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Abstract

This paper analyzes the likely economic consequences of a specific proposal for corporate income tax reform in Switzerland that is based on the recent ERU (2001) report. The proposal includes a partial dividend tax relief, more effective taxation of capital gains, and a property tax reduction, all relating to qualified stakes in corporate firms. Based on an analytical and quantitative analysis, we find that the reform removes an important tax barrier against dividend payments, reduces the cost of equity capital, thereby reduces debt leverage and encourages investment in the corporate sector. In stimulating transitional growth towards higher long-run income levels, the reform expands tax bases and thereby becomes considerably less costly in the long-run. A sensitivity analysis shows that the quantitative results are rather robust.[1]

Keywords

Tax reform, financial policy, organizational choice, dynamic general equilibrium modeling.

JEL Classification

C68, G32, H25

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1. INTRODUCTION

One of the important characteristics of corporate income taxation in Switzerland is the double taxation of distributed profits. Retained earnings, in contrast, are in many cases taxed only once since capital gains remain in principle tax free at the investor level. Although the tax administration has developed a number of special cases that require to declare realized capital gains as part of taxable personal income, the taxation of capital gains remains rather ineffective.[1] These two features create important problems with equity and efficiency in the taxation of business income. Industry representatives have since long complained about the double taxation of dividends on corporate and personal levels. On the other hand, the non-taxation of capital gains at the personal level is an obvious violation of the principle of equitable taxation, and was correspondingly recognized as a tax loophole by the EXPERTENKOMMISSION STEUERLÜCKEN (1998).

The large increases in stock prices in the late 90s that presumably allowed some wealthy individuals to realize capital gains tax free, led the labor unions to initiate a referendum which requested the introduction of a general capital gains tax. The proposal was turned down in November 2001. The government in fact conceded that the absence of an effective taxation of capital gains violates the principle of equitable taxation. However, it opposed the referendum on the grounds that a capital gains tax should only be considered as part of an overall reform of corporate income taxation, see BUNDESRAT (2000). It called for an investigation by an expert commission which delivered its report in 2001, see ERU (2001). The commission's key proposal was to introduce a more narrowly defined capital gains tax on corporate equity (Beteiligungsgewinnsteuer) in exchange for dividend tax relief which should partly eliminate the double taxation of dividends.

Based on the ERU (2001) report, the administration has by now formulated an official reform proposal that considers a more effective taxation of capital gains from equity ownership in exchange for a dividend tax relief.[2] Specifically, owners must declare under the new treatment only 60% of dividends received (fully taxed until now) but must also add 60% of capital gains (mostly tax free until now) to taxable personal income. As a complementary measure, the proposal also offers a business related property tax relief where individuals need to add only 60% of the value of their qualified share holdings to taxable private property, instead of 100% up to now. These measures apply only for qualified stakes in corporate firms where either the owner's share in the firm exceeds 5% of the total or attains a value in excess of one Mio. CHF. The personal tax treatment of non-qualified shareholdings remains unchanged. The tax reform initiative thus combines elements of tax relief with a tax increase. The net effect is not

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[1] These cases are discussed, for example, in BUNDESRAT (2000) and in EXPERTENKOMMISSION STEUERLÜCKEN (1998). For example, companies that realize capital gains, and qualified traders must add capital gains to their taxable income.

[2] The essential elements of the proposal are described in DIGERONIMO (2002).

readily determined and apparently depends on the financial structure of the corporate sector. The authors were asked to provide a quantitative evaluation of the short- and long-run economic effects of the reform which resulted in the report by KEUSCHNIGG and DIETZ (2002).

The reform clearly intends to implement a more equitable taxation of dividends and capital gains but also aims at some important efficiency gains. First, the reform should strengthen incentives to invest by removing tax barriers to investment and improve the quality of Switzerland as a location for international investment. Although tax rates are low compared to other neighboring countries,[3] the lacking growth performance in recent years has spurred a discussion about the competitiveness of the Swiss economy in general and the tax system in particular.[4] The reform should thus reduce or, at least, not increase the effective marginal tax rate on investment. Second, the reform aims at a more neutral tax treatment of external and internal equity finance. The double taxation of dividends and the ineffective taxation of capital gains creates a strong incentive for Swiss companies to retain free cash flow and finance investments internally, instead of paying out dividends and financing with external equity capital. The differential treatment of dividends and capital gains is said to be responsible for the traditionally low pay-out ratios of Swiss companies. If firms follow an optimizing dividend policy, such preferential tax treatment is surely an efficiency reducing tax distortion that raises the cost of capital and inhibits investment. Correspondingly, a more neutral tax treatment of dividends and retained earnings would reduce the cost of equity capital, encourage investment and thereby boost income and welfare.

Third, the proposed reform is also expected to affect to some extent the firm's capital structure. Note that any given statutory tax rate applied to capital gains is less distorting than the same statutory rate applied to dividends. The capital gains tax is paid only upon realization so that the unrealized gains remain untaxed during the holding period. The ability to postpone tax payment until realization of the asset gives a tax credit with zero interest cost and thereby creates a tendency to avoid realization (lock-in effect). For the same reason, the *effective* tax rate on capital gains is much lower than the statutory rate. The dividend tax, in contrast, is paid instantaneously. Consequently, the dividend tax reduction counts as a full tax cut while the effect of the capital gains tax increase is discounted due to the tax postponement effect of the realization principle. When the dividend tax cut dominates over the capital gains tax increase, the net effect is likely to result in a lower cost of equity capital. The cost of debt finance, in contrast, is not affected by the reform. It depends on the corporate income tax and the personal tax on interest income which both remain unchanged. As the cost of equity capital declines relative to the cost of debt finance, the reform should lead firms to shift to some extent from debt and to equity finance. For this reason, the proposed reform is expected to strengthen the equity base of corporate firms and to moderately reduce their reliance on debt finance.

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[3] See GUTEKUNST and SCHWAGER (2001).

[4] SECO (2002) mentions that corporate income tax reform is an important policy area to boost sustained growth.

Finally, the tax reform applies only to the corporate sector while the taxation of sole proprietors of personal firms remains unaffected. One of the motivations of the expert study ERU (2001) was to investigate whether the current tax system holds a systematic bias against incorporation. In Switzerland, about 70% of employment is in the corporate sector. Assuming that there is a natural organizational form for each firm that allows for a maximum earnings potential, such a tax bias could prevent some firms to adopt the corporate form even though their earnings potential before taxes would benefit from incorporation. After all, larger firms almost exclusively rely on the corporate form while very small firms remain to a large extent as a personal proprietorship subject to normal income taxation. In between there is a fringe of firms for whom the decision to incorporate becomes a relevant economic choice. The econometric study of MACKIE-MASON and GORDON (1997), for example, found that the choice of organizational form is clearly sensitive to tax differentials, see also GOOLSBEE (2002), and that the tax distortion of organizational choice causes an excess burden of approximately 16% of corporate income tax revenue.

Whether the current tax system in Switzerland favors corporate or personal firms is not clear, however, but largely depends on the dividend pay-out ratio.[5] Firms with a high pay-out ratio suffer from double taxation of dividends which makes the corporate form rather unattractive. However, if the pay-out ratio is low, owners are rewarded mainly with lightly taxed capital gains rather than heavily taxed dividends. Since the corporate tax (lying on retained earnings) is low relative to the income tax relevant for a personal business, firms have a tendency to incorporate when they intend to choose a low pay-out ratio. For these firms, current taxation distorts in favor of the corporate form. For average, intermediate pay-out ratios, the current tax system probably does not systematically distort in one or the other direction. Given that the reform proposal holds a small net tax relief for corporate firms, it should induce a fringe of small personal firms to adopt the corporate form. We expect, however, that the welfare consequences of such induced adjustment are small since the net distortion of current taxation is probably rather small as well.

An economic assessment of the proposed business tax reform must duly take into account the four important margins in the business sector that we discussed above: (i) investment incentives and capital accumulation, (ii) dividend pay-out policies of corporate firms reflecting the tradeoff between retained earnings and external equity as a source of investment finance, (iii) debt policy relating to the tradeoff between debt and equity, and (iv) choice of organizational form. Quantifying the economic benefits and costs of the reform must also take account of the macroeconomic repercussions, both in the short- and long-run, that result from the firms' investment and financial decisions. It is of first order importance to policy makers to be informed about the likely effects on tax revenue, macroeconomic income growth and

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[5] This ambiguity is also reflected in the ERU (2001) report which documents in an appendix various calculations of the relative attractiveness under a range of pay-out ratios.

the key distributional implications of tax reform. Given the economy wide repercussions and the long-term consequences of company tax reform obviously requires a dynamic general equilibrium growth model for a meaningful policy evaluation. For this purpose, we have developed a general equilibrium model for Switzerland with a particularly detailed modeling of the business sector that distinguishes between corporate and non-corporate firms and models in detail the differential taxation of these firms. This paper provides a quantitative analysis of company tax reform in terms of various comparative static and dynamic exercises around a balanced growth path of the Swiss economy.

