschillen in de fiscale behandeling van rentebetalingen, dividenden en vermogenswinsten verstoorde het Nederlandse belastingstelsel de financieringsbeslissingen van vennootschappen en verstoorde het de aanwending van de bedrijfsopbrengsten. Bovendien had het belastingstelsel een impact op de marktintrede van het aantal nieuwe ondernemers en op de marktdynamiek.

Ook bij een aanmerkelijk belanghouder (er is sprake van een 'aanmerkelijk belang' wanneer een aandeelhouder minstens 5% van de aandelen van de vennootschap bezit) worden de bedrijfsopbrengsten min de rentebetalingen belast onder de vennootschapsbelasting. De dividenden en de gerealiseerde vermogenswinsten worden vervolgens belast onder het speciale tarief van 25%. De rentebetalingen worden enkel belast onder het progressieve inkomensbelastingtarief. Opbrengsten van investeringen door de zelfstandige worden belast onder de progressieve inkomensbelasting. Rentebetalingen zijn echter ook hier fiscaal aftrekbaar.
Door deze verschillen in de fiscale regelgeving verstoorde het Nederlandse belastingstelsel de financieringsbeslissingen van zowel besloten vennootschappen als van éénmanszaken. Het belastingstelsel verstoorde ook de manier waarop deze bedrijven hun opbrengsten gebruikten. Bovendien beïnvloedde het Nederlandse belastingstelsel de legale vorm die door bedrijven werd verkozen.

Gezinnen kunnen rechtstreeks sparen in schuld en aandelen van vennootschappen. Gezinnen die echter de progressieve inkomensbelasting op dividenden en rentebetalingen willen vermijden, kunnen sparen via een vermogensgroeifonds of een pensioenfonds. Het groeifonds wordt belast op de opbrengst van de beleggingen, die worden ingehouden en geherinvesteerd, met een laag proportioneel tarief. De belastingbetaler wordt echter niet meer belast op de vermogenswinsten wanneer het de aandelen van het groeifonds verkoopt. Gezinnen kunnen ook sparen voor een pensioen via een pensioenfonds. Deze besparingen zijn aftrekbaar van het belastbare inkomen. Het pensioen wordt echter volledig belast onder de progressieve inkomensbelasting, maar het pensioenfonds wordt niet belast. Bovendien worden ook investeringen in de eigen zelfbewoonde woning gunstig belast.
Vóór de belastinghervorming verstoorde het Nederlandse belastingstelsel de spaarbeslissingen van gezinnen. En dit tengevolge van de verschillen in de fiscale regelgeving met betrekking tot directe gezinsbesparingen, besparingen via een vermogensgroeifonds of een pensioenfonds en investeringen in de eigen zelfbewoonde woning.

Belastingbetalers kunnen besparingen financieren met geleend geld. Vóór de belastinghervorming waren de interestbetalingen vaak aftrekbaar van het belastbare inkomen aan het progressieve inkomensbelastingtarief. Het belastingstelsel verstoorde bijgevolg de beslissing om besparingen te financieren met eigen of geleend geld.

De belastinghervorming van 1 januari 2001

Vóór de belastinghervorming van 1 januari 2001 hadden belastingbetalers dus heel wat prikkels om over te gaan tot belastingarbitrage. De hierboven besproken distorsies leidden tot de hervorming van de belastingen op kapitaalinkomen.

De belangrijkste component van de hervorming van de belastingen op kapitaalinkomen is de verandering in de belasting op dividenden en rentebetalingen op het gezinsniveau. Deze worden niet meer belast onder de progressieve inkomensbelasting. De fiscus veronderstelt dat het persoonlijk vermogen van de belastingbetaler een opbrengst genereert van 4%. Deze opbrengst wordt vervolgens belast aan een proportioneel tarief van 30%. Het werkelijk genoten inkomen wordt bijgevolg niet meer belast. Bovendien wordt ook de oude vermogensbelasting afgeschaft. De nieuwe vermogensrendementsheffing kan echter worden beschouwd als een impliciete vermogensbelasting van 1.2%.
Belastingbetalers kunnen besparingen financieren met geleend geld. Het geleende geld, behalve de hypothecaire leningen voor de investering in de eigen zelfbewoonde woning, is aftrekbaar van het persoonlijk vermogen dat wordt belast onder de vermogens-rendementsheffing. Enkel de interestbetalingen tengevolge van schuldgefinancierde investeringen in de eigen zelfbewoonde woning zijn nog aftrekbaar van het inkomen dat wordt belast onder de progressieve inkomensbelasting.

