The Capital Gains Tax: A Curse but Also a Blessing for Venture Capital Investment

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Abstract

Our study analyzes the effect of the capital gains tax on the individual investment decisions of venture capitalists. By doing so, we are able to study the decisions for a sample of 76,852 funding rounds in 32 countries from 2000 to 2012. Our results support the predictions of the theoretical model that higher capital gains tax rates are associated with fewer start-ups financed and a lower probability of receiving follow-up funding. However, the results concerning the effect on the probability of success of start-ups show that a higher tax burden is associated with a higher probability of eventual start-up success.

JEL Classification Numbers : G24, H25, H32

Keywords: Venture Capital, Capital Gains Tax, Selection Effect, Follow-up Funding, Innovation

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INTRODUCTION

Governments around the world introduce programs to spur innovation and the creation of start-ups. The availability of venture capital is one factor that is considered beneficial for the foundation and growth of young and innovative companies. Based on the conviction that venture capital can foster entrepreneurship and thus innovation (Kang *et al.*, 2011), many policy measures are directed toward establishing favorable conditions for venture capital investments.

To stimulate venture capital investments, governments apply at least four different measures: First, governments try to reduce the risk of investing in start-ups by directly subsidizing them in the early development stages or by investing through state-owned venture capital funds. Hence, venture capitalists aiming to invest in more developed start-ups bear a reduced risk of these start-ups not being able to persist in the market. Second, governments try to 'set the table', that is, alleviate institutional constraints by investing in basic R&D or reducing the cost of R&D and by establishing a suitable legal framework so that start-ups have improved conditions to subsist in the market (Bonini & Alkan, 2009; Lerner, 1999, 2009). Third, venture capitalists need profitable exit options for their investments in start-ups. In this regard, governments encourage the creation of viable stock markets for young companies so that venture capitalists have the opportunity to take portfolio companies public and realize a high return (Black & Gilson, 1998; Bonini & Alkan, 2009; Da Rin *et al.*, 2006). Fourth, the profits of venture capitalists and entrepreneurs are both affected by taxation so that governments use tax breaks to incentivize venture capital investments (Gompers *et al.*, 1998; Jeng & Wells, 2000; Da Rin *et al.*, 2006, 2011a).

Despite this political interest, it is not completely understood how tax policy influences investment in venture capital-backed companies and thus the entrepreneurial process. Our analysis sheds light on this aspect by examining the effect of the capital gains tax on venture capital investment. Capital gains are the most important source of compensation in the venture capital context (Cumming & MacIntosh, 2006; Cumming & Johan, 2008); therefore, the taxation of these gains could have a particularly large influence on investments in start-ups. When a venture capitalist provides

funding for a start-up, he or she wants to achieve high capital gains by exiting the company at a higher price than that upon entry. The venture capitalist invests only if the taxed capital gains cover the costs incurred by monitoring and advising the start-up. Consequently, if the government increases taxes on capital gains, this change should reduce the incentives for venture capitalists to invest in start-ups, since they have less means to finance and monitor investments. With increasing tax rates, companies with high monitoring costs will face financing constraints even though their funding could contribute to innovation and they could become growth companies (Chemmanur *et al.*, 2014; Ueda & Hirukawa, 2008; Da Rin *et al.*, 2011).

We empirically investigate whether an increase in the capital gains tax rate has an effect on venture capitalists' investment decisions in funding start-ups. In a first step, we determine whether the capital gains tax has an effect on the number of start-ups financed and whether the probability of success of the start-ups that receive venture capital increases or decreases with the tax rate. In a second step, we study whether the capital gains tax affects venture capitalists' decisions to continue financing start-ups in consecutive funding rounds. Existing studies have exclusively concentrated on the question of tax effects on the investment volume of venture capital within an economy (Bonini & Alkan, 2009; Gompers *et al.*, 1998; Jeng & Wells, 2000; Da Rin *et al.*, 2006). Our study expands this literature by considering the investment decisions of venture capitalists. This allows deeper insight into the effects the capital gains tax has on the innovativeness of an economy that is influenced by the number and quality of start-ups.

To determine the effects of tax rates on venture capitalists' investment decisions, we use the data from the Thomson One Database on companies that received venture capital between 2000 and 2012. The analysis considers not only companies that received venture capital for the first time, but also those that received further funding rounds. In addition, the exit type for the start-up is determined to identify whether a successful exit could be achieved. We classify a company as successful if it is eventually acquired or taken public (Gompers *et al.*, 2008). In total, our dataset includes 32 countries for which detailed characteristics of the capital gains tax are carefully determined. Since venture capitalists typically invest for a holding period of two to seven years and

hold a substantial stake in the company, the corresponding tax rates are applied. In our analysis, we measure the effect of the capital gains tax on four different dependent variables: the number of financed firms, the number of successful firms, the probability of a financed company being successful, and the probability of a firm receiving follow-up investment. To guide our empirics, we develop a theoretical model in which an investor responds to rising taxes by selecting firms to fund. This model predicts that an increase in the capital gains tax rate should result in fewer firms financed, fewer successful firms, and – for start-ups in later development stages – in a lower probability of receiving follow-up investment.

Our results support the theoretical predictions that higher capital gains tax rates indeed lead to fewer companies receiving investments by venture capitalists. In addition, the number of firms realizing a successful exit is reduced by an increase in the capital gains tax rate. In our data, an increase in the capital gains tax rate of one percentage point is associated with around 1.04 fewer companies per 10 million inhabitants receiving their first investment. This is a reduction of 3.6 percent relative to a mean of 29.27 new companies per 10 million inhabitants. Interestingly, we find that the ratio of successful companies rises with increasing tax rates. These results point to a selection effect of taxes. Venture capitalists seem to be able to pick the companies to invest in more diligently when tax rates are high. This finding provides some evidence for the question discussed in the literature of whether venture capitalists are able to identify potentially more successful companies during their initial due diligence process (Bertoni *et al.*, 2011; Brander *et al.*, 2002; Dimov & Shepherd, 2005; Dimov *et al.*, 2007; Lerner, 1994). The results are corroborated when we analyze venture capital investments in consecutive funding rounds. Companies have a lower probability of receiving further funding rounds when capital gains taxes are high. However, if the capital gains tax was high at the time of the first funding, the company has a higher probability of receiving funding in consecutive rounds, again pointing at a selection effect.

Our study contributes to understanding the effect of taxes on venture capital investment by considering new outcome variables that have so far often been neglected: the probability of receiving follow-up investment, the probability of a company's success, and the proportion of successful

firms.[1] Prior studies focus on the effect of taxes on the investment volume of venture capital funds in an economy and therefore cannot consider outcomes related to company success. This focus is astonishing, because policy interventions – such as a change in the capital gains tax rate – should consider the effect of taxes on success variables, since they measure an important aspect: The reinvestment probability is correlated with firm survival and only surviving firms can contribute to innovation and become growth companies. The propensity of being successful is important since it is one measure of how efficient entrepreneurs and the venture capital industry generate these new firms and products.

The remainder of this article is organized as follows. The next section outlines the relevant literature and develops a theory about the proposed causal channel of the capital gains tax on venture capitalists' investment decisions. We then discuss our sample construction. The empirical specification is outlined in the method section, before the results are described. After a discussion of the results, the last section concludes the paper.

