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The impact of corporate and personal income taxes on the location of firms and on employment: some panel evidence for the Swiss cantons

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Abstract

The impact of corporate income taxes on location decisions of firms is widely debated in the tax competition literature. Tax rate differences across jurisdictions may lead to distortions of firms' investment decisions. Empirical evidence on tax-induced relocation and subsequent economic development in the US and Europe is still inconclusive. Much the same applies to Switzerland. While there is some evidence on personal income tax competition between Swiss cantons, evidence on the impact of intercantonal corporate income tax differences on the location of business within Switzerland is missing. In this paper, we present econometric evidence on the influence of corporate and personal income taxes on the regional distribution of firms in 1981 and 1991 and on cantonal employment using a panel data set of the 26 Swiss cantons from 1985 to 1997. The results show that corporate and personal income taxes deter firms to locate in a canton and subsequently reduce cantonal employment.
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1. Introduction

The interest of politicians, economists and the general public in international

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and interregional tax competition is lasting for decades now. This holds for example for the European Union (EU) where proposals about a minimum harmonisation of corporate and capital income taxes are presented again and again. It also holds for the group of OECD countries that pushes in the direction of a basic harmonisation and information exchange about corporate and capital income (OECD, 1998). Although Switzerland, often blamed of being one of the tax havens in OECD countries, still refuses to adjust to international tax harmonisation pressures, some discussion about corporate and personal income tax harmonisation in Switzerland at the level of the states (cantons) takes place, that has resulted in a tax harmonisation law for the Swiss cantons in 1993. This law forces the Swiss cantons to comply with a set of minimum standards of personal and corporate income taxation in order to prevent harmful tax competition among them. Indeed, tax competition for business location should be considerable in Switzerland given the large variation in corporate income tax burden between the cantons.

Theoretically, corporate income tax competition will lead to allocative distortions which can be circumvented by proper economic policy. According to Sinn (1997), tax competition results in a suboptimal provision of public services if the latter are public goods in the Samuelsonian sense and if governments do 'what they ought to do' (p. 254). Gordon (1983, 1986, 1992) and Razin and Sadka (1991) show how tax harmonisation or at least co-operation between governments may lead to Pareto-improvements as compared to the competition case. The precondition for allocative distortions to arise is that private investment is actually influenced by fiscal incentives.

The evidence on the impact of taxes on location and investment decisions of firms and subsequent economic development is however inconclusive. On the one hand, some authors, like Devereux and Griffith (1998) or Altshuler and Grubert (1999), find a strong impact of corporate income taxes on investment and financing decisions of multinationals. Bartik (1985), Papke (1991) and Hines (1996) present evidence on the negative relationship between taxes and firms' location decisions in U.S. states. Mark et al. (2000) report a significant negative impact of business taxes on annual employment growth in the metropolitan area of Washington, DC. On the other hand, Carlton (1983) and Tannenwald (1996), among others, find contradicting evidence.[1]

These studies mainly use data on the regional location decisions of US firms or on investment decisions of US multinationals. Given that the US studies do not tell an unambiguous story about the impact of taxes on private investment and firm location, evidence from European countries may be welcome to lend support for or against this relationship. However, there is only limited evidence on corporate income tax competition in the European context. Despite its strong variation in the

[1]Hines (1997) provides a survey of the studies of international tax competition while Newman and Sullivan (1988), Wasylenko (1991), Mark et al. (1997) and Feld (2000b) summarise the empirical results of interregional fiscal competition for business.

firms' tax burden, much the same holds for Switzerland, although there are consistent results about personal income tax competition.[2] The reason for this lack of results is that micro-level data on individual firms are seldom available in European countries and particularly not in Switzerland.[3]

In this paper, we present first econometric evidence on the impact of taxes on the regional distribution of firms using two pooled cross sections of the 26 Swiss cantons for the tax periods 1981/82 and 1991/92 and on total cantonal employment using a panel data set of the cantons from 1985 to 1997. We focus on the role that the corporate and the personal income tax burden play for location decisions and the subsequent changes in employment by following the approach of Carlton (1983). In addition to taxes, we introduce real wages, public education and public capital spending and some socio-demographic variables as explanatory factors in order to control for other determinants of business climate at the Swiss cantonal level. Our results indicate that corporate and personal income taxes contribute significantly to the explanation of the regional distribution of firms and of regional differences in employment in Switzerland. This result can be interpreted as an outcome of competition for business between Swiss cantons and of tax incentives for profit shifting.

The paper is organised as follows: First, we briefly describe the Swiss fiscal constitution in Section 2. In Section 3, the model which serves as the basis of our estimates is outlined. The estimation results for the impact of corporate and personal income taxes on the regional distribution of small and medium sized firms and on cantonal employment are presented in Section 4. We conclude with some final remarks in Section 5.

2. The Swiss fiscal constitution

Switzerland consists of three government levels, which establish strong fiscal competencies of the single cantons and local government units. This holds especially true for the tax structure: The main progressive taxes on personal and corporate income are state and local taxes. The cantons have the basic power to tax income, wealth and capital. The local jurisdictions can levy a surcharge on cantonal direct taxes and raise own property and wealth taxes. The central government relies mainly on indirect (proportional) taxes, the VAT and specific

[2] See, e.g. Kirchgässner and Pommerehne (1996), Feld (2000a) or Feld and Kirchgässner (2001).

[3] Nevertheless, there are studies using time series to analyse the impact of corporate income taxes on Swiss aggregate investment. Junge and Zarin-Nejadan (1986) find a significant negative relationship between corporate income taxes and the share of investment from GDP for the period 1953–1980. Zarin-Nejadan (1992) confirms these results in a similar model for the time period 1953–1986. Zarin-Nejadan (1991) also computes effective marginal corporate income tax rates for the Swiss cantons in 1987, but does not use them in a cross section regression analysis.

consumption taxes like the mineral oil tax. It also relies on a source tax on interest income. There is as well a small but highly progressive federal income tax, which, together with revenue from the source tax on interest income, amounts to 28.3% of total federal tax revenue in 1999, while the cantons and municipalities rely on income, wealth and property taxes to about 50% of their total revenue and 95% of their tax revenue during the 1990s. Private capital gains are not taxed at all in Switzerland. While there is no federal or cantonal deductibility of taxes paid at the cantonal or local level in the case of personal income taxes, such a tax deductibility exists in the case of corporate income taxes.

All in all, corporate income taxes in Switzerland vary considerably between the cantons. From anecdotal evidence it is known that two tax havens are in or close to Switzerland, the small country of Liechtenstein, which forms an economic union with Switzerland, and the canton of Zug. Taking the value of the (weighted) average for Switzerland as 100, the index of the tax burden of corporate income and capital taxes varied from 56.8 in the canton of Zug to 144.2 in Neuchâtel in 1990, the respective average tax burden for the whole country being 100, while the standard deviation was only slightly reduced from 18.33 in 1970 to 17.94 in 1990. In 1994, it varied from 57.9 in the canton of Zug to 146.0 in the canton of Graubünden, and the standard deviation even increased to 18.67.

Switzerland is supposed to have a relatively low average effective tax burden in comparison to other OECD countries. Since 1998, corporate income is taxed proportionally by a rate of 8.5% at the federal level. Revenue from taxes on profits and capital amounted to 1.9% of GDP in 1996. In the OECD and the EU, this figure was 3.1% and thus considerably higher.[4] On the other hand, the Swiss system of corporate income taxation appears to be quite complicated not only but also because of the sub-federal competencies. All in all, capital may bear seven different taxes: the corporate income tax on profits, the capital tax, the federal source tax on interest and dividend income, an emission charge, the property tax, the church tax and — in some cantons — a minimum tax if revenue from the corporate income tax does not reach a certain amount. Zarin-Nejadan (1997) estimates that taxation of profits and capital induces administrative costs of about SFr 14 000 per firm and year, an amount which is about 40% of the average administrative costs small and medium sized firms bear due to public regulation and about 3% of their investment in equipment.