We proceed in several steps. Section 2 first presents a stylized version of the computational model that mainly focuses on the dividend pay-out decision. This allows us to characterize analytically the key transmission channels that drive the numerical results. We refer the reader to the technical report in KEUSCHNIGG (2002) for the other aspects of the complete model that play a minor role in this exercise. Section 3 reports the long-run simulation results together with a sensitivity analysis and some transitional considerations. Section 4 concludes.

2. A FORMAL ANALYSIS OF TAX REFORM

Our analysis is based on a neoclassical growth model of a small open economy with taxes.[6] The interest rate is taken as given on international markets, and inflation follows an exogenous trend. Growth is driven by a constant rate of labor augmenting technical progress which results in a constant long-run growth rate. The model covers a variety of taxes on consumption, property and personal income (labor income, interest, dividends and capital gains) and business income, allowing for a realistic distinction between economic and tax depreciation rules. The model duly takes account of the differences in the taxation of personal and corporate firms. To fully capture the behavioral response of the business sector to changing tax incentives, investment, financial policy and organizational choice are all fully endogenous. The most important aspect of the proposed tax reform is that it eliminates to a large extent the differential taxation of dividends and retained profits. Obviously then, one needs a model of corporate finance to capture the consequences for firm financial policy. We follow the approach of AUERBACH (2002) and SØRENSEN (1994) which is empirically supported by POTERBA and SUMMERS (1985), see the discussion in section 2.2. To highlight the consequences of the tax reform for dividend behavior as a key transmission mechanism, we simplify the formal presentation of the model by abstracting from organizational choice, debt policy, inflation, adjustment costs to investment, and the household sector. The main message can be

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[6] See KING, PLOSSER and REBELO (1988) on a basic neoclassical simulation model. GRETHER and MÜLLER (2001) developed a computational growth model for Switzerland. Important extensions to public finance are found in AUERBACH and KOTLIKOFF (1987), KEUSCHNIGG (1991), GOULDER and THALMANN (1993), HUTTON and KENC (1998) and ALTIG, AUERBACH, KOTLIKOFF, SMETTERS and WALLISER (2001).

stated without these aspects that are less important in the present policy context. For more complete information on the full model, we refer the reader to a separate technical report.[7]

2.1. A Neoclassical Growth Model With Taxes

Production uses capital K and labor L in a neoclassical technology of the CES type (constant elasticity of substitution) to produce output Y. The elasticity of substitution determines the elasticity of capital demand with respect to user cost. Capital accumulation is the single most important transmission channel in the model:

$$Y = F(K, L). \tag{1}$$

Firms accumulate economic and tax depreciable capital stocks, K and K^T, as in (2). In the de-trended version of the model, all variables remain stationary in the long-run. The accumulation equations must thus include a constant growth factor $G=1+g$, equal to one plus the growth rate. In the long-run, capital stocks must grow at the rate g to keep the capital endowment per efficiency unit of labor constant. The capital stock expands in line with real investment at rate I but declines on account of geometric depreciation at a constant rate δ. Real investment requires expenditure qK where q is the relative price of capital. The output price is normalized to unity. The rate of tax depreciation is δ^T:[8]

$$GK_{t+1} = I + (1-\delta)K, \quad GK^T_{t+1} = qI + (1-\delta^T)K^T. \tag{2}$$

In our stylized model, we include only the corporate sector. Profits consist of revenues Y minus the wage bill wL, depreciation δqK and corporate taxes T. The rate of tax depreciation is relevant to compute the corporate tax liability. If the rate of tax depreciation exceeds the economic rate of depreciation, the government effectively gives an investment subsidy due to postponed tax payments,

$$\pi = Y - wL - \delta qK - T, \qquad T = t(Y - wL - \delta^T K^T). \tag{3}$$

Investment and financial policy is restricted by a flow of funds condition saying that inflows (after-tax profits π and new equity VN) must be equal to outflows (dividend payments D and net

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[7] The full model is documented in KEUSCHNIGG (2002) and can be downloaded from www.iff.unisg.ch. In part, the model also builds on KEUSCHNIGG (2001).

[8] As a convention, we include the time index only if it refers to a period different from t.

investments *IN*). Note that corporate profits are already reduced by replacement investment which is thus internally financed,

$$D = \pi + VN - IN, \qquad IN = q(GK_{t+1} - K) = q(I - \delta K). \tag{4}$$

The valuation of firms reflects investors' interests. Potential investors may either hold bonds that yield a net of tax interest *(1- t^B)i*, if the residence principle of interest taxation is effectively enforced. The world market rate of interest *i* is assumed to be exogenously given for a small country. Alternatively, investors may hold corporate equity that pays a return *s*. The return on equity includes a premium *p* that reflects the investors' concern of getting back the expected return on their investment,

$$s = (1 - t^B) \cdot i + p. \tag{5}$$

Investors are willing to hold a stake in domestic ventures only if firms pay an (after tax) rate of return equal to *s* as in (5). The return on corporate equity consists of dividends and capital gains. At the personal level, dividends *D* are subject to a dividend tax at rate t^D. Capital gains on outstanding shares (total increase in firm value minus the equity injections of new owners) GV_{t+1}-*V-VN* are subject to a capital gains tax t^G. This effective tax rate on capital gains is rather low for two reasons. First, capital gains on corporate shares may go largely tax free as in Switzerland and, second, the realization principle allows for tax postponement during the holding period and thereby implies an interest free loan to the tax payer. Taking account of personal taxes, the investors' no-arbitrage condition implicitly determines the capital market evaluation of business equity,

$$sV = (1 - t^D)D + (1 - t^G)[GV_{t+1} - V - VN]. \tag{6}$$

2.2. Corporate Financial Policy: Dividends

The tax reform proposal mainly changes the relative taxation of dividends and retained earnings and therefore importantly affects the firms' dividend policy. To endogenize dividend behavior, we follow the approach pioneered and empirically supported by POTERBA and SUMMERS (1985). It was later adopted by SØRENSEN (1994) to discuss corporate tax reform. The dividend pay-out ratio is the share of dividends in the investors' total return on outstanding equity, i.e. the sum of dividends and capital gains,

$$D = \theta(D + GV_{t+1} - V - VN). \tag{7}$$

Using the capital market equilibrium condition (5-6) together with the definition of the pay-out ratio in (7), one obtains the discount rate that corporate firms must use to maximize investor value V,

$$rV = D + GV_{t+1} - V - VN, \qquad r = \frac{(1-t^B)i + p}{(1-t^D)\theta + (1-t^G)(1-\theta)}. \tag{8}$$

This formula for the required rate of return on equity capital before personal taxes includes two limiting cases of special interest: with a pay-out ratio of zero ($\theta = 0$), the model collapses to the "new view" of dividend taxation which postulates a cost of equity capital equal to $r^{NV} = s/(1-t^G)$. The new view claims that investment is fully financed with retained earnings at the margin rather than new shares.[9] It thus predicts that the dividend tax does not affect marginal investment decisions but only reduces firm value (tax capitalization). If, instead, the pay-out ratio is set at unity ($\theta = 1$), the cost of equity capital corresponds to the "old view" of dividend taxation, $r^{OV} = s/(1-t^D)$. The old view assumes that dividends are paid out and that investment is financed with new shares at the margin.[10] When the investor receives the future return in the form of dividends, the firm must earn a higher pretax return on equity to be able to offer an after dividend tax return equal to the usual market interest rate. The dividend tax thus raises the firm's cost of equity and retards investment.

None of these extreme views seems an appropriate description for the entire economy where we observe all modes of finance in the investment aggregates. At least a fringe of firms must rely on risk capital, i.e. new shares, to finance new investment. Consequently, the old view will be relevant for at least part of the business sector where new shares are given in exchange of future dividends, and where dividend taxes require firms to earn a higher pre tax return to offer investors the going net of tax market rate of return. The dividend tax is thus a particular burden for young and fast growing firms which typically have to rely on external equity as their marginal source of finance as profit retentions are small compared to investment opportunities. That the dividend tax is a burden on such firms is recognized even by some staunch supporters of the new view, see SINN (1991). We therefore adopt the approach by POTERBA and SUMMERS (1985) which derives in (8) the cost of equity capital as a weighted average of the new and old view of dividend taxation, with the dividend pay-out ratio being the weighting factor. The higher is the dividend pay-out ratio, the more relevant is the old view, and the more distorting the dividend tax becomes. We choose the pay-out ratio according to empirical evidence. Since the reduction

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[9] In this case, we can not apply (7) but must set $VN=0$, get dividends residually as in (4) and substitute $D = \pi - IN$ into (6). Intertemporal optimization then yields the cost of equity r^{NV} for the new view.

