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Hans Ulrich Bacher and Marius Brülhart

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Hans Ulrich Bacher, Credit Suisse AG
Marius Brülhart, Université de Lausanne and CEPR

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Centre for Economic Policy Research
53–56 Gt Sutton St, London EC1V 0DG, UK
Tel: (44 20) 7183 8801, Fax: (44 20) 7183 8820
Email: cepr@cepr.org, Website: www.cepr.org

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ABSTRACT

Progressive Taxes and Firm Births*

Tax reform proposals in the spirit of the 'flat tax' model typically aim to reduce three parameters: the average tax burden, the progressivity of the tax schedule, and the complexity of the tax code. We explore the implications of changes in these three parameters on entrepreneurial activity, measured by counts of firm births. The Swiss fiscal system offers sufficient intra-national variation in tax codes to allow us to estimate these effects with considerable precision. We find that high average taxes and complicated tax codes depress firm birth rates, while tax progressivity per se promotes firm births. The latter result supports the existence of an insurance effect from progressive corporate income taxes for risk averse entrepreneurs. However, implied elastiticities with respect to the level and complexity of corporate taxes are an order of magnitude larger than elasticities with respect to the progressivity of tax schedules.

JEL Classification: H25, H32, H7 and R3
Keywords: corporate taxation, entrepreneurship, firm location and risk taking

Hans Ulrich Bacher
Credit Suisse AG
8070 Zurich
SWITZERLAND
Email:
hans.u.bacher@credit-suisse.com

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Marius Brülhart
DEEP - HEC
University of Lausanne
Internef, Dorigny
CH - 1015 Lausanne
SWITZERLAND
Email: marius.brulhart@unil.ch

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1 Introduction

Despite a recent recession-induced shift toward more progressive taxation, the flat-tax model retains widespread appeal. By April 2010, 23 countries are operating flat-rate income tax systems, as do seven US states.[1] Many other countries and regions have considered reforms that would flatten their tax schedules. The most frequently invoked argument in favor of flat taxes is that they simplify both compliance and enforcement, but moving toward flat-rate taxation has a host of other economic implications, in terms of both efficiency and equity.[2] In this paper, we focus on one efficiency-related dimension of a particular type of flat tax: the impact of flat-rate corporate income taxes on the generation of new firms.[3]

The specific choice between flat and progressive corporate tax rates is a topic of ongoing debate in a number of industrialized countries. The United States, for example, raises a progressive federal corporate income tax, as do Japan and the United Kingdom. Conversely, Canada, France, Germany, Italy and Spain apply essentially flat-rate corporate taxes (with some exceptions for small businesses). The two approaches sometimes coexist at sub-national level. In the United States, for example, 31 states levy flat-rate corporate income taxes, 17 states levy progressive corporate income taxes and 3 states do not tax corporate income.

Births of new firms, in turn, are of interest for at least two reasons. First, we consider them a proxy for entrepreneurship, which, following Schumpeter, has come to be regarded as a key driver of economic growth.[4] Second, the number of firms choosing to start operations in a particular jurisdiction can be taken as a measure of that jurisdiction's locational attractiveness.

Our empirical work is based on data for Switzerland, which offers a well suited setting for an analysis of this issue. While the Swiss federal government levies a flat-rate corporate income tax, a wide variety of (flat and progressive) tax schedules are applied at the sub-federal

[1] See http://en.wikipedia.org/wiki/Flat_tax.

[2] See, e.g., Keen, Kim and Varsano (2008) for a general appraisal of recent flat-tax reforms.

[3] By considering corporate taxes in isolation, we take a narrower view than the most radical flat-tax model, in which a single tax rate is applied across all tax bases and corporate income may be taxed only when paid out as dividends (see, e.g., Hall and Rabushka, 2007).

[4] This intuitive assertion finds theoretical support in endogenous growth models, where entrepreneurs are primarily cast in the role of conduits between scientific research and market-oriented production (see, e.g., Michelacci, 2003). We can also invoke some relevant empirical evidence. Reynolds, Miller and Maki (1995) and Audretsch and Fritsch (2002) have found that regions with higher firm formation rates enjoy higher growth, in the United States and Germany respectively. These results were broadly confirmed by a number of country-level studies in the January 2008 special issue of Small Buisness Economics (see Fritsch, 2008). Employing indirect measures of entrepreneurship, Glaeser, Kallal, Scheinkman and Shleifer (1992) have found industry-level employment growth to be higher in US with below-average firm sizes; and Murphy, Shleifer and Vishny (1991) have reported positive growth effects of the share of engineering graduates in a large cross section of countries.

level, by Switzerland's 26 fiscally autonomous cantons. Furthermore, below the cantonal level, some 2,700 municipalities levy taxes at often very different average rates and with some further variations in progressivity.

We exploit the variation of tax schedules within Switzerland for an analysis of the impact of corporate tax progressivity on the creation of new firms. Our analysis is organized around three dimensions of corporate income taxes: the implications of higher or lower average tax burdens (the "level effect"), the implications of progressivity (the "insurance effect"), and the implications of tax complexity. To the best of our knowledge, ours is the first study to evaluate these three effects jointly. The smallness and regulatory homogeneity of Switzerland coupled with considerable intra-national variance in tax regimes limit the potential for estimation bias due to unobserved locational determinants of firm births.

The remainder of this paper is organized as follows. In the next section we review the salient literatures on firm births, firm location, taxation and risk taking. In Section 3, we present a simple model of risk taking and progressive taxation to formalize the intuition of the insurance effect. In Section 4 we present our empirical model and our data set for Switzerland. Estimation results are presented and discussed in Section 5. Section 6 concludes.

2 Literature background: taxes and firm births

The three dimensions of corporate tax policy we focus on have previously been subject to very different degrees of scientific scrutiny. While we can build on an extensive theoretical and empirical literature on the effect of changes in the level of (average and marginal) corporate tax rates, much less attention has been paid to the effect of corporate tax progressivity, and even less evidence exists on the implications of tax complexity.

2.1 The tax level effect

A sizeable empirical literature shows that firms seek to maximize post-tax profits and therefore prefer low corporate taxes to high corporate taxes, ceteris paribus. In a meta-analysis of 25 empirical studies on taxation and location choices of foreign investors, De Mooij and Ederveen (2003), for example, have reported a median value of the tax-rate semi-elasticity of -3.3, implying that a one-percentage-point reduction in the host-country corporate tax rate raises foreign direct investment into that country by fully 3.3 percent. In a qualitative survey of much the same literature, Hines (2007) detected signs of an increase over time in the tax responsiveness of international investment.

Negative coeﬃcients are also estimated in the majority of studies relating counts of new firms to local corporate tax burdens using discrete choice modeling.[5] A noteworthy recent development in this research area is the use of finely spatially disaggregated data, allowing precise estimation of tax effects in the face of spatial heterogeneity. For example, Guimaraes, Figueiredo and Woodward (2004) have estimated a count model of firm births at the level of US counties, again finding significantly negative local tax rate elasticities, controlling for local factor costs and agglomeration effects. US counties cover an average area of some 2,650 square kilometers. Rathelot and Sillard (2008) zoomed the analysis to an even finer spatial scale, drawing on data on firm births in French municipalities, which on average cover an area of 15 square kilometers. Their data did not allow them to control for spatial variations in factor costs, a problem they circumvented by comparing neighboring municipalities on either side of the borders separating larger administrative regions. They detected a rather small but statistically significant negative elasticity of firm-birth rates relative to local taxes. Brülhart, Jametti and Schmidheiny (2007), using data on firm births in a sample of Swiss municipalities (which on average cover an area of some 20 square kilometers) found that high corporate taxes act as a deterrent to local firm creation, but that this relationship is weaker in spatially concentrated sectors than in dispersed sectors.[6] The most spatially disaggregated study is by Duranton, Gobillon and Overman (2007), who compared firm births and employment growth of firms within one kilometer on either side of English regional boundaries. They found that local taxes impact significantly negatively on firm's employment growth, but they detected no significant effect of tax differentials on firm births. Duranton et al. (2007) explain the seeming irrelevance of local taxes for firm births by pointing out that local corporate taxes in the UK take the form of property taxes and are therefore likely to be largely capitalized in into property prices.

In a related strand of literature, economists have explored the impact of corporate tax levels on "income shifting" between the personal and the corporate tax base. Most tax systems leave considerable room for manoeuvre on this choice, mainly via different organizational forms and

[5] The seminal contributions are Carlton (1983) using the conditional logit estimator, and Papke (1991) using the Poisson count mondel.

[6] Using spatially more aggregated (canton-level) data, Feld and Kirchgässner (2003) also found that high corporate income taxes impact negatively on local firm numbers and employment in Switzerland.

via ‡exible accounting rules governing the heading under which the remuneration of owner-workers is declared. Several available studies show that, not surprisingly, the share of income that is declared as corporate is higher the lower is the level of corporate relative to personal income taxes (see, e.g., Gordon and Slemrod, 2000; Goolsbee, 2004; Cullen and Gordon, 2007; and de Mooij and Nicodème, 2008). Some of the observed income shifting into the corporate tax base is due to the incorporation of previously non-corporate organizations or due to the division of larger corporations into smaller …rms. In that sense, income shifting also contributes to the creation of new …rms.

Overall, therefore, the available evidence strongly supports the existence of a moderating impact of the level of corporate taxes on …rm births at both the national and the local level.

2.2 The tax progressivity e¤ect (insurance e¤ect)

If tax payers' decisions are made under uncertainty, the progressivity of tax schedules will have implications that di¤er from those of the level of (average e¤ective) taxes. Thus, under uncertainty, the variance of the tax bill matters in addition to the expected level of the tax bill.

Domar and Musgrave (1944) have famously shown that taxation can encourage risk taking.[7] Whilst assuming a ‡at tax schedule, they also took account of loss-o¤set provisions that imply a negative tax in case of losses. A higher tax rate then reduces both the expected level and the expected variance of post-tax income, which, depending on investor preferences, may make risky ventures relatively more attractive by reducing risk through an implied insurance e¤ect of taxation.

The Domar-Musgrave model, by featuring a ‡at tax over positive income, is not well suited to a formal distinction between the implications of changes in the level of the expected tax bill and changes in progressivity per se. An intuitive conjecture from the Domar-Musgrave result is that increased progressivity, provided it does not a¤ect the expected tax bill, should be favorable to entrepreneurial risk taking.[8] This intuition is supported to some extent by formal analysis. Ahsan (1974) considered investment in a risky asset under a ‡at-rate tax

[7] A corresponding analysis concerning personal income taxes has been provided by Varian (1980).

[8] Cullen and Gordon (2006b) have put it as follows: "For any given tax treatment of losses, a progressive tax schedule on pro…ts, holding expected taxes constant, should encourage risk taking. With progressive rather than proportional taxes, the owners get to keep a smaller fraction of large pro…ts but a larger fraction of small pro…ts. If expected tax payments are held …xed, this is a trade-o¤ that any risk-averse individual gains from making."

with and without a tax-exempt threshold, the former corresponding to a progressive schedule. Conditional on constant expected tax revenue, he found that risk taking is greater under the progressive tax than under the proportional tax, given standard assumptions on investors' aversion to risk. In a similar model, Cowell (1975) found that progressivity favours investment in the risky asset if the utility function is assumed to be quadratic, but may deter risk taking under di¤erent preferences.[9] Gordon (1985), allowing for a general form of risk aversion and corporate tax progressivity in a general-equilibrium setting, found that raising the marginal tax rate, other things equal, promotes investment while raising the average tax rate, other things equal, discourages investment. Waterson (1985) considered the implications of a quadratic tax function, again assuming a constant expected tax bill. He concluded that, while the e¤ect of progressivity on risk taking is positive for certain parameter con…gurations, its sign cannot be established in general.[10]

Empirically, the impact of personal income tax progressivity on entry into self-employment has been explored by Gentry and Hubbard (2000, 2005). They report negative impacts of personal income progressivity on entrepreneurship. The main explanation for these …ndings is that progressive taxation acts as a "success tax" on pro…table ventures: since entrepreneurs on average have higher incomes than employees, progressive income taxation discourages entrepreneurial risk taking. Crucially, however, this e¤ect confounds the impact of tax progressivity with that of the expected tax bill.[11]

Cullen and Gordon (2007) have estimated a model of entrepreneurial risk, controlling for both level and progressivity e¤ects of corporate tax schedules using US data. Entrepreneurial risk taking is de…ned empirically as the fraction of single tax …lers who report active non-corporate losses in excess of 10 percent of reported wage income. While their estimated regression coe¢ cients represent the impact of composite terms capturing "income shifting"

[9] Cowell (1975) used the term "compensation" for what we refer to as the "constant expected tax bill" condition.

[10] If entrepreneurial ventures are externally …nanced and entrepreneurs are subject to moral hazard (i.e. they have an incentive to shirk if their stake in the success of the venture is low), then the risk-reducing element implicit in progressive taxation may impede entrepreneurship (see e.g. Keuschnigg and Nielsen, 2004; and Hagen and Sannarnes, 2007). To the extent that the incidence of progressive taxation is felt by …nanciers rather than by entrepreneurs, however, the …ndings of the earlier literature on taxation and risk taking still apply.

[11] Gentry and Hubbard (2000, 2005) have regressed the probability that an individual switches from employment to self-employment on a set of variables including (a) the projected tax rate in case of unchanged employment status and (b) a measure of tax progressivity computed as the di¤erence in tax rates between a "successful" scenario, where taxable income increases by x percent, and an "unsuccessful" scenario, where taxable income decreases by y percent. They did not, however, control for the expected (i.e. probability weighted) tax rate in case of a switch to self-employment.

and "combined risk" effects inherent in the tax code, and therefore elude simple interpretation, their derived simulation results reported in Cullen and Gordon (2006a) show that a revenue-neutral shift to a flat tax à la Hall and Rabushka (2007) would reduce entrepreneurial risk taking by more than half. Their results are thus consistent with economically significant insurance effects. The main difference between our approach and that of Cullen and Gordon (2006a, 2007) is that we explore the impact of taxation on the birth rates of incorporated firms across different locations, whereas they focus on entrepreneurial individuals reporting high losses across quantiles of predicted potential earnings. Our empirical setting offers inter-jurisdictional variation in the entire tax schedule. It thereby allows a simple quantification of the various relevant dimensions of tax policy.

2.3 The tax complexity effect

A third way in which a change to a flat corporate income tax could potentially influence entrepreneurship (in sectors other than accounting and legal services) is by simplifying compliance via a reduction in complexity. Complexity has two components: the number of tax brackets and the definition of the tax base.

First, calculating tax liabilities is simpler with a single statutory tax rate than with a progressive tax schedule featuring multiple tax brackets. It seems reasonable, however, to question the practical importance of the complexity implied by progressive schedules alone.[12]

The most compelling case for the view that complexity raises compliance costs can be made if one moves beyond the narrow implications of progressivity alone and considers the statutory definitions of the tax base. Administrative complications are most evident where numerous different types of tax bases are distinguished and where the definitions of tax bases are subject to exceptions, deductions, tax credits and the like. Such complexity is not a necessary correlate of progressivity, but flat-tax proposals usually involve a reduction both in progressivity and in the complexity of the determination of the tax base.

Edmiston, Mudd and Valev (2004) found that the number of special corporate tax rates had a significantly negative impact on flows of foreign direct investment into European and Asian transition countries in the 1990s. However, and somewhat paradoxically, they report

[12] To cite Slemrod and Bakija (2004, p. 166), "a graduate tax-rate structure does not by itself directly contribute any significant complexity to the taxpaying process. Once taxable income is computed, looking up tax liability in the tax tables is a trivial operation (...)."

positive coefficients on an alternative complexity variable defined as the number of lines in the respective tax codes (similar to the measure that we will apply).[13] We are not aware of any prior empirical work relating firm births to the two components of tax complexity.

3 A simple model of tax progressivity and entrepreneurship

In this section, we present a highly stylized model to formalize the effect of progressivity on entrepreneurial risk taking, given a certain expected tax bill. As noted above, this effect has been analyzed before (Ahsan, 1974; Cowell, 1975; Waterson, 1985). We propose a simple framework primarily for its heuristic value.[14]

Suppose a risk averse entrepreneur has to choose where to locate her firm. She will make a high or low profit at the end of the year with a certain probability. The only salient difference between two potential locations arises from their corporate income tax schedules: one location features a flat tax while the other location has a progressive schedule. We ask which location the entrepreneur is better off choosing, provided that the expected corporate tax payments are the same in both locations. This constant expected tax bill condition is crucial to our analysis. Keeping the expected after-tax profit constant, progressive taxation reduces the variance of profits by more than linear taxation. As a consequence, tax progressivity serves as an insurance device: in bad times, an entrepreneur has to pay less than under a flat tax, whereas in good times the tax bill is higher. This, in a nutshell, is how progressivity can favor entrepreneurial risk taking.

To formalize the intuition, consider a risk averse entrepreneur with a standard Bernoulli utility function over income w, $U(w)$, with $U_w(w) > 0$ and $U_{ww}(w) < 0$. The entrepreneur faces a simple lottery $L = (p_L, p_H)$ over two possible profit outcomes $\{\pi_L, \pi_H\}$, with $\pi_H > \pi_L$ and $\pi_L \neq 0$.[15]

Profits are subject to either a flat or progressive tax schedule, defined as:

[13] Edmiston et al. (2004) explain the apparent positive effect of the length of tax codes by pointing out that more lines could imply greater legal precision - an aspect which might indeed be relevant in transition countries.

[14] The main simplification of our approach compared to existing theory is that we constrain the range of choices to two options. This simplification allows us to posit a general (Bernoulli) utility function, which, unlike those adopted in prior studies, need not exhibit increasing absolute risk aversion (see also Feldstein, 1969). Cullen and Gordon (2006a) propose a similar model, taking utily as the log of income.

[15] This framework also applies to cases where $\pi_L < 0$. In such cases, the corporate tax rate turns negative, implying a subsidy (e.g. through loss-offset or carry-forward provisions). Since taxation in our model does not include a lump-sum tax part (payable independently of the realisation of profits), we exclude $\pi_L = 0$. In our model, if $\pi_L = 0$, only π_H would be taxed (at the same rate as the flat tax rate).

- flat tax rate: t

- progressive tax rate: $t_L^{prog} = t + k_L$ if $\pi = \pi_L$ and $t_H^{prog} = t + k_H$ if $\pi = \pi_H$ with $k_L < 0 < k_H$, where k_L, k_H are constants.

In addition, we impose the following three conditions:

Condition 1 Constant expected tax bill condition

The expected tax bill is constant:

$$[t + k_L]p_L\pi_L + [t + k_H]p_H\pi_H = tp_L\pi_L + tp_H\pi_H.$$

Hence, expected after-tax income is assumed to be the same under the two tax schedules.

Condition 2 Spread condition

Risk is a function of the spread (the difference) of the two outcomes, π_L and π_H, whereas the probabilities and expected pretax profits are held constant.

This defines π_L:

$$\pi_L = \frac{\bar{\Pi} - \bar{p}_H\pi_H}{\bar{p}_L}, \tag{1}$$

where $\bar{\Pi} = p_L\pi_L + p_H\pi_H \geq 0$ is expected pre-tax profit, and upper bars design constants.

This condition implies that an increase in the variance of post-tax income w (and thus in risk) follows only from an increase in the spread of the two pre-tax profit levels. For notational ease, we suppress the upper bars henceforth.[16]

Conditions 1 and 2 allow us to express k_L as a function of π_L, π_H and k_H:

$$k_L = -\frac{p_H\pi_H}{\Pi - p_H\pi_H}k_H. \tag{2}$$

Condition 3 No-reversal condition

Post-tax income in the low-profit outcome cannot be higher than post-tax income in the high-profit outcome:

$$[1 - t - k_L]\pi_L \leq [1 - t - k_H]\pi_H.$$

[16] In what follows, brackets are used for mathematical operations, whereas parentheses are used for functions.

Hence, tax rates are not allowed to be so progressive as to reverse the ordering of the post-tax outcomes relative to the pre-tax outcomes.