Three characteristics are fundamental to the taxation of corporate income:

1. In many cantons, the tax on profits follows a progressive tax schedule according to the rate of return on capital. For reasons of taxation, this rate of return is measured by the firm's effective profits divided by the amount of capital and reserves according to the firm's accounts. As mentioned above, the

[4] See OECD (1998), Revenue Statistics of OECD Member Countries 1965–1997; Paris, pp. 79ff.

federal level levies a proportional tax on corporate profits since the tax reform act of 1998. Seven cantons have used a proportional tax rate before that reform while the canton of Geneva introduced it after the reform.

2. In addition to taxation of profits according to the rate of return on capital, capital is taxed separately by all cantons. In most cases a proportional rate is used. The federal government abolished its tax on firms' capital in 1998.
3. The Swiss corporate income tax has to be characterised as a classical corporate income tax as it is employed in the US. Thus, profits are taxed at the corporate level and again at the shareholder level as dividend income.

Because of the importance of the rates of return in Swiss taxation, it is necessary to have a look at the distribution of firms according to their rate of return (in percent) shown by Fig. 1 and according to their size measured by capital (in 1000 SFr) shown by Fig. 2.[5] The most astonishing fact is the large share of firms with a zero rate of return. Although these are the firms that do not report any taxable profit from a legal point of view,[6] it does not necessarily mean that these are firms without earnings. Nearly half of Swiss firms do not *report* any rate of return. It may indicate that at least a part of these firms is successful in manipulating their balance sheets such that no earnings accrue. The remaining distribution is double-

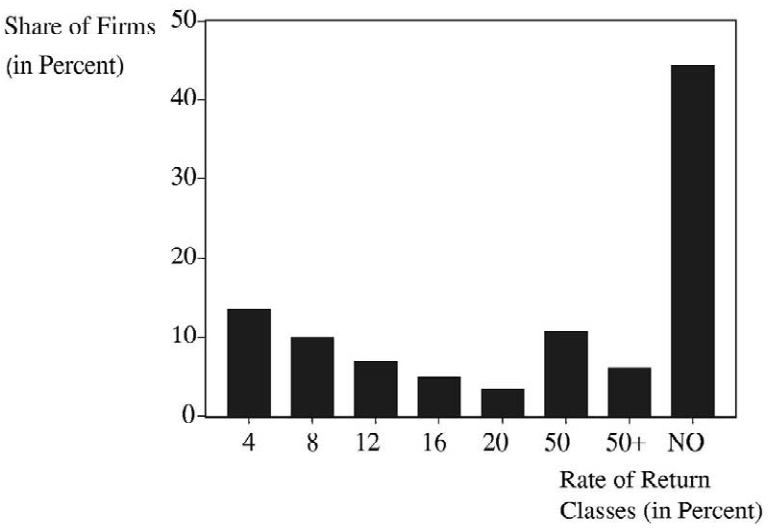

Fig. 1. The distribution of firms in different rate of return classes in Switzerland: taxation period 1991/1992.

[5]Data on the distribution of firms across assets are not available.

[6]Legally, 'zero' cannot be interpreted as meaning that a positive rate of return close to zero can be reported to qualify for that class.

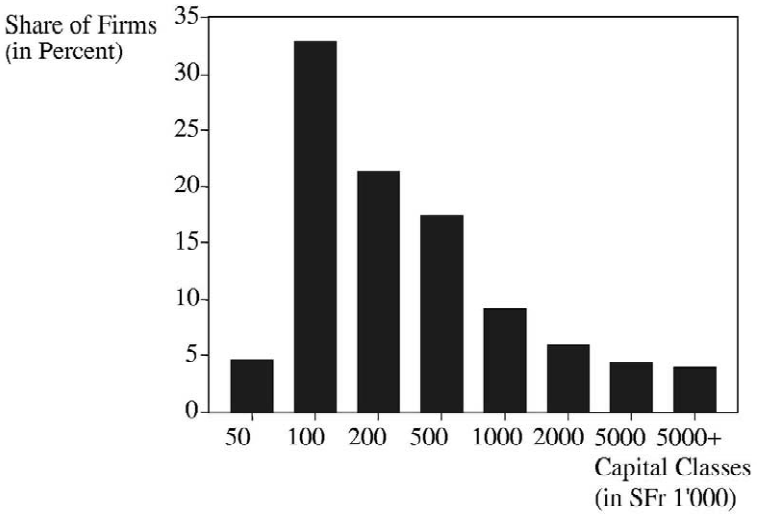

Fig. 2. The distribution of firms in different capital classes in Switzerland: taxation period 1991/1992.

peaked having the second highest share of firms at a rate of return of 4%, the third highest share at one of 50%, and a continuously declining importance of rates of return in between. This rate of return distribution of firms points to the fact that firms appear to be rather successful in their tax management. The size distribution of firms (Fig. 2) is positively skewed with the highest share of firms having a capital between SFr 50 000 and SFr 100 000. Large firms in Switzerland are those with SFr 5 million capital or more, a figure that may at best characterise medium-sized firms in other countries. Anyway, small and medium sized firms in Switzerland appear to be relatively more important in sheer number than large firms.

A particular feature of corporate income taxation in Switzerland is the fact that holding companies are taxed with lower rates or, in some cantons, not at all in order to avoid double taxation of profits of parent and affiliate companies. On the other hand, generous tax exemptions for holding companies provide incentives for profit shifting of firms. The canton of Zug is supposed to owe its economic wealth from such a policy. In addition, nearly all cantons, with the notable exceptions of Zug and Aargau, have special tax holidays for 'newly founded' firms which are restricted by the federal tax harmonisation law of 1993 to be limited to 10 years at most in all cantons from 2001 on. 'Newly founded' may mean anything from the construction of new firms or affiliates to the relocation of companies traditionally having been located in other cantons for years.

Given the strong differences in tax burdens between Swiss cantons, double taxation agreements between cantons and profit allocation rules for firms with plants in different cantons play a non-negligible role. Between Swiss cantons, an

exemption system is used exclusively. If for example a firm resides in Zurich and has a subsidiary in Zug, Zurich exempts the profits earned in Zug from taxation in Zurich. Moreover, profit allocation between both cantons is regulated by a kind of formula apportionment. There does not exist a unique harmonised formula apportionment rule for all cantons. This leaves room for a strong variety of such rules between cantons. Payroll, capital or sales are used as a basis for the calculation of profit shares. For example profits of retail firms are usually allocated according to sales while profits of manufacturing firms are allocated according to capital and payroll (capitalised by 10%). Since capital is taxed in addition to profits and profits are taxed on the basis of rates of return on capital, not only profit allocation rules but also capital allocation rules are used.

To give an example, which is borrowed from Höhn and Waldburger (1999, p. 896), suppose a manufacturing firm is located in Zurich and has a subsidiary in Zug. The firm is supposed to earn SFr 3 million in total. It pays SFr 200 000 wages in Zurich and SFr 300 000 in Zug and has capital of SFr 640 000 in Zurich and SFr 360 000 in Zug. Profits between the cantons are shared for tax purposes by first allocating 10% in advance to the parents location, i.e. SFr 300 000 are allocated to Zurich. Forty-four percent of the remaining SFr 2.7 million are allocated to Zurich and 56% to Zug because payroll, capitalised by 10%, and capital sum up to SFr 2 640 000 in Zurich and SFr 3 360 000 in Zug. The firm thus pays taxes on profits of SFr 1 490 000 in Zurich and SFr 1 510 000 in Zug.