THEORETICAL BACKGROUND

Literature

Venture capital funds are often the only source of funding for young high-risk companies (Elango *et al.*, 1995; Gompers *et al.*, 1998).[2] For such start-up companies, traditional bank financing is unavailable, since they do not have assets that can be pledged as collateral. Instead of demanding collateral, a venture capital fund intensively monitors these start-ups after investing so that the risk of exploitation of private benefits is reduced and entrepreneurial effort is incentivized (Becker & Hellmann, 2003; Kaplan & Strömberg, 2004; Gompers *et al.*, 1998). The monitoring effort renders investments more costly for venture capital funds, limiting the possibility of simultaneosly investing in numerous start-ups simultaneously (Holmstrom & Tirole, 1997). Consequently, ventures with high monitoring costs face financing constraints (Elango *et al.*, 1995; Gompers *et al.*,

[1] (Gompers *et al.*, 2008) and (Brander *et al.*, 2010) also consider the determinants of success probability of venture capital investments as outcome variables.

[2] We use the terms $venture$, $start-up$, and *company* interchangeably throughout the article.

1998). Nevertheless, these start-ups could contribute to innovation and become growth companies. Therefore, the provision of venture capital to young and innovative companies is often desired from a political point of view. Since monitoring costs can hardly be influenced, governments try to use different policy measures to increase the returns of venture capital investments (Bonini & Alkan, 2009). Tax policy is the most direct way of influencing the venture capitalist's return, since the capital gains tax directly reduces the sales price of companies when investments are exited (Poterba, 1989a,b; Gompers *et al.*, 1998).

To improve their bargaining position in the monitoring process, venture capitalists do not invest the required funds all at once but provide them in consecutive funding rounds. That means that, after a certain period, venture capitalists evaluate whether to continue investing in a start-up, depending on the expected net present value of the investment. The investment in a start-up is profitable if the investor is able to sell the acquired share of the company for a profit. The most profitable exit routes are selling the start-up either to another company in a trade sale or to the public in an initial public offering (IPO). These two exit types deliver the highest returns for venture capitalists (Cochrane, 2005; Dai *et al.*, 2012; Dimov *et al.*, 2007; Nahata, 2008; Pollock *et al.*, 2009).

In our analysis, we consider the investment decisions of a representative venture capitalist who aims to achieve a minimum return on investment. The venture capitalist closes a funding round for the venture if the expected gains from the investment, that is, the expected sales price net of taxes less the expected costs associated with the investment, are high enough that the required minimum return is met or exceeded.[3] Thus, the probability of venture capitalists providing funding to young companies increases if tax policy is designed so that the venture capitalists' potential returns are high.

The capital gains tax is considered to be the most decisive tax in the context of venture capital investments, since it is levied on the difference between the sales price and the amount invested.

[3]The minimum rate of return is the so-called hurdle rate. The minimum return the venture capital fund managers expect is also determined by the cost and expenditure associated with the investment. Among other factors, this minimum return is influenced by the risk-free rate of return and the capital gains tax rate that would have to be paid on the return. Nanda & Rhodes-Kropf (2011) use a similar model for venture capital to explain innovation waves.

Several studies document from a theoretical point of view that the capital gains tax directly reduces the incentives of the entrepreneur and the venture capitalist (Keuschnigg & Nielsen, 2004; Poterba, 1989a,b). The venture capitalist's return is decreased by the capital gains tax, as is the venture capitalist's incentive to invest in, advise, and monitor the venture (Keuschnigg & Nielsen, 2003). Poterba (1989a) argues that this is a demand-driven effect, since an increase in the capital gains tax rate induces some entrepreneurs to take up regular employment, reducing the demand for venture capital. The author negates a supply effect because most limited partners of venture capital funds are tax exempt, especially in the United States. However, this argument neglects that the tax exemption of limited partners is not the case in several other countries and venture capital fund managers' compensation can be taxed as capital gains, which also triggers incentives.

Empirical studies on the capital gains tax mainly confirm the theoretical predictions. Gompers *et al.* (1998) find in a time series for the United States from 1978 to 1994 that higher individual capital gains taxes lead to less venture capital raised and to lower fund commitments. Since their study is also based on a U.S. sample, they argue that the effect is mainly demand driven by the tax exemption of limited partners. Whereas Jeng & Wells (2000) do not find an effect of the individual capital gains tax rate on the investment volume of venture capital in a panel of 21 countries from 1986 to 1995, Da Rin *et al.* (2006) detect a significantly negative effect regarding the corporate capital gains tax rate on the volume for early-stage and high-tech investments in a panel study on 14 countries from 1988 to 2001.

In contrast to prior studies, our analysis does not consider the overall investment volume of venture capital in a particular country (Da Rin *et al.*, 2006; Gompers *et al.*, 1998; Jeng & Wells, 2000) but the single investment decisions of venture capitalists. It is not clear through which channel capital gains tax rates influence investment volumes and whether changes in volume directly lead to the changed investment decisions of venture capital fund managers. An increase in the total volume might, for example, lead not to a larger number of start-ups receiving financing but, rather, to higher average investment amounts provided. Thus, size alone is not a satisfactory measure for determining whether changes in the capital gains tax rate affect venture capitalists' single

investment decisions.

Beyond that, lower capital gains tax rates could have an effect on venture success, since with lower taxes to pay implies venture capitalists have more means for providing monitoring and advice and can hence increase the success probability of their ventures. Therefore, besides the initial decision of whether to invest in a start-up at all, we consider the association of the capital gains tax rate and consecutive investment decisions in further funding rounds, as well as the probability of a successful exit. Venture capitalists adopt a thorough due diligence process to detect promising investments. This process should be carried out diligently and independently for each venture to determine the future probability of a start-up's success. However, venture capitalists could become more diligent in deciding which start-ups are promising investments when capital gains tax rates are high, since their returns are reduced by a higher percentage of taxes.[4]

Evidence on the potential mechanism of the success probability is scarce so far. Gordon (1998) finds that the survival rate of newly founded companies is low if personal tax rates are too low. The author ascribes this effect to efficiency losses, since too many start-ups – not just promising ones – are founded during periods of low tax rates. Gompers *et al.* (2008) investigate the effect of the company-specific market-to-book ratio on a venture capital fund's number of investments in young companies and their success probability in a given industry. Among other things, their results indicate that venture capitalists might have the ability to detect more prosperous investments initially because they find that venture capitalists with vast industry experience have a higher chance of achieving a successful exit. Brander *et al.* (2010) examine the influence of governmental support on the probability of venture capital funds realizing a successful exit. They find that moderate government support is helpful in this goal, whereas strong government participation is harmful.[5]

Our analysis could run into identification issues, since venture capital investors may try to exert influence on policy makers to change the capital gains tax rates in their interest. This influence is, however, not very probable, since the capital gains tax usually applies to all capital gains investors

[4]Such selection effects due to high costs associated with investments are described in the heterogeneous firm literature started by Melitz (2003).