[10] In terms of our model, we have $VN=IN$ and $D = \pi$ by (4). Substituting into (6), intertemporal optimization yields the cost of equity r^{OV} for the old view.

of the dividend tax is such an important element of the current tax reform proposal, it will be important to provide some sensitivity analysis with respect to this number.

It is assumed that a higher dividend pay-out ratio reduces the equity premium, resulting in a lower cost of equity capital to the firm:

$$p = p(\theta), \qquad p'(\theta) < 0, \qquad p''(\theta) > 0. \tag{9}$$

This behavioral assumption on the investors' demand for an equity premium might reflect, for example, that a high dividend pay-out ratio signals a good quality of the firm and thereby induces investors to demand a lower premium. Conversely, a low pay-out ratio exposes investors to a higher risk of being expropriated by managers who strive to emancipate themselves from investor control by financing investments with retained earnings even if these investments earn a below market rate of return. This tends to raise the investors' risk premium on corporate equity. There is considerable empirical evidence for both interpretations that we discuss in a moment. In assuming (9), we adhere to the *trade-off theory* of corporate finance which assumes that corporations determine an optimal financial policy by equating potential advantages and disadvantages of rival sources of finance at the margin. For example, when the tax disadvantage of dividends over capital gains is high, investors prefer capital gains over dividend payments for tax reasons. To serve such investor preferences, firms should choose a lower pay-out ratio which, on the other hand, exposes investors' return to a larger risk due to inefficient internal investment or diversion of funds by managers. According to the trade-off theory, the optimal pay-out ratio then balances the tax disadvantage of an extra dividend payment with the non-tax disadvantage (increase in the equity premium) of a marginal increase in retained earnings. We follow the trade-off theory also with respect to debt finance. In exploiting the tax advantage of debt over equity finance, firms raise debt leverage until the tax savings of more debt is just offset at the margin by the increase in the interest surcharge on business debt on account of higher bankruptcy cost, see KEUSCHNIGG (2002) for details. Therefore, in equilibrium, optimal financial policy simultaneously draws on all three modes of finance.

On the other hand, the *pecking order theory* of MYERS (1984) and MYERS and MAJLUF (1984) predicts that corporations sequentially use financial sources according to an optimal ranking. Firms will turn to the next best mode of finance only if the cheapest source of funds is used up and is not available any more.[11] Testing the two competing hypotheses does not favor one over the other, see FAMA and FRENCH (2002). For the purpose of a macroeconomic model, however, the trade-off theory should be the relevant choice for two main reasons: First, it seems natural to rule out corner solutions of the capital structure which are not observed in reality so that the trade-off theory is the relevant model at least in the

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[11] In the Swiss case, for example, the double taxation of dividends coupled with largely untaxed capital gains creates a strong preference of corporate firms for retained earnings over new equity.

long-run. This mean reversion in the long-run is supported empirically by the results of FAMA and FRENCH (2002). Second, and more importantly, all financial sources are used simultaneously in reality. One can thus interpret the results of the trade-off theory by the law of large numbers as an aggregation of a variety of pecking order (or maybe trade-off) decisions.

Modern research on dividend policy started with LINTNER (1956) who argued that corporations are not willing to change their dividend ratios. Several microeconomic models, for instance BHATTACHARYA (1979), MILLER and ROCK (1985) and BERNHEIM (1991), predict that the dividend ratio can be taken as a positive signal of firm quality, leading investors to claim a smaller equity premium. Paying constantly high dividends for a long time helps companies to prove that their assets in place can generate sustainable positive cash flow. On the other hand, such signals are costly as investment opportunities are forgone and additional taxes have to be paid when high dividends are chosen. BERNHEIM (1991) argues that the signaling function of dividends can even involve issuing new equity together with paying dividends.

A long list of econometric studies starting with POTERBA and SUMMERS (1985) supports the positive signaling effect. Earlier empirical papers in this line include CAMPBELL and SHILLER (1988) or FAMA and FENCH (1988) while recently GRULLON, MICHAELY and SWAMINATHAN (2002) have again confirmed the relationship. Research in this area is, however, far from finished. The signaling model represents the conventional approach to dividend policy which has occasionally been challenged. It is, however, the only available formulation of dividend policy with a broad support by empirical studies and theoretical applications.

Equation (9) also corresponds with another macroeconomic interpretation for the beneficial influence of high dividend ratios. The corporate governance literature pioneered by JENSEN (1986) and JENSEN and MECKLING (1976) argues that managers have a tendency to emancipate themselves from investor control by financing investments internally even if they generate a below market rate of return. High pay-out ratios help to prevent managers diverting funds to unprofitable uses and investing too much internally. Managers are thus forced to return the funds back to investors who can reallocate them to the most efficient projects available on the external capital market. If firms have to raise new capital from external capital markets, new investors will closely monitor the investments and thereby eliminate potential moral hazard problems. LA PORTA, LOPEZ-DE-SILANES, SHLEIFER and VISHNY (2000) test and confirm the predictions of this hypothesis. If the tax system now favors capital gains over dividends, it induces corporations to reduce their dividend payments and to invest profits internally in order to create ligthly taxed capital gains. Established firms with high free cash flow find it optimal to invest in additional projects with lower pretax returns since their low return is offset by the favorable tax treatment of capital gains. In contrast, growing firms without sufficient internal cash flows are denied funds and

must leave good investment opportunities unused.[12] Taxes thereby give rise to an aggregate outcome where most new investments are undertaken by established firms that use internal capital markets while new firms with small cash flow face the tax disadvantage on new external equity and thus find it hard to raise money for their profitable investments. In the aggregate, this will show up in lower investment as a result of the tax bias against dividend payments and in favor of retained earnings. Our model formulation condenses these arguments in equation (9) and thereby integrates the predictions of the theoretical and empirical literature on the negative relation between the dividend pay-out ratio and the equity premium.

2.3.   *Investment and Financial Policy in Equilibrium*

We now formally derive optimal investment and financial policy. Corporations are assumed to maximize firm value. Using equations (2), (4) and (8) gives the Bellman equation of dynamic programming,

$$V = \max_{L,I,\theta} \left[\pi - q\left(I - \delta K\right) + GV_{t+1} \right] / \left(1 + r(\theta)\right), \quad \pi = \left(1-t\right)\left[Y - wL\right] - \delta qK + t\delta^{T}K^{T}. \quad (10)$$

Note that the value function V is a function of the stock variables K and K^{T}. We define the shadow prices $\eta = dV/dK$ for the marginal value of capital and $z = dV/dK^{T}$ for the marginal value of the tax depreciable capital stock. The optimality conditions for the controls take the following, well known form:

$$
\begin{array}{lll}
\text{(a)} & L: & w = F_{L}, \\
\text{(b)} & I: & \eta_{t+1} = \left(1 - z_{t+1}\right)q, \\
\text{(c)} & \theta: & p'(\theta) = -\left(t^{D} - t^{G}\right)r.
\end{array}
\quad (11)
$$

According to (11a), firms increase labor demand until the marginal product of labor equals the real wage. Optimal investment must satisfy (11b). Since investment receives a tax subsidy due to accelerated tax depreciation, the private cost of one unit of capital, stated on the right hand side, is below the market price q. The marginal value of capital next period when investments today start increasing productivity, will be shown to be equal to the present value of future returns to capital. Condition (11b) is the present value criterion of the optimal investment calculus. Equation (11c) yields optimal dividend policy. Increasing dividends sends a positive signal that is able to decrease the risk premium while it increases the tax burden of investors if dividends are taxed higher than capital gains. Corporations increase their payment of dividends until the marginal tax cost of doing so (the right hand side) equals the marginal decline in the yield demand of potential investors, i.e. the reduction of the equity premium. The

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[12] See AUERBACH (2002) for a formal argument in the context of our theoretical model.

convex dependence of the risk premium on the pay-out ratio assures a unique solution, the optimal dividend policy with taxes.

Taking the envelope conditions in (10) for the stock variables yields the optimal shadow prices

$$(a) K : (1+r)\eta = (1-t)F_K + (1-\delta)\eta_{t+1}$$
$$(b) K^T : (1+r)z = t\delta^T + (1-\delta^T)z_{t+1}$$
(12)

Solving (12a) forward in time, the shadow price of capital is seen to be equal to the present value of the induced stream of marginal return on capital, discounted by the rate of capital depreciation and by r, the investor's required return on equity before personal taxes. Equation (12b) similarly determines the value of tax depreciable capital equal to the present value of tax depreciation allowances.