Due to the small size of the country and its subfederal units, corporate taxpayers can easily move to places with low tax burdens and should respond to cantonal tax differentials accordingly. The exemption system basically provides an incentive for tax induced relocation while profit sharing rules, in the sense of a kind of formula apportionment, reduce incentives for profit shifting. Moreover, the differences in cantonal legal and accounting systems are not as substantial to render firms' relocations difficult. All in all, firms may have sufficient fiscal incentives to relocate between cantons. In addition, formula apportionment might not work as perfectly as to totally prevent profit shifting from occurring. Thus, tax competition for mobile capital in Switzerland may take place either by relocation of real capital leading to subsequent changes in economic activity or by profit shifting among cantons.

3. The model

The theoretical model which is the basis of our econometric estimates is taken from Carlton (1983). The relationship between taxes, location decisions of firms and employment is derived from a profit function starting from the basic consideration what happens if the firms in a particular industry have decided to open a new plant. From the usual assumption that firms maximise their profits subject to certain restraints, each firm can be expected to locate this plant where it

yields the highest profit. The locations differ according to firm-specific location effects for each firm and across plants. The profit function, π_{ij}, of the plant of firm i in location j can be defined as:

$$\pi_{ij} = K_0 X_1(j)^{\beta_1} \cdot \cdot \cdot X_m^{\beta_m}(j)(e^{\epsilon_{ij}}) \tag{1}$$

where $X_s(j)$ are explanatory variables at location j, $s = 1, \ldots, m$, K_0, $\beta_1, \ldots, \beta_m$ are unknown constants, and ϵ_{ij} is a firm-location specific effect.[7]

Taking logs of Relation (1), the following equation is obtained:

$$\ln \pi_{ij} = \beta_0 + \sum_k \beta_k \ln X_k(j) + \epsilon_{ij} \tag{2}$$

with $\beta_0 = \ln(K_0)$.

Firm i locates in jurisdiction j^* if profits are highest there such that $\pi_{ij}^* = \max_j \pi_{ij}$, which requires that the right hand side of Eq. (2) is higher in location j^* than in all other regions.

Just like the location of a firm, the number of employed at a chosen location provides information on the parameters of the latent profit function. The demand for labour by firm i at location j, $L_i(j)$ can be obtained by differentiating the profit function (1) with respect to wages and multiplying by (-1). If X_1 is labour's wage and we differentiate (1) with respect to X_1, rearrange terms and multiply by (-1), the demand for labour, $L_i(j)$, following Carlton (1983, p. 441), is derived as:

$$\ln L_i(j) + \ln X_1 = \beta_0 + \sum_k \beta_k \ln X_k(j) + \epsilon_{ij} \tag{3}$$

where K is a constant. Shifting $\ln X_1$ to the right hand side, we get the equation to be estimated with:

$$\ln L_i(j) = \beta_0 + \sum_k \tilde{\beta}_k \ln X_k(j) + \epsilon_{ij} \tag{3'}$$

with $\tilde{\beta}_1 = \beta_1 - 1$ and $\tilde{\beta}_k = \beta_k$ for $k \neq 1$.

Since only aggregate data are available for this study, we have to assume that the error terms in Eqs. (2) and (3′) are independent from each other, although theoretically, the error term ϵ_{ij} which is responsible for location j^* to be the preferred location by a firm will also influence the demand of labour of that firm.

As the same variables influence the location decision of a firm and how many people are employed by this firm, the functional form of relation (3′) might also

[7] It is assumed that ϵ_{ij} is independently distributed across i and j and that it follows a log-normal distribution.

be used to estimate an equation for the location decision of the firm. Then, the left hand variable should be the probability (relative frequency) that a firm is located in a certain canton. However, because of the different sizes of the cantons it makes sense to 'normalise' these probabilities by using, e.g. the size of the population of the different cantons.[8]

4. The econometric model

Following the Carlton (1983) approach, it would be natural to estimate the location and labour demand decisions of firms simultaneously. However, while we have annual data of cantonal employment from 1985 to 1997, data on the regional distribution of the firms are only available for the years 1981/1982 and 1991/1992.[9] Therefore, we have to estimate the two systems of equations separately. While we can estimate a panel with 14 annual observations for employment the panel for the location decision has only two points in time.[10] In addition, we do not have firm level data but only data for the numbers of firms and the number of employees in the different cantons. Thus, we have to aggregate within the cantons.

4.1. The regional distribution of large firms

The description of the Swiss federal constitution in Section 2 shows that in many cantons the Swiss corporate income tax follows a progressive tax scheme according to the rate of return on capital of firms. Moreover, all cantons employ a tax on firms' capital. Thus, firms have different countervailing investment and location incentives depending on their possibilities for avoiding taxation. Progressive corporate taxation according to the rate of return on capital punishes very profitable firms. If these firms manage to increase their capital stock given a certain profit, they can save tax payments. On the other hand, splitting up a firm in smaller units, locating them in other cantons with lower taxes and shifting profits to these cantons might also be a possibility of tax avoidance. Profit shifting or

[8]There are other possibilities to derive this functional form, e.g. by using a conditional logit model. See, e.g. MacFadden (1974, p. 118f.).

[9]In Switzerland, until the 1990s tax assessment was only every second year, always for a 2-years period: Taxable income in year t and $t+1$ was the average income of the years $t-1$ and $t-2$. In the 1990s, it slowly started to change to a taxation of the actual income with annual assessment.

[10]Because the same set of underlying parameters (the β values in Eq. (2)) is used one might also think of cross-equation-restrictions between the employment and the location equations which could be exploited (and tested) in the empirical work. However, because of the differences of the two data sets which demand separate estimations as well as different estimation procedures this is hardly possible.

intelligent tax management may significantly reduce tax payments as well.[11] In this case, firms are able to report only a low or no rate of return on capital and are thus taxed less. All in all, an interesting pattern of interdependencies emerges between investment, location and profit shifting incentives that are caused by corporate income taxation.

This picture is complicated by the fact that Switzerland uses a classical corporate income tax which provides incentives for firms to finance investment by retained earnings. Moreover, no capital gains tax for private persons exists in Switzerland. Dividend payments to shareholders are thus reduced in order to avoid double taxation of dividends by the corporate and personal income tax and replaced by income from capital gains which are tax exempt. Differences in personal income taxes between cantons may first play a role for small firms which can reduce their tax burden by paying higher management salaries to their owners. In this case, personal income taxes are more relevant to owners of small firms than corporate income taxes. Second, personal income tax differences play a role for large firms to the extent to which they deter high income and highly skilled managers from accepting an offer in a high tax jurisdiction. Since the high skilled segment of the labour market in Switzerland is to a large extent dominated by the supply side, it may be expected that managers shift the personal income tax burden to firms in their compensation negotiations.

A data set suitable to model these different tax incentives would normally have to be a microdata set consisting of individual firms. The available Swiss data for the study of the location decision of firms are, however, aggregate data on the cantonal distribution of corporate taxpayers according to classes of rates of return and of capital with the respective average statutory tax rates in the rate of return classes. Instead of considering all capital classes, we had to concentrate on firms with a capital between SFr 100 000 and 200 000, subsequently called the small firms, and on firms with a capital between SFr 2 million and 5 million, the medium sized firms.[12] In addition, we use data for different classes of rates of return which are aggregated to one with firms having low rates of return on capital, higher than

[11] According to the Swiss Federal Tax Bureau, numerous cases of profit shifting are known. Typically, profit shifting in Switzerland occurs in the case of financial subsidiaries and of the distribution of management fees between parents and subsidiaries. In the foods industry for example, when Nestlé purchased Hero, a smaller firm in Lenzburg (canton of Aargau), management fees were allocated in the size of 3–5% of turnover of Hero in order to increase costs and to allow for profit shifting. Unfortunately, systematic evidence illustrating the importance of profit-shifting in Switzerland does not exist, but the tax administration believes that profit shifting is ubiquitous.