[5]Gompers & Lerner (2000) and Amit *et al.* (2002), among others, also consider the success probability a dependent variable.

realize, that is including dividends and gains from investments in stocks and real estate, which make up the highest share of all capital gains in an economy. The influence of interested parties others than venture capitalists on policy makers is thus presumably higher in terms of power to influence the political process.

Looking at venture capitalists' estimated capital gains from IPOs in relation to all capital gains occurring in the United States indicates that venture capitalists do not have a strong influence. If the post offer value of venture capital-backed IPOs is generously taken as a proxy measure for venture capitalists' gains, the share of these gains to total capital gains between 2000 and 2009 is, on average, only around 8 percent only (see Table 1; for a similiar comparison: (Poterba, 1989a)). This low share implies that the capital gains tax is not the main tax that policy makers will change upon the influence of venture capitalists because the share of capital gains realized by venture capitalists is comparably small. Further, the capital gains tax rate might be changed mainly for the purpose of stimulating entrepreneurship. However, two reasons indicate that this argument is not the most persuasive. First, we could not detect that changes in capital gains taxes were introduced to foster entrepreneurship, since changes occur infrequently and not according to economic situations. Within our sample period, there was, for example, only one change in the tax rate in the United States, in 2003. The change of the capital gains tax rate was initiated within the scope of the 2003 Jobs and Growth Tax Relief Reconciliation Act, which aimed to alleviate the general economic downturn caused by the terror attacks of 2001. However, the reform's main target group was not entrepreneurs or venture capitalists.

[Table 1 about here.]

Theoretical Framework

In this section, we model the influence of a change in the capital gains tax on investment in a start-up. We consider two periods. In the first period, the venture capital investor considers whether it is worth investing in a start-up. The venture capital investor invests in the start-up if the expected profit from doing so is positive. Before investing, the venture capitalist can observe a

return η about the profitability of this particular start-up. The total investment amount the venture capitalist provides for a start-up is fixed and denoted I. Every dollar the venture capitalist invests is associated with opportunity costs c for monitoring and supporting the start-up, where c is larger than one and the same for all investors.

In the second period, after the investment period, the venture capitalist decides to exit the investment and sells the company at the stock exchange (IPO) or to another company (acquisition), realizing a capital gain if the start-up showed successful development. At this point, the venture capitalist learns the true sales price from the investment, which is the expected return η from period one and the unknown random component ε, that is, $\eta + \varepsilon$. The variable ε is assumed to be normally distributed with a mean of zero and a variance σ_ε. The venture capitalist sells the company if the realized return is positive, that is, $\eta + \varepsilon > 0$. In case the venture capitalist can realize a successful exit – through an IPO or an acquisition – the state levies a capital gains tax on the difference between the sales price and the amount $\tau((\eta + \varepsilon)I - I)$ originally invested by the venture capitalist, with τ as the tax rate.

The expected return perceived by the venture capitalist in period one is given by $\eta^+ = \mathbb{E}[(\eta + \varepsilon)|\eta + \varepsilon > 0]$, that is, η^+ is the expectation of the return, given that a successful exit can be realized with the venture. Since the venture capitalist has to pay taxes on the positive return realized with the investment and has to pay a cost c for monitoring and supporting the venture, the venture capitalist's expected pay-off Π before investing in period one can be formally written as follows:

$$\Pi(\eta^+, \tau) = (1 - \tau) \cdot \eta^+ \cdot I - I + \tau \cdot I - c \cdot I \tag{1}$$

One aspect of interest is how the probability for a start-up receiving venture capital changes with an increase in the capital gains tax rate. For ease of exposition, we compare high tax rates τ^{high} with low tax rates τ^{low}. From (1), it follows that every start-up with a positive expected after tax profit ($\Pi \geq 0$) is financed. This condition implies that there is a threshold level $\underline{\eta}$ of the expected return η^+ above which all start-ups receive funding from a venture capitalist, given a

specific tax rate:[6]

$$\{\underline{\eta}|E[\eta+\varepsilon|\eta+\varepsilon>0]=\eta^{+}=\frac{c-\tau}{1-\tau}\}$$

If taxes increase from τ^{low} to τ^{high}, all ventures characterized by a signal $\eta \in [\underline{\eta}^{low}, \underline{\eta}^{high})$ no longer receive venture capital, since the venture capitalist does not expect a positive pay-off $Pi(\eta^{+},\tau)$ due to the increase in the capital gains tax rate. Figure 1 illustrates this situation. Consequently, the number of investments that receive venture capital decreases, which is depicted by a higher cut-off line $\underline{\eta}^{high}$.

This relation leads to the following proposition.

Proposition 1 *The number of companies receiving venture capital investment decreases with an increase in the capital gains tax rate.*

This line of argumentation can be extended if a start-up receives several funding rounds. If taxes increase in between two financing rounds, the marginal expected return $\underline{\eta}$ that a start-up has to deliver increases in the eyes of the venture capitalist, leading to a lower probability of the venture receiving a follow-up financing round and, thus, of it persisting in the market.

This leads to the following proposition.

Proposition 2 *The probability of receiving a follow-up funding round decreases with an increase in the capital gains tax in between two funding rounds. Thus, an increase in the capital gains tax reduces the number of start-ups financed.*

[Figure 1 about here.]

Next, we describe the effects of taxes on the joint probability of a venture capitalist providing funding for a company and achieving a successful exit with it. The venture capitalist realizes a successful exit when a positive return is achievedfrom an investment in a company. For this condition to be met, the unknown part of the final return ε must not be negative enough to outweigh the positive value of η, that is, if ($\varepsilon > -\eta$ holds. Since the capital gains tax rate τ influences neither

[6] All proofs are available from the authors on request.

η nor ε, it follows that the capital gains tax does not influence the probability of a successful exit, given the company already received an investment. However, as illustrated in Figure 2, an increase in the capital gains tax rate reduces the number of start-ups receiving a first funding round and the probability of a start-up receiving a follow-up funding round from a venture capitalist. Therefore, if fewer companies are funded with increasing tax rates, fewer start-ups have the chance of being potentially successful which leads to the following proposition.

Proposition 3 *An increase in the capital gains tax rate reduces the number of eventually successful start-ups.*

[Figure 2 about here.]

According to Propositions 1 and 3, an increase in the capital gains tax rate reduces the total number of financed companies, as well as the number of successful companies. However, which effect dominates in the aggregate is of interest. It can be stated that, if the capital gains tax rate increases marginally, the venture capitalist will decide to no longer finance the start-up with a marginal positive expected return $\underline{\eta}$. This start-up has the lowest probability of achieving a successful exit, since its signal η is expected to be the lowest of all the start-ups that receive funding. Therefore, if the capital gains tax rate is increased, the start-up with the lowest success probability will no longer receive venture capital. Since this is the start-up whose successful exit is the least probable, the success probability for all companies, on average, that receive financing should rise with increasing tax rates.

This leads to the following proposition.

Proposition 4 *The average success probability of all companies receiving investment for the first time is higher for a higher capital gains tax rate.*

This logic can be transferred to the venture capitalist's decision of whether to provide a follow-up funding round. If the start-up faced high capital gains tax rates at the time of the first funding, its probability of receiving a follow-up funding round is higher than if it faced low tax rates (holding

the current tax rate constant). The reason is that a start-up facing a high tax rate has, on average, a higher signal η and a higher probability of developing successfully, so that the probability of receiving venture capital in consecutive funding rounds is increased, leading to this proposition.