2.4.   Taxation: Comparative Static Analysis

The core proposition of the tax reform proposal is to raise the capital gains tax in exchange for a lower dividend tax. We are now ready to analyze the effects on investment and dividend pay-out behavior. The most important and immediate effect of these taxes is to raise the investors' required return on equity before personal taxes, r. Personal taxes thereby raise the firms' discount rate and the cost of capital which ultimately depresses investment. Taking derivatives of r in (8) and using the FOC in (11c) then gives

$$\frac{dr}{dt^D} = \frac{\theta}{(1-t^D)\theta + (1-t^G)(1-\theta)} \cdot r > 0,$$

$$\frac{dr}{dt^G} = \frac{1-\theta}{(1-t^D)\theta + (1-t^G)(1-\theta)} \cdot r > 0.$$
(13)

Not surprisingly, both taxes raise the cost of equity, equal to the investors' required return before personal taxes and the firm's discount rate. The quantitative importance of this effect depends very much on the dividend pay-out ratio θ. A high pay-out ratio is more in the spirit of the old view of dividend taxation where firms rely less on retained earnings and relatively more on new shares as a source of investment finance. The dividend tax then importantly raises the cost of equity. With a low pay-out ratio, most of investment is financed by retained earnings, as the new view assumes, so that the capital gains tax becomes more important in determining the equity cost while the dividend tax is less relevant.[13] Our

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[13] These arguments take the debt equity ratio as given. The simulation model also endogenizes debt policy which is determined by a comparison of the cost of equity, being a weighted average of the cost of retained earnings and new shares, with the cost of debt finance which is not directly affected by the tax reform. When the cost of equity declines, firms will rely more on equity finance and should eventually reduce debt leverage.

choice of a dividend pay-out ratio implements an intermediate case. The effect of the Swiss tax reform, however, is not immediately anticipated from (13). It cuts the dividend tax but raises the capital gains tax. We conjecture, however, that the net effect will be to reduce the cost of equity. Due to the tax postponement effect built into the realization principle, the increase in the capital gains tax is discounted much and will thus be dominated by the cut in the dividend tax to moderately reduce the cost of equity. This conjecture will be verified by our numerical results.

Differentiating (11c) reveals the influence of personal taxes on the dividend pay-out ratio,

$$\frac{d\theta}{dt^D} = -\frac{r + \left(t^D - t^G\right)\cdot\left(dr/dt^D\right)}{p''(\theta)} < 0, \quad \frac{d\theta}{dt^G} = \frac{r - \left(t^D - t^G\right)\cdot\left(dr/dt^G\right)}{p''(\theta)}. \tag{14}$$

The effect of the capital gains tax is ambiguous at first sight since $t^D > t^G$. Using (11c) and (13), we obtain after some rearrangement

$$\frac{d\theta}{dt^G} = \frac{1 - t^D}{\left(1 - t^D\right)\theta + \left(1 - t^G\right)(1 - \theta)}\cdot\frac{r}{p''(\theta)} > 0. \tag{15}$$

If there is any sensitivity of dividend policy with respect to taxes, the proposed tax reform should have a pronounced effect on dividend pay-out ratios. The dividend tax cut and the capital gains tax increase reinforce each other to encourage dividend payments.[14]

Consider now the long-run effect of tax reform on investment incentives. In a (detrended) steady state, the shadow prices η_t and z_t stay constant. Using (12) and the investment condition in (11b), we rearrange and find

$$\frac{F_K}{q} - \delta = \frac{1 - z}{1 - t}(r + \delta) - \delta \equiv u, \quad z = \frac{t\delta^T}{r + \delta^T}. \tag{16}$$

The shadow price z equals the present value of tax savings from depreciation allowances which reduce the private acquisition cost of a unit of capital. The investment condition equates the marginal rate of

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[14] Due to the envelope theorem, the lower equity premium does not reduce the cost of equity capital beyond the effect already noted in (13).

return $MRR=F_K/q$ net of depreciation δ on the left hand side with the user cost of capital u.[15] The user cost reflects the cost of equity capital r together with depreciation δ, after taking into account corporate taxes and tax depreciation as measured by the factor *(1-z)/(1-t)*.[16] Personal taxes deter investment by raising the cost of equity capital r which is given in (8) and reflects the investor's opportunity cost and personal taxes.

Finally, we derive the marginal effective tax rate to measure the overall distortion of tax policy with respect to investment incentives.[17] This measure compares the pretax return in (16) with the after-tax return to private investors:

$$s = \left(1-t^B\right) \cdot i + p. \tag{17}$$

Note that (16) implies $u>r$ as long as $z<t$. Comparing r in (8) with (17), we find $r>s$ and, therefore, $u>r>s$. Obviously, taxes both at the corporate and personal level drive a wedge between the required pre-tax return u and the net of tax return s of households. The effective marginal tax rate (EMTR) t^{eff} provides a single indicator of the overall distortion and is defined as

$$t^{eff} = \frac{u-s}{u}, \qquad \left(1-t^{eff}\right) \cdot u = \left(1-t^B\right) \cdot i + p. \tag{18}$$

These formulas are usually derived in a partial analyis of an investment appraisal with a special focus on taxes as done by KING and FULLERTON (1984) and OECD (1991) and are commonly used to analyze and compare corporate income tax systems. A recent application on Switzerland includes GUTEKUNST and SCHWAGER (2001) who showed that the effective tax rate for domestic investment is still quite low compared to neighboring countries. Our analysis goes one step further since we compute how these effective rates *change* as a result of policy reform. More importantly, we use them as an integral part of our simulation model to quantify the economic consequences of tax reform for corporate financial policy and economy wide investment.

Figure 1: Taxation and Investment

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[15] Rearranging (16) yields the alternative interpretation that optimal investment equates the private acquisition cost of capital *(1-z)q* with the present value of marginal returns net of the corporate tax where personal taxes raise the discount rate equal to the cost of equity capital r: $\left(1-t\right) \cdot F_K / \left(r+\delta\right) = \left(1-z\right)q$.

[16] A cash flow corporate tax sets $z=t$ so that it is neutral with respect to investment incentives.

[17] We model the relevant personal and corporate taxes in about the same detail as in EUROPEAN COMMISSION (2001) so that our formulas can literally be compared to the relevant expressions therein.
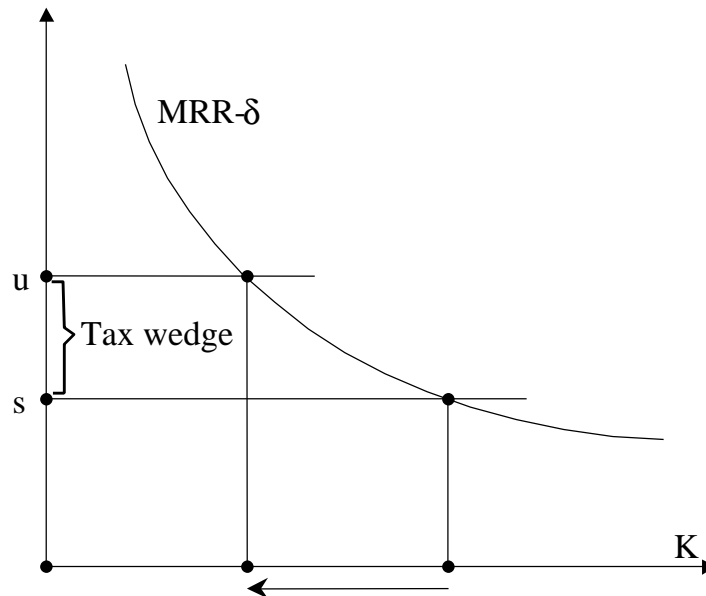
To illustrate the effects of tax reform on capital accumulation, we show the investment condition (16) in Figure 1. With decreasing returns to capital, the marginal rate of return MRR-δ as defined on the left hand side of (16) declines when more capital is accumulated. Absent any taxes, the cost of capital u coincides with the net of tax return s of private investors where the interest rate i is taken as given on international capital markets, see (8), (16) and (17). The intersection of the s-line with the MRR schedule would give the long-run capital stock. By the arguments following (17), dividend and capital gains taxes at the personal level and the corporate income tax at the firm level raise the required pretax return, or cost of capital u. Figure 1 illustrates how taxes thereby impair investment and long-run capital stocks. In lowering the cost of equity capital, as we have argued before, the planned tax reform will remove investment barriers to some extent. The induced capital accumulation will eventually raise capital intensity and result in higher wages as well.