Expected utility with a flat tax schedule then takes the following form:

$$\begin{aligned} EU(w^{flat}) &= p_L U([1-t]\pi_L) + p_H U([1-t]\pi_H) \\ &= p_L U\left([1-t]\frac{\Pi - p_H\pi_H}{p_L}\right) + p_H U([1-t]\pi_H), \end{aligned}$$

while expected utility with a progressive tax schedule becomes:

$$\begin{aligned} EU(w^{prog}) &= p_L U([1-t-k_L]\pi_L) + p_H U([1-t-k_H]\pi_H) \\ &= p_L U\left(\left[1-t+\frac{p_H\pi_H}{\Pi - p_H\pi_H}k_H\right]\frac{\Pi - p_H\pi_H}{p_L}\right) \\ &\quad + p_H U([1-t-k_H]\pi_H). \end{aligned}$$

We can now explore whether a change from a flat to a progressive tax schedule benefits a risk-averse entrepreneur.

Proposition 1 Expected utility is higher with a progressive tax schedule than with a flat-rate tax:

$$\frac{\partial\left[EU(w^{prog}) - EU(w^{flat})\right]}{\partial k_H}\Big|_{k_H=0} > 0.$$

Proof. Taking the derivative with respect to k_H around $k_H = 0$ results in:

$$\frac{\partial \Delta EU(w)}{\partial k_H}\Big|_{k_H=0} = -p_H\pi_H\left[U_w(w_H^{prog}) - U_w(w_L^{prog})\right] > 0,$$

where: $\Delta EU(w) = EU(w^{prog}) - EU(w^{flat})$, and $U_w(w_\ell^{prog}) = U_w([1-t-k_\ell]\pi_\ell)$, $\ell = \{L, H\}$.
■

This is the insurance effect: progressive taxation reduces the variance (and thus risk) by more than a flat rate. Therefore, the expected utility of after-tax income is higher under progressive taxation and a risk averse entrepreneur prefers progressive to flat taxation.

The logic of this simple model can be applied both to the location decision (choice between a location with a progressive tax and a location with a flat tax) and the entry-into-self-employment decision. Figure 1 illustrates this. Take the location decision, and suppose the two possible realizations π_L and π_H are equally probable. The entrepreneur can choose between two locations. The first one has a flat tax rate, and the corresponding after-tax realizations of π_L and π_H are w_L^{flat} and w_H^{flat}, respectively. At the second location, after-tax realizations of π are w_L^{prog} and w_H^{prog}. By the definition of progressive taxation and given the no-reversal condition, $w_L^{flat} < w_L^{prog} < w_H^{prog} < w_H^{flat}$. From the concavity of the utility function it follows that expected utility with a progressive tax, $EU\left(w^{prog}\right)$, is higher than expected utility with a flat tax, $EU\left(w^{flat}\right)$: the entrepreneur prefers the location with the progressive tax.

The same analysis can be applied to the entry decision. Again, suppose equally probable realizations π_L and π_H. Suppose that under a progressive tax the potential entrepreneur is just indifferent between entering self-employment and being employed, in which case she receives a fixed wage corresponding to the certainty equivalent of $EU\left(w^{prog}\right)$.[17] Imagine a switch to a flat tax. As a consequence, and easily seen in Figure 1, the expected utility from being self-employed, $EU\left(w^{flat}\right)$ decreases and so does the corresponding certainty equivalent (not drawn). Now, the potential entrepreneur unequivocally prefers remaining in risk-free employment.

It is intuitive, given the logic of the insurance effect of progressive taxation, that this effect becomes more pronounced for riskier ventures: the greater is the dispersion of uncertain outcomes, the more a potential entrepreneur stands to gain from progressive taxation. This can be expressed formally as follows.

Proposition 2 The greater is the spread between π_L and π_H, the more an increase in progressivity is preferred:

$$\frac{\partial^2 \Delta EU\left(w\right)}{\partial k_H \partial \pi_H} > 0$$

Proof. See Appendix A. ■

[17] The certainty equivalent of $EU\left(w^{prog}\right)$ is not represented in Figure 1. From Jensen's inequality it follows that this point is located to the left of $E\left(w^{flat,\ prog}\right)$.

4 Empirical model and data

4.1 A count model of …rm births

Our empirical project is straightforward: we seek to estimate the impact of the level, the progressivity and the complexity of corporate taxes on entrepreneurial activity.

We represent increases in entrepreneurial activity by the entry of new …rms. New …rms can be created in a jurisdiction through two basic processes. In the "latent-startup" process, immobile local residents are potential entrepreneurs who continuously compute the discounted expected utility from creating a …rm and become active once that value exceeds the utility associated with their safe(r) outside option. In the "footloose-startup" process, entrepreneurs are mobile and scan potential locations for the best certainty-equivalent pro…t opportunity, conditional on having decided to set up a …rm.

Despite the fundamental di¤erences between the two processes, they have both been shown formally to be compatible with a Poisson count model of …rm births. The latent-startup process has been modelled by Becker and Henderson (2000) and shown to lead directly to a Poisson model, subject to standard regularity conditions. Starting with Carlton (1983), the footloose-startup process has traditionally been modelled through a conditional logit representation, which can be formally derived from …rm-level pro…t functions. Guimaraes, Figueiredo and Woodward (2003) have demonstrated that Poisson estimation with group …xed e¤ects returns identical coe¢ cients to those obtained with conditional logit estimation.

We can therefore directly write an expression for $E(n_{ijt})$, the expected number of new …rms (or of jobs in new …rms) created in jurisdiction i, sector j and year t:

$$\begin{aligned} E(n_{ijt}) &= \lambda_{ijt} \quad (3) \\ &= \exp(\alpha_1 corptaxlevel_{ijt} + \alpha_2 corptaxprogressivity_{it} \\ &\quad + \alpha_3 risk_j ¤ corptaxprogressivity_{it} + \alpha_4 corptaxcomplexity_{it} \\ &\quad + ¯^{0}\text{taxcontrols}_{ijt} + °^{0}\text{othercontrols}_{ijt} + \mu^{0}\text{d}_j + ³^{0}\text{d}_t), \end{aligned}$$

where n_{ijt} follows a Poisson distribution, $corptaxlevel$ is a measure of of the expected average corporate income tax rate, $corptaxprogressivity$ is a measure of the progressivity of the corporate income tax schedule, $corptaxcomplexity$ is a measure of the complexity of the corporate tax code, $risk$ is a measure of the inherent riskiness of entrepreneurial ventures in sector j, **taxcontrols** is a vector of variables to represent tax burdens other than those on corporate pro…ts, **othercontrols** is a vector of non-tax factors in‡uencing the likelihood of …rm births, $\mathbf{d}_j$ is a set of sector dummies, and $\mathbf{d}_t$ is a set of year dummies.

Our four hypotheses are:

1. $\alpha_1 < 0$ (the e¤ect on …rm births of the expected corporate income tax level is negative),

2. $\alpha_2 > 0$ (following Proposition 1, the e¤ect on …rm births of tax progressivity is positive),

3. $\alpha_3 > 0$, (following Proposition 2, the positive e¤ect of tax progressivity is stronger in inherently riskier sectors), and

4. $\alpha_4 < 0$ (the e¤ect on …rm births of tax schedule complexity is negative).

4.2 Identi…cation and inference

When seeking to identify the coe¢ cients of our empirical model (3), we face the potential problem that, in general, corporate tax rules may be both cause and consequence of …rms' location choices. Resident …rms in‡uence local tax provisions through the local tax base or through the political process of local tax setting. Our strategy for avoiding potential simultaneity bias is to study location choices of new …rms in narrow sectors. While it is easy to conceive how existing …rms in a jurisdiction together may in‡uence local taxation, we consider it highly unlikely that entrants in a particular sector, location and period exert signi…cant and systematic in‡uence on pre-existing local tax rates. In our empirical setting, local jurisdictions are legally bound to apply identical statutory taxes across all sectors.[18] This allows us to treat tax rates as exogenous not only from the viewpoint of an individual …rm but also from that of a cohort of new …rms in a particular sector, location and period.

Another challenge to identi…cation concerns the variable $corptaxlevel$, which stands for the expected corporate tax rate. With progressive tax schedules, the expected tax rate depends

[18] Corporate taxation in Switzerland is based on legally binding statutory rates that depend solely on …rms' pro…tability and capital base. The de…nitions of these tax bases have been harmonized countrywide by a federal law that has been in force since 1993 and that foresees no …rm-speci…c or sector-speci…c regimes except for some clauses to avoid double taxation of holding companies. Some (mainly industrial) …rms can be o¤ered tax rebates for a maximum of ten years after setting up a new operation. Available evidence suggests that they a¤ect less than 4 percent of new …rms (Brülhart et al., 2007).

on expected pro…tability, which also a¤ects the rate of …rm births. Hence, our estimates of α_1 might be biased. Furthermore, to underestimate expected pro…tability would tend to bias estimates of α_2 and α_3 downward, and to overestimate it would tend to bias them upward, because progressivity would then correlate with the mismeasured expected tax rate. Speci…cally, when expected pro…tability is underestimated, this will tend to induce a positive correlation between the unobserved component of the true expected tax rate and the progressivity measure, thus biasing downward the estimated α_2. It is therefore important to take account of any systematic di¤erences in expected pro…tability. We compute $corptaxlevel$ separately for each sector-location pair, based on observed sector-average pro…tability rates. To the extent that …rms' expected pro…tability is sector speci…c conditional on the included regressors, our coe¢ cient estimates will be unbiased.

Finally, we need to think carefully about potential speci…cation and omitted-variable bias. In the absence of a natural experiment and of su¢ cient intertemporal variation, we have to rely essentially on cross-section identi…cation. Our approach is to control for all conceivably relevant determinants of …rm births in addition to the tax variables and to test the robustness of the estimated tax e¤ects across a range of speci…cations. The smallness and institutional homogeneity of Switzerland plays to our advantage in this respect, as it facilitates our task of generating an exhaustive set of controls.

Some features of our research design a¤ect inference. First, the Poisson model implies that the expected count, λ_{ijt}, is equal to the variance of n_{ijt}. This is a strong assumption in our applications, as the variance mostly exceeds the expected count (overdispersion), and as we observe a large number of zero observations on the dependent variable. Second, our model includes several explanatory variables that are purely municipality-year speci…c (such as the progressivity of the corporate tax schedule), while the dependent variable is municipality-sector-year speci…c. Such aggregate variables bias the estimated standard errors downward if not correctly adjusted for (Moulton, 1986). Third, we observe …rm startups over …ve years. We cannot exploit this panel structure by including location-sector …xed e¤ects, as the changes over time in our main explanatory are too small for the identi…cation of any statistically significant e¤ects. However, the likely presence of location-sector random e¤ects needs to be taken into account when estimating standard errors. All three issues are addressed by clustering standard errors in the two dimensions: by municipality-year and by municipality-sector. We therefore apply multi-way clustering as proposed by Cameron, Gelbach and Miller (2010). Clustering by municipality-year takes care of the second issue discussed above, clustering by municipality-sector addresses the third issue, and either of the clusters automatically accommodates the …rst issue.

4.3 Data

4.3.1 The Swiss corporate tax system

Several features of its political structure and tax system make Switzerland particularly well suited to serve as a laboratory for research on the e¤ects of …scal policy. Speci…cally, the Swiss system features three propitious characteristics.

1. Local tax autonomy

   Swiss taxes on corporate as well as on personal income are levied at three hierarchically nested jurisdictional levels: by the federal government, by the 26 cantons and by some 2,700 municipalities. The federal government taxes pro…ts at a ‡at rate of 8.5% and does not tax corporate capital. The cantons enjoy complete autonomy in the setting of their tax schedules. They all levy taxes on pro…ts and corporate capital as well as on personal income and wealth. In 21 of the 26 cantons, municipalities apply a single multiplier to the applicable cantonal tax schedules.[19] In the remaining cantons, the same multiplier applies to all municipalities within the canton, implying no municipal autonomy (see Table 1, last column).

2. Heterogenous tax schedules

   The autonomy of local tax setters yields large intra-national variance in taxation. The geography of corporate tax burdens is illustrated in Figure 2, which shows consolidated cantonal and municipal average corporate income tax rates on a representative …rm for the 26 cantonal capitals. The highest tax rate (Geneva, 23.5%) exceeds the lowest tax rate (Zug, 6.4%) by a factor of nearly four. As can be gleaned from Figures 3 and 4 for 2001 and 2005 respectively, the progressivity of these tax schedules exhibits similar intra-national heterogeneity. Eleven cantons, among them the cantons of Zurich (since

[19] In 8 of those 21 cantons, municipalities decide on a single multiplier that applies to both personal and corporate taxes. In the remaining 13 cantons, at least some municipalities apply separate multipliers to the two tax bases.

2005) and Geneva, apply a ‡at tax rate on pro…ts. The remaining …fteen cantons apply progressive schedules with two or more tax brackets. Additional heterogeneity arises from the fact that some cantons base the calculation of the simple tax on the amount of pro…ts, others on pro…tability, and some on a combination. Recent changes have without exception been in the direction of ‡atter tax schedules, as is evident in Figure 5.

3. Comparable jurisdictions

   Switzerland has an area of 41,285 square kilometers and a population of 7.5 million. It therefore covers about twice the area, and hosts roughly the same population, as the US state of Massachusetts. Many hard-to-measure geographical, cultural or political di¤erences that a¤ect international comparisons should not be of much concern in a study across jurisdictions at such a small spatial scale. In addition, institutional features such as the social security system, unemployment insurance and health insurance are either governed by federal law or substantively harmonized across cantons.

As our interest is in di¤erential …rm birth rates as a function of di¤erences in tax schedules, we need to ascertain that corporate income taxes indeed a¤ect these …rms. In Switzerland, distributed pro…ts are taxed twice, …rst at the level of the …rm, through the corporate income tax, and then at the level of the individuals receiving dividend payments, through the personal income tax. When a pro…table …rm's owners are also their employees - a frequent occurrence in startup …rms - then these owners have an incentive to declare these pro…ts as wages in order to avoid the corporate income tax. If there were no limits to this practice, the corporate income tax would become largely irrelevant for …rms run by owner-employees. Swiss …scal law, however, explicitly bans the "disguised" distribution of pro…ts via in‡ated wages, and jurisprudence consistently applies the "arm's-length principle", whereby wage payments to owner-employees have to conform to standard remuneration levels in the given occupation and sector.[20] Therefore, corporate income taxation is of relevance also to small owner-run …rms.

[20] See Henneberger and Ziegler (2008).

4.3.2 Variables used

Our study is based on a municipality-sector level panel data set for the …ve years from 2001 to 2005. The number of municipalities for which we have the required tax data ranges from 665 in 2001, covering 72 percent of the Swiss population, to 846 in 2005, covering 83 percent of the population.[21] Sectors are de…ned according to the two-digit level of Eurostat's NACE classi…cation, which distinguishes 51 sectors.[22] Table 2 lists our variables and data sources, Table 3 reports summary statistics, and Table 4 reports raw correlations.

Our dependent variable, new…rms, is the count of new …rms per municipality, sector and year. The alternative dependent variable, newjobs, is the count of full-time and part-time jobs created by those new …rms. The data set covers all new …rms created in Switzerland between 2001 and 2005. The average new …rm has 2.6 employees at birth, and 43 percent of new …rms have a single employee. Using newjobs as an alternative regressand may be useful by reducing the weight of one-person …rms in driving our results. Firms are de…ned as market-oriented incorporated organizations that are operating for at least 20 hours per week. New entities created by mergers, takeovers, breakups, changes of their legal form are not counted. Foreign …rms' …rst subsidiary in Switzerland, however is considered a new …rm. This provides us with data for 25,419 new …rms and 64,927 new jobs created over the sample period.

The main component of the explanatory part of our model are corporate tax burdens. In order to construct sector-speci…c representative corporate tax rates, we …rst need data on representative pro…ts and capital stocks. While nation-wide statistics exist neither at the level of …rms nor at the level of sectors, we can draw on a …rm-level data set for one of the 26 cantons (Aargau). This data set, obtained from the cantonal tax authority, reports pre-tax pro…ts and capital bases for 2004. It covers the universe of 15,731 …rms based in that canton, which represents 11 percent of Swiss …rms in 2004. We have two reasons to be con…dent that the micro data for Aargau are representative of patterns for Switzerland at large. First, the overall distribution of …rm-level pro…ts in that canton closely matches that for the whole

[21] The average population of our sample municipalities was 7,928 in 2001 and 7,243 in 2005. These municipalities were host to 85 (89) percent of all new …rms in 2001 (2005). The data cover roughly the upper size quartile of Swiss municipalities. Tax data for smaller municipalities are not collected centrally.

[22] A more sectorally disaggregated approach is not possible since our data on the distribution of pro…ts and capital are available at the two-digit level only. We were forced to omit four sectors, for which no …rm births were observed in our sample period: NACE 10 (coal mining), 12 (ore mining), 13 (uranium mining) and 23 (coke, re…ned petroleum and nuclear fuel). We also had to drop NACE 16 (tobacco) due to missing wage data. We therefore work with 46 sectors throughout.

country.[23] Second, the corporate tax burden in the canton of Aargau, computed by the federal tax administration, is very close to the national average.[24] From the Aargau data we can compute average profits, average capital stocks and average profitability for corporations with positive profits per two-digit sector.

Based on these data, we then construct sector-specific corporate-income tax measures.

- Level of the corporate income tax (corptaxlevel): Based on statutory tax rates and estimated industry-level average profits and capital stocks, we calculate the industry-specific effective average tax rate (EATR) on profits for all sample municipalities and years.[25]

- Progressivity of the corporate income tax (corptaxprogressivity): Based on the national distribution of capital and profitability across all sectors, we collected tax rates for first, third and fifth sextile profitability firms, characterized by profits amounting to 2, 9 and 32 percent, respectively, of own capital.[26] This was done separately for three capital levels, representing the first, second and third quartile of the distribution of capital. Our three alternative progressivity measures are then computed as weighted averages across the three representative capital levels.[27] The first progressivity measure, corptax-progressivity1, is the difference between the EATR for firms with high (32 percent) and low (2 percent) profitability. The second progressivity measure, corptaxprogressivity2,

[23] The first, third and fifth sextiles for pre-tax rate of returns are 3, 12 and 37 percent (canton of Aargau) against 2, 9 and 32 percent (Switzerland). The quantiles for Aargau are based on firm-level reported profit data, whereas the national quantiles are calculated using the national profit and capital distributions published by the Federal Tax Administration.

[24] The index of the corporate income tax burden computed by the Federal Tax Administration for the year 2004 has a value of 97.4 for the canton of Aargau. The national average is 100, with values ranging from 57.3 (Schwyz) to 126.7 (Geneva). Aargau levies a minimum corporate tax of 500 Swiss francs ($\approx$ 500 US dollars) on profits and capital together. Therefore, to calculate sector averages, we excluded all observations with a simple tax of 500 francs, even if they declared positive but very low profits. Furthermore, we considered observations with an implied pre-tax rate of return of more than 200 percent to be unreliable and excluded them.

[25] The Swiss corporate tax system allows corporations to deduct actual tax payments from their pre-tax income. Therefore, our EATRs are defined as $\frac{t^{\pi}(\pi - t^K K)}{(1+t^{\pi})\pi}$, where π denotes pre-tax profits, K is own capital, t^{π} is the statutory corporate income tax rate and t^K is the statutory capital tax rate.

[26] Due to some small cell sizes, the Aargau data do not allow us to calculate sufficiently reliable sector-level distributions. We therefore prefer to rely on frequency distributions for Switzerland as a whole (available aggregated across sectors) for the profitability dispersion measure.

[27] The weights applied are 0.375 for the cases of low and high capital and 0.25 for the median-capital case, thus taking into account that the low and high cases refer to the upper end of the first and third quartile respectively. The fact that two of our progressivitiy measures have negative minima (see Table 3) is explained by one canton (Aargau) applying a fixed minimum tax of CHF 500 on all incorporated firms, which implies regressive taxation for certain small firms with low profitability. Furthermore, the definiton of EATRs implies that there is some small within-canton variation in progressivity even though municipalities apply a single multiplier to the canton-level tax schedule. Eliminating this variation by taking averages of the progressivity measures within each canton and year has no discernible impact on our results.

corrects for the tax level: we divide corptaxprogressivity1 by the arithmetic mean of the EATR for firms with low, median and high profitability. A third measure of progressivity, corptaxprogressivity3, measures the redistributive impact of a given tax schedule compared with a proportional tax. By construction, this index ranges from -1 to +1. A value of $corptaxprogressivity3 > 0$ (< 0) indicates a progressive (regressive) tax system, while $corptaxprogressivity3 = 0$ stands for a proportional system.[28] Table 4 shows that these three measures are highly but not perfectly correlated, with correlation coefficients ranging from 0.89 to 0.98.