Proposition 5 *If the capital gains tax rate is high at the time of the first funding, the probability of the company receiving a follow-up funding round is increased, since the company has, on average, a higher expected pay-off* Π.

With the help of Figure 3, the idea of Propositions 4 and 5 can be illustrated with a bivariate uniform density distribution. To facilitate understanding, we define four disjoint sets: A comprises start-ups with (η, ε) that are successful but only financed if the capital gains tax is low; B comprises successful start-ups that are financed when capital gains taxes are high; C consists of start-ups that do not deliver a successful exit and which are financed only in the case of low tax rates; and D comprises unsuccessful companies that are financed in the case of capital gains tax rates being high. Then $A \cup B$ consists of all successful firms and $B \cup D$ comprises all firms that are financed in the case of high tax rates. Furthermore, P_X is the probability of a firm belonging to set X.

With high tax rates ($\underline{\eta}^{high}$), the probability of a venture capitalist realizing a successful exit with a start-up that received funding, $\frac{P_B}{P_{B\cup D}}$, is quite substantial and, as illustrated in Figure 3, far above 50 percent. In contrast, as illustrated, when the tax rates are low ($\underline{\eta}^{low}$), the probability of a start-up being successful given that it received funding, $\frac{P_{A\cup B}}{P_{A\cup B\cup C\cup D}}$, is lower and around 50 percent. The reason for this decrease can be understood when considering the relative success probabilities given high and low tax rates. The relative average probability of a start-up's success considering all funded start-ups in the case of low tax rates, $\frac{P_A}{P_{A\cup C}}$, is far lower than the relative average probability of a start-up's success considering all funded start-ups in the case of high tax rates, $\frac{P_B}{P_{B\cup D}}$.

[Figure 3 about here.]

METHODOLOGY

Sample

For our dataset, we assemble the capital gains tax rates of 32 countries from 2000 to 2012 from the Ernst&Young Global Executive tax guides and the tax handbooks published by the International Bureau of Fiscal Documentation (see Table 2. We calculate the tax rate for an investor who holds a substantial stake in a company for about five years. If there is dedicated capital gains tax relief for venture capital investors, such as 'relief on disposal of a business' in the United Kingdom, we assume it applies. This relief, for example, reduces the capital gains tax rate from a usual 28 percent to 10 percent if the venture capital investor owned more than 5 percent of the shares of the company and has a board seat. Figure 4 depicts the evolution of the individual capital gains tax rate for eight major economies.

[Table 2 about here.]

[Figure 4 about here.]

The tax data are matched with venture capital investments from the Thomson One Banker database. Our dataset contains information on consecutive funding rounds for a large sample of venture capital-financed companies, including the name, country, founding date, date of the investment round, round description, and final company status.[7] To focus on venture capital investments, we select all rounds related to venture capital, such as seed, early stage, expansion, or later stage rounds. Rounds related to private equity (e.g. , a management buyout or a leveraged buyout) are deleted. Additionally, we restrict our dataset to companies that received their first investment after 1999, since the Thomson One Banker database has good international coverage only after this date (Brander *et al.*, 2010).

[7]The total investment amount of one round is usually provided by several venture capitalists. If this is the case, these investments are aggregated to one round. Funding rounds do not necessarily correspond to the development stages of the company, that is, a start-up can have several funding rounds during its early stage.

Our data cover 32 different countries from 2000 to 2012 and include 76,852 funding rounds of 33,949 companies.

Dependent variables

To be able to analyze the number and percentage of successful firms, we have to define success. We use a classification based on a company's exit type. This appears reasonable, because Phalippou & Gottschalg (2009) show that exit types are correlated with the returns of venture capital investments. In line with common literature on venture capital, the following Thomson One Banker exit types for the investee company are classified as successful: acquisitions, pending acquisition, merger, in registration for an IPO, and those that went public. If an investee company is defunct or bankrupt, it is considered a failure. Since the database does not provide any further detailed information on companies that have an active status since years, we conservatively assume that they are classified as failures. This classification is common in venture capital research and similar to that used by Gompers *et al.* (2008).[8]

For our analyses, we distinguish two sets of data. For the first set of analyses, the dataset is aggregated at the country-year level and contains three different dependent variables: The first dependent variable, #*Firms*, is the number of firms receiving their first venture capital investment in a particular country and year. The second dependent variable, #*Success*, is the number of companies that realize a successful exit. We standardize both these measures by the population size of the respective countries and years following Da Rin *et al.* (2006). Dividing the number of successful companies with the total number of first investments yields the percentage of successful firms, *%Success*, the third dependent variable. The second set of analyses aggregates the data at the firm level in order to analyze the effect of venture capitalists' investment decisions on a single company. The dependent variable, *Investment*, is a dummy that indicates for every investment round whether there was a subsequent funding round or whether the venture capitalist realized a successful exit.

[8]According to their data description, Gompers *et al.* (2008) do not include the pending acquisition category as a successful exit. However, it seems reasonable to include it, since the category in registration for an IPO is also included. A similar classification is used by other authors (Hochberg *et al.*, 2007; Brander *et al.*, 2010). These articles exclude mergers from successful exits. Our results are robust to excluding this exit type.

If either is the case, the variable is set equal to one and to zero otherwise.

Independent variables

The independent variable of primary interest for the first set of analyses is the capital gains tax rate lagged by one year (initial capital gains tax). This is the same timing assumption as that of Gompers *et al.* (2008). To analyze in the second set the effect of the capital gains tax rate on the probability of receiving a follow-up investment round, the initial capital gains tax in place at the time of the first funding as well as the capital gains tax of the current funding round are used as independent variables. The assumption about the timing of the variables is the same as in the first set of analyses, which is sensible, since funding rounds have an average duration of about one year.

Control variables

All specifications include country and year-fixed effects. The following control variables are used: the income tax, the corporate income tax rate, and the dividend tax rate control for tax changes that might be correlated across different tax rates. All these tax changes might be relevant, since they set incentives for employees to become entrepreneurs or tax the income retrieved from start-ups. The market-to-book ratio is included to act as a public market signal, as for Gompers *et al.* (2008), and as a proxy for generally perceived investment opportunities. Additionally, we control for gross domestic product (GDP) growth as a signal of the state of economic environment. Industrial and academic R&D control for R&D expenditures, which could create spillover to venture capital investment (Gompers *et al.*, 1998; Da Rin *et al.*, 2006). When using firm-level data in the second set of the analyses, we further include funding round, industry, and development stage fixed effects. Throughout the analyses, the standard errors reported below the coefficients are clustered at the country level to account for the correlation of tax rates within a country over time (Bertrand *et al.*, 2004).

RESULTS

Main results

The summary statistics as well as the correlation table for all the variables are given in Tables 3 and 4.

[Table 3 about here.]

[Table 4 about here.]

We analyze our propositions using ordinary least squares (OLS) regression models. In the first set of analyses with the data aggregated at the country–year level, we consider the effect of the capital gains tax on the number of start-ups receiving venture capital for the first time. For this analysis, the estimation method is an OLS regression weighted by the population size. In the second set of analyses of the firm–level data, the estimation method is simple OLS.