2.5.   *The Complete Simulation Model*

As we pointed out earlier, the complete simulation model is considerably richer to capture a number of other important details of the Swiss economy. To begin with, we use an extended version of an overlapping generations model with life-time uncertainty as in BLANCHARD (1985) and thereby model household sector savings and consumption in an open economy. Apart from domestic equity, households may also invest their accumulated wealth in business and government bonds as well as foreign assets. Income effects on labor supply are excluded so that it depends exclusively on the real wage. With Switzerland being a small open economy, the market rate of interest is taken as given on international markets so that the current account is explained in terms of a savings investment gap. The public sector collects taxes that are modeled in much detail, spends on government consumption and transfers, and

accumulates public debt at a sustainable rate. The model allows for trend growth of labor productivity and inflation with exogenous long-run growth rates.

Most importantly for the purpose at hand, we have one of the most refined models of the business sector that is available in the established literature. It not only takes account of dividend policy, but also features an endogenous choice of debt leverage. The basic idea is again the trade-off theory which views firms as trading off the tax advantage of debt against the increasing interest cost that results when an increasing debt asset ratio leads to higher bankruptcy costs. After all, an increase in the debt-asset ratio surely leads to higher vulnerability of firms to adverse economic shocks. Finally, and more closely related to the proposed business tax reform, our model distinguishes among corporate and non-corporate firms and also allows for endogenous organizational choice. Partnerships differ from corporations in several ways. First of all, they are not subject to double taxation since profits are directly assigned to the personal income of the owner. The non-corporate form, however, limits firms in terms of their growth perspectives. It does not allow for easy access to outside equity which, as debt usage is related to underlying equity, severely restricts growth. Partnerships might be suitable for small businesses while the corporate form becomes indispensable for larger firms. Differential tax treatment gives rise to an extra excess burden of business taxation. For example, when corporate firms are taxed more heavily than personal partnerships, a fringe of small and medium sized firms will shy away from incorporating for tax reasons even though they would have a higher earnings capacity with corporate status.

2.6.   Calibration

We calibrate the model to a stationary equilibrium along a balanced growth path of the Swiss economy. First, we set interest, growth and inflation rates according to long-run average values together with economic and tax depreciation rates. Tax rates reflect averages across cantons. The macroeconomic data are taken from the national accounts but had to be averaged over time to reflect the long-run structure of the Swiss economy in a state of balanced growth. Finally, we extract a number of important behavioral elasticities from the empirical literature that link changes in prices and tax rates to changes in business and households sector behavior. Table 1 summarizes the most important parameter values.

Table 1: Key Parameters

Parameters			in %
Real growth rate	g	=	1.37
Nominal interest	i^*	=	4.34
Inflation rate	g_π	=	1.30
Equity premium	P	=	4.00
Depreciation	δ	=	10.00

Tax depreciation	δ^T	=	14.47
Pay-out ratio	θ	=	40.00

Table 2 collects the key behavioral elasticities and refers to our principal source of empirical information. Consider dividend policy, for example. POTERBA and SUMMERS (1985) have estimated, for alternative specifications, an elasticity of the pay-out ratio with respect to the tax disadvantage of dividends to be in the range of -1.8 to -2.6 (p. 267) or -1.0 to -2.1 (p. 269). GORDON and MACKIE-MASON (1990) have used these measures to evaluate the 1986 U.S. tax reform and have found them to be overly high. We therefore use their lowest estimate of -1.0 and will provide a sensitivity analysis with alternative values. An elasticity of -1.0 can be interpreted as follows: If the dividend tax is decreased by 5 percentage points, we must expect an increase of the pay-out ratio by 5 percentage points as well.

The other entries of Table 2 are similarly interpreted. Our capital demand elasticity implies that the long-run capital stock declines by one percent in response to an increase in the user cost by one percentage point. The adjustment speed is characterized by the half-life of investment. Starting from a given initial condition, it takes eight years in our model until half of the long-run increase in the capital stock is accumulated. The debt elasticity implies that firms raise the debt asset ratio by 1.8 percentage points (=.36 x 5) if the tax rate on profits is increased by five percentage points, indicating a larger tax benefit from using debt. Further, an increase in the pay-out ratio by 30 percent leads to a decline in the equity premium by one percentage point. Finally, with our elasticity of organizational choice, an income tax cut for the owners of personal firms by 10 percentage points would shift about 0.2 percent (a fifth of a percentage point) of the entire capital stock from the corporate to the non-corporate sector.

Table 2 : Key Behavioral Elasticities

Elasticity of capital demand[1] (CHIRINKO 2002)	-1.000
Half life time of capital accumulation[*] (CUMMINS et al. 1996)	8.000
Elasticity of debt-asset ratio[2] (GRAHAM et al. 1998)	0.360
Elasticity of pay-out ratio[3] (POTERBA and SUMMERS 1985)	-1.000
Elasticity of equity premium[4] (GRULLON et al. 2002)	-0.033
Elasticity of organizational choice[5] (MACKIE-MASON and GORDON 1997)	-0.002

Legend: *) In years. Elasticities are with respect to the following coefficients: 1) cost of capital, 2) profit tax (corporate) or income tax (non-corporate), 3) dividend tax, 4) pay-out ratio and 5) income tax of owner of non-corporate firm.

3. SIMULATION RESULTS

3.1.   Policy Scenario

Table 3 reports the taxation of corporate firms prior and after the proposed tax reform. Since the reform does not directly affect the income derived from personal ventures, we leave out for simplicity the taxation of personal firms. The column "Status Quo" reports current marginal tax rates in Switzerland, including all levels of government and taking an average over all taxes levied by cantons and municipalities. This yields a tax rate on corporate profits of 23.2%. At the personal level, dividends are subject to the personal income tax which is levied at a top rate of 37.32%. Capital gains on privately held shares are, in principle, tax free. However, current tax practice defines a number of special cases where capital gains are subject to the normal income tax, see BUNDESRAT (2000). Such treatment applies, for example, to "professional traders" and other constructs. We assume that about 20% of capital gains on private share holdings are already now effectively taxed, upon realization, at the same rate as dividends. Taking account of the tax postponement benefit inherent in the realization principle, we apply the usual formula as in OECD (1991) based on an average holding period of 10 years to compute an effective tax rate equal to .5981 of the statutory rate. This procedure yields an effective capital gains tax rate equal to .2*37.32*.5981=.0446 as in Table 3.

The proposed tax reform affects only corporate firms. It differentiates the taxation of dividends and capital gains according to qualified and non-qualified stakes in order to avoid compliance costs with small holdings. The taxation of business related income from non-qualified stakes continues unchanged with double taxation of dividends but also leaving the tax exemption on privately realized capital gains in place. However, the reform initiative affects quite considerably the tax treatment of qualified stakes as proposed by ERU (2001). A stake qualifies for the new treatment if it represents more than 5% of the outstanding shares of a corporation and/or if its value exceeds 1 Mio. Swiss Francs. Tax evasion on qualified stakes is hardly possible and compliance costs tend to be small relative to tax revenues. Furthermore, the owners of qualified stakes are often able to directly influence corporate financial policy in their own tax interest and can thereby avoid taxes to a larger extent. A more equal treatment of dividends and capital gains is not only a matter of efficiency but also of fairness and equitability in taxation. An empirical assessment of the Swiss treasury [see PETERS (2002)] indicates that about 65.11% of all dividends and 53.55% of all property values can be related to qualified stakes.

Table 3: Tax Rates Pre and Post Reform

Tax rate on *	Status Quo	Reform		
		NQ	Q	Av

Corporate profits #	23.20	23.20	23.20	23.20
Dividends	37.32	37.32	**22.39**	**27.60**
Capital gains	4.46	2.23	**13.39**	**9.50**
Property	0.70	0.70	**0.42**	**0.55**

Legend: *) Tax rates apply to corporations. Only bold numbers change as a result of the reform. #) In percent of taxable profit. NQ) non-qualified and Q) qualified stakes. Av) Average values are calculated using qualified and non-qualified stakes as weights, .65 for dividends and capital gains and .54 for share holdings. For example, the new effective dividend tax rate is .65*22.39+.35*37.32=27.60, while the new property tax rate amounts to .54*.42+.46*.7=.55.