- Industry-specific risk (risk): In accordance with Condition 2, we define risk as the standard deviation of industry profits, expressed as a deviation from the cross-sector average standard deviation (risk therefore has mean zero), and based on the firm-level data for Aargau. This variable is then interacted with the three measures of corporate tax progressivity to provide a test of Proposition 2.

- Complexity of the corporate income tax schedule (corptaxbrackets): Following Slemrod (2005), we define corptaxbrackets as the number of different statutory corporate income tax brackets.

- Complexity of the entire corporate tax code (corptaxwordcount): We define this variable as the count of words in the cantonal corporate tax codes.[29]

In our baseline specification, we control for a range of additional potentially relevant tax variables concerning both corporate and personal income (taxcontrols) and for non-tax

[28] This measure is known as a "relative share adjustment" (see, e.g., Kesselman and Cheung, 2004). It is a weighted average of a local index of tax progressivity, RSA_k, where $RSA_k = \frac{1 - ATR_k}{1 - ATR} - 1$. ATR_k is the average tax rate for the k^{th} income group, and ATR is the aggregate average tax rate. RSA_k has an intuitive interpretation, since it can be used to calculate the gain or loss to a specific income group of switchig to a fully proportional tax. For example, if $RSA_k = 0.03$, a k-type taxpayer would suffer an income loss of 3 percent if the existing system were replaced by a proportional tax. The global index of progressivity, RSA_G, is then calculated as follows: $RSA_G = \sum_{k=1}^{K} \phi_k RSA_k$, where $\phi_k = \theta_k \left(\theta_k + 2 \sum_{l=k+1}^{K} \theta_l \right)$, and $\theta_k = \frac{w_k}{\sum_{k=1}^{K} w_k}$ is post-tax income share of the k^{th} taxpayer (w_k being post-tax income of the k^{th} taxpayer).

[29] Word counts are based on the official compendium of cantonal tax laws Steuern der Schweiz. This compendium reproduces the content of all cantonal tax laws in a standardized format. It has the advantage of using harmonized terminology and thus allowing meaningful comparisons of word counts. The fact, that three Swiss cantons are officially bilingual and have identical tax codes in both French and German, allows us to quantify the "excess words" in tax codes due to the French language. In the canton of Berne, the French version of the tax code is 36 percent longer than the German one, and in the cantons of Fribourg and Valais, these differences correspond to 44 and 29 percent respectively. Thus, the average "surplus word count" due to to the French language is 37 percent. Therefore, we devide the word count for Latin cantons by 1.37 (the tax code for the Italian-speaking canton of Ticino being recorded in French in the compendium).

explanatory variables that are also likely to determine …rm birth rates (othercontrols). The list of those variables is given in Appendix B.

5 Results

5.1 Baseline estimates

We estimate equation (3) using …xed-e¤ects Poisson regression with two-way clustered standard errors. Table 5 reports the baseline estimations for six di¤erent variants of our empirical model.

Our results are reassuringly consistent across speci…cations: all corporate tax variables and all statistically signi…cant controls retain their sign across the six regression runs. Whether we de…ne our dependent variable as counts of new …rms (columns 1-3) or as counts of jobs created by those new …rms (columns 4-6), is of little consequence to our estimates. Any observed regularities, therefore, do not seem to be driven by particularly small or particularly large new …rms. The estimated coe¢cient signs generally conform with expectations. Numbers of …rm births are relatively high in large municipalities, in municipalities with high (non-transfer) public expenditure and in municipalities with high rates of unemployment (which imply fewer outside options for "latent entrepreneurs"). Conversely, …rm birth rates are relatively low in remote municipalities (in terms of distance from the highway network). The one counterintuitive statistically signi…cant result on the control variables concerns property prices, for which we estimate a positive coe¢cient. This result very likely re‡ects the fact that property prices correlate with certain relevant but unobserved location-speci…c features without fully capitalizing them.[30]

Turning to the corporate tax variables, we …nd con…rmation for our main hypotheses.

1. The level of taxation has a statistically signi…cantly negative impact, with our corporate income tax variable corptaxlevel returning precisely estimated negative coe¢cients throughout. The existence of a negative tax level e¤ect is corroborated by the …nding that capital taxes (captaxlevel), personal income taxes (incometaxlevel) and inheritance taxes (inheritancetax) also consistently yield statistically negative coe¢cient estimates.

[30] Unobserved location-speci…c variables can be fully controlled for by including municipality-level …xed effects. We found that inclusion of such …xed e¤ects has no signi…cant impact on our results.

The only exception are wealth taxes (wealthtaxlevel), for which we obtain positive coe¢ - cients. A possible explanation for this result is that high wealth taxes act as an incentive for investing in privately held corporations. Overall, however, the conclusion that high average taxes depress …rm births is strongly supported.

2. The estimated e¤ects of tax progressivity are positive throughout, in line with our Proposition 1. These coe¢ cients are generally measured somewhat less precisely than those on the tax level variables. Nonetheless, all six coe¢ cients estimated on the variants of corptaxprogressivity are found to be statistically signi…cant at least at the …ve percent level. Our estimated coe¢ cients on the interactions of corporate income tax progressivity with our proxy measures for sector-speci…c risk are all positive, which is in line with Proposition 2. Only two of these interaction terms are statistically signi…cant (at the ten percent level), which is very likely due to the inevitably approximate measure of risk in our empirical context. Taken together, these estimates lend support to the prediction that, given a certain expected tax bill, progressivity promotes …rm births.

3. We …nd no signi…cant evidence that the complexity of the corporate income tax schedule itself (corptaxbrackets) a¤ects the rate of …rm births. The number of di¤erent tax brackets per se therefore seems to be of no consequence for entrepreneurial activity. In contrast, the complexity of the overall corporate tax code, measured via corptaxwordcount, has a statistically signi…cantly negative impact. Hence, entrepreneurship-promoting simpli…cation of corporate taxation would seem to be best achieved not by reducing the number of brackets of the tax schedule but by simplifying the tax code.

5.2 Robustness

In Table 6, we report variations on the baseline estimates of Table 5, in order to gauge the sensitivity of the baseline estimates. Given the similarity of the two sets of estimates reported in Table 5, we now limit our analysis to speci…cations with new…rms as the dependent variable.

We report estimates for twelve speci…cations, alternatively dropping variables from the baseline runs. In columns 1 to 3, we drop the control for the sector-speci…c expected level of the corporate income tax bill, corptaxlevel. This reverses the sign of the coe¢ cients on corporate tax progressivity, implying a negative e¤ect of progressivity - in line with the "success tax" argument proposed by Gentry and Hubbard (2000, 2005). These estimations show clearly that any verdict on the implications of tax progressivity hinges on whether or not one controls for the expected tax bill.

We also experiment with dropping the two complexity measures, corptaxbrackets (columns 4 to 6) and corptaxwordcount (columns 7 to 9). These changes turn out not to affect any of our coefficient estimates qualitatively, but they strengthen the measured positive impact of corporate tax progressivity. This could suggest that progressivity tends to be associated with more complex tax codes. However, we observe that it is especially the omission of the complexity measure corptaxwordcount that boosts the estimated coefficients on the progressivity measures (columns 7 to 9), although these variables are basically uncorrelated (Table 4). The low bivariate correlations suggest that progressive schedules are perfectly compatible with simple tax codes. The regression results, however, imply that, conditional on other factors, these two variables do comove, and that this comovement to some extent dampens the measured positive effect of corporate tax progressivity.

As a final robustness test, we drop all variables not related to corporate taxation bar the scaling variable munsize. These results are shown in columns 10 to 12 of Table 7. The signs and significance levels on our coefficients of interest are reassuringly similar to those found for the full model in Table 5. Unlike in the baseline estimations, the impact of capital taxes is now estimated to be statistically significantly negative. The coefficients on corptaxwordcount are up to 40 percent smaller, but they remain statistically significantly negative throughout. Less plausibly, the coefficient on dividendprovision turns statistically significant negative. Our main results, however, do not seem to be driven by the particular set of conditioning variables chosen for the baseline estimations.

We have conducted a number of additional sensitivity tests not reported here but available on request. The main alternatives we tried were (a) models with newjobs as the dependent variable, (b) models with the coefficient on the exposure variable munsize forced to unity, (c) models with municipality-level fixed effects, (d) models with canton-level instead of municipality-level personal tax variables, (e) models with sector-level coefficient estimates on wage and propertyprice to account for different factor intensities, and (f) models with additional controls (for municipal debt burdens, urban areas, length of lake shores, individual components of public expenditure, and local unemployment rates). None of our qualitative

…ndings turned out to be a¤ected.

5.3 Quantitative e¤ects

Our central research question is qualitative in nature: does corporate tax progressivity promote …rm births, given the expected corporate tax bill? The answer appears to be yes. We can go further than this, however, and evaluate the magnitudes of the various determinants of …rm births, related to taxes and otherwise. The Poisson coe¢ cients reported so far are semielasticities, measuring the proportionate change in the conditional mean of …rm births for a one-unit change in the respective regressor. Since the scales of our regressors di¤er considerably (see Table 3), these semielasticities are not directly comparable.

In Table 7, we therefore show transformations of the baseline estimates that can be compared across variables. Columns 4 to 6 report elasticities, computed as the product of the Poisson coe¢ cients (columns 1-3) multiplied by the means of the relevant regressors (column 10). These numbers give the percentage e¤ect of a one-percent change in the value of the respective regressor. As an alternative, we report semistandardized coe¢ cients in columns 7 to 9, de…ned as the product of the Poisson coe¢ cients (columns 1-3) and the standard deviations of the relevant regressors (column 11). The semistandardized coe¢ cients quantify the percentage e¤ect of a one-standard-deviation change in the value of the respective regressors.

Both sets of transformed coe¢ cients highlight the importance of taxes for …rm births. Of all regressors included in our model, by far the strongest e¤ects are measured for corporate tax levels, with an elasticity of around 3.3 in absolute value. Di¤erences in corporate income tax levels clearly have strong e¤ects on …rm formation rates across Swiss municipalities.[31]

Second to the impact of the expected level of the corporate tax bill comes the impact of the expected level of the personal tax bill, with an elasticity of slightly above 1 in absolute value. Given the di¢ culty of attributing relevant personal tax variables to municipalities (due to commuting), this variable likely su¤ers from some mismeasurement. This in turn implies attenuation bias for the coe¢ cient estimate, which makes the strong estimated e¤ect of personal taxes all the more noteworthy. The third most important dimension of taxation is the complexity of the corporate tax code (corptaxwordcount), with an elasticity of around

[31] Our estimates suggest a more than proportional reaction of …rm births to changes in corporate tax levels. It would of course be erroneous to read into this a potential for revenue-increasing tax cuts, as our model does not capture responses of the entire tax base.

-0.9. All other aspects of the tax code have comparatively minor e¤ects on …rm births. The average elasticity with respect to the progressivity of corporate taxes is estimated at around 0.08 - an order of magnitude smaller than the complexity e¤ect. The smallest quantitative e¤ect of all tax variables is found for corptaxbrackets and dividendprovision, with an average elasticity of very close to zero.

In sum, we …nd a clear hierarchy of tax e¤ects, with tax levels having by far the strongest impact on …rm birth rates, the complexity of tax codes coming second, and the progressivity of tax schedules having a comparatively small but statistically signi…cantly positive impact.

6 Conclusion

Tax reforms in the spirit of the "‡at tax" model have three central components: a reduction in the average tax rate, a reduction in the progressivity of the tax schedule, and a reduction in the complexity of the tax code. Using data on sub-federal jurisdictions in Switzerland, we estimate the separate e¤ects of these three components of corporate income taxes on the incidence of …rm births.

Our results con…rm that lower average tax rates and reduced complexity of the tax code promote …rm births. Controlling for these e¤ects, reduced progressivity inhibits …rm births. Our reading of this result is that tax progressivity has an insurance e¤ect that facilitates entrepreneurial risk taking.[32]

The positive e¤ects of lower tax levels and reduced complexity are estimated to be signi…cantly stronger than the negative e¤ect of reduced progressivity. To the extent that …rm births re‡ect desirable entrepreneurial dynamism, it is not the ‡attening of tax schedules that is key to successful tax reforms, but the lowering of average tax burdens and the simpli…cation of tax codes. Flatness per se is of secondary importance and even appears to be detrimental to …rm births.

[32] An alternative interpretation could be that new …rms prefer more progressive tax schedules, given an expected tax bill, because they are credit constrained: the lower tax liability in case of a bad pro…t outcome may o¤er a greater gain in terms of access to external funding than the loss implied by a higher tax liability in case of a good outcome. See Keuschnigg and Ribi (2009) for a model of corporate income taxation with credit-constrained …rms.

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A Appendix: Proof of Proposition 2

From (1) and (2) it follows that

$$\frac{\partial \pi_L}{\partial \pi_H} = -\frac{p_H}{p_L}, \tag{4}$$

and

$$\frac{\partial k_L}{\partial \pi_H} = -\frac{\Pi p_H k_H}{(\Pi - p_H \pi_H)^2}. \tag{5}$$

Then, Proposition 1 and equations (4) and (5) imply:

$$\begin{aligned}
\frac{\partial^2 \Delta EU(w)}{\partial k_H \partial \pi_H} &= -p_H \Delta U_w(w^{prog}) - p_H \pi_H \left[\begin{array}{c} U_{ww}\left(w_H^{prog}\right)[1 - t - k_H] \\ - U_{ww}\left(w_L^{prog}\right)\left[-\frac{\partial k_L}{\partial \pi_H}\pi_L + [1 - t - k_L]\frac{\partial \pi_L}{\partial \pi_H} \right] \end{array} \right] \\
&= -p_H \Delta U_w(w^{prog}) - p_H \pi_H \left[\begin{array}{c} U_{ww}\left(w_H^{prog}\right)[1 - t - k_H] \\ - U_{ww}\left(w_L^{prog}\right)\left[\begin{array}{c} \frac{\Pi p_H k_H}{(\Pi - p_H\pi_H)^2}\frac{\Pi - p_H\pi_H}{p_L} \\ - \left(1 - t + \frac{p_H\pi_H}{\Pi - p_H\pi_H}k_H\right)\frac{p_H}{p_L} \end{array} \right] \end{array} \right] \\
&= -p_H \Delta U_w(w^{prog}) - p_H \pi_H [1 - t - k_H] \left(U_{ww}\left(w_H^{prog}\right) + \frac{p_H}{p_L} U_{ww}\left(w_L^{prog}\right) \right) \\
&> 0,
\end{aligned}$$

where:

$$\begin{aligned}
U_{ww}\left(w_L^{prog}\right) &= U_{ww}\left([1 - t - k_L]\pi_L\right) < 0, \\
U_{ww}\left(w_H^{prog}\right) &= U_{ww}\left([1 - t - k_H]\pi_H\right) < 0, \\
\Delta U_w(w^{prog}) &= U_w(w_H^{prog}) - U_w(w_L^{prog}) < 0.
\end{aligned}$$

A Appendix: Control variables

The list of baseline explanatory tax variables (taxcontrols) is as follows.

- Level of capital tax (captaxlevel): We calculate an industry-specific EATR on corporate capital for all municipalities and years.
- Provisions to alleviate double taxation of dividends (dividendprovision): Dummy variable which is set equal to 1 if a canton has a reduced tax rate on dividend income and to 0 otherwise.
- Level of the personal income tax (incometaxlevel): The Swiss federal tax administration publishes representative EATRs on personal income for all of the municipalities in our sample.[33] As we cannot know what municipality the owners of our sample firms reside in, we have considered two hypotheses for all personal taxes: (a) firm owners live in the municipality their firm is located in, or (b) owners live in the canton their firm is located in. Since the results do not differ significantly, we report results based on the second hypothesis. We thus compute incometaxlevel as the weighted average personal income tax burden, using the published cantonal sample mean of the EATR on low, median and high income households (corresponding to the first, third and fifth sextile of the national household income distribution).

[33] The published EATRs correspond to average cantonal, municipal and church tax rates for a representative household (married couple with two children) and for a range of reference incomes.

- Progressivity of the personal income tax (incometaxprogressivity): Based on the published canton-average EATR on low, median and high income, we define incometaxprogressivity1, incometaxprogressivity2 and incometaxprogressivity3 analogously to corptaxprogressivity1-3.
- Level of the wealth tax (wealthtaxlevel): We compute this variable as the cantonal-average EATRs for a person with taxable wealth of 300,000 Swiss francs (≈ 300,000 US dollars), which corresponds approximately to the mean wealth level among individuals with non-zero declared wealth over our sample period.
- Inheritance tax (inheritancetax): This variable takes the value of 1 if a canton has an inheritance tax for direct descendants in a given year and 0 otherwise.

The list of baseline non-tax explanatory variables (othercontrols) is as follows.

- Public expenditure (publicexp): Firms not only pay taxes, they may also benefit from public spending. We construct this variable as the sum of municipal and cantonal per-capita public spending, excluding social transfers and deflated with the consumer price index. The public spending items included in publicexp are public administration, security, education, culture and sports, roads, and public transport.[34]
- Wage level (wage): We control for average monthly wages per sector and region, deflated by the consumer price index.[35]
- Property prices (propertyprice): This variable is defined as the unweighted average of median municipality–year-level market prices per square meter of retail space, office space and industrial real estate, deflated by the consumer price index.[36]
- Geography: To capture accessibility (and thus potentially agglomeration effects), we include three additional control variables: disthighway, the road distance from every municipality to the nearest highway access, distairport, the road distance to the nearest international airport, and distuniversity, the distance to the nearest university.
- Culture (latin): We control for potential cultural and attitudinal differences by introducing the dummy variable latin that takes the value of 1 if the main language of a canton is French or Italian and 0 if it is German.
- Unemployment (unemploymentrate): We control for the population share of registered unemployed workers by municipality and year.
- Size of the municipality (munsize): We use the log of the average resident population per year and municipality as the exposure variable.

[34] Annual municipal expenditures are only available for the 26 canton capitals and 16 other municipalities. However, the Swiss Federal Finance Adminstration publishes overall annual municipal spending for each canton. We compute annual municipal spending for the other municipalities by substracting the expenditure of the (26+16) municipalities from overall municipal expenditures and then dividing it by the population of the remaining municipalities. Thereby, the remaining municipalities are attributed identical values of publicexp within each canton.

[35] Wage data are compiled by the Swiss Federal Statistical Office for seven Swiss regions, five of which comprise several cantons (the cantons of Zurich and Ticino representing regions on their own), and for sectoral aggregates that correspond roughly to the NACE 1-digit level. These data are available for the years 2002 and 2004. We linearly extrapolate wage for the remaining years.

[36] We obtained these data from the consultancy firm Wüest & Partner.