Table 5 reports the results of OLS regressions testing Propositions 1 to 4. Column (1) shows the effect of a change in the capital gains tax rate on the number of firms per 10 million inhabitants. The coefficient of -1.04 is significant at the 1 percent level and suggests that an increase in the capital gains tax rate by one percentage point leads to about 1.04 fewer companies receiving venture capital per 10 million inhabitants. In particular, this estimation signifies that a tax increase of one percentage point leads to a reduction of 32.14 companies receiving their first investment for a population such as that of the United States (with 309 million inhabitants in 2010). In other words, this effect implies 2.64 percent fewer companies relative to the median of 1,215 companies receiving venture capital per year for the first time in the United States over our sample period. This finding supports Propositions 1 and 2, which predict a reduced probability of receiving venture capital if the capital gains tax rate is increased.

[Table 5 about here.]

In the second column of Table 5, the effects for the number of successful firms standardized by population size as the dependent variable are estimated. According to these estimates, an increase

in the capital gains tax rate by one percentage point should reduce the number of successful firms per 10 million inhabitants by 0.29; that is. such a tax increase leads to a 6.45 percent decrease relative to the mean of 4.50 successful firms per 10 million people. In the third column, the effect of a tax rate increase on the proportion of successful firms is predicted. The results show that increasing the capital gains tax rate by one percentage point is associated with a 0.68 percentage point higher probability of achieving a successful exit. The estimated coefficient is significantly different from zero at the 5 percent level. The average probability of exiting an investment via an IPO or an acquisition is around 25.06 percent for the United States in our sample. Therefore, a one percentage point tax increase leads to a 2.71 percent increase in the probability of realizing a successful exit relative to the mean. This finding implies that our empirical estimates support our theoretical prediction made in Proposition 4 of a selection effect of taxes: A firm's success probability should increase, on average, with increasing capital gains tax rates.

[Table 6 about here.]

The effect of the capital gains tax rate on the probability of a firm receiving follow-up funding rounds is estimated in Table 6. Considering the effect of the capital gains tax rate in place when the follow-up funding round is closed in column (1), we find a negative influence of the capital gains tax rate of 1.64 on the probability of receiving another funding round which is significantly different from zero at the 1 percent level. With an average reinvestment probability of 63.91 percent in our sample, such a tax increase leads to a 2.56 percent lower probability of receiving a follow-up funding round relative to the mean.

According to Proposition 5, the probability of receiving a follow-up funding round should increase if the capital gains tax rate in place at the time of the first funding increases. To test this effect, we add the inital capital gains tax" rate, which is the tax rate in force a year before the first venture capital investment in the start-up, as an explanatory variable in the second column. The effect of the capital gains tax remains statistically significantly negative in this case. Interestingly, we find that a one percentage point higher initial capital gains tax rate is associated with a 0.45

percentage point higher probability of receiving follow-up funding, on average.[9] These findings again corroborate the selection effect of taxes predicted in Proposition 5. If the capital gains tax rate is high when a start-up receives its first funding round, the probability of this start-up receiving follow-up funding rounds or achieving a successful exit is higher. Thus, venture capitalists seem to choose more diligently the start-ups in which to invest if capital gains tax rates are high and they seem to be able to assess their future success probability.

Robustness

We conduct a number of robustness tests. Since our analysis covers a wide time span from 2000 to 2012, our data include two crisis periods that might affect the results. The tech bubble reached its peak in March 2000 and deflated during 2001. The financial crisis showed its effects toward the end of our sample period, in 2009 and 2010. If, for example, during such a crisis the government introduced a series of measures to support the entrepreneurial sector and a tax change occurred at the same time, our estimates would misleadingly reflect the overall effect of those measures and not just that of the tax change. However, if this is not the case, we could lose information by restricting our sample period. To demonstrate the robustness of our results, we repeat our regressions with a different time span. Table 7 shows the results for a sample period ranging from 2002 to 2008 without any crisis. The results show that our main results remain unaffected. The mean estimates of all coefficients concerning the number of firms, the success probability, as well as the probability of receiving a follow-up funding round are of similar magnitude. Only the coefficient of the effect of the capital gains tax on the number of firms is barely not statistically different from zero at conventional levels (p-value of 0.126); however, at -1.59, it is even a bit larger than the mean estimate in the full sample.

[Table 7 about here.]

Another concern is that the results are driven by our timing assumption of considering the capital gains tax rate in place a year before the investment took place. To alleviate this concern, we

[9]Note that we do not control for the funding round number in specification (2). The funding round number a company achieves depends largely on the industry and should therefore not be used as an explanatory variable.

rerun our regressions by considering the tax rates two years before the funding (lagged regressors) and the year of the funding decision (forward regressors). Table 8 shows the respective results. The results remain basically unchanged for the analysis with lagged regressors. Only the effect of the initial capital gains tax rate for follow-up investment vanishes. For the regressions with the regressors measured at the time of the first investment, the statistically significant effects mostly cannot be confirmed. The reason for this effect may be that not enough time lapsed for many of the tax changes to materialize and take effect immediately for the funding of the start-ups if the tax change is assumed to have occurred the year of the funding decision. Our results of the main regressions are hence unaffected by this analysis.

[Table 8 about here.]

Our sample covers a large database of international venture capital investments. However, while international coverage is certainly a strength, it is also likely to distort our main results, since too many small countries with only a few venture capital investments affect the findings. Therefore, we address this issue by conducting our regressions only with countries that make more than 500 venture capital investments a year (see Table 9). This analysis gives us confidence that our findings of the main regressions are reliable, since the coefficients and significances for the capital gains tax are very similar when considering only more active venture capital economies.

In further robustness tests, not tabulated here, we re-estimate the regression for the first round without using analytic weights. The results remain largely unchanged; only the coefficients for the number of firms and the number of successful firms become insignificant. Again, the results remain unchanged from our main regression results and thus do not alter our conclusions.

[Table 9 about here.]

DISCUSSION

Our study examines the influence the capital gains tax rate has on venture capitalists' investment decisions. Specifically, we concentrate on the effects of the number of companies funded and

on their success. Our analysis is based on several theoretical predictions explaining the rationale behind the funding decisions of venture capitalists in the context of the capital gains tax burden. The predictions are supported by our internationally based empirical analysis. Hence, the results provide evidence that the capital gains tax influences venture capitalists' incentives in funding start-ups and – due to the common practice in the venture capital industry of providing consecutive funding rounds – also has an impact on start-up success. These findings contribute to the literature of venture capitalists' funding decisions in general and the influence of macroeconomic factors on decision making in particular. They advance our understanding of the impact of the capital gains tax as a specific macroeconomic factor. Previous studies often examine the combined influence of several macroeconomic factors on venture capital investment, the capital gains tax being just one among several (Bonini & Alkan, 2009; Gompers *et al.*, 1998; Jeng & Wells, 2000; Da Rin *et al.*, 2006). Since our study concentrates on the capital gains tax and models its effect in detail, we are able to derive conclusions on the specific impact of this tax rate. By and large, our results complement previous research on the negative impact of the capital gains tax burden on venture capitalists' willingness to provide funding for start-ups but we find more specific results due to the consideration of new dependent variables.