Aiming at more neutrality in the taxation of dividends and capital gains, the tax reform initiative partly eliminates the double taxation of dividends but, on the other hand, introduces a capital gains tax on qualified stakes. Under the new treatment, 60% of dividends (fully taxed until now) as well as 60% of capital gains (tax free until now) must be added to taxable personal income. The proposal also offers a business related property tax relief, requiring individuals to add only 60% of the value of their qualified share holdings to their taxable private property, instead of 100% up to now. At first glance, the initiative seems to restore fully equal treatment of dividends and capital gains. However, since capital gains are only taxed upon realization, tax payers receive a tax deferral which significantly decreases the effective capital gains tax burden. Using typical holding periods and discount rates, the effective capital gains tax is only about half the statutory rate. For this reason, the tax reform leads only to a moderate increase in the *effective* capital gains tax. First, some capital gains are already taxed in a number of special cases. In fact, some tax payers who have been subject to such treatment until now and who hold a qualified stake, will now benefit from the new treatment of capital gains since they will have to add only 60% of their gains to personal income instead of all of it until now. The majority of stake holders will, however, have to pay taxes where they didn't until now. Taking account of the tax advantage of the realization principle, the capital gains of qualified stakes will be subject to an effective tax rate of .6*37.32*.5981=13.39%. Non-qualifying stakes will be subject to the same treatment as until now. Capital gains will be in principle tax free but even for non-qualifying stakes some of the special cases mentioned above will still apply. We assume that this is the case for about 10 percent of the non-qualifying stakes, giving an effective tax rate of .1*.373*.5981=2.23%. If 65% of capital gains result from qualified stakes, we obtain an effective tax rate of .65*13.39+.35*2.23=9.5% on average as is listed in Table 3. The upshot from this discussion is that the increase in the effective capital gains tax rate on corporate shares (about 5 percentage points) is considerably lower than the reduction of the dividend tax rate (about 10 percentage points). The new

effective tax rates reported in Table 3 show that the personal taxation of corporate income is still far away from neutrality even after the reform.

3.2.   Long-Run Effects

The proposed tax reform introduces a more effective taxation of capital gains in exchange for a tax relief on dividends and property tax on qualified share holdings in corporate firms. The discussion relating to Table 3 suggests that the increase in the capital gains tax is quite moderate compared to the dividend tax cut. Given this observation, and based on our analytical insights of section 2, we expect the following effects: First, the cost of equity capital should fall to some extent as long as the pay-out ratio is not overly small, see equation (13). Second, the dividend pay-out ratio should increase quite considerably since both the dividend tax cut and the capital gains tax increase work in the same direction, see (14-15). Third, in lowering the cost of equity capital, the reform also contributes to lower user cost of capital and thereby encourages investment, see equation (16). Although we have not explicitly derived analytical results, one can easily argue for some further unambiguous effects. Fourth, the higher capital intensity boosts both wages and employment (on account of endogenous labor supply) which should further magnify the investment led expansion. Fifth, since the corporate tax rate is left unchanged, the tax treatment of business debt remains unchanged. With a lower cost of equity, firms should rely more on equity finance and reduce somewhat their debt leverage. Sixth, since the reform reduces the effective tax burden on corporate firms while non-corporate firms receive no stimulus, a fringe of firms should adopt the corporate form and economic activity should consequently shift towards the corporate sector. And seventh, since the increase in the *effective* capital gains tax is rather small while the broad based dividend and property taxes are significantly reduced, the reform is expected to lose revenues.

What can one reasonably expect in terms of quantitative effects? We first consider long-run effects and turn to short-run and transitional effects in the next subsection. Table 4 summarizes simulation results for two alternative scenarios and compares them to the status quo of a balanced growth equilibrium without tax reform. The first scenario considers the effects of tax reform under the assumption that the revenue cost is financed with non-distorting taxes on households. The advantage of this scenario is that it allows to investigate the allocative effects of business taxes in isolation from other taxes that might also change incentives. In reality, however, all taxes available are distorting to some extent, and a cut in government spending will not be neutral as well. Therefore, scenario II considers the case where the budget is balanced with an adequate, i.e. endogenously determined, increase in consumption taxes (value added tax). Since the simulation model distinguishes between corporate and non-corporate firms, each scenario is reported in a double column with each subcolumn referring to either one of the two sectors.

Table 4: Long-Run Effects

Variable	Sector *)	Status Quo C	P	Scenario I C	P	Scenario II C	P
t^D Dividend tax		37.3%	0%	27.6%	0%	27.6%	0%
t^G Capital gains tax		4.5%	15.9%	9.5%	15.9%	9.5%	15.9%
t^P Property tax		0.7%	0.7%	0.6%	0.7%	0.6%	0.7%
t^{eff} Effective marginal tax rate		45.8%	47.0%	43.6%	47.0%	43.6%	47.0%
T^C Value added tax			7.6%		7.6%		8.0%
θ Pay-out ratio		0.400	1.000	0.479	1.000	0.479	1.000
P Equity premium		0.040	0.040	0.038	0.040	0.038	0.040
R Cost of equity		0.082	0.080	0.078	0.080	0.078	0.080
B Debt ratio		0.439	0.624	0.427	0.624	0.427	0.624
K Sectoral capital		#)		1.563	0.871	1.387	0.695
L^D Sectoral labor		#)		0.492	-0.193	0.317	-0.367
Y Sectoral output		#)		0.808	0.121	0.633	-0.053
W Wages		#)			0.569		0.569
L Employment		#)			0.284		0.110
K Capital stock		#)			1.353		1.177
GDP Gross domestic product		#)			0.470		0.278
C Private consumption		#)			0.638		0.463
T^R Tax revenue		#)			-0.479		0.000

*) C: Corporate sector, P: Personal sector. Scenario I: Budget balance with non-distorting tax. Scenario II: Budget balance with VAT. #) Percentage change. Other values are absolute.

The first five lines of Table 4 list the relevant tax rates and thereby define the specific policy scenario. The tax rates on corporate profits are as in Table 3. The personal income tax rate relevant for non-corporate firms is kept constant as well. The fourth line reports the effective marginal tax rate (EMTR) and thereby captures the combined effect of the tax reform on investment incentives. We find that reform succeeds to cut the EMTR for corporations by about two percentage points while non-corporate firms continue to face the same rate. The next lines show how the policy scenarios change behavior and eventually result in a new long-run equilibrium. The immediate effect of the reform is to raise the dividend pay-out ratio which contributes to a somewhat smaller equity premium consistent with the investors' preference for dividend payments. Given the elasticities in Table 2, the effect on the pay-out ratio is quite large (8 percentage points) while the equity premium declines only to a minor extent. As argued above, the dividend tax cut dominates over the increase in the capital gains tax and thereby squeezes the cost of equity capital from 8.2 to 7.8%. With equity relatively cheaper compared to debt

finance, corporate firms find it optimal to rely relatively more on equity finance and, to a minor extent, reduce their debt leverage.

The lower cost of equity r also implies a lower overall cost of capital, see (16), and thereby strengthens investment incentives. Since about 70% of economic activity is concentrated in the corporate sector, the reduction of tax inclusive capital costs considerably stimulates macroeconomic investment. The aggregate capital stock expands by more than 1.3% in the long-run. More capital intensive production boosts labor productivity and wages which, in turn, strengthens labor supply and employment. In labor market equilibrium, wages are up by .6% and employment by .3% in the long-run. Given the increase in both factors, GDP expands by almost half a percentage point. Since the net interest rate to households is fixed internationally, the long-run increase in aggregate consumption very much reflects the increase in disposable wage income and, consequently, grows by about .64%. In the long-run, the revenue cost of the tax reform amounts to about half a percent of the initial aggregate tax revenue which is financed by an increase in other non-distorting taxes in this scenario.

One of the motivations of the ERU (2001) report was to investigate whether Swiss taxes discriminate the firms' choice of their preferred legal status. How effective is differential taxation in shifting economic activity across sectors differentiated by organizational form? On net, the current tax reform offers a tax relief to corporate firms while the taxation of personal partnerships remains unchanged. Our model is parameterized to incorporate the econometric evidence about the relevant elasticity as reported in Table 2. In Table 4, we thus find that much of the investment is concentrated in the corporate sector. With 1.6%, the long-run increase in corporate capital is almost double the increase of capital used by non-corporate firms (+.9%). To accommodate the extra investment, corporate firms must also hire more labor which must be released in part from the personal sector since the overall labor supply increases only weakly. Consequently, employment in the personal sector slightly declines in absolute terms to allow for an increase in corporate employment. Note, however, that this sectoral reallocation is not to be interpreted physically and is not at the "expense" of the personal sector. This reallocation is "only" organizational and partly reflects the fact that some firms change their legal status. With fewer firms staying with the status of a personal partnership, they also end up hiring fewer employees in the aggregate. Nevertheless, the personal sector "benefits" from the general macroeconomic expansion and registers a slight increase in output (+.1%). The output gain is due to the fact that these firms must become more capital intensive much like corporate firms in order to afford the higher wages that are paid on the common labor market.