Figure 1: Expected utility with flat and progressive taxation

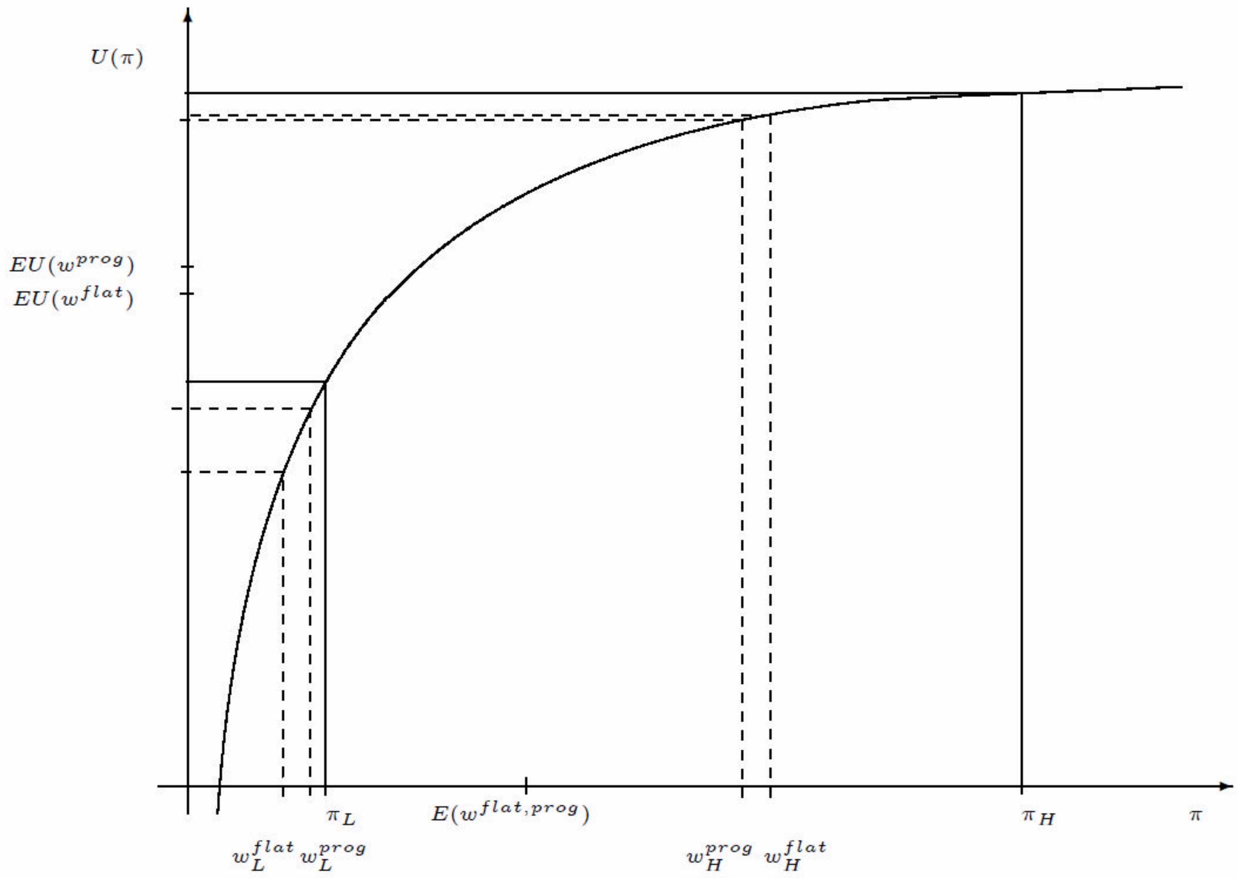
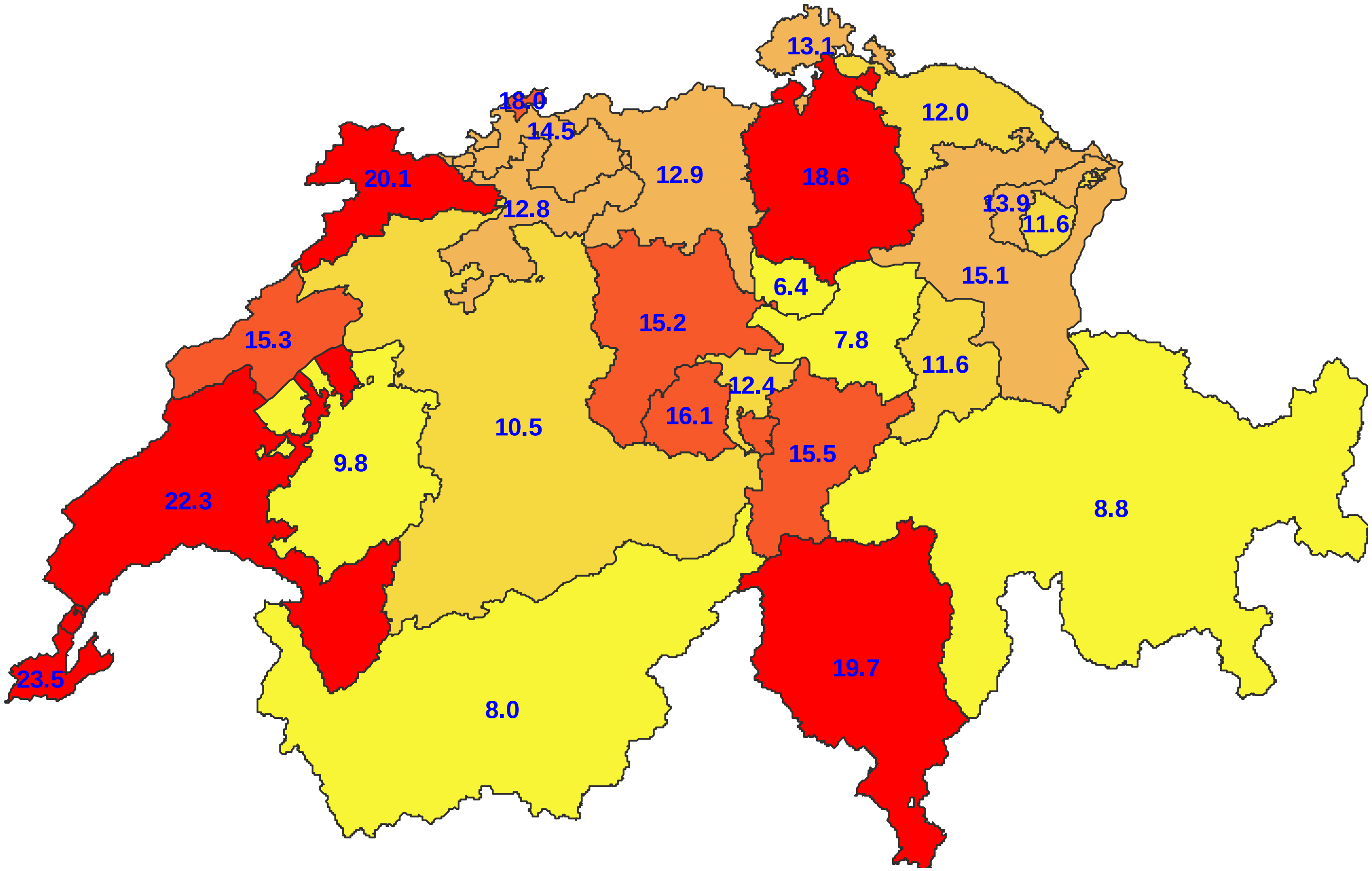


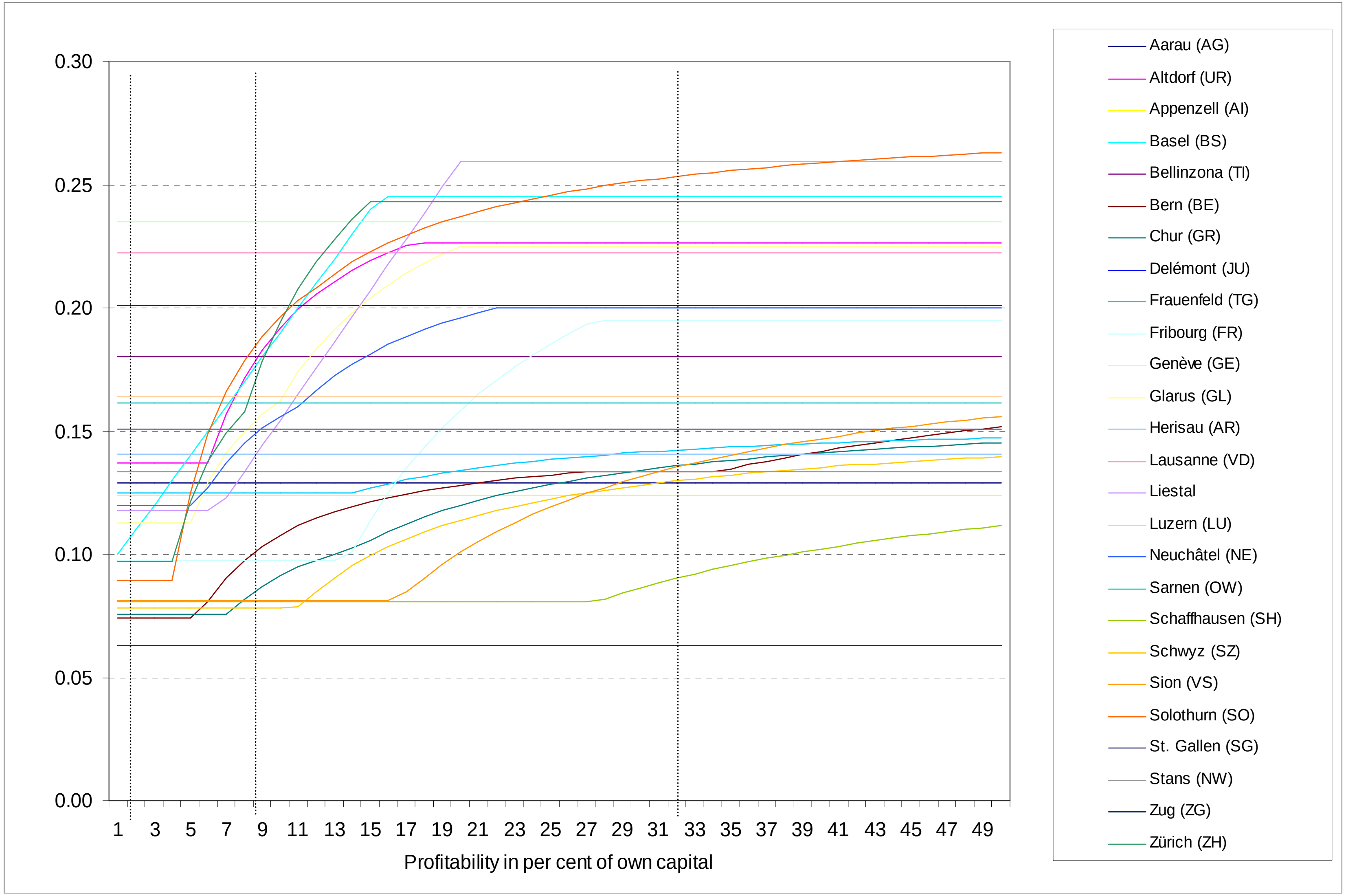
Figure 2: Average statutory corporate income tax rates, 2005

(consolidated cantonal and municipal corporate income tax rate on 9 percent profit in cantonal capital)



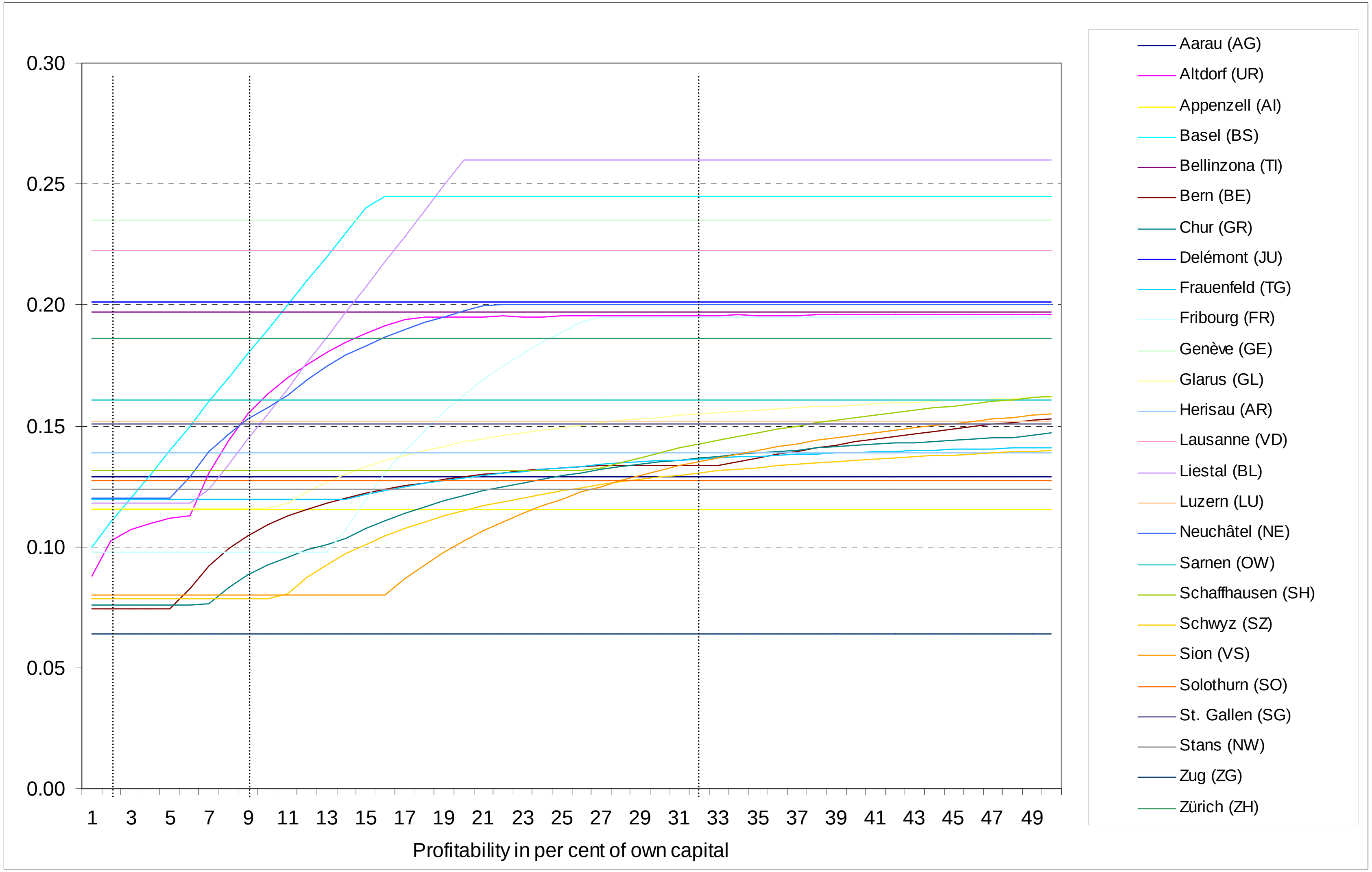
The map shows average statutory corporate income tax rates calculated for a corporation with a capital stock of CHF 188,000 and 9 percent profitability, which corresponds to the median value of the national distribution of capital stocks and profitability across all sectors. We define the average statutory tax rate as: (municipal + church + cantonal corporate income taxes) / gross profit. We do not allow for deductions nor for fixed minimum taxes. As some cantons differentiate their tax treatment of retained and of distributed profits, we assume a distribution rate of 50 percent of gross profits.

Figure 3: Average statutory corporate income tax schedules, 2001



Average statutory corporate income tax rates are calculated for a corporation with a capital stock of CHF 182,000, which corresponds to the median value of the national distribution of capital stocks across all sectors. We define the average statutory tax rate as: (municipal + church + cantonal corporate income taxes) / gross profit. We do not allow for deductions nor for fixed minimum taxes. As some cantons differentiate their tax treatment of retained and of distributed profits, we assume a distribution rate of 50 percent of gross profits. The dashed vertical lines correspond to profitabilities of 2, 9 and 32 percent of capital, which correspond to the first, third and fifth sextile of the national profitability distribution across all sectors. See Table 1 for an explanation of canton acronyms.

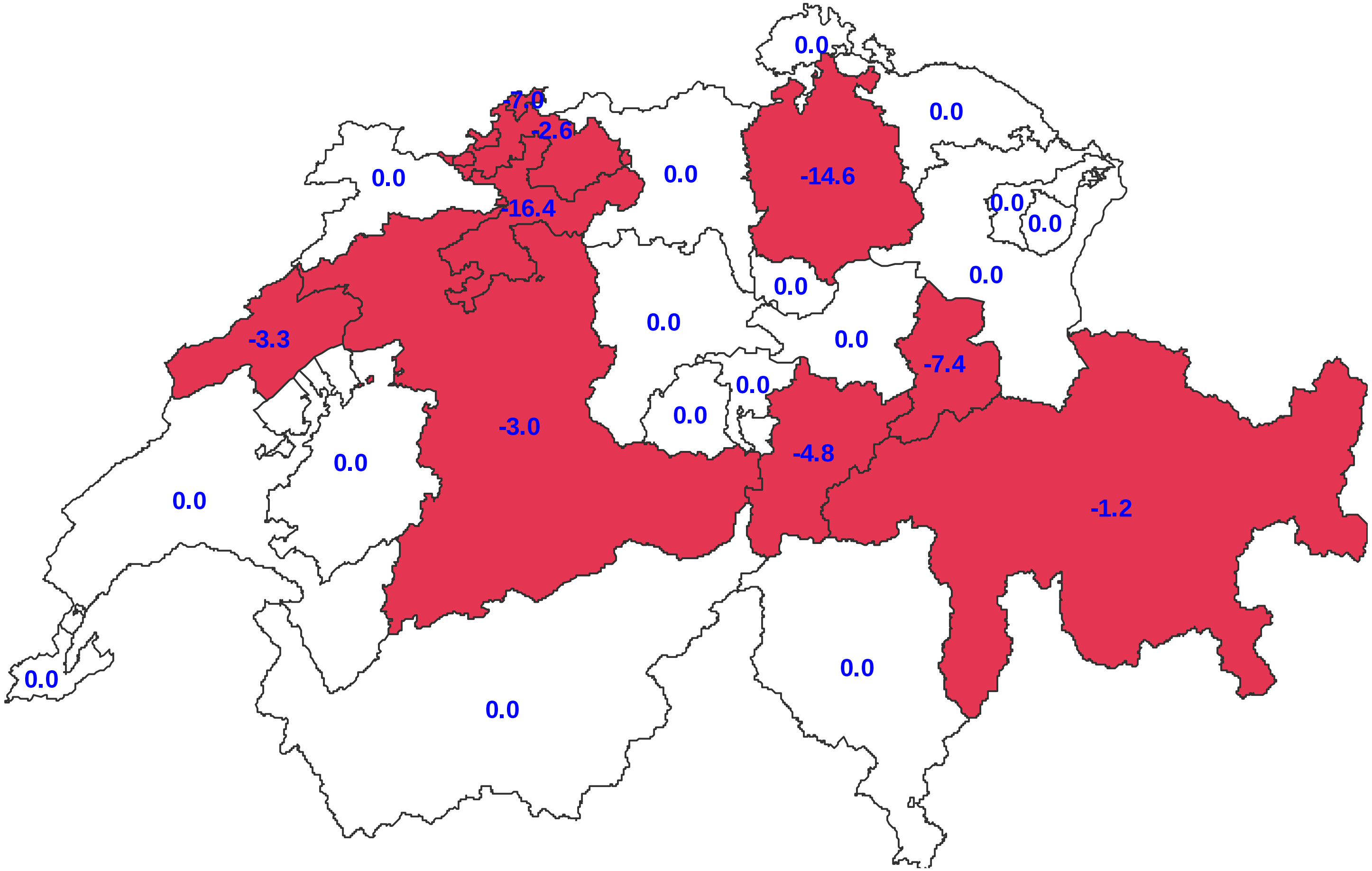
Figure 4: Average statutory corporate income tax schedules, 2005



Average statutory corporate income tax rates are calculated for a corporation with a capital stock of CHF 188,000, which corresponds to the median value of the national distribution of capital stocks across all sectors. We define the average statutory tax rate as: (municipal + church + cantonal corporate income taxes) / gross profit. We do not allow for deductions nor for fixed minimum taxes. As some cantons differentiate their tax treatment of retained and of distributed profits, we assume a distribution rate of 50 percent of gross profits. The dashed vertical lines correspond to profitabilities of 2, 9 and 32 percent of capital, which correspond to the first, third and fifth sextile of the national profitability distribution across all sectors. See Table 1 for an explanation of canton acronyms.

Figure 5: Change in corporate income tax progressivity, 2001-2005

(change in *corptaxprogressivity*1, in tax percentage points)



The map shows the change between 2001 and 2005 in the difference between average statutory corporate income tax rates calculated for a corporation with 32 percent profitability and for a corporation with 2 percent profitability (i.e. $corptaxprogressivity1_{2005} - corptaxprogressivity1_{2001}$). Firms are assumed to have a capital stock of CHF 188,000 . We define the average statutory tax rate as: (municipal + church + cantonal corporate income taxes) / gross profit. We do not allow for deductions nor for fixed minimum taxes. As some cantons differentiate their tax treatment of retained and of distributed profits, we assume a distribution rate of 50 percent of gross profits.