One contribution of our analysis is that we outline a theoretical framework that predicts the effects of the capital gains tax on the funding of ventures and their success. The theoretical model is then tested on a large international sample, which allows us to test the predictions of the model empirically. Hence, our analysis provides empirical evidence of whether theoretically expected reactions really occur. The results have important implications for public policy regarding how mechanisms induced by the capital gains taxation affect the venture capital sector and how public policy can intervene to guide venture capital investments in the desired direction.

We extend prior research that focuses on the impact of the capital gains tax on the total volume invested in the venture capital industry in a specific country. Our analysis goes beyond the effect of changes in tax rates on the whole investment volume and concentrates on the single investment decisions of venture capitalists of whether to provide funding for a start-up. This aspect is partic-

ularly interesting because it allows for a more direct measure of the impact on the innovativeness of an economy than looking at aggregated investment volumes alone. By considering the effect of changes in capital gains tax rates on the number of start-ups that receive venture capital, deductions can be made on the direct effect of how many start-ups receive the opportunity to drive forth their innovative products and services. Our findings reveal that an increase in the capital gains tax leads to a reduction of start-ups receiving venture capital. This result implies, first, that an increase in the tax rate leads to fewer companies obtaining sufficient financial means to expand their idea as planned and hence, presumably, to less innovation within an economy.

Beyond the effect on the first funding probability, our study considers the effect on the further development and success probability of start-ups. We can thus isolate the effect of changes in the capital gains tax at the level of single portfolio companies, which is not possible in aggregated analyses. The procedure allows us to obtain a more precise picture of venture capitalists' decision-making processes and their determining factors, extending prior literature on these aspects. Our findings indicate that an increase in the capital gains tax leads to a lower probability for a once funded venture of receiving another funding round, again pointing out a harmful effect of the tax for the growth and survival probability of ventures. However, when considering the initial capital gains tax rate that was in place at the beginning of a start-up's funding history, we find that the probability of ventures receiving further funding rounds is increased when the initial capital gains tax is high. This result is particularly interesting because it indicates that, when tax rates are high, venture capitalists seem to pick companies that they consider more successful. Hence, we contribute to the literature on venture capital with evidence indicating the existence of the so-called selection effect, that is, that, at the time of their first funding decision, venture capitalists have the ability to judge to a certain extent how successful a venture might be. The potential of venture capitalists having this ability is a contentious issue in the literature (Bertoni *et al.*, 2011; Brander *et al.*, 2002; Dimov & Shepherd, 2005; Dimov *et al.*, 2007; Lerner, 1994; Wuebker *et al.*, 2014).

The selection effect is further confirmed when using the proportion of successful companies as a new dependent variable in this context. The results reveal that the proportion of successful

companies is also increased when the capital gains tax increases. Consequently, not only does the capital gains tax seem to have a positive effect in terms of receiving further funding rounds within a start-up's life but also venture capitalists seem to choose start-ups that give them a higher chance of realizing a profitable exit in the future. Thus, this analysis supports the outcome that a selection effect prevails and that venture capitalists are apparently able to judge the success probability of ventures, since they predominantly invest in companies with a higher success probability when tax rates are increased. These findings are stable to several robustness tests.

One can conclude that the capital gains tax seems to work like a double-edged sword. On the one hand, it harms the entrepreneurial sector, since venture capitalists provide funding for fewer start-ups if their potential profits are taxed at a high capital gains tax. On the other hand, venture capitalists seem to choose more diligently which companies to invest in when tax rates are high and apparently fund start-ups with a higher success probability in the first place.

Our results not only provide theoretical contributions, but also have implications in, for example, policy making. As could be shown, the capital gains tax has a negative effect on the funding of start-ups by venture capitalists and a high tax rate hampers thier creation and development and the entrepreneurial sector. Therefore, the harmful effect of a high capital gains tax rate cannot be neglected. However, an increase in the tax can also lead to the selection of only the more promising ventures, so that the financing capabilities of venture capitalists concentrate more on the development of start-ups that contribute most to the innovativeness of an economy. It would now be of great interest to determine something like an 'optimal' capital gains tax rate, but this request can hardly be fulfilled, since the effects induced by the capital gains tax evidently vary in different legal settings and different countries. Since the capital gains tax is a rather broad tax on all types of capital gains and not only those relevant to the venture capital sector, one might recommment that policy makers concentrate on instruments tailored to reducing the capital gains tax burden specifically for venture capital investors.

Limitations

As with any empirical study, our analysis is not devoid of limitations. First, our sample contains many companies that have an active status. They are classified as failures because there is often no information available from Thomson Reuters on their development since several years and it is therefore reasonable to assume that these companies are no longer in the market. However, it might also be the case that the holding periods of these companies are simply longer than usual and that they contribute to innovation and create jobs. We therefore test the robustness of our results if these companies are not classified as failures and find that our results remain basically unchanged.

Our dataset comprises a large number of countries and a rather substantial period, from 2000 to 2012. However, since programs fostering entrepreneurship were introduced by public policy only during the last 15 years in many countries and since tax rates are often not changed every year, an investigation of a longer period might be desirable. Unfortunately, the data provided by Thomson Reuters on venture capital investments are not very detailed or reliable prior to 2000, so that extending the sample period to an earlier time period is not reasonable. The main effects of the capital gains taxation on venture capital investments can hence be tested on our dataset. What is not possible, however, because the period is too short, is the measurement of the returns generated by the funded start-ups to economic growth. To determine these effects, the sample period would have to be longer.

Future research

To further advance our understanding of the effects of the capital gains tax on venture capital investments, future research could examine how the capital gains tax affects the funding of young companies, taking more detailed performance measures into account. Since only the exit type is available as a proxy for success in the Thomson Reuters database, we could not consider the typical specific performance measures that venture capitalists realize from single investments, such as internal rates of return or the money multiples. Venture capitalists are extremely reluctant to publish such confidential measures; however, it would be of great value if reasearchers had access

to these data to investigate the effects the capital gains tax has on venture capitalists' investment decisions when knowing the specific realized returns of single investments.

Venture capital is an important source of financing for start-ups. However, other investors support ventures in the early stages of development, such as business angels and crowdfunding investors. We did not evaluate the effects of changes of the capital gains tax on the decisions of these investor types. For example, if the relevant data were available, future research could analyze the tax effects for other types of investors to determine whether high capital gains taxes harm not only venture capital investments but also other capital sources that ventures typically use.

Our study concentrates on the effect of changes in the capital gains tax rate on venture capital investments as one very decisive tax influencing venture capitalists' decision making. An avenue for future research would be to analyze whether further tax instruments that are relevant to start-ups and their investors create incentives or distort decision making, such as loss carryforward or loss carryover provisions or corporate income tax rate reductions for young companies.

Venture creation and fostering entrepreneurship are becoming increasingly important in many emerging economies, in the form of social entrepreneurship as well. It would be useful for future research to go beyond the geographical scope of our sample and examine the incentives of the capital gains tax for the entrepreneurial sector in emerging economies.