The next scenario turns to the fact that, in reality, the public sector will have to pay for the tax cut by raising one of the other major taxes which will distort the supply side as well. Taking the stream of public expenditure and the public debt to GDP ratio as constant, we consider an increase in the value added tax which is rather low in Switzerland by international standards. In the main scenario, the revenue loss amounted to almost five percent of initial tax revenue which was covered by lump-sum transfers

(negative non-distorting taxes). Now we keep real transfers per capita constant and endogenously compute the value added tax rate which keeps the budget balanced. We find that an increase of the VAT rate by .4% suffices to pay for the tax cut and finance a constant stream of real government expenditure. The main effect of the VAT increase is that it erodes, for any given market wage, the real disposable wage of households and, thereby, restricts labor supply.[18] The increase in labor supply and employment is less than half the size as compared to the main scenario. Since the VAT is inconsequential for investment decisions, we find that the increase in the capital intensity is almost exactly identical in the two scenarios.[19] Therefore, capital accumulation is scaled down in proportion to the reduction of labor supply. In this case, the tax reform is noticeably less powerful to initiate an investment led expansion of the economy. The other results are scaled down but remain qualitatively the same.

3.3.   Transitional Effects

The results in Table 4 are best considered as an upper boundary since they importantly rely on capital accumulation as the principal transmission channel. It takes, however, rather long time until capital accumulation succeeds to move the economy to a new balanced growth path. In the short-run when capital is largely predetermined, the expansionary effect of the tax reform will thus be much less pronounced. How much time is required for the long-run effects to materialize? We have calibrated the investment dynamics of our model to replicate empirical studies that predict a half-life of capital accumulation of about eight years.[20] We have computed in Table 4 a long-run increase of the capital stock by 1.353%. It will thus take about eight years until half of the long-run increase in capital is accumulated (+.68%), and another eight years until the remaining distance is cut in half again. After 16 periods, the capital stock will therefore have increased by about 1.015% and so on. Basically, the dynamics of capital accumulation governs, on the production side, the transitional pattern towards the long-run equilibrium that is reported in Table 4. Real wages, output and other variables will follow much the same pattern.

The dynamics of tax revenues is a particularly interesting and also important matter. With some qualifications, the transitional effects on tax revenues very much reflect the same pattern as capital accumulation, see Figure 1. The instantaneous loss in tax revenues in the first period when the reform is announced and implemented, amounts to –0.74%. So the reform is considerably more expensive in the short-run than in the long-run (-.479%, see Table 4). The slow accumulation of capital is increasingly felt in higher output, labor supply and wages which expands the tax bases of other large taxes and raises additional revenues. Like in any recovery, tax revenues grow in line with the general economy when

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[18] The real wage elasticity in our model is .5.

[19] The ratio increases by 1.177-.11=1.067 in the VAT case compared to 1.353-.284=1.069 in the main scenario.

[20] The adjustment of savings and consumption on the household side of an overlapping generations model is much slower since macroeconomic aggregates also reflect demographic turnover of the population which is generally a slow process.

investment slowly expands capacity, output and income. Consequently, the tax cuts become self-financing to some extent, making the reform considerably less expensive in the long-run.

Figure 1: Dynamics of Tax Revenues
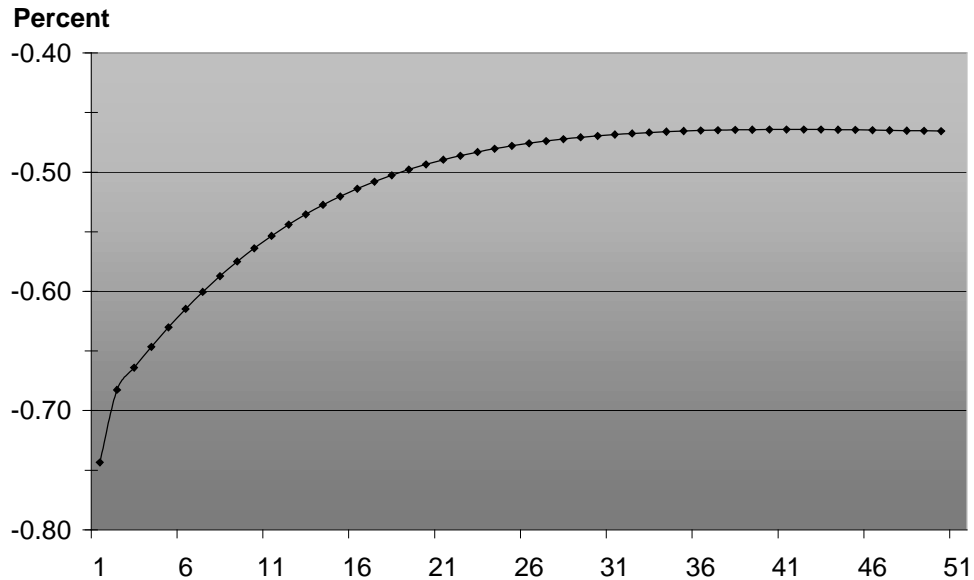
Note that even the short-run revenue loss is smaller than what is expected by conventional budget calculations that assume a constant tax base and thereby ignore any behavioral response to tax reform. To highlight this point, we calculate in column "Static" of Table 5 the revenue effect when all tax bases are held constant and only tax rates are changed. Obviously then, the dividend and property tax cuts lose revenues while the capital gains tax (narrowly defined on shares in corporate firms) raises some minor amount. Given constant tax bases, there is, of course, no revenue effect on other taxes which are not part of the reform initiative. We thus obtain a total net revenue loss of about 1.1% of initial tax revenue. In equilibrium, however, all major tax bases already change in the first period even though the capital stock is predetermined. For example, the rather pronounced increase in the pay-out ratio (from 40 to 48%, see Table 4) should considerably strengthen the dividend tax base and thereby generate revenues. The increase in dividends tends to reduce the tax base for capital gains which are, however, very lightly taxed in the initial state so that not much revenue is lost from the shrinking of capital gains. Also the tax base for consumption taxes should expand in the short-run. Consumption should be strong in the short-run due to income smoothing when households anticipate future increases in income. For these reasons, we find in Figure 1 a short-run loss of .74% of initial tax revenue which is considerably lower than the static loss calculated in Table 5.

Table 5: Static and Dynamic Budget Effects

Type of tax	Static	Dyn.	Total
t^D Dividend tax	-1.065	0.348	-0.717
t^G Capital gains tax	0.209	-0.108	0.101
t^P Property tax	-0.242	0.044	-0.197
Other taxes (VAT, wage tax, ...)	0.000	0.335	0.335
Total revenue effect	-1.098	0.619	-0.479

Legend: In percent of total tax revenues. Static: Static effect for a
constant tax base. Dyn.: Dynamic effect from tax base adjustment.

Subsequently, induced investment expands the economy and thereby increases revenues from other, seemingly unrelated taxes. For example, the wage bill increases by .85% and consumption by +0.64%, strengthening revenues of wage income and consumption taxes. Similarly, profits should pick up with more employment and capital, thereby swelling the tax bases for capital income taxes. Other taxes alone add another .335% of initial tax revenues. Quite impressively, the dividend tax alone adds about the same amount of revenue (.348%) which results from the strong expansion of the tax base when corporations raise their pay-out ratio. As a consequence, the capital gains tax base must shrink when firms reward their investors more with dividends instead of capital gains. Summing up, the dynamic tax base effects raise about .6% of initial tax revenues. In the long-run, the tax reform is significantly cheaper and costs only 0.479% of initial tax revenue. This is less than half of the static result.

3.4.   Sensitivity Analysis

We check the robustness of our results with a sensitivity analysis with respect to important parameters. The most important ones are those relating to dividend policy and the demand for capital. Table 5 summarizes the results but reports only aggregate figures, leaving out sectoral results. The first lines report the parameter values that are to be changed in the sensitivity analysis. The first column repeats the base case results while the next ones each report the long-run results based on an alternative parameter value. We consider only one parameter change at a time. For example, the column "PRatio" recalculates the tax reform when the initial pay-out ratio is 25 instead of 40%. Due to the large heterogeneity of firms in the corporate sector, it is actually quite difficult to derive a representative average pay-out ratio from the statistics. Small corporations often do not pay any dividend at all. Instead, owners largely extract income in terms of a management salary and a directors' remuneration. Big corporations and, in particular, those quoted on the stock market, pay out higher shares of net of tax profits, often exceeding 60%. We lack any reliable information concerning the distribution of these clienteles in Switzerland. Empirical country studies report different values as well, depending on the

particular portfolio of corporations included in their sample. For the purpose of a sensitivity analysis, we take a pay-out ratio of 25% as it is reported in LA PORTA ET AL. (2000, S. 14) for Switzerland.