Table 1: Corporate taxation in Swiss cantons and municipalities

Canton acronym	Canton name	No. of sample municipalities, 2001	No. of sample municipalities, 2005	Flat tax rate on capital	Flat tax rate on corp. inc.	Progressive corporate income tax schedule based on: Profits	Profit rate	Both	Unique tax multiplier within canton
ZH	Zurich	77	108	x	x [1]				
BE	Bern	61	119	x		x			
LU	Luzern	38	44		x				
UR	Uri	5	5	x			x		
SZ	Schwyz	16	19	x		x			
OW	Obwalden	5	6	x	x				
NW	Nidwalden	6	7	x	x				
GL	Glarus	7	7	x		x			
ZG	Zug	10	10	x		x			
FR	Fribourg	20	26	x		x			
SO	Solothurn	28	33	x		x			
BS	Basel-Stadt	3	3	x			x		x
BL	Basel-Land	31	29	x			x		
SH	Schaffhausen	5	6	x		x			
AR	Appenzell-Ausserrhoden	8	7	x	x				
AI	Appenzell-Innerrhoden	5	5	x	x				x
SG	St. Gallen	59	60	x				x	x
GR	Graubünden	18	24			x			x
AG	Aargau	79	88	x				x	x
TG	Thurgau	32	38	x	x				
TI	Ticino	42	43	x	x				
VD	Vaud	45	68	x	x				
VS	Valais	22	37			x			
NE	Neuchâtel	16	16	x		x			
GE	Geneva	20	28	x	x				
JU	Jura	7	9	x	x				
	Total	665	845						

[1] in 2005

Table 2: Data sources

Dependent variables	
newfirms	Swiss Federal Statistical Office (UDEMO database)
newjobs	Swiss Federal Statistical Office (UDEMO database)
Corporate tax variables	
corptaxlevel	Own calculations, based on statutory tax data from the official compendium of cantonal tax laws (*Steuern der Schweiz*, editions 2001- 2005), on cantonal and municipal tax multipliers obtained from the 26 cantonal tax authorities, and on sectoral profitability data for 2004 obtained from the tax authorities of the canton of Aargau
*corptaxprogressivity*1-3	Own calculations, based on statutory tax data from the official compendium of cantonal tax laws (*Steuern der Schweiz*, editions 2001-2005), on cantonal and municipal tax multipliers obtained from the 26 cantonal tax authorities, and on national profitability data published by the Swiss Federal Finance Administration
risk	Own calculations, based on sectoral profitability data for 2004 from the tax authorities of the canton of Aargau
corptaxbrackets	Own calculations, based on statutory tax data from the official compendium of cantonal tax laws (*Steuern der Schweiz*, editions 2001-2005)
corptaxwordcount	Own calculations, based on the official compendium of cantonal tax laws (*Steuern der Schweiz*, editions 2001- 2005)
captaxlevel	Own calculations, based on statutory tax data from the Swiss Federal Tax Administration and on sectoral profitability data provided by the tax authorities of the canton of Aargau
dividendprovision	Official compendium of cantonal tax laws (*Steuern der Schweiz*, editions 2001-2005)
Personal tax variables	
incometaxlevel	Effective average tax rates published by the Swiss Federal Tax Administration
*incometaxprogresssivity*1-3	Own calculations, based on effective average tax rates published by the Swiss Federal Tax Administration
wealthtaxlevel	Effective average tax rates published by the Swiss Federal Tax Administration
inheritancetax	Official compendium of cantonal tax laws (*Steuern der Schweiz*, editions 2001-2005)
Other control variables	
publicexp	Swiss Federal Department of Finance
wage	Swiss Federal Statistical Office
propertyprice	Wüest & Partner
disthighway	Swiss Federal Statistical Office
distairport	Swiss Federal Statistical Office
distuniversity	Swiss Federal Statistical Office
unemployment	State Secretariat for Economic Affairs
munsize	Swiss Federal Statistical Office

Note: For details on the construction of the variables, see Section 4.2.2.

Table 3: Summary statistics

	Obs[1]	Mean	S.D.	Min	Max	Mun / cant with min[2]	Mun / cant with max[2]
Dependent variables							
newfirms	182,620	0.14	1.55	0	209	(*several*)	Zurich
newjobs	182,620	0.36	4.06	0	579	(*several*)	Zurich
Corporate tax variables							
corptaxlevel	182,620	0.21	0.02	0.12	0.28	Freienbach	(*several*)[3]
*corptaxprogressivity*1	182,620	0.05	0.04	-0.02	0.15	(*several*)[4]	Liestal
*corptaxprogressivity*2	182,620	0.29	0.23	-0.06	0.89	(*several*)[4]	Liestal
*corptaxprogressivity*3	182,620	0.007	0.006	0.001	0.024	(*several*)[5]	(*several*)[6]
risk × *corptaxprogressivity*1	182,620	0.00	0.24	-0.54	3.26	Liestal	Liestal
risk × *corptaxprogressivity*2	182,620	0.00	1.38	-3.23	19.45	Liestal	Liestal
risk × *corptaxprogressivity*3	182,620	0.00	0.03	-0.09	0.53	(*several*)[6]	(*several*)[6]
corptaxbrackets (count)	182,620	2.64	2.35	1	15	(*several*)	GR
corptaxwordcount (in 100 words)	182,620	5.87	0.96	3.61	7.93	VS	GR
captaxlevel	182,620	0.0033	0.0013	0.0001	0.0123	(*several*)[7]	(*several*)[8]
dividendprovision (dummy)	182,620	0.04	0.19	0	1	(*several*)	(*several*)
Personal tax variables							
incometaxlevel	182,620	0.09	0.02	0.03	0.14	ZG	JU
*incometaxprogresssivity*1	182,620	0.08	0.02	0.03	0.12	SZ	GE
*incometaxprogresssivity*2	182,620	0.96	0.25	0.55	1.88	OW	GE
*incometaxprogresssivity*3	182,620	0.01	0.00	0.00	0.01	SZ	GE
wealthtaxlevel	182,620	0.0025	0.0012	0.0004	0.0053	ZG	FR
inheritancetax (dummy)	182,620	0.40	0.49	0	1	(*several*)	(*several*)
Other control variables							
publicexp (per capita/year, in CHF 10,000)	182,620	0.70	0.11	0.38	1.33	Appenzell	Zug
wage (monthly, in CHF 10,000)	182,620	0.56	0.10	0.20	0.99	TI	ZH
propertyprice (in CHF 1,000/m^2)	182,620	0.14	0.03	0.07	0.26	Couvet	Geneva
disthighway (in 100 km)	182,620	0.06	0.08	0.00	0.95	Morges	Poschiavo
distairport (in 100 km)	182,620	0.59	0.41	0.00	2.27	(*several*)	Poschiavo
distuniversity (in 100 km)	182,620	0.23	0.17	0.00	1.00	Bern	Scuol
latin (dummy)	182,620	0.26	0.44	0	1	(*several*)	(*several*)
unemploymentrate	182,620	0.01	0.01	0.00	0.05	(*several*)	Muralto
population (in thousands)	182,620	7.30	17.64	0.21	365,375	Bourg-St-Pierre	Zurich
munsize	182,620	8.42	0.80	5.36	12.81	Bourg-St-Pierre	Zurich

[1] balanced sample for baseline estimations (reported in Table 5)
[2] acronyms (see Table 1) are used for cantons
[3] all of the municipalities in the canton of Graubünden
[4] all of the municipalities in the canton of Aargau
[5] all of the municipalities in the canton of St. Gallen
[6] all of the municipalities in the canton of Basel-Stadt
[7] all of the municipalities in the canton of Appenzell-Ausserrhoden
[8] several municipalities in the canton of Appenzell-Ausserrhoden

Table 4: Correlation matrix

	newfirms	*newjobs*	*corptaxlevel*	*corptaxprogressivity1*	*corptaxprogressivity2*	*corptaxprogressivity3*	*corptaxbrackets*	*risk × corptaxprogressivity1*	*risk × corptaxprogressivity2*	*risk × corptaxprogressivity3*	*corptaxwordcount*	*captaxlevel*	*dividendprovision*	*incometaxlevel*	*incometaxprogresssivity1*	*incometaxprogresssivity2*	*incometaxprogresssivity3*	*wealthtaxlevel*	*inheritancetax*	*publicexp*	*wage*	*propertyprice*	*disthighway*	*distairport*	*distuniversity*	*latin*	*unemployment*
newfirms	1.000																										
newjobs	0.943	1.000																									
corptaxlevel	0.000	0.005	1.000																								
corptaxprogressivity1	0.013	0.017	0.388	1.000																							
corptaxprogressivity2	0.009	0.012	0.354	0.979	1.000																						
corptaxprogressivity3	0.009	0.012	0.351	0.888	0.916	1.000																					
corptaxbrackets	-0.007	-0.006	0.325	0.367	0.443	0.356	1.000																				
risk × corptaxprogressivity1	0.048	0.045	0.063	0.008	0.008	0.008	0.003	1.000																			
risk × corptaxprogressivity2	0.047	0.044	0.067	0.008	0.008	0.007	0.004	0.991	1.000																		
risk × corptaxprogressivity3	0.047	0.044	0.066	0.008	0.008	0.009	0.003	0.951	0.963	1.000																	
corptaxwordcount	-0.006	-0.006	-0.091	-0.029	0.030	0.126	0.416	0.000	0.000	0.001	1.000																
captaxlevel	-0.014	-0.011	0.172	0.232	0.284	0.357	0.307	0.000	0.001	0.004	0.286	1.000															
dividendprovision	-0.005	-0.006	-0.234	-0.097	-0.113	-0.146	-0.120	-0.001	-0.001	-0.001	0.029	-0.114	1.000														
incometaxlevel	-0.029	-0.026	0.120	0.122	0.118	-0.025	0.015	0.001	0.001	0.000	-0.146	-0.012	0.090	1.000													
incometaxprogresssivity1	-0.011	-0.009	0.279	-0.131	-0.152	-0.201	-0.075	-0.001	-0.001	-0.002	-0.243	0.030	-0.141	0.326	1.000												
incometaxprogresssivity2	0.020	0.018	0.078	-0.266	-0.286	-0.204	-0.125	-0.002	-0.002	-0.002	-0.096	0.043	-0.167	-0.603	0.513	1.000											
incometaxprogresssivity3	-0.011	-0.008	0.271	-0.099	-0.115	-0.177	-0.047	-0.001	-0.001	-0.002	-0.258	0.074	-0.148	0.356	0.986	0.484	1.000										
wealthtaxlevel	-0.030	-0.027	0.111	-0.076	-0.082	-0.290	-0.101	-0.001	-0.001	-0.003	-0.425	-0.047	0.009	0.596	0.445	-0.170	0.452	1.000									
inheritancetax	-0.015	-0.013	0.188	0.158	0.163	-0.029	0.139	0.001	0.001	0.000	0.041	0.000	0.030	0.433	0.391	-0.078	0.357	0.512	1.000								
publicexp	0.078	0.077	0.375	0.288	0.250	0.153	0.393	0.002	0.002	0.001	-0.070	0.103	-0.038	-0.047	0.030	0.100	0.041	-0.093	0.080	1.000							
wage	0.024	0.015	0.053	0.042	0.045	0.096	0.000	0.154	0.158	0.154	0.071	0.023	-0.014	0.017	-0.101	-0.105	-0.112	-0.116	-0.050	0.081	1.000						
propertyprice	0.110	0.109	0.057	0.135	0.115	0.138	0.057	0.001	0.001	0.001	0.103	-0.032	-0.023	-0.252	-0.038	0.212	-0.058	-0.303	-0.044	0.406	0.085	1.000					
disthighway	-0.028	-0.029	0.098	0.054	0.093	0.028	0.392	0.001	0.001	0.000	0.148	0.151	0.002	0.074	0.000	-0.080	0.010	0.069	0.167	0.110	-0.012	-0.101	1.000				
distairport	-0.029	-0.029	-0.053	-0.090	-0.058	-0.250	0.214	-0.001	-0.001	-0.002	-0.333	-0.022	0.017	0.113	0.149	0.074	0.191	0.376	0.124	-0.026	-0.202	-0.258	0.328	1.000			
distuniversity	-0.045	-0.046	0.065	-0.039	0.024	-0.025	0.445	0.000	0.000	0.000	0.039	0.262	-0.074	0.073	-0.058	-0.138	-0.027	0.097	0.007	0.013	-0.029	-0.314	0.437	0.425	1.000		
latin	0.004	0.004	0.144	-0.081	-0.138	-0.263	-0.261	-0.001	-0.001	-0.002	-0.647	0.119	-0.115	0.046	0.296	0.274	0.298	0.480	0.114	0.287	-0.070	0.050	-0.064	0.382	-0.041	1.000	
unemploymentrate	0.072	0.073	0.107	-0.042	-0.079	-0.050	-0.152	-0.000	-0.001	-0.000	-0.139	0.029	-0.131	0.005	0.161	0.177	0.125	-0.097	-0.053	0.227	0.090	0.270	-0.215	-0.103	-0.175	0.304	1.000
munsize	0.171	0.175	0.050	0.090	0.078	0.096	-0.012	0.001	0.001	0.001	0.008	-0.029	-0.024	-0.058	-0.065	-0.009	-0.062	-0.113	-0.066	0.185	0.049	0.440	-0.177	-0.187	-0.188	-0.071	0.375

Note: 198,750 observations

Table 5: Baseline results

	Dependent variable= Number of new firms per municipality, sector and year (newfirms)			*Dependent variable= Employment by new firms per municipality, sector and year (newjobs)*		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
corptaxlevel	-15.76***	-15.65***	-16.29***	-15.11***	-15.14***	-15.69***
	(1.47)	(1.38)	(1.52)	(1.56)	(1.47)	(1.60)
*corptaxprogressivity*1	1.61**			1.73**		
	(0.66)			(0.77)		
*corptaxprogressivity*2		0.26**			0.29**	
		(0.12)			(0.14)	
*corptaxprogressivity*3			14.24***			14.40***
			(4.59)			(5.02)
risk × *corptaxprogressivity*1	0.05			0.06		
	(0.06)			(0.06)		
risk × *corptaxprogressivity*2		0.01			0.01	
		(0.01)			(0.01)	
risk × *corptaxprogressivity*3			0.54*			0.62*
			(0.32)			(0.35)
corptaxbrackets	0.02	0.02	0.01	0.02	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
corptaxwordcount	-0.16***	-0.16***	-0.14***	-0.15***	-0.15***	-0.14***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
captaxlevel	-8.47	-10.12	-22.79	-11.70	-14.99	-24.60
	(17.15)	(18.81)	(18.62)	(22.29)	(23.92)	(24.30)
dividendprovision	-0.004	0.01	0.02	-0.07	-0.05	-0.05
	(0.08)	(0.08)	(0.08)	(0.14)	(0.13)	(0.14)
incometaxlevel	-12.14***	-13.00***	-11.57***	-8.39***	-9.56***	-7.58***
	(2.34)	(2.85)	(2.23)	(2.56)	(3.11)	(2.47)
*incometaxprogresssivity*1	-1.26			-2.14		
	(1.75)			(1.88)		
*incometaxprogresssivity*2		-0.10			0.14	
		(0.13)			(0.13)	
*incometaxprogresssivity*3			-9.34			-16.95
			(15.15)			(16.15)
wealthtaxlevel	101.17***	93.73**	105.60***	66.39	54.32	67.85*
	(38.51)	(37.52)	(37.84)	(41.48)	(41.20)	(40.45)
inheritancetax	-0.15***	-0.14***	-0.14***	-0.13**	-0.14**	-0.13**
	(0.05)	(0.05)	(0.04)	(0.06)	(0.06)	(0.05)
publicexp	0.69***	0.72***	0.77***	0.58**	0.61**	0.67***
	(0.25)	(0.26)	(0.25)	(0.26)	(0.26)	(0.26)
wage	0.13	0.08	0.06	-0.08	-0.10	-0.14
	(0.41)	(0.41)	(0.42)	(0.43)	(0.44)	(0.44)
propertyprice	6.65***	6.62***	6.55***	6.03***	5.95***	5.93***
	(0.72)	(0.73)	(0.72)	(0.87)	(0.89)	(0.86)
disthighway	-1.11***	-1.12***	-1.10***	-1.47***	-1.48***	-1.47***
	(0.30)	(0.30)	(0.30)	(0.39)	(0.39)	(0.40)
distairport	0.06	0.06	0.06	0.06	0.05	0.06
	(0.08)	(0.08)	(0.08)	(0.09)	(0.09)	(0.09)
distuniversity	-0.09	-0.10	-0.06	-0.07	-0.07	-0.03
	(0.14)	(0.14)	(0.14)	(0.16)	(0.16)	(0.16)
latin	-0.23**	-0.21*	-0.17	-0.17	-0.14	-0.11
	(0.11)	(0.11)	(0.11)	(0.11)	(0.12)	(0.12)
unemploymentrate	20.95***	21.09***	21.33***	22.45***	22.48***	22.83***
	(3.19)	(3.27)	(3.12)	(3.84)	(4.01)	(3.79)
munsize	0.97***	0.97***	0.97***	1.01***	1.01***	1.01***
	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)
Log likelihood	-38,081	-38,081	-38,063	-94,756	-94,759	-94,707

Notes: Poisson estimation; 182,620 observations; fixed effects included for 46 sectors and 5 years but not reported; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; standard errors clustered two ways (by municipality-year and by municipality-sector)

Table 6: Robustness

	Dependent variable = Number of new firms per sector, year and municipality (newfirms)											
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
corptaxlevel	(***dropped***)	(***dropped***)	(***dropped***)	-15.47***	-15.37***	-16.12***	-16.14***	-15.82***	-16.96***	-16.88***	-16.43***	-17.26***
				(1.49)	(1.39)	(1.54)	(1.50)	(1.38)	(1.53)	(2.67)	(2.65)	(2.76)
*corptaxprogressivity*1	-1.32*			1.98***			3.01***			1.22*		
	(0.73)			(0.62)			(0.66)			(0.65)		
*corptaxprogressivity*2		-0.16			0.33***			0.53***			0.10	
		(0.15)			(0.11)			(0.11)			(0.13)	
*corptaxprogressivity*3			-11.99**			16.29***			24.06***			11.14*
			(5.65)			(4.10)			(4.36)			(5.94)
risk × *corptaxprogressivity*1	0.07			0.05			0.05			0.05		
	(0.06)			(0.06)			(0.06)			(0.08)		
risk × *corptaxprogressivity*2		0.01			0.01			0.01			0.01	
		(0.01)			(0.01)			(0.01)			(0.01)	
risk × *corptaxprogressivity*3			0.58**			0.54*			0.55*			0.53
			(0.29)			(0.32)			(0.33)			(0.45)
corptaxbrackets	-0.03*	-0.04**	-0.02	(***dropped***)	(***dropped***)	(***dropped***)	-0.01	-0.01	-0.01	-0.02	-0.01	-0.02*
	(0.01)	(0.01)	(0.01)				(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
corptaxwordcount	-0.20***	-0.18***	-0.22***	-0.14***	-0.14***	-0.13***	(***dropped***)	(***dropped***)	(***dropped***)	-0.08**	-0.08***	-0.09***
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)				(0.03)	(0.03)	(0.02)
captaxlevel	21.53	17.26	41.60	-9.57	-11.93	-25.27	-52.75***	-57.71***	-70.76***	-48.25**	-45.42**	-51.62**
	(22.90)	(26.26)	(26.31)	(17.02)	(18.62)	(18.52)	(14.44)	(14.58)	(14.22)	(19.19)	(19.61)	(20.74)
dividendprovision	0.01	0.05	-0.02	-0.02	-0.01	0.01	-0.02	-0.002	0.02	-0.22**	-0.21**	-0.21**
	(0.09)	(0.08)	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.10)	(0.10)	(0.10)
Controls	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	***no***	***no***	***no***
Log likelihood	-38,568	-38,609	-38,564	-38,085	-38,084	-38,065	-38,132	-38,131	-38,101	-40,206	-40,218	-40,180

Notes: Poisson estimation; 182,850 observations; *munsize* and fixed effects for 46 sectors and 5 years included but not reported; standard errors in parentheses; controls include all variables shown in Table 5 but not here; *** p<0.01, ** p<0.05, * p<0.1; standard errors clustered two ways (by municipality-year and by municipality-sector)