[12] It was not possible to obtain more data than those on these two groups of capital from the Federal Tax Bureau for several reasons. Data on the distribution of firms with a capital of more than SFr 5 million are not provided due to data protection laws. In small cantons there may be only one such large firm. In addition, many rates of return classes would not contain any observation in the case of large firms. This would not make sense for this analysis. In our sample, the canton of Appenzell i. Rh. does not have a firm with a capital between SFr 2 and 5 million and no rate of return in 1981. Finally, data on the remaining capital classes are only partly available making a concentration necessary.

zero and lower than 12%, $firm_t^l$, one with high rates of return on capital above 12%, $firm_t^h$, and one with a rate of return of zero, $firm_t^n$. For two capital classes times three rates of return classes, we thus obtain six groups of firms. To illustrate the structure of the data, an inspection of Figs. 1 and 2 is useful. The data cover all rates of return classes shown in Fig. 1 by aggregating them to three classes, i.e. the group with no rate of return, the lower three and the higher four classes. With respect to the capital classes shown in Fig. 2, only the third and the seventh group are represented in our data set. Loosely speaking, we analyse the impact of taxes on the cantonal distribution of two groups of small and medium sized firms in classes of no, low and high rates of return on capital. The different tax incentives discussed above may be observed more easily in such a combination of small and medium sized firms according to capital and of different rates of return than in aggregate investment or in the aggregate number of firms.

The explanatory variables, X_k, of the model outlined in Section 3 are derived from the consideration which factors influence the decision to locate a firm in a certain jurisdiction j^*. First, we include $\ln X_1$, the wage rate, as an explanatory variable in order to see how strong the expected negative effects of wages on the location decision of firms as well as on labour demand are. Data on average cantonal hourly wages and monthly salaries for males and females are available. We use cantonal averages of monthly salaries of males, w, as an indicator for labour costs.

Second, four variables capturing the impact of the public budget are included in the model. Aside from the tax rates on corporate income, personal income tax rates may have an impact on the location decision as well because personal income taxes drive a wedge between the marginal productivity of labour and the wage rate. Plenty of different corporate and personal income tax rates are available and could be used in the model. We assume a rate of return on capital of 8% as being normal and include the respective tax rate in the equation for firms with no or low profits, i.e. with a rate of return not above 12%. In the equation for the firms with above normal profits we include the tax rate for a rate of return of 40%.[13] The corporate tax rate is obtained by dividing real effective average cantonal and (weighted) local tax payments in a certain class of rate of return and of capital by respective profits. This implicit tax rate thus is an average effective tax rate, neither a statutory nor a marginal tax rate. The corporate income tax rate is assumed to have a negative impact. In a slightly different fashion, we select the tax rate on taxable personal income of SFr 1 million per year from the available income tax rates in the statistics. The personal income tax rate is also expected to exert a negative influence on the location decision.

The other two fiscal variables are from the spending side of the public budget.

[13].We use the cantonal and (weighted) local tax rate on rates of return of 8% as being representative for the corporate taxpayers with no or low rates of return and the cantonal and (weighted) local tax rate on rates of return of 40% for the taxpayers with high rates of return on capital.

Data on firm-specific benefits from public spending are not available.[14] Thus, real public educational spending per capita and real public investment spending per capita are introduced in the model as indicators of public services benefiting firms at least indirectly. The higher public infrastructural spending in a canton is, the higher is public investment, the more attractive is a canton for firms as a location for new plants. Public educational spending may serve as a proxy for cantonal human capital or for quantity and quality of schools and universities. In the first case, it can be expected that firms are attracted by higher human capital in a canton as a production factor. In the second case, a firm will be attracted because better schools and universities are attractive for (the children of) highly skilled employees and the firm would like to hire them as people incorporating human capital.

The share of the urban population is included in the model in order to control for agglomeration effects. In addition, population serves as an explanatory variable to capture the sizes of the cantons. Moreover, a year dummy for 1981 is introduced in order to control for time effects. Finally, after an analysis of outliers we decided to include a dummy variable for the canton of Uri in order to capture the effect caused by this negative outlier.[15] Following Eq. (3′), all variables are expressed in log terms. Thus, the model for the regional distribution of firms is as follows:

$$firm^i - pop = f(w, ctax^i, ptax, edexp, pubinv, urbpop, pop, d1981, duri) \tag{4}$$

with: $firm^i$ as number of firms in the i-th class of rate of return, $i = 1, 2, 3$; *pop*, population; *w*, average real monthly salaries of the male population; $ctax^i$, corporate income tax rate for corporations with a rate of return on capital of 8 ($i = 1$) or 40 ($i = 2$) percent; *ptax*, personal income tax rate for the income group of taxable income of SFr 1 million per year; *edexp*, real public educational expenditure per capita; *pubinv*, real public investment per capita; *urbpop*, share of urban population; $d1981$, dummy variable for the year 1981 ($d1981 = 1$ for the first 26 observations and zero otherwise); *duri*, dummy variable for the canton Uri ($duri = 1$ for Uri and zero otherwise).

As described above, we use a panel of the 26 Swiss cantons for the two periods 1981/82 and 1991/92. Given this time structure of the data and the fact that we

[14] Similarly, data on tax holidays are not available from most cantons.

[15] Uri is special in some sense because it is known as a canton that gains the most from vertical fiscal equalisation. In addition, we had to include a dummy variable for the canton of Appenzell i.Rh. in 1981 in the capital class between SFr 2 and 5 million and no rate of return because no such firm existed in this canton in 1981. The estimates for this dummy variable are not reported below (see footnote 11). The results are however relatively robust to the inclusion or exclusion of outliers. Mainly the test statistics on normality of the residuals are influenced by these changes in the specification.

estimate static regressions, i.e. do not include lagged endogenous variables, the estimation results rather indicate long-run effects of taxation than short-run adjustments to tax rates. With two capital classes and three classes of rates of return on capital, six equations have to be estimated. These six equations are estimated simultaneously using the Zellner–Aitken seemingly unrelated regression procedure (SUR). This procedure is used because the six different equations may be dependent from each other following the discussion of the different interdependencies of tax induced investment, location and profit shifting incentives outlined in the beginning of this section. If for example a canton — ceteris paribus — increases the corporate tax rate for very profitable medium sized firms with a high rate of return on capital, i.e. it increases the progressiveness of the corporate income tax schedule, the number of firms in this group of taxpayers in the respective canton can be expected to be reduced. This might happen because, first, the firm relocates to a canton with lower taxes for highly profitable firms, and second, because it shifts profits to other low tax cantons, or third, successfully manages taxes by seeking tax loopholes. The latter two strategies reduce the number of firms in the group of medium sized firms with high rates of return on capital in the particular canton and increase the number of medium sized firms with low or no rates of return in the same canton such that the aggregate number of firms in the canton remains the same. A simultaneous equations model captures these countervailing effects.

The results we obtain for the system of six equations are presented in Table 1.[16] The model explains the number of small and medium sized firms per capita with no or high rates of return reasonably well. In this case, at least 34% of the variation are explained by the model. In the case of small firms with low rates of return, much the same holds in explaining the variation by about 50%. The cantonal variation of the number of medium sized firms with normal rates of return is only explained to about 19%. The values of the Jarque–Bera statistics show that the null hypothesis of normal distribution of the residuals cannot be rejected on any conventional significance level in the case of firms with low and high rates of return. The hypothesis of normal distribution of the residuals is rejected for the firms with no rates of return despite the inclusion of the dummy variable for the canton of Uri which has already been identified as an outlier. Another outlier according to the residuals of the two equations of firms with no rate of return is the canton of Jura. Excluding this observation from the sample does not change the estimation results considerably, while the hypothesis of a normal distribution of the residuals cannot be rejected in the case of this reduced sample.

In the whole system of equations, the hypothesis that corporate income taxes do not have any impact on the distribution of large firms in the three classes of rates of return for small and medium sized firms can be rejected with $\hat{\chi}^2 = 19.471$ on the

[16]Excluding the observation of Appenzell i.Rh. in 1981 in the third equation did not alter the estimation results.