De belastinghervorming heeft geen impact op de fiscale behandeling van schuld en aandelen op het bedrijfsniveau, zowel bij vennootschappen als bij eenmanszaken (behalve dan de daling in de marginale inkomensbelastingtarieven). Pensioenen en investeringen in de eigen woning blijven genieten van een gunstige fiscale behandeling.

Evaluatie van de belastinghervorming

De belastinghervorming verhoogt de reële return na belastingen van directe investeringen in de vennootschap. Deze return is niet langer afhankelijk van de hoogte van het arbeidsinkomen en van het marginale inkomensbelastingtarief van het gezin. Deze stijging impliceert dan ook een stijging van de door de belastingbetaler geëiste opbrengst in andere investeringsopportuniteiten.

Interne versus externe aandelenfinanciering

De belastinghervorming verhoogt de kapitaalkost van investeringen gefinancierd met ingehouden winsten; ook deze investeringen worden belast met de vermogens-rendementsheffing. De belastingdruk op investeringen gefinancierd met nieuwe aandelen is niet meer hoger dan de belastingdruk op investeringen gefinancierd met ingehouden

winsten. Bijgevolg zitten deze ingehouden winsten niet meer vast in de vennootschap en worden zij niet langer meer in projecten met een lage opbrengst geïnvesteerd (vóór de hervorming had de vennootschap een prikkel om winsten te herinvesteren zodat de dividendbelasting zolang mogelijk kon worden uitgesteld). Het belastingstelsel verstoort bijgevolg niet langer de allocatie van de bedrijfsopbrengsten. De afwezigheid van belastingprikkels om de dividendbelasting uit te stellen impliceert dat de vennootschap onmiddellijk de optimale kapitaalstock zal aantrekken. De vennootschap zal dus niet langer meer gekenmerkt worden door interne groeifases. Dit impliceert dat de markttoegang voor jonge, nieuw opgerichte bedrijven niet langer meer wordt belemmerd door het belastingstelsel. De belastinghervorming zorgt er dus voor dat vennootschappen die niet over voldoende winsten beschikken om investeringen te financieren niet langer meer worden benadeeld door het belastingstelsel.

Schuld versus aandelen

Na de belastinghervorming wordt de belastingdiscriminatie van aandelen op het bedrijfsniveau (ten opzichte van schuld, want enkel interesten zijn aftrekbaar onder de vennootschapsbelasting) niet langer meer gecompenseerd door een belastingvoordeel op het gezinsniveau (de afwezigheid van een vermogenswinstbelasting in tegenstelling tot de progressieve inkomensbelasting op rentebetalingen vóór de hervorming). Het belastingstelsel zorgt er daarom eenduidig voor, dat schuld de meest verkozen financieringsbron wordt. Bijgevolg worden vennootschappen die geen schuld kunnen aantrekken door het belastingstelsel benadeeld. Jonge, nieuw opgerichte bedrijven die beperkt zijn in het aantrekken van schuld hebben dus ook na de belastinghervorming een concurrentieel nadeel (ten opzichte van bedrijven die geen kredietbeperkingen kennen).
De belastinghervorming zorgt voor een stijging van de kapitaalkost (van met ingehouden winsten gefinancierde investeringen). Daarom wordt het lange termijn evenwicht van volwassen vennootschappen na de belastinghervorming gekenmerkt door een lagere kapitaalstock.

'Adverse selection' in de schuld en aandelenmarkten

'Adverse selection' in de aandelenmarkt impliceert dat de kost van nieuw uitgegeven aandelen hoger is dan de kost van ingehouden winsten. 'Adverse selection' in de markt voor schuld kan er zelfs voor zorgen dat niet schuld maar ingehouden winsten de meest geprefereerde financieringsbron is na de belastinghervorming. Net zoals vóór de belastinghervorming hebben vennootschappen die externe financiering moeten aantrekken dan een concurrentieel nadeel ten opzichte van bedrijven die voldoende opbrengsten genereren om de investeringen te financieren.