Table 7: Interpretation of coefficients (Baseline results)

	Dependent variable= Number of new firms per municipality, sector and year (newfirms)										
	Baseline estimates (Table 5)			Elasticities			Semistandarized coefficients			Mean	SD
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
corptaxlevel	-15.76***	-15.65***	-16.29***	-3.32	-3.32	-3.45	-0.30	-0.30	-0.31	0.212	0.019
*corptaxprogressivity*1	1.61**			0.08			0.11			0.048	0.041
*corptaxprogressivity*2		0.26**			0.07			0.06		0.287	0.227
*corptaxprogressivity*3			14.24***			0.10			0.09	0.007	0.006
risk × *corptaxprogressivity*1	0.05			0.00			0.01			0	0.238
risk × *corptaxprogressivity*2		0.01			0.00			0.01		0	1.375
risk × *corptaxprogressivity*3			0.54*			0.00			0.02	0	0.032
corptaxbrackets	0.02	0.02	0.01	0.04	0.04	0.02	0.05	0.04	0.02	2.641	2.351
corptaxwordcount	-0.16***	-0.16***	-0.14***	-0.94	-0.94	-0.82	-0.15	-0.15	-0.13	5.872	0.956
captaxlevel	-8.47	-10.12	-22.79	-0.01	-0.01	-0.03	-0.001	-0.001	-0.002	0.0013	0.0001
dividendprovision	-0.004	0.01	0.02	-0.00	-0.00	-0.00	-0.001	0.002	0.004	0.036	0.186
incometaxlevel	-12.14***	-13.00***	-11.57***	-1.09	-1.17	-1.04	-0.24	-0.26	-0.23	0.090	0.020
*incometaxprogresssivity*1	-1.26			-0.10			-0.02			0.083	0.016
*incometaxprogresssivity*2		-0.10			-0.09			-0.03		0.964	0.253
*incometaxprogresssivity*3			-9.34			-0.07			-0.02	0.008	0.002
wealthtaxlevel	101.17***	93.73***	105.60***	0.25	0.23	0.26	0.12	0.11	0.13	0.0025	0.0012
inheritancetax	-0.15***	-0.14***	-0.14***	-0.06	-0.05	-0.05	-0.07	-0.07	-0.07	0.395	0.489
publicexp	0.69***	0.72***	0.77***	0.48	0.50	0.53	0.08	0.08	0.09	0.699	0.112
wage	0.13	0.08	0.06	0.07	0.04	0.03	0.01	0.01	0.01	0.558	0.099
propertyprice	6.65***	6.62***	6.55***	0.92	0.91	0.90	0.21	0.21	0.20	0.138	0.031
disthighway	-1.11***	-1.12***	-1.10***	-0.07	-0.07	-0.06	-0.09	-0.09	-0.08	0.059	0.077
distairport	0.06	0.06	0.06	0.03	0.03	0.03	0.02	0.02	0.02	0.594	0.414
distuniversity	-0.09	-0.10	-0.06	-0.02	-0.02	-0.01	-0.01	-0.02	-0.01	0.232	0.165
Latin	-0.23**	-0.21*	-0.17	-0.06	-0.06	-0.04	-0.10	-0.09	-0.08	0.264	0.442
unemploymentrate	20.95***	21.09***	21.33***	0.29	0.30	0.30	0.17	0.17	0.17	0.014	0.008
munsize	0.97***	0.97***	0.97***	8.17	8.17	8.17	0.78	0.78	0.78	8.421	0.801

Notes: Poisson estimation; 182,850 observations; fixed effects included for 46 sectors and 5 years but not reported; standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; standard errors clustered two ways (by municipality-year and by municipality-sector); elasticities = estimated coefficient multiplied by the sample mean of the explanatory variable; semistandardized coefficients = estimated coefficient multiplied by the standard deviation of the explanatory variable; *munsize* being in logs, the estimated coefficients already represent elasticities

1 Introduction

Despite a recent recession-induced shift toward more progressive taxation, the flat-tax model retains widespread appeal. By April 2010, 23 countries are operating flat-rate income tax systems, as do seven US states.[1] Many other countries and regions have considered reforms that would flatten their tax schedules. The most frequently invoked argument in favor of flat taxes is that they simplify both compliance and enforcement, but moving toward flat-rate taxation has a host of other economic implications, in terms of both efficiency and equity.[2] In this paper, we focus on one efficiency-related dimension of a particular type of flat tax: the impact of flat-rate *corporate income* taxes on the generation of *new firms*.[3]

The specific choice between flat and progressive corporate tax rates is a topic of ongoing debate in a number of industrialized countries. The United States, for example, raises a progressive federal corporate income tax, as do Japan and the United Kingdom. Conversely, Canada, France, Germany, Italy and Spain apply essentially flat-rate corporate taxes (with some exceptions for small businesses). The two approaches sometimes coexist at sub-national level. In the United States, for example, 31 states levy flat-rate corporate income taxes, 17 states levy progressive corporate income taxes and 3 states do not tax corporate income.

Births of new firms, in turn, are of interest for at least two reasons. First, we consider them a proxy for entrepreneurship, which, following Schumpeter, has come to be regarded as a key driver of economic growth.[4] Second, the number of firms choosing to start operations in a particular jurisdiction can be taken as a measure of that jurisdiction's locational attractiveness.

Our empirical work is based on data for Switzerland, which offers a well suited setting for an analysis of this issue. While the Swiss federal government levies a flat-rate corporate income tax, a wide variety of (flat and progressive) tax schedules are applied at the sub-federal

[1] See http://en.wikipedia.org/wiki/Flat_tax.

[2] See, e.g., Keen, Kim and Varsano (2008) for a general appraisal of recent flat-tax reforms.

[3] By considering corporate taxes in isolation, we take a narrower view than the most radical flat-tax model, in which a single tax rate is applied across all tax bases and corporate income may be taxed only when paid out as dividends (see, e.g., Hall and Rabushka, 2007).

[4] This intuitive assertion finds theoretical support in endogenous growth models, where entrepreneurs are primarily cast in the role of conduits between scientific research and market-oriented production (see, e.g., Michelacci, 2003). We can also invoke some relevant empirical evidence. Reynolds, Miller and Maki (1995) and Audretsch and Fritsch (2002) have found that regions with higher firm formation rates enjoy higher growth, in the United States and Germany respectively. These results were broadly confirmed by a number of country-level studies in the January 2008 special issue of *Small Buisness Economics* (see Fritsch, 2008). Employing indirect measures of entrepreneurship, Glaeser, Kallal, Scheinkman and Shleifer (1992) have found industry-level employment growth to be higher in US with below-average firm sizes; and Murphy, Shleifer and Vishny (1991) have reported positive growth effects of the share of engineering graduates in a large cross section of countries.

level, by Switzerland's 26 fiscally autonomous cantons. Furthermore, below the cantonal level, some 2,700 municipalities levy taxes at often very different average rates and with some further variations in progressivity.

We exploit the variation of tax schedules within Switzerland for an analysis of the impact of corporate tax progressivity on the creation of new firms. Our analysis is organized around three dimensions of corporate income taxes: the implications of higher or lower average tax burdens (the "level effect"), the implications of progressivity (the "insurance effect"), and the implications of tax complexity. To the best of our knowledge, ours is the first study to evaluate these three effects jointly. The smallness and regulatory homogeneity of Switzerland coupled with considerable intra-national variance in tax regimes limit the potential for estimation bias due to unobserved locational determinants of firm births.

The remainder of this paper is organized as follows. In the next section we review the salient literatures on firm births, firm location, taxation and risk taking. In Section 3, we present a simple model of risk taking and progressive taxation to formalize the intuition of the insurance effect. In Section 4 we present our empirical model and our data set for Switzerland. Estimation results are presented and discussed in Section 5. Section 6 concludes.

2 Literature background: taxes and firm births

The three dimensions of corporate tax policy we focus on have previously been subject to very different degrees of scientific scrutiny. While we can build on an extensive theoretical and empirical literature on the effect of changes in the level of (average and marginal) corporate tax rates, much less attention has been paid to the effect of corporate tax progressivity, and even less evidence exists on the implications of tax complexity.

2.1 The tax level effect

A sizeable empirical literature shows that firms seek to maximize post-tax profits and therefore prefer low corporate taxes to high corporate taxes, *ceteris paribus*. In a meta-analysis of 25 empirical studies on taxation and location choices of foreign investors, De Mooij and Ederveen (2003), for example, have reported a median value of the tax-rate semi-elasticity of -3.3, implying that a one-percentage-point reduction in the host-country corporate tax rate raises foreign direct investment into that country by fully 3.3 percent. In a qualitative survey of much the same literature, Hines (2007) detected signs of an increase over time in the tax responsiveness of international investment.

Negative coefficients are also estimated in the majority of studies relating counts of new firms to local corporate tax burdens using discrete choice modeling.[5] A noteworthy recent development in this research area is the use of finely spatially disaggregated data, allowing precise estimation of tax effects in the face of spatial heterogeneity. For example, Guimaraes, Figueiredo and Woodward (2004) have estimated a count model of firm births at the level of US counties, again finding significantly negative local tax rate elasticities, controlling for local factor costs and agglomeration effects. US counties cover an average area of some 2,650 square kilometers. Rathelot and Sillard (2008) zoomed the analysis to an even finer spatial scale, drawing on data on firm births in French municipalities, which on average cover an area of 15 square kilometers. Their data did not allow them to control for spatial variations in factor costs, a problem they circumvented by comparing neighboring municipalities on either side of the borders separating larger administrative regions. They detected a rather small but statistically significant negative elasticity of firm-birth rates relative to local taxes. Brülhart, Jametti and Schmidheiny (2007), using data on firm births in a sample of Swiss municipalities (which on average cover an area of some 20 square kilometers) found that high corporate taxes act as a deterrent to local firm creation, but that this relationship is weaker in spatially concentrated sectors than in dispersed sectors.[6] The most spatially disaggregated study is by Duranton, Gobillon and Overman (2007), who compared firm births and employment growth of firms within one kilometer on either side of English regional boundaries. They found that local taxes impact significantly negatively on firm's employment growth, but they detected no significant effect of tax differentials on firm births. Duranton *et al.* (2007) explain the seeming irrelevance of local taxes for firm births by pointing out that local corporate taxes in the UK take the form of property taxes and are therefore likely to be largely capitalized in into property prices.

In a related strand of literature, economists have explored the impact of corporate tax levels on "income shifting" between the personal and the corporate tax base. Most tax systems leave considerable room for manoeuvre on this choice, mainly via different organizational forms and

[5] The seminal contributions are Carlton (1983) using the conditional logit estimator, and Papke (1991) using the Poisson count mondel.

[6] Using spatially more aggregated (canton-level) data, Feld and Kirchgässner (2003) also found that high corporate income taxes impact negatively on local firm numbers and employment in Switzerland.

via flexible accounting rules governing the heading under which the remuneration of owner-workers is declared. Several available studies show that, not surprisingly, the share of income that is declared as corporate is higher the lower is the level of corporate relative to personal income taxes (see, e.g., Gordon and Slemrod, 2000; Goolsbee, 2004; Cullen and Gordon, 2007; and de Mooij and Nicodème, 2008). Some of the observed income shifting into the corporate tax base is due to the incorporation of previously non-corporate organizations or due to the division of larger corporations into smaller firms. In that sense, income shifting also contributes to the creation of new firms.

Overall, therefore, the available evidence strongly supports the existence of a moderating impact of the level of corporate taxes on firm births at both the national and the local level.

2.2 The tax progressivity effect (insurance effect)

If tax payers' decisions are made under uncertainty, the progressivity of tax schedules will have implications that differ from those of the level of (average effective) taxes. Thus, under uncertainty, the variance of the tax bill matters in addition to the expected level of the tax bill.

Domar and Musgrave (1944) have famously shown that taxation can encourage risk taking.[7] Whilst assuming a flat tax schedule, they also took account of loss-offset provisions that imply a negative tax in case of losses. A higher tax rate then reduces both the expected level and the expected variance of post-tax income, which, depending on investor preferences, may make risky ventures relatively more attractive by reducing risk through an implied insurance effect of taxation.

The Domar-Musgrave model, by featuring a flat tax over positive income, is not well suited to a formal distinction between the implications of changes in the level of the expected tax bill and changes in progressivity *per se*. An intuitive conjecture from the Domar-Musgrave result is that increased progressivity, provided it does not affect the expected tax bill, should be favorable to entrepreneurial risk taking.[8] This intuition is supported to some extent by formal analysis. Ahsan (1974) considered investment in a risky asset under a flat-rate tax

[7] A corresponding analysis concerning personal income taxes has been provided by Varian (1980).

[8] Cullen and Gordon (2006b) have put it as follows: "For any given tax treatment of losses, a progressive tax schedule on profits, holding expected taxes constant, should encourage risk taking. With progressive rather than proportional taxes, the owners get to keep a smaller fraction of large profits but a larger fraction of small profits. If expected tax payments are held fixed, this is a trade-off that any risk-averse individual gains from making."

with and without a tax-exempt threshold, the former corresponding to a progressive schedule. Conditional on constant expected tax revenue, he found that risk taking is greater under the progressive tax than under the proportional tax, given standard assumptions on investors' aversion to risk. In a similar model, Cowell (1975) found that progressivity favours investment in the risky asset if the utility function is assumed to be quadratic, but may deter risk taking under different preferences.[9] Gordon (1985), allowing for a general form of risk aversion and corporate tax progressivity in a general-equilibrium setting, found that raising the *marginal* tax rate, other things equal, promotes investment while raising the *average* tax rate, other things equal, discourages investment. Waterson (1985) considered the implications of a quadratic tax function, again assuming a constant expected tax bill. He concluded that, while the effect of progressivity on risk taking is positive for certain parameter configurations, its sign cannot be established in general.[10]

Empirically, the impact of personal income tax progressivity on entry into self-employment has been explored by Gentry and Hubbard (2000, 2005). They report negative impacts of personal income progressivity on entrepreneurship. The main explanation for these findings is that progressive taxation acts as a "success tax" on profitable ventures: since entrepreneurs on average have higher incomes than employees, progressive income taxation discourages entrepreneurial risk taking. Crucially, however, this effect confounds the impact of tax progressivity with that of the expected tax bill.[11]

Cullen and Gordon (2007) have estimated a model of entrepreneurial risk, controlling for both level and progressivity effects of corporate tax schedules using US data. Entrepreneurial risk taking is defined empirically as the fraction of single tax filers who report active non-corporate losses in excess of 10 percent of reported wage income. While their estimated regression coefficients represent the impact of composite terms capturing "income shifting"

[9] Cowell (1975) used the term "compensation" for what we refer to as the "constant expected tax bill" condition.

[10] If entrepreneurial ventures are externally financed and entrepreneurs are subject to moral hazard (i.e. they have an incentive to shirk if their stake in the success of the venture is low), then the risk-reducing element implicit in progressive taxation may impede entrepreneurship (see e.g. Keuschnigg and Nielsen, 2004; and Hagen and Sannarnes, 2007). To the extent that the incidence of progressive taxation is felt by financiers rather than by entrepreneurs, however, the findings of the earlier literature on taxation and risk taking still apply.

[11] Gentry and Hubbard (2000, 2005) have regressed the probability that an individual switches from employment to self-employment on a set of variables including (a) the projected tax rate in case of unchanged employment status and (b) a measure of tax progressivity computed as the difference in tax rates between a "successful" scenario, where taxable income increases by x percent, and an "unsuccessful" scenario, where taxable income decreases by y percent. They did not, however, control for the expected (i.e. probability weighted) tax rate in case of a switch to self-employment.

and "combined risk" effects inherent in the tax code, and therefore elude simple interpretation, their derived simulation results reported in Cullen and Gordon (2006a) show that a revenue-neutral shift to a flat tax à la Hall and Rabushka (2007) would reduce entrepreneurial risk taking by more than half. Their results are thus consistent with economically significant insurance effects. The main difference between our approach and that of Cullen and Gordon (2006a, 2007) is that we explore the impact of taxation on the birth rates of incorporated firms across different locations, whereas they focus on entrepreneurial individuals reporting high losses across quantiles of predicted potential earnings. Our empirical setting offers inter-jurisdictional variation in the entire tax schedule. It thereby allows a simple quantification of the various relevant dimensions of tax policy.

2.3 The tax complexity effect

A third way in which a change to a flat corporate income tax could potentially influence entrepreneurship (in sectors other than accounting and legal services) is by simplifying compliance via a reduction in complexity. Complexity has two components: the number of tax brackets and the definition of the tax base.

First, calculating tax liabilities is simpler with a single statutory tax rate than with a progressive tax schedule featuring multiple tax brackets. It seems reasonable, however, to question the practical importance of the complexity implied by progressive schedules alone.[12]

The most compelling case for the view that complexity raises compliance costs can be made if one moves beyond the narrow implications of progressivity alone and considers the statutory definitions of the tax base. Administrative complications are most evident where numerous different types of tax bases are distinguished and where the definitions of tax bases are subject to exceptions, deductions, tax credits and the like. Such complexity is not a necessary correlate of progressivity, but flat-tax proposals usually involve a reduction both in progressivity and in the complexity of the determination of the tax base.

Edmiston, Mudd and Valev (2004) found that the number of special corporate tax rates had a significantly negative impact on flows of foreign direct investment into European and Asian transition countries in the 1990s. However, and somewhat paradoxically, they report

[12] To cite Slemrod and Bakija (2004, p. 166), "a graduate tax-rate structure does not by itself directly contribute any significant complexity to the taxpaying process. Once taxable income is computed, looking up tax liability in the tax tables is a trivial operation (...)."

positive coefficients on an alternative complexity variable defined as the number of lines in the respective tax codes (similar to the measure that we will apply).[13] We are not aware of any prior empirical work relating *firm births* to the two components of tax complexity.

3 A simple model of tax progressivity and entrepreneurship

In this section, we present a highly stylized model to formalize the effect of progressivity on entrepreneurial risk taking, *given a certain expected tax bill.* As noted above, this effect has been analyzed before (Ahsan, 1974; Cowell, 1975; Waterson, 1985). We propose a simple framework primarily for its heuristic value.[14]

Suppose a risk averse entrepreneur has to choose where to locate her firm. She will make a high or low profit at the end of the year with a certain probability. The only salient difference between two potential locations arises from their corporate income tax schedules: one location features a flat tax while the other location has a progressive schedule. We ask which location the entrepreneur is better off choosing, provided that the expected corporate tax payments are the same in both locations. This *constant expected tax bill condition* is crucial to our analysis. Keeping the expected after-tax profit constant, progressive taxation reduces the variance of profits by more than linear taxation. As a consequence, tax progressivity serves as an insurance device: in bad times, an entrepreneur has to pay less than under a flat tax, whereas in good times the tax bill is higher. This, in a nutshell, is how progressivity can favor entrepreneurial risk taking.

To formalize the intuition, consider a risk averse entrepreneur with a standard Bernoulli utility function over income w, $U(w)$, with $U_w(w) > 0$ and $U_{ww}(w) < 0$. The entrepreneur faces a simple lottery $L = (p_L, p_H)$ over two possible profit outcomes $\{\pi_L, \pi_H\}$, with $\pi_H > \pi_L$ and $\pi_L \neq 0$.[15]

Profits are subject to either a flat or progressive tax schedule, defined as:

[13] Edmiston *et al.* (2004) explain the apparent positive effect of the length of tax codes by pointing out that more lines could imply greater legal precision - an aspect which might indeed be relevant in transition countries.

[14] The main simplification of our approach compared to existing theory is that we constrain the range of choices to two options. This simplification allows us to posit a general (Bernoulli) utility function, which, unlike those adopted in prior studies, need not exhibit increasing absolute risk aversion (see also Feldstein, 1969). Cullen and Gordon (2006a) propose a similar model, taking utily as the log of income.

[15] This framework also applies to cases where $\pi_L < 0$. In such cases, the corporate tax rate turns negative, implying a subsidy (e.g. through loss-offset or carry-forward provisions). Since taxation in our model does not include a lump-sum tax part (payable independently of the realisation of profits), we exclude $\pi_L = 0$. In our model, if $\pi_L = 0$, only π_H would be taxed (at the same rate as the flat tax rate).