Table 1
The regional distribution of small and medium sized firms: 1981 and 1991 ($N=52$)

Firms	Medium	Medium	Medium	Small	Small	Small	Medium	Small
Rate of return	Low	High	No	Low	High	No	All	All
C	−16.230	−25.350	−10.684	18.781(*)	21.593(*)	15.709	−13.998	19.037
	(1.07)	(1.62)	(0.60)	(1.79)	(1.75)	(1.26)	(1.08)	(1.70)
Wages	2.415	2.390	1.652	−1.745	−2.355(*)	−1.101	1.770	−1.323
	(1.38)	(1.34)	(0.81)	(1.45)	(1.67)	(0.78)	(1.19)	(1.03)
Corporate tax rate	0.113	−1.090**	0.006	−0.131	−0.468(*)	−0.032	−0.428*	0.092
	(0.52)	(3.90)	(0.02)	(0.93)	(1.74)	(0.21)	(2.16)	(0.35)
Personal tax rate	−1.579**	−1.223*	−2.036**	−1.605**	−1.385**	−1.992**	−1.455**	−1.943**
	(2.74)	(2.02)	(3.05)	(4.05)	(2.83)	(4.28)	(2.93)	(4.34)
Educational expenditure	0.448	0.286	0.828*	0.691**	0.780**	0.880**	0.389	0.850**
	(1.62)	(1.03)	(2.58)	(3.62)	(3.57)	(3.92)	(1.63)	(4.28)
Public investment	0.074	0.413**	0.464**	0.316**	0.168	0.325**	0.266*	0.271*
	(0.49)	(2.67)	(2.66)	(3.06)	(1.37)	(2.65)	(2.07)	(2.44)
Share of urban population	−0.116	0.245	0.130	−0.146	−0.008	0.002	0.008	−0.073
	(0.61)	(1.25)	(0.59)	(1.12)	(0.05)	(0.01)	(0.05)	(0.52)
Population	−0.072	−0.100	−0.022	−0.012	−0.113	−0.069	−0.094	−0.059
	(0.72)	(0.98)	(0.19)	(0.17)	(1.41)	(0.84)	(1.11)	(0.81)
Year dummy for 1981	0.059	0.155	0.057	−0.072	0.082	−0.240	0.061	−0.179
	(0.28)	(0.68)	(0.24)	(0.51)	(0.44)	(1.43)	(0.35)	(1.04)
Cantonal dummy for Uri	−1.528**	−1.690**	−1.761**	−1.678**	−1.739**	−1.723**	−1.646**	−1.717**
	(3.53)	(3.79)	(3.50)	(5.62)	(4.96)	(4.88)	(4.46)	(5.40)
$\bar{R}^2$	0.189	0.499	0.338	0.515	0.421	0.540	0.440	0.528
SER	0.559	0.577	0.658	0.386	0.454	0.457	0.493	0.412
J–B	1.079	0.052	9.865**	1.064	0.006	6.052*	2.753	2.621

The numbers in parentheses are the absolute values of the estimated t-statistics. **, *, or (*) show that the estimated parameter is significantly different from zero on the 1, 5, or 10% level, respectively. $\bar{R}^2$ is the adjusted coefficient of determination (corrected for the degrees of freedom), SER the standard error of regression, N is the number of observations and J–B the value of the Jarque–Bera statistic on the normal distribution of the residuals. The computations have been performed by EViews, Version 3.0

1% significance level. Similarly, the hypothesis that personal income taxes do not have any impact on the distribution of large firms in the three classes of rates of return for small and medium sized firms can be rejected with $\hat{\chi}^2=23.214$ even on the 0.1% significance level. Cantonal education spending per capita and cantonal real capital spending per capita have a significant impact on the system with $\hat{\chi}^2=33.773$ and $\hat{\chi}^2=29.416$ on the 0.1% level as well.

The control variables perform somewhat less well. The hypothesis that average monthly salaries have no impact can be rejected with $\hat{\chi}^2 = 19.321$ on the 1% significance level for the system of equations. However, while the impact on small firms seems to be negative as expected, it seems to be positive on firms with medium size. On the other hand, none of the negative coefficients is significantly different from zero at the 5% level, and none of the positive coefficients at any conventional level. Thus, looking at the single equations the wage rate does not seem to have a significant impact on the location of firms.

For the size of the canton the null hypothesis of no influence can neither be rejected for the single equations nor for the system as a whole: the corresponding test statistics for the latter is $\hat{\chi}^2 = 6.527$. That the share of the urban population has no impact can be rejected with $\hat{\chi}^2 = 13.255$ on the 5% significance level for all equations together, but again: none of the estimated coefficients is significantly different from zero at any conventional level. The same holds for the dummy variable for the year 1981, where the likelihood ratio test for the whole system of equations provides a value of $\hat{\chi}^2 = 21.181$ which indicates significance even on the 1% level. Contrary to this, the hypothesis that the cantonal dummy variable for the canton of Uri has no impact can be rejected with $\hat{\chi}^2 = 33.322$ even on the 0.1% significance level for the whole system and at least on the 1% level in the single equations.

The four fiscal variables of the model have nearly exclusively the expected impact on the number of firms in the different classes. Taxes have a negative impact, with minor exceptions in the case of the corporate income tax, and public spending has a positive impact. Educational spending exerts a highly significant positive impact on the number of small firms in any rate of return category, but reaches significance at the 5% level in the case of medium sized firms only for those with high rates of return. Public capital spending has differential impacts in the different groups of corporate income taxpayers.

The corporate income tax rate has a significant negative impact only on the number of small and medium sized firms with above average rates of return on capital, in the first case only on the 10% significance level. In some cases, like for medium sized firms with low or no rates of return, it even has the wrong sign but the value of its t-statistic is far from any conventional significance level. By far the most significant impact in statistical and economic terms in this system of equations is exerted by the personal income tax rate. It is highly significant at least on the 5% significance level in all six equations and has the expected negative sign. It is slightly larger for small firms with low or high profits than for respective medium sized firms, while the opposite holds for firms with no profits. Given that the variables are expressed in log terms and can thus be interpreted as elasticities, the magnitude of the tax effects is astonishingly large with an elasticity higher than one for the personal income tax rate and an elasticity of about one for the impact of the corporate tax rate on medium sized firms with high profits. An increase of

the personal tax rate by 1% for example reduces the number of medium sized firms per capita with no profits by about 2%.[17]

The last two columns of Table 1 contain the constrained estimation results of the model for medium-sized and small firms pooling three rates of return classes in each case. The previous results for the differentiated rates of return classes are basically corroborated. With respect to taxation, the personal income tax has a stronger negative impact than the corporate income tax. While the negative impact of the personal tax rate is statistically significant at the 1% level for both capital classes and has elasticities above 1, the negative impact of the corporate income tax rate is significant only for medium-sized firms and has an elasticity below 1. For small firms, it has the wrong sign and is far from reaching any conventional significance level.[18] The coefficients of the average salaries are — as in the single equations — positive for the medium and negative for the small sized firms; both are, however, far from being significantly different from zero. Thus, according to these estimates we find again no significant impact of the wage rate on the location of the firms.

In addition, the model was estimated by excluding personal income taxes in order to check the robustness of the estimated coefficient on the pre-tax wage in the light of a potential impact of labour taxes on workers' mobility. If workers are (perfectly) mobile, they will move from one canton to the other in order to exploit income tax differences until the net wages between cantons are equated:[19] Higher pre-tax wages are associated with higher marginal income tax rates. Moreover, pre-tax wages may be increased by personal income taxes if labour supply of high skilled employees in one canton is relatively more elastic than labour demand. Managers are, for example, able to shift the personal income tax burden to firms. The overall effect of an increase in the labour income tax on firm and factor locations thus contains a direct impact of income taxes and an indirect impact resulting from the wage rate. The robustness check is performed in order to test whether the results obtained in Table 1 are sensitive to the indirect effect of labour income taxes.