CONCLUSION

This study offers a new view on the effect of the capital gains tax in the entrepreneurial process. We document evidence that is consistent with a selection effect of taxes for investments in venture capital-backed companies. We do this by measuring the empirical association between the capital gains tax and the number and success of venture capital investments. Our results indicate that higher capital gains tax rates lead to a reduction in the number of companies receiving their first investment and to a lower probability of receiving a follow-up investment. However, they also lead to a selection effect: Higher capital gains tax rates at the time of the first funding are associated with a higher probability of receiving follow-up funding and eventually being acquired or going

public. Therefore, higher tax rates are correlated with fewer but, on average, more successful firms.

The venture capital industry is a special but important setting in which to learn about the effects of tax policy. Governments around the world introduce programs to promote venture capital and thus venture capital-financed start-up companies, because these are particularly innovative Kortum & Lerner (2000). Unfortunately, evidence of the effectiveness of such state programs encouraging venture capital is, at best, mixed (Lerner, 2009; Cumming, 2011; Da Rin *et al.*, 2011b; DeGennaro, 2010). We add to this larger public policy debate that higher capital gains tax rates are associated with a lower number of successful companies but increase the success probability of financed companies. The reason is that the underlying firm population is heterogeneous and, in our setting, higher taxes affect those companies with the lowest expected value the most. Thus higher taxes are harmful, but not as harmful as basic estimates would suggest.

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Table 1: Estimated U.S. venture capitalists' capital gains to total capital gains

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total Proceeds U.S. IPOs ($ million)	50,600	12,900	6,600	5,000	43,600	36,600	67,200	61,600	3,200	8,600	105,500	88400	115600
U.S. VC-backed M&A price ($ million)	68,165.5	16,770.3	7,586.7	7,521.1	16,043.8	17,324.6	19,034.8	29,460	13,775.4	14,068.1			
Total U.S. Capital Gains	644,285	349,441	268,615	323,306	499,154	690,152	798,214	924,164	497,841	263,460			
Ratio VC Capital Gains/All Capital Gains	18.43%	8.49%	5.28%	3.87%	11.95%	7.81%	10.80%	9.85%	3.41%	8.60%			

Source:
IPO: NVCA Yearbook 2013 (Post Offer Value)
venture capital-backed M&A: NVCA Yearbook 2010;
Capital gains: Worldbank

Table 2: Country, number of firms, and time span

	# firms	Percent	Time-span
USA	16,648	49.04	2000–2012
United Kingdom	2680	7.89	2000–2012
France	2,522	7.43	2000–2012
Germany	1,898	5.59	2000–2012
Canada	1,651	4.86	2002–2012
Korea	1,040	3.06	2005–2012
Sweden	911	2.68	2000–2012
Japan	736	2.17	2000–2012
Finland	689	2.03	2000–2012
Spain	681	2.01	2000–2012
Netherlands	540	1.59	2000–2012
Denmark	432	1.27	2000–2012
Israel	423	1.25	2003–2012
Italy	405	1.19	2000–2012
Australia	396	1.17	2005–2012
Belgium	342	1.01	2000–2012
Norway	334	0.98	2000–2012
Ireland	321	0.95	2000–2012
Switzerland	284	0.84	2000–2012
Portugal	217	0.64	2000–2012
Austria	213	0.63	2000–2012
Poland	170	0.50	2000–2012
Hungary	109	0.32	2000–2012
New Zeland	64	0.19	2000–2012
Greece	48	0.14	2000–2012
Turkey	39	0.11	2000–2012
Luxembourg	36	0.11	2000–2012
Iceland	32	0.09	2000–2012
Czech Republic	29	0.09	2000–2012
Mexico	26	0.08	2005–2012
Slovakia	23	0.07	2000–2012
Slovenia	10	0.03	2000–2012
Total	33949	100.00	

Table 3: Descriptive statistics and correlations: First round investments

	mean	sd	min	max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) # Firms	29.27	43.94	0	569	1.00										
(2) % Success	13.01	15.32	0	100	0.04	1.00									
(3) # Success	4.07	7.75	0	69	0.55***	0.45***	1.00								
(4) Capital gains tax	19.22	11.52	0	50	0.18***	0.02	0.16**	1.00							
(5) Market-to-book ratio	1.93	0.73	1	6	0.20***	0.16**	0.26***	0.12*	1.00						
(6) Income tax	37.29	9.68	0	60	-0.18***	0.00	-0.13*	-0.02	-0.07	1.00					
(7) Corporate income tax	26.54	6.75	9	42	0.01	0.12*	0.11*	0.17**	0.06	0.39***	1.00				
(8) Dividend tax	21.60	12.51	0	60	0.14**	0.18**	0.20***	0.10	0.02	0.14*	-0.20***	1.00			
(9) GDP growth	0.54	2.26	-1	10	-0.03	-0.02	0.01	0.00	0.05	0.00	-0.06	-0.09	1.00		
(10) Academic R&D	0.44	0.88	0	6	-0.01	0.10	0.10	0.01	0.23***	0.06	0.28***	0.05	-0.06	1.00	
(11) Total R&D	1.51	3.91	0	24	-0.02	0.14*	0.07	0.01	0.23***	0.04	0.26***	0.05	-0.06	0.85***	1.00

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Descriptive statistics and correlations: Follow-up rounds

	mean	sd	min	max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Investment	66.88	47.07	0	100	1.00								
(2) Capital gains tax	19.69	6.58	0	60	-0.00	1.00							
(3) Market-to-book ratio	2.68	1.04	0	6	0.19***	-0.02***	1.00						
(4) Income tax	37.64	7.42	0	70	-0.02***	0.04***	0.21***	1.00					
(5) Corporate income tax	31.81	5.52	9	42	0.15***	-0.15***	0.38***	0.32***	1.00				
(6) Dividend tax	27.07	8.30	0	60	0.01***	0.37***	0.34***	0.28***	-0.19***	1.00			
(7) GDP growth	0.15	1.17	-1	10	-0.03***	0.04***	-0.10***	-0.05***	-0.12***	0.06***	1.00		
(8) Academic R&D	2.5	1.9	0	6	0.10***	-0.28***	0.27***	-0.07***	0.58***	-0.30***	-0.12***	1.00	
(9) Total R&D	10.2	9.4	0	24	0.07***	-0.19***	0.37***	0.00	0.54***	-0.12***	-0.12***	0.77***	1.00

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Capital gains tax effects on the number of firms and their success

	First round		
	# Firms	# Success	% Success
Initial capital gains tax	-1.04***	-0.29*	0.68**
	(0.33)	(0.15)	(0.25)
Market-to-book ratio	1.40	2.69**	-0.77
	(1.63)	(1.28)	(0.88)
Income Tax	-0.24	-0.16*	-0.14**
	(0.22)	(0.08)	(0.07)
Corporate income tax	-0.13	-0.32**	-0.42***
	(0.28)	(0.15)	(0.08)
Dividend tax	-0.06	-0.07	0.03
	(0.09)	(0.06)	(0.08)
GDP growth	-0.83	-0.18	0.26
	(0.62)	(0.19)	(0.23)
Industrial R&D	-0.61***	-0.19***	0.12***
	(0.12)	(0.05)	(0.03)
Academic R&D	0.50	-0.76*	-1.38***
	(0.75)	(0.42)	(0.42)
Year fixed effect	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes
Adj. R2	0.77	0.78	0.91
N	394	394	368