- flat tax rate: t
- progressive tax rate: $t_L^{prog} = t + k_L$ if $\pi = \pi_L$ and $t_H^{prog} = t + k_H$ if $\pi = \pi_H$ with $k_L < 0 < k_H$, where k_L, k_H are constants.

In addition, we impose the following three conditions:

Condition 1 Constant expected tax bill condition

The expected tax bill is constant:

$$[t + k_L]\, p_L \pi_L + [t + k_H]\, p_H \pi_H = t p_L \pi_L + t p_H \pi_H.$$

Hence, expected after-tax income is assumed to be the same under the two tax schedules.

Condition 2 Spread condition

Risk is a function of the spread (the difference) of the two outcomes, π_L and π_H, whereas the probabilities and expected pretax profits are held constant.

This defines π_L:

$$\pi_L = \frac{\bar{\Pi} - \bar{p}_H \pi_H}{\bar{p}_L}, \tag{1}$$

where $\bar{\Pi} = p_L \pi_L + p_H \pi_H \geq 0$ is expected pre-tax profit, and upper bars design constants.

This condition implies that an increase in the variance of post-tax income w (and thus in risk) follows only from an increase in the spread of the two pre-tax profit levels. For notational ease, we suppress the upper bars henceforth.[16]

Conditions 1 and 2 allow us to express k_L as a function of π_L, π_H and k_H:

$$k_L = -\frac{p_H \pi_H}{\Pi - p_H \pi_H} k_H. \tag{2}$$

Condition 3 No-reversal condition

Post-tax income in the low-profit outcome cannot be higher than post-tax income in the high-profit outcome:

$$[1 - t - k_L]\, \pi_L \leq [1 - t - k_H]\, \pi_H.$$

[16] In what follows, brackets are used for mathematical operations, whereas parentheses are used for functions.

Hence, tax rates are not allowed to be so progressive as to reverse the ordering of the post-tax outcomes relative to the pre-tax outcomes.

Expected utility with a flat tax schedule then takes the following form:

$$\begin{aligned} EU(w^{flat}) &= p_L U([1-t]\pi_L) + p_H U([1-t]\pi_H) \\ &= p_L U\left([1-t]\frac{\Pi - p_H\pi_H}{p_L}\right) + p_H U([1-t]\pi_H), \end{aligned}$$

while expected utility with a progressive tax schedule becomes:

$$\begin{aligned} EU(w^{prog}) &= p_L U([1-t-k_L]\pi_L) + p_H U([1-t-k_H]\pi_H) \\ &= p_L U\left(\left[1-t+\frac{p_H\pi_H}{\Pi - p_H\pi_H}k_H\right]\frac{\Pi - p_H\pi_H}{p_L}\right) \\ &\quad + p_H U([1-t-k_H]\pi_H). \end{aligned}$$

We can now explore whether a change from a flat to a progressive tax schedule benefits a risk-averse entrepreneur.

Proposition 1 *Expected utility is higher with a progressive tax schedule than with a flat-rate tax:*

$$\frac{\partial\left[EU(w^{prog}) - EU(w^{flat})\right]}{\partial k_H}\Big|_{k_H=0} > 0.$$

Proof. *Taking the derivative with respect to* k_H *around* $k_H = 0$ *results in:*

$$\frac{\partial \Delta EU(w)}{\partial k_H}\Big|_{k_H=0} = -p_H\pi_H\left[U_w(w_H^{prog}) - U_w(w_L^{prog})\right] > 0,$$

where: $\Delta EU(w) = EU(w^{prog}) - EU(w^{flat})$, *and* $U_w(w_\ell^{prog}) = U_w([1-t-k_\ell]\pi_\ell)$, $\ell = \{L, H\}$.

■

This is the insurance effect: progressive taxation reduces the variance (and thus risk) by more than a flat rate. Therefore, the expected utility of after-tax income is higher under progressive taxation and a risk averse entrepreneur prefers progressive to flat taxation.

The logic of this simple model can be applied both to the location decision (choice between a location with a progressive tax and a location with a flat tax) and the entry-into-self-employment decision. Figure 1 illustrates this. Take the location decision, and suppose the two possible realizations π_L and π_H are equally probable. The entrepreneur can choose between two locations. The first one has a flat tax rate, and the corresponding after-tax realizations of π_L and π_H are w_L^{flat} and w_H^{flat}, respectively. At the second location, after-tax realizations of π are w_L^{prog} and w_H^{prog}. By the definition of progressive taxation and given the *no-reversal condition*, $w_L^{flat} < w_L^{prog} < w_H^{prog} < w_H^{flat}$. From the concavity of the utility function it follows that expected utility with a progressive tax, $EU(w^{prog})$, is higher than expected utility with a flat tax, $EU\left(w^{flat}\right)$: the entrepreneur prefers the location with the progressive tax.

The same analysis can be applied to the entry decision. Again, suppose equally probable realizations π_L and π_H. Suppose that under a progressive tax the potential entrepreneur is just indifferent between entering self-employment and being employed, in which case she receives a fixed wage corresponding to the certainty equivalent of $EU(w^{prog})$.[17] Imagine a switch to a flat tax. As a consequence, and easily seen in Figure 1, the expected utility from being self-employed, $EU\left(w^{flat}\right)$ decreases and so does the corresponding certainty equivalent (not drawn). Now, the potential entrepreneur unequivocally prefers remaining in risk-free employment.

It is intuitive, given the logic of the insurance effect of progressive taxation, that this effect becomes more pronounced for riskier ventures: the greater is the dispersion of uncertain outcomes, the more a potential entrepreneur stands to gain from progressive taxation. This can be expressed formally as follows.

Proposition 2 *The greater is the spread between π_L and π_H, the more an increase in progressivity is preferred:*

$$\frac{\partial^2 \Delta EU(w)}{\partial k_H \partial \pi_H} > 0$$

Proof. *See Appendix A.* ■

[17] The certainty equivalent of $EU(w^{prog})$ is not represented in Figure 1. From Jensen's inequality it follows that this point is located to the left of $E\left(w^{flat,\ prog}\right)$.

4 Empirical model and data

4.1 A count model of firm births

Our empirical project is straightforward: we seek to estimate the impact of the level, the progressivity and the complexity of corporate taxes on entrepreneurial activity.

We represent increases in entrepreneurial activity by the entry of new firms. New firms can be created in a jurisdiction through two basic processes. In the "latent-startup" process, immobile local residents are potential entrepreneurs who continuously compute the discounted expected utility from creating a firm and become active once that value exceeds the utility associated with their safe(r) outside option. In the "footloose-startup" process, entrepreneurs are mobile and scan potential locations for the best certainty-equivalent profit opportunity, conditional on having decided to set up a firm.

Despite the fundamental differences between the two processes, they have both been shown formally to be compatible with a Poisson count model of firm births. The latent-startup process has been modelled by Becker and Henderson (2000) and shown to lead directly to a Poisson model, subject to standard regularity conditions. Starting with Carlton (1983), the footloose-startup process has traditionally been modelled through a conditional logit representation, which can be formally derived from firm-level profit functions. Guimaraes, Figueiredo and Woodward (2003) have demonstrated that Poisson estimation with group fixed effects returns identical coefficients to those obtained with conditional logit estimation.

We can therefore directly write an expression for $E\left(n_{ijt}\right)$, the expected number of new firms (or of jobs in new firms) created in jurisdiction i, sector j and year t:

$$\begin{aligned} E\left(n_{ijt}\right) &= \lambda_{ijt} \\ &= \exp(\alpha_1 corptaxlevel_{ijt} + \alpha_2 corptaxprogressivity_{it} \\ &\quad + \alpha_3 risk_j * corptaxprogressivity_{it} + \alpha_4 corptaxcomplexity_{it} \\ &\quad + \boldsymbol{\beta}'\mathbf{taxcontrols}_{ijt} + \boldsymbol{\gamma}'\mathbf{othercontrols}_{ijt} + \boldsymbol{\theta}'\mathbf{d}_j + \boldsymbol{\zeta}'\mathbf{d}_t), \end{aligned} \tag{3}$$

where n_{ijt} follows a Poisson distribution, *corptaxlevel* is a measure of of the expected average corporate income tax rate, *corptaxprogressivity* is a measure of the progressivity of the corporate income tax schedule, *corptaxcomplexity* is a measure of the complexity of the corporate tax code, *risk* is a measure of the inherent riskiness of entrepreneurial ventures in sector j, **taxcontrols** is a vector of variables to represent tax burdens other than those on corporate profits, **othercontrols** is a vector of non-tax factors influencing the likelihood of firm births, $\mathbf{d}_j$ is a set of sector dummies, and $\mathbf{d}_t$ is a set of year dummies.

Our four hypotheses are:

1. $\alpha_1 < 0$ (the effect on firm births of the expected corporate income tax level is negative),

2. $\alpha_2 > 0$ (following Proposition 1, the effect on firm births of tax progressivity is positive),

3. $\alpha_3 > 0$, (following Proposition 2, the positive effect of tax progressivity is stronger in inherently riskier sectors), and

4. $\alpha_4 < 0$ (the effect on firm births of tax schedule complexity is negative).

4.2 Identification and inference

When seeking to identify the coefficients of our empirical model (3), we face the potential problem that, in general, corporate tax rules may be both cause and consequence of firms' location choices. Resident firms influence local tax provisions through the local tax base or through the political process of local tax setting. Our strategy for avoiding potential simultaneity bias is to study location choices of *new* firms *in narrow sectors*. While it is easy to conceive how existing firms in a jurisdiction together may influence local taxation, we consider it highly unlikely that entrants in a particular sector, location and period exert significant and systematic influence on pre-existing local tax rates. In our empirical setting, local jurisdictions are legally bound to apply identical statutory taxes across all sectors.[18] This allows us to treat tax rates as exogenous not only from the viewpoint of an individual firm but also from that of a cohort of new firms in a particular sector, location and period.

Another challenge to identification concerns the variable *corptaxlevel*, which stands for the expected corporate tax rate. With progressive tax schedules, the expected tax rate depends

[18] Corporate taxation in Switzerland is based on legally binding statutory rates that depend solely on firms' profitability and capital base. The definitions of these tax bases have been harmonized countrywide by a federal law that has been in force since 1993 and that foresees no firm-specific or sector-specific regimes except for some clauses to avoid double taxation of holding companies. Some (mainly industrial) firms can be offered tax rebates for a maximum of ten years after setting up a new operation. Available evidence suggests that they affect less than 4 percent of new firms (Brülhart *et al.*, 2007).

on expected profitability, which also affects the rate of firm births. Hence, our estimates of α_1 might be biased. Furthermore, to underestimate expected profitability would tend to bias estimates of α_2 and α_3 downward, and to overestimate it would tend to bias them upward, because progressivity would then correlate with the mismeasured expected tax rate. Specifically, when expected profitability is underestimated, this will tend to induce a positive correlation between the unobserved component of the true expected tax rate and the progressivity measure, thus biasing downward the estimated α_2. It is therefore important to take account of any systematic differences in expected profitability. We compute *corptaxlevel* separately for each sector-location pair, based on observed sector-average profitability rates. To the extent that firms' expected profitability is sector specific conditional on the included regressors, our coefficient estimates will be unbiased.

Finally, we need to think carefully about potential specification and omitted-variable bias. In the absence of a natural experiment and of sufficient intertemporal variation, we have to rely essentially on cross-section identification. Our approach is to control for all conceivably relevant determinants of firm births in addition to the tax variables and to test the robustness of the estimated tax effects across a range of specifications. The smallness and institutional homogeneity of Switzerland plays to our advantage in this respect, as it facilitates our task of generating an exhaustive set of controls.

Some features of our research design affect inference. First, the Poisson model implies that the expected count, λ_{ijt}, is equal to the variance of n_{ijt}. This is a strong assumption in our applications, as the variance mostly exceeds the expected count (overdispersion), and as we observe a large number of zero observations on the dependent variable. Second, our model includes several explanatory variables that are purely municipality-year specific (such as the progressivity of the corporate tax schedule), while the dependent variable is municipality-sector-year specific. Such aggregate variables bias the estimated standard errors downward if not correctly adjusted for (Moulton, 1986). Third, we observe firm startups over five years. We cannot exploit this panel structure by including location-sector fixed effects, as the changes over time in our main explanatory are too small for the identification of any statistically significant effects. However, the likely presence of location-sector random effects needs to be taken into account when estimating standard errors. All three issues are addressed by clustering standard errors in the two dimensions: by municipality-year and by municipality-sector. We therefore apply multi-way clustering as proposed by Cameron, Gelbach and Miller (2010). Clustering by municipality-year takes care of the second issue discussed above, clustering by municipality-sector addresses the third issue, and either of the clusters automatically accommodates the first issue.

4.3 Data

4.3.1 The Swiss corporate tax system

Several features of its political structure and tax system make Switzerland particularly well suited to serve as a laboratory for research on the effects of fiscal policy. Specifically, the Swiss system features three propitious characteristics.

1. Local tax autonomy

   Swiss taxes on corporate as well as on personal income are levied at three hierarchically nested jurisdictional levels: by the federal government, by the 26 cantons and by some 2,700 municipalities. The federal government taxes profits at a flat rate of 8.5% and does not tax corporate capital. The cantons enjoy complete autonomy in the setting of their tax schedules. They all levy taxes on profits and corporate capital as well as on personal income and wealth. In 21 of the 26 cantons, municipalities apply a single multiplier to the applicable cantonal tax schedules.[19] In the remaining cantons, the same multiplier applies to all municipalities within the canton, implying no municipal autonomy (see Table 1, last column).

2. Heterogenous tax schedules

   The autonomy of local tax setters yields large intra-national variance in taxation. The geography of corporate tax burdens is illustrated in Figure 2, which shows consolidated cantonal and municipal average corporate income tax rates on a representative firm for the 26 cantonal capitals. The highest tax rate (Geneva, 23.5%) exceeds the lowest tax rate (Zug, 6.4%) by a factor of nearly four. As can be gleaned from Figures 3 and 4 for 2001 and 2005 respectively, the progressivity of these tax schedules exhibits similar intra-national heterogeneity. Eleven cantons, among them the cantons of Zurich (since

[19] In 8 of those 21 cantons, municipalities decide on a single multiplier that applies to both personal and corporate taxes. In the remaining 13 cantons, at least some municipalities apply separate multipliers to the two tax bases.

2005) and Geneva, apply a flat tax rate on profits. The remaining fifteen cantons apply progressive schedules with two or more tax brackets. Additional heterogeneity arises from the fact that some cantons base the calculation of the simple tax on the amount of profits, others on profitability, and some on a combination. Recent changes have without exception been in the direction of flatter tax schedules, as is evident in Figure 5.

3. Comparable jurisdictions

   Switzerland has an area of 41,285 square kilometers and a population of 7.5 million. It therefore covers about twice the area, and hosts roughly the same population, as the US state of Massachusetts. Many hard-to-measure geographical, cultural or political differences that affect international comparisons should not be of much concern in a study across jurisdictions at such a small spatial scale. In addition, institutional features such as the social security system, unemployment insurance and health insurance are either governed by federal law or substantively harmonized across cantons.

As our interest is in differential firm birth rates as a function of differences in tax schedules, we need to ascertain that corporate income taxes indeed affect these firms. In Switzerland, distributed profits are taxed twice, first at the level of the firm, through the corporate income tax, and then at the level of the individuals receiving dividend payments, through the personal income tax. When a profitable firm's owners are also their employees - a frequent occurrence in startup firms - then these owners have an incentive to declare these profits as wages in order to avoid the corporate income tax. If there were no limits to this practice, the corporate income tax would become largely irrelevant for firms run by owner-employees. Swiss fiscal law, however, explicitly bans the "disguised" distribution of profits via inflated wages, and jurisprudence consistently applies the "arm's-length principle", whereby wage payments to owner-employees have to conform to standard remuneration levels in the given occupation and sector.[20] Therefore, corporate income taxation is of relevance also to small owner-run firms.

[20] See Henneberger and Ziegler (2008).

4.3.2 Variables used

Our study is based on a municipality-sector level panel data set for the five years from 2001 to 2005. The number of municipalities for which we have the required tax data ranges from 665 in 2001, covering 72 percent of the Swiss population, to 846 in 2005, covering 83 percent of the population.[21] Sectors are defined according to the two-digit level of Eurostat's NACE classification, which distinguishes 51 sectors.[22] Table 2 lists our variables and data sources, Table 3 reports summary statistics, and Table 4 reports raw correlations.

Our dependent variable, *newfirms*, is the count of new firms per municipality, sector and year. The alternative dependent variable, *newjobs*, is the count of full-time and part-time jobs created by those new firms. The data set covers all new firms created in Switzerland between 2001 and 2005. The average new firm has 2.6 employees at birth, and 43 percent of new firms have a single employee. Using *newjobs* as an alternative regressand may be useful by reducing the weight of one-person firms in driving our results. Firms are defined as market-oriented incorporated organizations that are operating for at least 20 hours per week. New entities created by mergers, takeovers, breakups, changes of their legal form are not counted. Foreign firms' first subsidiary in Switzerland, however is considered a new firm. This provides us with data for 25,419 new firms and 64,927 new jobs created over the sample period.

The main component of the explanatory part of our model are corporate tax burdens. In order to construct sector-specific representative corporate tax rates, we first need data on representative profits and capital stocks. While nation-wide statistics exist neither at the level of firms nor at the level of sectors, we can draw on a firm-level data set for one of the 26 cantons (Aargau). This data set, obtained from the cantonal tax authority, reports pre-tax profits and capital bases for 2004. It covers the universe of 15,731 firms based in that canton, which represents 11 percent of Swiss firms in 2004. We have two reasons to be confident that the micro data for Aargau are representative of patterns for Switzerland at large. First, the overall distribution of firm-level profits in that canton closely matches that for the whole

[21] The average population of our sample municipalities was 7,928 in 2001 and 7,243 in 2005. These municipalities were host to 85 (89) percent of all new firms in 2001 (2005). The data cover roughly the upper size quartile of Swiss municipalities. Tax data for smaller municipalities are not collected centrally.

[22] A more sectorally disaggregated approach is not possible since our data on the distribution of profits and capital are available at the two-digit level only. We were forced to omit four sectors, for which no firm births were observed in our sample period: NACE 10 (coal mining), 12 (ore mining), 13 (uranium mining) and 23 (coke, refined petroleum and nuclear fuel). We also had to drop NACE 16 (tobacco) due to missing wage data. We therefore work with 46 sectors throughout.

country.[23] Second, the corporate tax burden in the canton of Aargau, computed by the federal tax administration, is very close to the national average.[24] From the Aargau data we can compute average profits, average capital stocks and average profitability for corporations with positive profits per two-digit sector.

Based on these data, we then construct sector-specific corporate-income tax measures.

- Level of the corporate income tax (*corptaxlevel*): Based on statutory tax rates and estimated industry-level average profits and capital stocks, we calculate the industry-specific effective average tax rate (EATR) on profits for all sample municipalities and years.[25]

- Progressivity of the corporate income tax (*corptaxprogressivity*): Based on the national distribution of capital and profitability across all sectors, we collected tax rates for first, third and fifth sextile profitability firms, characterized by profits amounting to 2, 9 and 32 percent, respectively, of own capital.[26] This was done separately for three capital levels, representing the first, second and third quartile of the distribution of capital. Our three alternative progressivity measures are then computed as weighted averages across the three representative capital levels.[27] The first progressivity measure, *corptax-progressivity*1, is the difference between the EATR for firms with high (32 percent) and low (2 percent) profitability. The second progressivity measure, *corptaxprogressivity*2,

[23] The first, third and fifth sextiles for pre-tax rate of returns are 3, 12 and 37 percent (canton of Aargau) against 2, 9 and 32 percent (Switzerland). The quantiles for Aargau are based on firm-level reported profit data, whereas the national quantiles are calculated using the national profit and capital distributions published by the Federal Tax Administration.

[24] The index of the corporate income tax burden computed by the Federal Tax Administration for the year 2004 has a value of 97.4 for the canton of Aargau. The national average is 100, with values ranging from 57.3 (Schwyz) to 126.7 (Geneva). Aargau levies a minimum corporate tax of 500 Swiss francs ($\approx$ 500 US dollars) on profits and capital together. Therefore, to calculate sector averages, we excluded all observations with a simple tax of 500 francs, even if they declared positive but very low profits. Furthermore, we considered observations with an implied pre-tax rate of return of more than 200 percent to be unreliable and excluded them.