The results are presented in Table 2. Compared to Table 1, the differences in the specification do not matter considerably.[20] Excluding personal tax rates, the impact of the corporate tax rate on the number of firms in the cantons increases slightly. It

[17]We also estimated the model augmented by neighbourhood effects by introducing the weighted average of corporate and personal income tax rates of the other cantons using the inverse of the geographic distance as a weight. The results remained essentially the same and are, therefore, not reported.

[18]This might indicate that profit shifting is easier for medium sized than for small firms.

[19]Kirchgässner and Pommerehne (1996), Feld (2000a) and Feld and Kirchgässner (2001) provide evidence for the Swiss cantons that the income tax rate influences the residence decision of individuals.

[20]An analysis of outliers, as indicated by the Jarque–Bera test statistic, does not lead to different results. In particular, excluding the observation of Appenzell i.Rh. in 1981 in the third equation did not alter the results as well.

Table 2
The regional distribution of small and medium sized firms: 1981 and 1991 ($N=52$)

Firms	Medium	Medium	Medium	Small	Small	Small	Medium	Small
Rate of return	Low	High	No	Low	High	No	All	All
C	−15.828	−33.173*	−21.437	10.833	13.903	5.701	−22.188	9.129
	(1.51)	(2.03)	(1.15)	(0.93)	(1.06)	(0.41)	(1.56)	(0.72)
Wages	1.738	3.101	2.144	−1.451	−1.968	−0.707	2.234	−1.096
	(1.42)	(1.64)	(0.99)	(1.08)	(1.30)	(0.44)	(1.35)	(0.75)
Corporate tax rate	−0.264(*)	−0.817**	−0.109	−0.265(*)	−0.534*	−0.182	−0.439*	−0.286
	(1.71)	(3.07)	(0.462)	(1.86)	(2.30)	(1.17)	(2.45)	(1.29)
Educational expenditure	0.018	−0.119	0.194	0.188	0.367*	0.258	−0.057	0.304(*)
	(0.12)	(0.52)	(0.74)	(1.16)	(1.98)	(1.33)	(0.28)	(1.70)
Public investment	0.089	0.474**	0.581**	0.410**	0.246(*)	0.440**	0.347*	0.388**
	(0.87)	(2.96)	(3.19)	(3.61)	(1.92)	(3.25)	(2.49)	(3.13)
Share of urban population	0.013	0.402*	0.386(*)	0.055	0.169	0.252	0.193	0.174
	(0.11)	(2.10)	(1.77)	(0.40)	(1.10)	(1.55)	(1.16)	(1.17)
Population	−0.153*	−0.178(*)	−0.130	−0.099	−0.184*	−0.176*	−0.172(*)	−0.146(*)
	(2.31)	(1.70)	(1.09)	(1.34)	(2.20)	(2.00)	(1.91)	(1.80)
Year dummy for 1981	0.095	−0.139	−0.205	−0.266(*)	−0.088	−0.486**	−0.144	−0.294
	(0.69)	(0.59)	(0.85)	(1.77)	(0.46)	(2.72)	(0.78)	(1.58)
Cantonal dummy for Uri	−0.709*	−1.570**	−1.597**	−1.552**	−1.630**	−1.566**	−1.527**	−1.586**
	(2.35)	(3.32)	(2.98)	(4.64)	(4.31)	(3.92)	(3.73)	(4.34)
$\bar{R}^2$	0.167	0.447	0.251	0.399	0.336	0.420	0.362	0.388
SER	0.387	0.607	0.697	0.430	0.486	0.513	0.526	0.469
J–B	19.328**	0.079	8.974*	1.186	0.222	6.358*	11.460**	10.394**

The numbers in parentheses are the absolute values of the estimated t-statistics. **, *, or (*) show that the estimated parameter is significantly different from zero on the 1, 5, or 10% level, respectively. $\bar{R}^2$ is the adjusted coefficient of determination (corrected for the degrees of freedom), SER the standard error of regression, N is the number of observations and J–B the value of the Jarque–Bera statistic on the normal distribution of the residuals. The computations have been performed by EViews, Version 3.0

now has the expected negative sign in all rates of return classes and is significantly different from zero at least at the 10% significance level in four of six cases. Only small and medium sized firms with no rate of return are not influenced by corporate income taxes which, on the other hand, is hardly astonishing. The constrained estimates for the aggregate of the medium-sized and small firms again show that the corporate income tax particularly has an impact on the location of medium-sized firms of about the same magnitude as in the estimation in which the personal income tax is included whereas the impact on the small firms is increased without being significant however. The impact of the control variables remains relatively robust. Especially, the coefficient of the average salaries is now never significantly different from zero at any conventional significance level. The impact

of wages in the estimations without the personal income tax is quantitatively more important in the case of medium sized firms and less important in the case of small firms than in the estimations in which the personal income tax rate is included. We can therefore not conclude that the relationship between pre-tax wages and personal income tax rates is unambiguous. The direct impact of personal income tax rates seems to be dominant compared to the indirect impact through wages. It indirectly indicates that managers are relatively successful in shifting the tax burden of the personal income tax to firms.

We can summarise the tax effects in a similar fashion like we discussed them at the outset of this section. The corporate tax rate appears to significantly negatively affect the number of highly profitable firms only. It has no impact in all other cases. Only firms which did not manage to keep their taxable profits low due to profit shifting or other kinds of tax management are hit by the corporate income tax and have an incentive to relocate. Whether this significant reduction of highly profitable firms is the result of a relocation or of profit shifting cannot be identified.[21] Given the institutional environment in Switzerland with tax exemption as double taxation relief and formula apportionment, the results may indicate a mixture of both profit shifting and relocation decisions.

The results also confirm that the corporate income tax has a more important impact on highly profitable medium sized firms than on the respective small firm counterpart. The opposite holds in the case of personal income taxes. They appear to be more important for small firms. This makes sense given the fact that owners of small firms to a larger extent manage their own business. They can obtain higher salaries in order to avoid corporate tax payments. The personal income tax is thus more relevant to them. Even in the case of medium sized firms, the strong impact of personal tax rates confirms a notion often reported as piecemeal evidence: Personal tax rates in Switzerland are more important than corporate tax rates for the location of business because they are crucial for the attraction of highly skilled employees. But how does this pattern of tax effects on the regional distribution of firms translate into effects on real economic activity like employment?

4.2. The employment equation

For modelling the employment decision we also use aggregate cantonal instead of micro-level data on firms' labour demand, as the latter are not available.[22] Employment in canton j, $L(j)$, is the dependent variable from Eq. (3′). The major difference between the employment and the location equations is that we can use

[21]The positive sign of the corporate income tax in the case of medium sized firms with low or no rates of return on capital might be interpreted as supporting evidence for profit shifting. It is however not significant.

[22]Thus, we essentially follow the approach by Carroll and Wasylenko (1994).

time dummies to consider business cycle effects or other symmetric shocks, because we have a panel with annual data over 14 years. On the other hand, the panel structure of the data also demands that we take possible autocorrelation of the residuals into account.

Modelling the location decision, we used the two different corporate tax variables for firms with low and high rates of return. These two variables are, however, highly correlated which renders it useless to consider both in the (same) employment equation without differentiating between firms with different rates of return. Consequently, we use the variable which represents the 'normal' rate of return on capital of 8% as an indicator for the corporate tax burden. Again, however, we select the tax rate on taxable personal income of SFr 1 million per year from the available income tax rates. Both tax rates are expected to exert a negative influence on cantonal employment.