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Capital gains tax effects on follow-up funding rounds

	Follow-up investment	
	Investment	Investment
Initial capital gains tax		0.48***
		(0.06)
Capital gains tax	-1.64***	-1.97***
	(0.34)	(0.34)
Market-to-book ratio	-1.02	-1.23
	(1.78)	(1.78)
Income tax	0.17	0.17
	(0.27)	(0.27)
Corporate income tax	-0.31	-0.30
	(0.19)	(0.19)
Dividend tax	-0.24	-0.24
	(0.15)	(0.15)
GDP growth	-0.79	-0.83
	(0.78)	(0.77)
Industrial R&D	-0.08	-0.11
	(0.11)	(0.11)
Academic R&D	1.88**	2.25***
	(0.77)	(0.77)
Year fixed effect	Yes	Yes
Country fixed effect	Yes	Yes
Adj. R2	0.21	0.21
N	76,852	76,848

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Estimated effects for the years 2002 to 2008

	Years 2002 to 2008 only				
	First round			Follow-up	
	# Firms	# Success	% Success	Investment	Investment
Initial capital gains tax	-1.59	-0.20**	0.67*		0.56***
	(1.01)	(0.07)	(0.36)		(0.12)
Capital gains tax				-1.87***	-2.23***
				(0.57)	(0.53)
Market-to-book ratio	-5.77	0.80*	0.52	-2.09	-1.80
	(6.72)	(0.41)	(1.50)	(2.68)	(2.72)
Income tax	-0.03	-0.01	-0.14	0.46***	0.43***
	(0.29)	(0.06)	(0.21)	(0.16)	(0.16)
Corporate income tax	0.01	-0.14**	-0.34	0.00	0.01
	(0.44)	(0.06)	(0.42)	(0.31)	(0.31)
Dividend tax	-0.17	-0.08***	0.12	-0.60**	-0.62**
	(0.24)	(0.02)	(0.10)	(0.26)	(0.26)
GDP growth	-0.47	0.04	0.22	-0.35	-0.41
	(0.37)	(0.10)	(0.32)	(0.89)	(0.87)
Industrial R&D	-0.06	-0.02	0.01	0.12	0.10
	(0.27)	(0.03)	(0.09)	(0.17)	(0.18)
Academic R&D	-0.23	-0.24	-0.31	1.38	1.73
	(1.54)	(0.17)	(0.67)	(1.05)	(1.03)
Adj. R2	0.76	0.87	0.84	0.20	0.20
N	188	214	199	38,468	38,465

All regression include year and country fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Estimated effects of changes in the timing assumption

	Lagged regressors					Forward regressors				
	First round			Follow-up		First Round			Follow-up	
	# Firms	# Success	% Success	Investment	Investment	# Firms	# Success	% Success	Investment	Investment
Initial capital gains tax	-1.04***	-0.29*	0.53*		-0.06	-0.12	-0.04	-0.20		-0.70**
	(0.3)	(0.1)	(0.3)		(0.1)	(0.2)	(0.1)	(0.2)		(0.3)
Capital gains tax				-1.77***	-1.70***				-0.08	0.02
				(0.5)	(0.5)				(0.4)	(0.3)
Market-to-book ratio	1.40	2.69**	0.03	-1.51	-1.44	0.40	2.42*	0.98	-3.45	-2.57
	(1.6)	(1.3)	(1.4)	(1.9)	(1.9)	(1.5)	(1.2)	(1.5)	(2.3)	(2.0)
Income tax	-0.24	-0.16*	-0.09	0.17	0.18	-0.18	-0.14*	-0.14	0.33	0.26
	(0.2)	(0.1)	(0.1)	(0.3)	(0.3)	(0.2)	(0.1)	(0.1)	(0.4)	(0.3)
Corporate income tax	-0.13	-0.32**	-0.29*	-0.20	-0.22	-0.08	-0.30**	-0.33**	-0.16	-0.15
	(0.3)	(0.1)	(0.2)	(0.2)	(0.2)	(0.2)	(0.1)	(0.1)	(0.3)	(0.2)
Dividend tax	-0.06	-0.07	0.13**	-0.25	-0.25	-0.08	-0.08	0.15**	-0.28	-0.23
	(0.1)	(0.1)	(0.1)	(0.2)	(0.2)	(0.1)	(0.1)	(0.1)	(0.2)	(0.2)
GDP growth	-0.83	-0.18	-0.38	-0.66	-0.66	-0.72	-0.15	-0.44	-0.62	-0.66
	(0.6)	(0.2)	(0.3)	(0.9)	(0.9)	(0.6)	(0.2)	(0.3)	(0.9)	(0.9)
Industrial R&D	-0.61***	-0.19***	0.15	-0.09	-0.08	-0.56***	-0.17***	0.13	-0.02	0.05
	(0.1)	(0.0)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
Academic R&D	0.50	-0.76*	-2.65*	0.32	0.32	0.31	-0.81*	-2.52*	1.52*	1.39*
	(0.8)	(0.4)	(1.5)	(0.6)	(0.6)	(0.7)	(0.4)	(1.5)	(0.8)	(0.8)
Adj. R2	0.77	0.78	0.66	0.20	0.20	0.76	0.77	0.65	0.20	0.20
N	394	394	368	76,852	76,848	394	394	368	76,852	76,852

All regressions include year and country fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Estimated effects for countries with more than 500 companies funded per year

	More than 500 companies				
	First round			Follow-up	
	# Firms	# Success	% Success	Investment	Investment
Initial capital gains tax	-1.40**	-0.31	0.84***		0.50***
	(0.49)	(0.25)	(0.26)		(0.06)
Capital gains tax				-1.74***	-2.10***
				(0.41)	(0.40)
Market-to-book ratio	1.67	3.51**	-0.99	-0.91	-1.09
	(2.43)	(1.41)	(1.14)	(2.20)	(2.15)
Income tax	-0.69*	-0.33**	-0.11	0.33	0.34
	(0.32)	(0.11)	(0.09)	(0.41)	(0.41)
Corporate income tax	-0.06	-0.30*	-0.53***	-0.46**	-0.45**
	(0.37)	(0.15)	(0.09)	(0.19)	(0.19)
Dividend tax	-0.10	-0.15***	-0.02	-0.30	-0.31
	(0.13)	(0.03)	(0.13)	(0.20)	(0.20)
GDP growth	-1.79	-0.36	0.44	-0.89	-0.95
	(1.60)	(0.49)	(0.26)	(1.08)	(1.06)
Industrial R&D	-0.51***	-0.17**	0.11***	-0.09	-0.11
	(0.15)	(0.06)	(0.03)	(0.13)	(0.13)
Academic R&D	-0.01	-0.52	-1.02**	1.65*	2.03**
	(1.09)	(0.63)	(0.45)	(0.86)	(0.85)
Adj. R2	0.79	0.83	0.95	0.20	0.20
N	156	156	156	71,578	71,574

All regression include year and country fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$