Table 6: Sensitivity Analysis

	Variable	Base	PRatio	QuaSt	ElDiv	ElCap
Base case scenario						
θ	Pay-out ratio	40.000	**25.000**	40.000	40.000	40.000
	Qualifying fraction	65.110	65.110	**53.550**	65.110	65.110
	Elasticity dividends	-1.000	-1.000	-1.000	**-1.700**	-1.000
	Elasticity capital	-1.000	-1.000	-1.000	-1.000	**-1.500**
t^{eff}	EMTR pre reform	45.796	41.950	45.796	45.796	45.796
Reform scenario						
t^{eff}	EMTR post reform *)	43.645	41.464	43.578	43.645	43.645
b^f	Debt ratio *)	42.682	43.187	42.734	42.600	42.682
θ	Pay-out ratio *)	47.918	37.753	46.967	49.059	47.920
p^f	Equity premium *)	3.809	3.707	3.825	3.774	3.809
r^f	Cost of equity *)	7.796	7.502	7.811	7.772	7.796
w	Real wage #)	0.569	0.312	0.545	0.607	0.570
L	Employment #)	0.284	0.156	0.272	0.303	0.285
K	Capital stock #)	1.353	0.741	1.296	1.444	2.038
GDP	Gross domestic product #)	0.470	0.151	0.462	0.495	0.560
C	Private consumption #)	0.638	0.350	0.611	0.680	0.834
T^R	Tax revenue #)	-0.479	-0.611	-0.355	-0.446	-0.385

Legend: PRatio: Pay-out ratio of dividends; QuaSt: Fraction of qualified stakes; ElDiv: Dividend elasticity; ElCap: Substitution elasticity of capital. *) Corporate sector, #) Percentage change. Other values are absolute.

With a low pay-out ratio θ, investment finance relies relatively more on retained earnings instead of new equity. Consequently, this case gives more weight to the "new view" which claims that the dividend tax essentially is a lump-sum tax on investor wealth (tax capitalization) but is irrelevant for investment incentives since marginal investment is exclusively financed by retained earnings. Accordingly, the lower pay-out ratio gives less weight to the "old view" which holds that the dividend tax is distorting since investment must rely on new equity at the margin. Obviously then, we compute a lower effective marginal tax rate (EMTR) of 41.95% already in the initial steady state. With a lower initial pay-out ratio, the tax reform is much less effective in reducing the cost of equity capital since the dividend tax

cut is given only a smaller weight in (13) while the increase in the capital gains tax weights more heavily now. Consequently, the user cost of capital and, thereby, the EMTR are reduced much less than in the base case, and the tax reform holds much less power in stimulating investment.[21] The results are qualitatively the same, but are almost halved in magnitude as compared to the base case scenario. The capital stock now increases only by 0.741 instead of 1.353% in the base case. In line with the smaller economy wide expansion, one is not surprised to find a somehow bigger loss of tax revenue, –0.611%. An uncertainty in our policy scenario relates to the fraction of all share holdings which qualify for the new tax treatment. Since the tax treatment of non-qualified stakes is not changed by the reform, this figure determines the magnitude of the shock. An econometric study of the Swiss tax administration has estimated that 65.11% of all dividend payments and 53.55% of share values can be attributed to qualified stakes [see PETERS (2002)]. As a sensitivity analysis, we report in column "QuaSt" the comparative static results when only 53.55%, instead of 65.11% in the base case, of dividends and capital gains stem from qualified stakes. Accordingly, the size of the dividend tax cut and, less importantly, of the capital gains tax increase, is effectively reduced on average. One easily anticipates that the magnitude of the quantitative results are scaled down when the size of the shock is smaller. GDP, for example, increases only slightly less than in the base case, i.e. by .462 instead of .470%. Obviously, the reform is also somewhat less expensive if the effective dividend tax cut is smaller. We conclude that the exact fraction of qualified stakes is not that important for our results.

The most direct effect of the tax reform is to change incentives for dividend behavior and investment while it does not hold much potential with respect to debt leverage and choice of organizational form. Indeed, the pay-out ratio jumps from an initial 40 to about 47.9% in response to the tax spread t^D-t^G which falls from an initial 32.86 to 18.10%, see Table 3. It appears that the dividend elasticity might be crucial for some of our results. We argued that among the estimation results of POTERBA and SUMMERS (1985), the lower bound with an implied elasticity of –1.0 is most realistic, and we accordingly chose this value as our base case elasticity. To check robustness of our results, we now consider the higher estimate of –1.7 as was initially favored by POTERBA and SUMMERS (1985). The basic effect of the higher elasticity is to magnify the increase in the pay-out ratio which is now 49.1 instead of 47.9% in the base case. This impact is surprisingly low and is obviously a result of a non-linearity.[22] However, it might be reasonable to assume that there is an upper bound for tax induced changes to the pay-out ratio. Since the pay-out ratio increases only slightly more than in the base case, we also find that the implied reduction of the equity premium, and of the cost of equity, is magnified only

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[21] As before, we find that the pay-out ratio increases significantly, driving down the equity premium as well as the cost of equity. Note, however, that the pay-out ratio, the risk premium and the cost of equity now relate to different initial values. For these three variables, one therefore cannot readily compare in Table 6 the changes reported for this scenario with the changes for the base case scenario.

[22] The estimated elasticity is a point estimate and is calibrated to be valid at the initial pay-out ratio only.

rather moderately. Consequently, the quantitative results of the tax reform in column "ElDiv" of Table 6 are magnified only to a rather negligible amount.

The main transmission channel in our model is the effect of a (tax induced) change in the user cost of capital on capital accumulation. The size of this effect depends on the elasticity of capital demand with respect to the user cost. We can calibrate this demand elasticity by adequately setting the elasticity of substitution between capital and labor in the CES production function. This relates to the slope of the MRR-δ curve in Figure 1. The base case rests on an elasticity of -1. CHIRINKO (2002) reviews the empirical literature and finds a quite large range of econometric estimates that would support a higher value of -1.5 as well. The last column of Table 6 reports the quantitative effects of the tax reform for this alternative parameterization of the model. The capital stock now increases by more than 2%, compared to 1.353% in the base case scenario. The other adjustments are accordingly magnified.

To sum up, alternative estimates for important behavioral sensitivities on several important margins lead to only minor deviations from our base case results. To some extent, however, the model is sensitive to alternative values of the dividend pay-out ratio. This ratio implicitly fixes the weight that is attributed to the old or new view of dividend taxation which hold rather different predictions. On the other hand, the observed financial data of the Swiss economy allow only limited room for adjusting this ratio downwards. An overly low dividend pay-out ratio would imply a stationary equilibrium with negative new equity, i.e. share repurchases, which is hardly compatible with aggregate financial flows. All in all, based on the sensitivity analysis reported in Table 6, we conclude that the results are in general rather robust.

4. CONCLUSIONS

Based on a fully specified dynamic general equilibrium model of the Swiss economy, we have analyzed the likely economic consequences of the tax administration's recent official proposal for business tax reform. The main conclusions are: (i) The reform eliminates to a considerable extent the current tax bias against dividend payments although it fails to achieve full tax neutrality with respect to internal and external equity finance. (ii) In reducing the cost of equity capital as compared to the cost of debt finance, the reform to some extent reduces debt leverage and strengthens the equity base in the corporate sector. (iii) It reduces to a moderate extent the marginal effective tax rate on corporate investment, leaving the tax treatment of non-corporate firms unchanged. On average, it reinforces to some extent a given minor tax preference for corporate over non-corporate investment. However, the current tax preference and the distortion with respect to organizational choice seems to be rather small to begin with. (iv) It yields a moderate growth stimulus and raises wages, employment, and consumption. The effects are felt only after an extended transitional period, leading to rather small short-run but more pronounced long-run gains. (iv) While the revenue losses from the reform proposal materialize immediately, induced growth strengthens revenues by swelling the tax bases of wage and commodity taxes. The reform is thus more expensive in the short-run but considerably less costly in the long-run.

Even if the reform initiative should be fully implemented, business income taxation will continue to be fraught with some sizeable distortions. Although to a smaller extent, personal taxation continues to be biased against dividend payments. Due to the tax postponement effect of the realization principle, the effective tax rate on capital gains is much lower than the statutory rate. Even if dividends and capital gains are taxed at the same statutory rate at the personal level, the realization principle still favors retained earnings. To solve this problem would require a more fundamental approach to reforming business income taxation. Furthermore, the proposed tax reform has not considered the tradeoff between debt and equity finance. Since interest on business debt is tax deductible while the opportunity cost of equity capital is not, the tax system tends to favor debt over equity finance and may thereby contribute to higher debt leverage in the business sector. In reducing the cost of equity capital, the tax reform alleviates the problem somewhat. This distortion should, however, be investigated in more detail. Finally, even though the effective marginal tax rates in Switzerland seem to compare favorably with neighboring countries, the tax reform has not explicitly addressed the issue whether the existing tax bias against investment is necessary to the current extent. In particular, the tax depreciation schedules and investment expensing probably merit some closer investigation. In theory, immediate investment expensing as with a cash-flow tax would allow for rather full investment neutrality. These arguments notwithstanding, the proposed tax reform initiative fares quite favorably in our analytical and quantitative analysis.

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