Finally, we use the same variables for government spending, relative wages as the deviation of average monthly salaries from the Swiss weighted average and, in addition to the demographic variables of the previous system estimates, indicators capturing the demographic structure of the population. Since variables measuring schooling or other education effects are not available on an annual basis, the inclusion of the population age mix allows to control for differences in the number of people in working age. We thus expect both variables for the demographic structure to exert a negative impact on cantonal employment. Following Eq. (3′), all variables are expressed in log terms. Thus, our econometric model for the employment equation is as follows:

$$empl - pop = f(w, ctax, ptax, edexp, pubinv, pop, old, young, urbpop) \qquad (5)$$

with: *empl*, number of employed persons; *w*, deviation of the average real monthly salaries of the male population from the weighted Swiss average; *ctax*, corporate income tax rate for corporations with a rate of return on capital of 8%; *ptax*, personal income tax rate for the income group of taxable income of SFr 1 million per year; *edexp*, real public educational expenditure per capita; *pubinv*, real public investment per capita; *pop*, population; *old*, share of people with age above 65 years; *young*, share of young people younger than 20 years; *urbpop*, share of urban population.

In addition to these variables we always use time dummies for each point of time. We use a panel over the 26 Swiss cantons and for the 14 years from 1984 to 1997. Thus, our observational period covers the boom period during the end of the 1980s and the long recession which lasted from the beginning until nearly the end of the 1990s.

In estimating this model, we face several problems. There is first the possible simultaneity between the dependent and some of the right hand side variables. For example, government officials may adjust cantonal tax rates to the economic (employment) situation. If they set these tax rates procyclically in order to compensate for reductions in the tax base during a recession by increases in the tax

rates, the tax rate may depend upon employment. In such a situation, an instrumental variable estimator should be used. However, due to the small number of time series points (14) in relation to the number of cross-section points (26), the usual instrumental variable estimator is not feasible.[23] The potential simultaneity bias should however not severely affect the results because of the natural lags that occur in tax assessment in Switzerland. In the period covered by our data, tax assessment was only every second year, and always for a two years period: Taxable income in year t and $t+1$ was the average income of the years $t-1$ and $t-2$. Government officials would have to know how economic development 2 years in advance is going to be in order to adjust their tax rates according to projected growth and employment developments. They would thus have to have very rational expectations. Given the usual inertia in the public sector, this is an implausible assumption.[24] Thus, even if we do not get efficient, we should at least get consistent estimates.

Second we have high positive autocorrelation of the estimated residuals. This does not necessarily affect the consistency of the estimated parameters but leads in any case to inconsistently estimated standard errors. Thus, using a GMM procedure we correct the standard errors to take autocorrelation as well as heteroscedasticity of the residuals into account.[25] The estimation results of the model are presented in Table 3.

We start with a pooled cross section time series model of cantonal employment. All in all, the model explains the variation of cantonal employment to about 60%. Of the tax variables, only the personal income tax rate has the expected negative sign and is significant on the 5% level. The coefficient of the corporate income tax rate is not significant and has the 'wrong' (positive) sign. In addition, the coefficient of the corporate tax variable is rather small, while the personal income tax exerts a non-negligible impact on cantonal employment with an elasticity of 0.2. Public educational expenditure is significant at the 5% significance level and public investment is significant at the 1% significance level.

If we look at the structural coefficients, only the share of young people has the expected negative impact on employment: the smaller the part of the population younger than 20, the smaller employment will — ceteris paribus — be. The share of the old population has a positive sign, but is far from any conventional significance level. On the other hand, it is interesting to note that the share of the urban population from total population has nearly no effect on employment: There appears to be no systematic difference between the employment situations in the cities and in rural areas.

[23] In addition, other more advanced estimators like GMM also cannot be used for this reason.

[24] This does not mean that firms are not able to make reasonable forecasts of their tax burden. The reaction of firms to taxation is however following the proposed direction of causation. The simultaneity bias arises because taxes may depend on employment.

[25] See for this Greene (1998, p. 408).

Table 3
The employment equation: 1984–1997 ($N=364$)

Effects	Non	Fixed	Non	Fixed	Non	Fixed
Relative wages	0.242	0.071			0.347*	0.078
	(1.63)	(1.40)			(2.26)	(1.54)
Corporate tax rate	0.015	−0.088**	0.007	−0.083**	−0.023	−0.090**
	(0.35)	(4.62)	(0.02)	(4.45)	(0.46)	(4.70)
Personal tax rate	−0.212*	−0.060*	−0.233**	−0.063*		
	(2.53)	(2.06)	(2.82)	(2.16)		
Educational expenditure	0.059*	0.066**	0.066*	0.066**	0.003	0.067**
	(2.15)	(3.18)	(2.46)	(3.20)	(0.11)	(3.25)
Public investment	0.054**	0.008	0.052**	0.007	0.068**	0.007
	(2.83)	(1.36)	(2.85)	(1.33)	(2.36)	(1.34)
Population	0.011	−0.553**	0.011	−0.549**	0.002	−0.529**
	(0.96)	(7.38)	(0.96)	(7.31)	(0.13)	(7.10)
Share of old population	0.015	0.028	0.001	0.047	−0.086	0.048
	(0.10)	(0.51)	(0.01)	(0.87)	(0.62)	(0.89)
Share of young population	−0.825**	−0.048	−0.871**	−0.012	−0.880**	−0.046
	(4.41)	(0.62)	(4.82)	(0.17)	(4.79)	(0.60)
Share of urban population	−0.028	−0.210(*)	−0.029	−0.172	−0.008	−0.167
	(1.39)	(1.71)	(1.41)	(1.43)	(0.39)	(1.37)
$\bar{R}^2$	0.627	0.975	0.623	0.974	0.605	0.974
SER	0.148	0.148	0.148	0.148	0.148	0.148
df	346	321	347	322	347	322

The numbers in parentheses are the absolute values of the estimated t-statistics, based on the Newey–West autocorrelation consistent standard errors. **, *, or (*) show that the estimated parameter is significantly different from zero on the 1, 5, or 10% level, respectively. SER is the standard error of regression, df are the degrees of freedom and N the number of observations. The estimations have been performed using LIMDEP, Version 7.0.

A surprising result is that the log of the deviation of real monthly salaries from the Swiss weighted average has a positive coefficient: Contrary to the expectation an increase of real monthly salaries may lead to an increase of employment. This coefficient could also reflect a causation in the opposite direction: an increase of employment might tighten the labour market and, thus, lead to a wage increase. It could also suggest that employment expands because of a dominance of labour demand shocks over labour supply shocks. However, this positive effect of the wage proxy does not gain statistical significance in most of the specifications used and should thus not worry too much. As the results in column 3 and 4 of Table 3 show, dropping this variable from the equation renders virtually the same results. Checking the robustness of the estimates with respect to the indirect effect of personal income taxes in the light of worker mobility by dropping the personal

income tax rate (columns 5 and 6) increases the importance of the wage variable. In this specification, the deviation of real monthly salaries has a significantly positive impact on employment. The coefficients of the control variables remain however rather stable.

If we introduce fixed cantonal effects in addition to the time effects, the results exhibit an interesting change. On the one hand, the corporate income tax rate now has the expected negative impact on employment and is significant at the 1% significance level. Its coefficient is relatively small such that an elasticity of less than 0.1 results. On the other hand, the impact of the personal income tax rate is reduced. It remains significantly different from zero at the 5% level and has the expected negative sign, but the estimated elasticity is less than a third of the coefficient estimated in a specification without fixed cantonal and with fixed time effects. Again dropping the deviation of real monthly salaries does not change these results and the impact of the corporate tax rate remains robust in the two sided fixed effects specification if the personal income tax rate is dropped. In all specifications with fixed cantonal effects, the deviation of real monthly salaries does not reach any conventional significance level. In addition to both tax rates, educational spending per capita keeps its significantly positive impact while the impact of public investment spending per capita is not robust to the introduction of fixed cantonal effects. The demographic structure does not have any impact on employment in this specification. Population is significantly negative and the share of the urban population has a marginally significant negative impact on employment which is however not robust to the inclusion of the deviation of real monthly salaries and the personal income tax rate.