[25] The Swiss corporate tax system allows corporations to deduct actual tax payments from their pre-tax income. Therefore, our EATRs are defined as $\frac{t^{\pi}\left(\pi - t^{K}K\right)}{(1+t^{\pi})\pi}$, where π denotes pre-tax profits, K is own capital, t^{π} is the statutory corporate income tax rate and t^{K} is the statutory capital tax rate.

[26] Due to some small cell sizes, the Aargau data do not allow us to calculate sufficiently reliable sector-level distributions. We therefore prefer to rely on frequency distributions for Switzerland as a whole (available aggregated across sectors) for the profitability dispersion measure.

[27] The weights applied are 0.375 for the cases of low and high capital and 0.25 for the median-capital case, thus taking into account that the low and high cases refer to the upper end of the first and third quartile respectively. The fact that two of our progressivitiy measures have negative minima (see Table 3) is explained by one canton (Aargau) applying a fixed minimum tax of CHF 500 on all incorporated firms, which implies regressive taxation for certain small firms with low profitability. Furthermore, the definiton of EATRs implies that there is some small within-canton variation in progressivity even though municipalities apply a single multiplier to the canton-level tax schedule. Eliminating this variation by taking averages of the progressivity measures within each canton and year has no discernible impact on our results.

corrects for the tax level: we divide *corptaxprogressivity*1 by the arithmetic mean of the EATR for firms with low, median and high profitability. A third measure of progressivity, *corptaxprogressivity*3, measures the redistributive impact of a given tax schedule compared with a proportional tax. By construction, this index ranges from -1 to +1. A value of *corptaxprogressivity*3 > 0 (< 0) indicates a progressive (regressive) tax system, while *corptaxprogressivity*3 $= 0$ stands for a proportional system.[28] Table 4 shows that these three measures are highly but not perfectly correlated, with correlation coefficients ranging from 0.89 to 0.98.

- Industry-specific risk (*risk*): In accordance with Condition 2, we define *risk* as the standard deviation of industry profits, expressed as a deviation from the cross-sector average standard deviation (*risk* therefore has mean zero), and based on the firm-level data for Aargau. This variable is then interacted with the three measures of corporate tax progressivity to provide a test of Proposition 2.

- Complexity of the corporate income tax schedule (*corptaxbrackets*): Following Slemrod (2005), we define *corptaxbrackets* as the number of different statutory corporate income tax brackets.

- Complexity of the entire corporate tax code (*corptaxwordcount*): We define this variable as the count of words in the cantonal corporate tax codes.[29]

In our baseline specification, we control for a range of additional potentially relevant tax variables concerning both corporate and personal income (**taxcontrols**) and for non-tax

[28] This measure is known as a "relative share adjustment" (see, e.g., Kesselman and Cheung, 2004). It is a weighted average of a local index of tax progressivity, RSA_k, where $RSA_k = \frac{1-ATR_k}{1-ATR} - 1$. ATR_k is the average tax rate for the k^{th} income group, and ATR is the aggregate average tax rate. RSA_k has an intuitive interpretation, since it can be used to calculate the gain or loss to a specific income group of switchig to a fully proportional tax. For example, if $RSA_k = 0.03$, a k-type taxpayer would suffer an income loss of 3 percent if the existing system were replaced by a proportional tax. The global index of progressivity, RSA_G, is then calculated as follows: $RSA_G = \sum_{k=1}^{K} \phi_k RSA_k$, where $\phi_k = \theta_k \left(\theta_k + 2\sum_{l=k+1}^{K} \theta_l\right)$, and $\theta_k = \frac{w_k}{\sum_{k=1}^{K} w_k}$ is post-tax income share of the k^{th} taxpayer (w_k being post-tax income of the k^{th} taxpayer).

[29] Word counts are based on the official compendium of cantonal tax laws *Steuern der Schweiz*. This compendium reproduces the content of all cantonal tax laws in a standardized format. It has the advantage of using harmonized terminology and thus allowing meaningful comparisons of word counts. The fact, that three Swiss cantons are officially bilingual and have identical tax codes in both French and German, allows us to quantify the "excess words" in tax codes due to the French language. In the canton of Berne, the French version of the tax code is 36 percent longer than the German one, and in the cantons of Fribourg and Valais, these differences correspond to 44 and 29 percent respectively. Thus, the average "surplus word count" due to to the French language is 37 percent. Therefore, we devide the word count for Latin cantons by 1.37 (the tax code for the Italian-speaking canton of Ticino being recorded in French in the compendium).

explanatory variables that are also likely to determine firm birth rates (**othercontrols**). The list of those variables is given in Appendix B.

5 Results

5.1 Baseline estimates

We estimate equation (3) using fixed-effects Poisson regression with two-way clustered standard errors. Table 5 reports the baseline estimations for six different variants of our empirical model.

Our results are reassuringly consistent across specifications: all corporate tax variables and all statistically significant controls retain their sign across the six regression runs. Whether we define our dependent variable as counts of new firms (columns 1-3) or as counts of jobs created by those new firms (columns 4-6), is of little consequence to our estimates. Any observed regularities, therefore, do not seem to be driven by particularly small or particularly large new firms. The estimated coefficient signs generally conform with expectations. Numbers of firm births are relatively high in large municipalities, in municipalities with high (non-transfer) public expenditure and in municipalities with high rates of unemployment (which imply fewer outside options for "latent entrepreneurs"). Conversely, firm birth rates are relatively low in remote municipalities (in terms of distance from the highway network). The one counterintuitive statistically significant result on the control variables concerns property prices, for which we estimate a positive coefficient. This result very likely reflects the fact that property prices correlate with certain relevant but unobserved location-specific features without fully capitalizing them.[30]

Turning to the corporate tax variables, we find confirmation for our main hypotheses.

1. The **level** of taxation has a statistically significantly negative impact, with our corporate income tax variable *corptaxlevel* returning precisely estimated negative coefficients throughout. The existence of a negative tax level effect is corroborated by the finding that capital taxes (*captaxlevel*), personal income taxes (*incometaxlevel*) and inheritance taxes (*inheritancetax*) also consistently yield statistically negative coefficient estimates.

[30] Unobserved location-specific variables can be fully controlled for by including municipality-level fixed effects. We found that inclusion of such fixed effects has no significant impact on our results.

The only exception are wealth taxes (*wealthtaxlevel*), for which we obtain positive coefficients. A possible explanation for this result is that high wealth taxes act as an incentive for investing in privately held corporations. Overall, however, the conclusion that high average taxes depress firm births is strongly supported.

2. The estimated effects of tax **progressivity** are positive throughout, in line with our Proposition 1. These coefficients are generally measured somewhat less precisely than those on the tax level variables. Nonetheless, all six coefficients estimated on the variants of *corptaxprogressivity* are found to be statistically significant at least at the five percent level. Our estimated coefficients on the interactions of corporate income tax progressivity with our proxy measures for sector-specific risk are all positive, which is in line with Proposition 2. Only two of these interaction terms are statistically significant (at the ten percent level), which is very likely due to the inevitably approximate measure of risk in our empirical context. Taken together, these estimates lend support to the prediction that, given a certain expected tax bill, progressivity promotes firm births.

3. We find no significant evidence that the **complexity** of the corporate income tax schedule itself (*corptaxbrackets*) affects the rate of firm births. The number of different tax brackets *per se* therefore seems to be of no consequence for entrepreneurial activity. In contrast, the complexity of the overall corporate tax code, measured via *corptaxwordcount*, has a statistically significantly negative impact. Hence, entrepreneurship-promoting simplification of corporate taxation would seem to be best achieved not by reducing the number of brackets of the tax schedule but by simplifying the tax code.

5.2 Robustness

In Table 6, we report variations on the baseline estimates of Table 5, in order to gauge the sensitivity of the baseline estimates. Given the similarity of the two sets of estimates reported in Table 5, we now limit our analysis to specifications with *newfirms* as the dependent variable.

We report estimates for twelve specifications, alternatively dropping variables from the baseline runs. In columns 1 to 3, we drop the control for the sector-specific expected level of the corporate income tax bill, *corptaxlevel*. This reverses the sign of the coefficients on corporate tax progressivity, implying a negative effect of progressivity - in line with the “success tax” argument proposed by Gentry and Hubbard (2000, 2005). These estimations show clearly that any verdict on the implications of tax progressivity hinges on whether or not one controls for the expected tax bill.

We also experiment with dropping the two complexity measures, *corptaxbrackets* (columns 4 to 6) and *corptaxwordcount* (columns 7 to 9). These changes turn out not to affect any of our coefficient estimates qualitatively, but they strengthen the measured positive impact of corporate tax progressivity. This could suggest that progressivity tends to be associated with more complex tax codes. However, we observe that it is especially the omission of the complexity measure *corptaxwordcount* that boosts the estimated coefficients on the progressivity measures (columns 7 to 9), although these variables are basically uncorrelated (Table 4). The low bivariate correlations suggest that progressive schedules are perfectly compatible with simple tax codes. The regression results, however, imply that, conditional on other factors, these two variables do comove, and that this comovement to some extent dampens the measured positive effect of corporate tax progressivity.

As a final robustness test, we drop all variables not related to corporate taxation bar the scaling variable *munsize*. These results are shown in columns 10 to 12 of Table 7. The signs and significance levels on our coefficients of interest are reassuringly similar to those found for the full model in Table 5. Unlike in the baseline estimations, the impact of capital taxes is now estimated to be statistically significantly negative. The coefficients on *corptaxwordcount* are up to 40 percent smaller, but they remain statistically significantly negative throughout. Less plausibly, the coefficient on *dividendprovision* turns statistically significant negative. Our main results, however, do not seem to be driven by the particular set of conditioning variables chosen for the baseline estimations.

We have conducted a number of additional sensitivity tests not reported here but available on request. The main alternatives we tried were (a) models with *newjobs* as the dependent variable, (b) models with the coefficient on the exposure variable *munsize* forced to unity, (c) models with municipality-level fixed effects, (d) models with canton-level instead of municipality-level personal tax variables, (e) models with sector-level coefficient estimates on *wage* and *propertyprice* to account for different factor intensities, and (f) models with additional controls (for municipal debt burdens, urban areas, length of lake shores, individual components of public expenditure, and local unemployment rates). None of our qualitative findings turned out to be affected.

5.3 Quantitative effects

Our central research question is qualitative in nature: does corporate tax progressivity promote firm births, given the expected corporate tax bill? The answer appears to be yes. We can go further than this, however, and evaluate the magnitudes of the various determinants of firm births, related to taxes and otherwise. The Poisson coefficients reported so far are semielasticities, measuring the proportionate change in the conditional mean of firm births for a one-unit change in the respective regressor. Since the scales of our regressors differ considerably (see Table 3), these semielasticities are not directly comparable.

In Table 7, we therefore show transformations of the baseline estimates that can be compared across variables. Columns 4 to 6 report elasticities, computed as the product of the Poisson coefficients (columns 1-3) multiplied by the means of the relevant regressors (column 10). These numbers give the percentage effect of a one-percent change in the value of the respective regressor. As an alternative, we report semistandardized coefficients in columns 7 to 9, defined as the product of the Poisson coefficients (columns 1-3) and the standard deviations of the relevant regressors (column 11). The semistandardized coefficients quantify the percentage effect of a one-standard-deviation change in the value of the respective regressors.

Both sets of transformed coefficients highlight the importance of taxes for firm births. Of all regressors included in our model, by far the strongest effects are measured for corporate tax levels, with an elasticity of around 3.3 in absolute value. Differences in corporate income tax levels clearly have strong effects on firm formation rates across Swiss municipalities.[31]

Second to the impact of the expected level of the corporate tax bill comes the impact of the expected level of the personal tax bill, with an elasticity of slightly above 1 in absolute value. Given the difficulty of attributing relevant personal tax variables to municipalities (due to commuting), this variable likely suffers from some mismeasurement. This in turn implies attenuation bias for the coefficient estimate, which makes the strong estimated effect of personal taxes all the more noteworthy. The third most important dimension of taxation is the complexity of the corporate tax code (*corptaxwordcount*), with an elasticity of around

[31] Our estimates suggest a more than proportional reaction of firm births to changes in corporate tax levels. It would of course be erroneous to read into this a potential for revenue-increasing tax cuts, as our model does not capture responses of the entire tax base.

-0.9. All other aspects of the tax code have comparatively minor effects on firm births. The average elasticity with respect to the progressivity of corporate taxes is estimated at around 0.08 - an order of magnitude smaller than the complexity effect. The smallest quantitative effect of all tax variables is found for *corptaxbrackets* and *dividendprovision*, with an average elasticity of very close to zero.

In sum, we find a clear hierarchy of tax effects, with tax *levels* having by far the strongest impact on firm birth rates, the *complexity* of tax codes coming second, and the *progressivity* of tax schedules having a comparatively small but statistically significantly positive impact.

6 Conclusion

Tax reforms in the spirit of the "flat tax" model have three central components: a reduction in the average tax rate, a reduction in the progressivity of the tax schedule, and a reduction in the complexity of the tax code. Using data on sub-federal jurisdictions in Switzerland, we estimate the separate effects of these three components of corporate income taxes on the incidence of firm births.

Our results confirm that lower average tax rates and reduced complexity of the tax code promote firm births. Controlling for these effects, reduced progressivity inhibits firm births. Our reading of this result is that tax progressivity has an insurance effect that facilitates entrepreneurial risk taking.[32]

The positive effects of lower tax levels and reduced complexity are estimated to be significantly stronger than the negative effect of reduced progressivity. To the extent that firm births reflect desirable entrepreneurial dynamism, it is not the flattening of tax schedules that is key to successful tax reforms, but the lowering of average tax burdens and the simplification of tax codes. Flatness *per se* is of secondary importance and even appears to be detrimental to firm births.

[32] An alternative interpretation could be that new firms prefer more progressive tax schedules, given an expected tax bill, because they are credit constrained: the lower tax liability in case of a bad profit outcome may offer a greater gain in terms of access to external funding than the loss implied by a higher tax liability in case of a good outcome. See Keuschnigg and Ribi (2009) for a model of corporate income taxation with credit-constrained firms.

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A Appendix: Proof of Proposition 2

From (1) and (2) it follows that

$$\frac{\partial \pi_L}{\partial \pi_H} = -\frac{p_H}{p_L}, \tag{4}$$

and

$$\frac{\partial k_L}{\partial \pi_H} = -\frac{\Pi p_H k_H}{(\Pi - p_H \pi_H)^2}. \tag{5}$$

Then, Proposition 1 and equations (4) and (5) imply:

$$\begin{aligned}
\frac{\partial^2 \Delta EU(w)}{\partial k_H \partial \pi_H} &= -p_H \Delta U_w(w^{prog}) - p_H \pi_H \begin{bmatrix} U_{ww}\left(w_H^{prog}\right)[1-t-k_H] \\ -U_{ww}\left(w_L^{prog}\right)\left[-\frac{\partial k_L}{\partial \pi_H}\pi_L + [1-t-k_L]\frac{\partial \pi_L}{\partial \pi_H}\right] \end{bmatrix} \\
&= -p_H \Delta U_w(w^{prog}) - p_H \pi_H \begin{bmatrix} U_{ww}\left(w_H^{prog}\right)[1-t-k_H] \\ -U_{ww}\left(w_L^{prog}\right) \begin{bmatrix} \frac{\Pi p_H k_H}{(\Pi - p_H\pi_H)^2}\frac{\Pi - p_H \pi_H}{p_L} \\ -\left[1-t+\frac{p_H\pi_H}{\Pi - p_H\pi_H}k_H\right]\frac{p_H}{p_L} \end{bmatrix} \end{bmatrix} \\
&= -p_H \Delta U_w(w^{prog}) - p_H \pi_H [1-t-k_H]\left[U_{ww}\left(w_H^{prog}\right) + \frac{p_H}{p_L}U_{ww}\left(w_L^{prog}\right)\right] \\
&> 0,
\end{aligned}$$

where:

$$\begin{aligned}
U_{ww}\left(w_L^{prog}\right) &= U_{ww}\left([1-t-k_L]\,\pi_L\right) < 0, \\
U_{ww}\left(w_H^{prog}\right) &= U_{ww}\left([1-t-k_H]\,\pi_H\right) < 0, \\
\Delta U_w(w^{prog}) &= U_w(w_H^{prog}) - U_w(w_L^{prog}) < 0.
\end{aligned}$$

A Appendix: Control variables

The list of baseline explanatory tax variables (**taxcontrols**) is as follows.

- Level of capital tax (*captaxlevel*): We calculate an industry-specific EATR on corporate capital for all municipalities and years.
- Provisions to alleviate double taxation of dividends (*dividendprovision*): Dummy variable which is set equal to 1 if a canton has a reduced tax rate on dividend income and to 0 otherwise.
- Level of the personal income tax (*incometaxlevel*): The Swiss federal tax administration publishes representative EATRs on personal income for all of the municipalities in our sample.[33] As we cannot know what municipality the owners of our sample firms reside in, we have considered two hypotheses for all personal taxes: (a) firm owners live in the municipality their firm is located in, or (b) owners live in the canton their firm is located in. Since the results do not differ significantly, we report results based on the second hypothesis. We thus compute *incometaxlevel* as the weighted average personal income tax burden, using the published cantonal sample mean of the EATR on low, median and high income households (corresponding to the first, third and fifth sextile of the national household income distribution).

[33] The published EATRs correspond to average cantonal, municipal and church tax rates for a representative household (married couple with two children) and for a range of reference incomes.

- Progressivity of the personal income tax (*incometaxprogressivity*): Based on the published canton-average EATR on low, median and high income, we define *incometaxprogressivity*1, *incometaxprogressivity*2 and *incometaxprogressivity*3 analogously to *corptaxprogressivity*1-3.

- Level of the wealth tax (*wealthtaxlevel*): We compute this variable as the cantonal-average EATRs for a person with taxable wealth of 300,000 Swiss francs ($\approx$ 300,000 US dollars), which corresponds approximately to the mean wealth level among individuals with non-zero declared wealth over our sample period.

- Inheritance tax (*inheritancetax*): This variable takes the value of 1 if a canton has an inheritance tax for direct descendants in a given year and 0 otherwise.

The list of baseline non-tax explanatory variables (**othercontrols**) is as follows.

- Public expenditure (*publicexp*): Firms not only pay taxes, they may also benefit from public spending. We construct this variable as the sum of municipal and cantonal per-capita public spending, excluding social transfers and deflated with the consumer price index. The public spending items included in *publicexp* are public administration, security, education, culture and sports, roads, and public transport.[34]

- Wage level (*wage*): We control for average monthly wages per sector and region, deflated by the consumer price index.[35]

- Property prices (*propertyprice*): This variable is defined as the unweighted average of median municipality–year-level market prices per square meter of retail space, office space and industrial real estate, deflated by the consumer price index.[36]

- Geography: To capture accessibility (and thus potentially agglomeration effects), we include three additional control variables: *disthighway*, the road distance from every municipality to the nearest highway access, *distairport*, the road distance to the nearest international airport, and *distuniversity*, the distance to the nearest university.

- Culture (*latin*): We control for potential cultural and attitudinal differences by introducing the dummy variable *latin* that takes the value of 1 if the main language of a canton is French or Italian and 0 if it is German.

- Unemployment (*unemploymentrate*): We control for the population share of registered unemployed workers by municipality and year.

- Size of the municipality (*munsize*): We use the log of the average resident population per year and municipality as the exposure variable.

[34] Annual municipal expenditures are only available for the 26 canton capitals and 16 other municipalities. However, the Swiss Federal Finance Adminstration publishes overall annual municipal spending for each canton. We compute annual municipal spending for the other municipalities by substracting the expenditure of the (26+16) municipalities from overall municipal expenditures and then dividing it by the population of the remaining municipalities. Thereby, the remaining municipalities are attributed identical values of *publicexp* within each canton.

[35] Wage data are compiled by the Swiss Federal Statistical Office for seven Swiss regions, five of which comprise several cantons (the cantons of Zurich and Ticino representing regions on their own), and for sectoral aggregates that correspond roughly to the NACE 1-digit level. These data are available for the years 2002 and 2004. We linearly extrapolate *wage* for the remaining years.

[36] We obtained these data from the consultancy firm Wüest & Partner.