Investeringsprojecten

De belastinghervorming verandert de fiscale behandeling van afschrijvingen niet. Het Nederlandse belastingstelsel, vóór en na de hervorming, begunstigt investeringen in immateriële activa ten opzichte van investeringen in machines, uitrustingen en transportmiddelen. Investeringen in gebouwen worden door het belastingstelsel het minst gunstig behandeld.

Spaarstrategieën voor het gezin
Besparingen via een vermogensgroeifonds verliezen door de belastinghervorming hun fiscale aantrekkingskracht. Sparen voor een pensioen en investeringen in de eigen zelfbewoonde woning blijven echter ook na de hervorming fiscaal aantrekkelijk. De belastinghervorming geeft de belastingbetalers zelfs een grotere prikkel om investeringen in de eigen woning te financieren met geleend geld dan vóór de hervorming. Intermediairs blijven schuld boven aandelen verkiezen.

De eenmanszaak
De belastinghervorming verhoogt de kapitaalkost van investeringen in de eenmanszaak die worden gefinancierd met eigen vermogen. Dit impliceert dat zelfstandigen na de hervorming schuld beginnen verkiezen boven eigen vermogen als financieringsbron van investeringen in de eenmanszaak.

De aanmerkelijk belanghouder
Ook de aanmerkelijk belanghouder verkiest na de belastinghervorming schuld boven aandelen als financieringsbron (ingehouden winsten blijven verkozen boven nieuwe aandelen). De aanmerkelijk belanghouder heeft na de belastinghervorming dus geen prikkel meer om de eigen fondsen in de besloten vennootschap te investeren.
Omdat de belastinghervorming de belastingdruk op investeringen in de eenmanszaak gefinancierd met eigen vermogen verlaagt, heeft de ondernemer na de belastinghervorming eventueel zelfs een prikkel om de eenmanszaak te verkiezen boven de besloten vennootschap als ondernemingsvorm.

Belastinghervorming: de volgende ronde

Het belangrijkste gevolg van de Nederlandse hervorming van de belastingen op kapitaalinkomen van 1 januari 2001 is dat vennootschappen indifferent zijn tussen nieuwe aandelen en ingehouden winsten als financieringsbron (we maken abstractie van eventuele 'adverse selection' problemen), en dat gezinnen indifferent zijn tussen dividenden en vermogenswinsten. Aangezien gezinnen geen prikkel meer hebben om zwaar belaste dividenden om te zetten in onbelaste vermogenswinsten, verliezen besparingen via een vermogensgroeifonds hun fiscale aantrekkingskracht. De belastinghervorming vermindert daarom de prikkels tot belastingarbitrage.

Er zijn echter ook na de hervorming nog heel wat distorsies en mogelijkheden tot belastingarbitrage, zowel op het bedrijfsniveau als op het gezinsniveau. Zo blijft het belastingstelsel de financieringsbeslissingen van bedrijven verstoren. Omdat enkel interestbetalingen aftrekbaar zijn van de vennootschapsbelasting wordt schuld de geprefereerde financieringsbron voor alle ondernemingen (vennootschappen, besloten vennootschappen en eenmanszaken). Bovendien blijft het belastingstelsel de ondernemingsvorm van bedrijven en het type van investeringsproject verstoren. Tenslotte blijven ook besparingen voor een pensioen en met schuld gefinancierde investeringen in de eigen zelfbewoonde woning genieten van een gunstige fiscale wetgeving.

De Nederlandse fiscus heeft voor een belastinghervorming gekozen die de neutraliteit tussen nieuw uitgegeven aandelen en ingehouden winsten als financieringsbron herstelt (in de afwezigheid van 'adverse selection' problemen). Na de hervorming wordt de keuze tussen schuld en aandelen echter nog sterker verstoord dan vóór de hervorming. Er kan daarom worden geargumenteerd dat de Nederlandse fiscus de vereiste neutraliteit tussen aandelen en schuld uit het oog heeft verloren. Net hetzelfde kan worden gezegd over de gewenste neutraliteit tussen de verschillende ondernemingsvormen.

De Nederlandse belastinghervorming van 1 januari 2001 toont daarom aan dat fundamentele belastinghervormingen zelden succesvol zijn indien de distorsies ten gevolge van de belastingen op kapitaalinkomen slechts partieel worden opgelost. De analyse in deze thesis suggereert daarom de noodzaak van een volgende ronde in de hervorming van de belastingen op kapitaalinkomen in Nederland.

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