By estimating the model with fixed time effects, we focus on the cross sectional variation of cantonal employment. Estimating the model with fixed cantonal effects puts a stronger emphasis on the variation of employment over time. Including both, spurious factors are relatively satisfactorily controlled for. Some authors refer to such a specification as the ‘gold standard’ in panel data analysis. With respect to the impact of taxes on employment as an indicator to what extent tax rate differences and subsequent location decisions lead to real economic outcomes, these results of a model with and without fixed effects indicate the difference in the emphasis of cross section effects. The fixed cantonal effects might capture some of the differences in the personal income tax rate between cantons and thus reduce the impact of this variable on employment. That the corporate tax rate becomes significant if fixed cantonal effects are included might be interpreted as a particular influence of corporate tax rates on employment over time.

All in all, the results of the employment equation show that taxes do not appear to have a dramatic impact on cantonal employment despite their strong importance in the explanation of the regional distribution of firms. While the impact of corporate and personal income taxes on cantonal employment is significantly different from zero in the fixed cantonal and time effects specification, their

coefficients are relatively small. Although the coefficient of personal income taxes in the fixed time effects specification is larger, it is still far from being impressive. Again, like in the model for the regional distribution of firms, it appears that the direct effect of personal income taxes on employment is dominating the indirect impact through wages. Thus, tax rate differences between the Swiss cantons matter, but do not exert major effects on employment although their impact on the regional distribution of taxpayers is considerable.

5. Concluding remarks

The results in this paper provide empirical evidence that corporate and personal income taxes have an impact on the regional distribution of small and medium sized firms with no, low or high rates of return on capital in Switzerland in 1981/82 and 1991/92, and on cantonal employment from 1984 to 1997. Though the empirical evidence has to be interpreted cautiously, the empirical results show that corporate income taxes have at least some influence on location and employment decisions of private firms. The corporate income tax rate negatively affects the number of highly profitable firms. This effect appears to be stronger for medium sized than for small firms. It has no statistically significant impact in all other cases. Only firms which do not manage to keep their taxable profits low due to profit shifting or other kinds of tax management are hit by the corporate income tax and have an incentive to relocate. Personal income taxes have a more considerable negative impact on the regional distribution of firms in all six classes of firms analysed. They are however relatively more important for small than for medium sized firms. This is a reasonable result in the case owners of small firms manage their own business to a larger extent. Even in the case of medium sized firms, the strong impact of personal tax rates confirms some piecemeal evidence: Personal tax rates in Switzerland are more important for the location of business than corporate tax rates because they are crucial for the attraction of highly skilled employees. Due to the relatively higher elasticity of labour supply, they are able to shift the personal income tax burden to firms.

While these results may rather indicate long-run effects of taxation than short-run adjustments, the analysis of cantonal employment puts some more emphasis on the influence of taxes over time. According to our results, corporate tax rates only exert a negative impact on cantonal employment in the specification with two-way fixed effects in which a stronger weight is put on the development of employment over time. We can only speculate about the origin of this result. It may perhaps indicate that firms adjust to corporate tax rates transitionally by reducing their labour demand. Such an interpretation has to be confirmed by additional investigations in firms investment behaviour possibly with firm-level data. While the impact of personal tax rates on employment is relatively smaller in

the two-way fixed effects specifications than in the one with time fixed effects only, it remains significantly negative in all specifications.

The most interesting characteristic of the results is that corporate and in particular personal income taxes have a stronger impact on the cantonal distribution of firms than on employment. Together with the differential impact of both taxes in the different classes of rates of return on capital for differently sized firms, this difference provides some indirect evidence for the existence of profit shifting among cantons or for smart tax management for a firm located in one canton only. This holds despite the several incentives provided by intercantonal tax laws such as the tax exemption system and formula apportionment.

These results do not necessarily imply that only small and medium-sized firms, which do not employ many people, are sensitive to taxes and large firms with a higher employment leverage are not. First, the number of small and medium-sized firms is relatively high such that in sum total employment created by that business segment easily exceeds that of large firms. Second, our empirical results on the distribution of small and medium-sized firms cannot be extended towards large firms unless we do not include this group in the empirical analysis. To obtain a clearer impression whether and to what extent profit shifting or tax induced relocation of firms results in subsequent changes of employment, it appears to be necessary to analyse firm-level data which are not yet available.

That the evidence of the impact of taxes on employment is not stronger might also be due to the fact that the Swiss system of corporate income taxation has been rather complicated in the past which creates severe problems to construct a single really informative indicator of the corporate income tax burden. Moreover, at least with respect to firms moving into a canton, there often are special tax holidays over the first ten years, which makes the official tax rates even less indicative for the tax burden of those firms which are most relevant in the tax competition between the cantons. Similarly, hidden subsidies are paid to firms in the form of specific public services which are not fully paid for by the firms. Moreover, administrative costs of taxation impose indirect taxes on firms as well and are also not captured by our tax variable measure. A final reason might be that, as many other studies show, the tax burden is just one factor for the location decision of private firms; many other factors can play a much more important role.[26]

Last, but not least, is should be noted that — at least up to now — corporate income tax competition might play a lesser role for real economic decisions as is often assumed. Switzerland is a small country, and costs for moving within the country are low compared to moving costs between, e.g. member states of the European Union. If in such a situation the employment decisions are only to a small extent influenced by corporate income tax rates, it is reasonable to assume that differences in corporate income tax rates will have an even smaller impact on

[26]See, e.g. Calzonetti and Walker (1991), who show in a survey that most studies concede only a minor role for fiscal variables with respect to location decisions of firms.

employment in the different EU member states. The main impact of such differences is presumably not the impact on the location decisions of the actual production, i.e. on employment, but on the firm's decision where corporate income taxes are paid. As the example of BMW shows, these points might be very far away from each other.[27] All in all, our results provide some support for the conjecture that profit shifting remains important even if tax rules like formula apportionment are used. The main problem with respect to tax competition today is not the regional impact on the employment decisions but on the incentives for profit shifting and thus for the tax revenues.

6. Data sources

$firm^i$	number of firms with a capital of SFr 2 million in the i-th class of rate of return
Source	Eidgenössische Steuerverwaltung, Bern, Unpublished data on the regional distribution of corporate income taxpayers.
$ctax^i$	corporate income tax rate for corporations with a rate of return on capital of 8 ($i=1$) or 40 ($i=2$) percent
ptax	personal income tax rate for the income group of taxable income of SFr 1 million per year
Source	Eidgenössische Steuerverwaltung, Steuerbelastung in der Schweiz, Tables 23 and 43, Bern, various years.
empl	number of employed persons
Source	BAK Basel, personal correspondence
w	average real monthly salaries of the male population
Source	Bundesamt für Industrie, Gewerbe und Arbeit (BIGA), Abteilung Wirtschaft und Statistik, Sektion Lohnstatistik, Durchschnittliche Löhne nach Kantonen und Agglomerationen, Bern, various years.
edexp	real public educational expenditure per capita
Source	Eidgenössische Finanzverwaltung, Öffentliche Finanzen der Schweiz, Table 28, Bern, various years.
pubinv	real public investment per capita
Source	Eidgenössische Finanzverwaltung,Öffentliche Finanzen der Schweiz 1989, Table 29, Bern, 1991.
pop	population

[27]Over many years, BMW which produced in Germany paid hardly any corporate income taxes there, but paid them in Dublin (See: So viele Inseln: Die hohen deutschen Steuern jagen immer mehr Unternehmen in die Flucht; das Ausland lockt mit attraktiven Sätzen und Vergünstigungen, in: Wirtschaftswoche No. 47, November 14, 1996, pp. 80–101). For a description of the mechanisms which allow such a 'splitting' see, e.g. Müller (1998).

old	share of people with age above 65 years
young	share of young people not over 20 years old
urbpop	share of urban population
Source	Bundesamt für Statistik, Informationsdienst, Sektion Bevölkerungsentwicklung, personal correspondence with Ursula Wegmüller.

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