// NO.21-008 | 11/2022

DISCUSSION PAPER

// ANNA THERESA BÜHRLE

Do Tax Loss Restrictions Distort Venture Capital Funding of Start-Ups?

Leibniz Association

ZEW

Do Tax Loss Restrictions Distort Venture Capital Funding of Start-ups?

Anna Theresa Bührle*

ZEW and University of Mannheim

-First version: January 13th, 2021-

-This version: November 23rd, 2022-

Abstract:

I analyze whether anti-tax loss trafficking rules affect the funding of start-ups in Europe. I base my empirical analysis on a panel of VC-funded companies in the EU28 Member States from 1999 to 2014. These regulations disallow the use of loss carry-forwards after a substantial change in ownership or activity. This restriction could threaten accumulated loss carry-forwards of start-ups. Accounting for the increased risk and reduced return on their investment, venture capital (VC) investors could reduce their funding. My findings suggest that strict anti-tax loss trafficking rules indeed impair VC funding. Especially companies in high-tech industries are affected.

JEL: M13, G24, H25

Keywords: venture capital, loss carry-forward, start-ups, anti-tax loss trafficking

Acknowledgments: I thank Christoph Spengel, Jost Heckemeyer, Johannes Voget, Philipp Dörrenberg, and three anonymous referees for their comments and suggestions. I also received valuable feedback from the participants at the brown-bag seminar at the University of Mannheim, the joint workshop at the University of Brescia, the MannheimTaxation Campus Meeting in December 2019, the 76th Annual Congress of the IIPF, the 113th NTA Annual Conference on Taxation and the OPFS Graduate Student Workshop. I am grateful to the researchers at the Polytechnic University of Milan and InvestEurope for providing me with data on venture capital investments used in this study. This work received financial support from the Leibniz ScienceCampus MannheimTaxation and RISIS2 (Research Infrastructure for Innovation Policy Studies 2) funded by the European Union's Horizon 2020 research and innovation program under the grant number n°824091.

* Centre for European Economic Research (ZEW), L7 1, D-68131 Mannheim, Germany, Mail: theresa.buehrle@zew.de, Phone: +49 (0)621 1235-172

1. Introduction

Start-ups contribute to creating new jobs and are considered an essential driver of innovation (Coad et al., 2016; Haltiwanger et al., 2013; Lawless, 2014; Van Praag and Versloot, 2007). However, they often suffer from credit constraints due to insufficient collateral (Carpenter and Petersen, 2002a, 2002b; Cosh et al., 2009; Da Rin et al., 2006). Especially in high-tech sectors, start-ups might lack funding and experience (Gans and Stern, 2003). Venture capital (VC) funds support entrepreneurs in their start-up phase. Besides funding, VC investors also provide valuable advice (Hellmann and Puri, 2002; Kaplan and Strömberg, 2001), leading to enhanced firm performance (Colombo and Murtinu, 2017; Croce et al., 2013; Puri and Zarutskie, 2012). However, so-called anti-tax loss trafficking (or change in ownership) rules have been argued to deter VC funding and discourage risky investments (Bührle and Spengel, 2020; BVK, 2016; Parker, 1990; Ward et al., 2021). In particular, this claim applies to companies carrying substantial amounts of start-up losses. In this paper, I investigate whether VC investors indeed reduce the financing of start-ups in response to anti-tax loss trafficking rules.

Anti-tax loss trafficking deny the use of accumulated LCFs after substantial changes in ownership and activity. LCFs result from net losses that could not be set off against current profits. For tax purposes, net losses generally do not result in corresponding tax refunds in the year they are incurred. Instead, negative net income must be set off against positive income in previous (loss carry-back (LCB)) or following periods (loss carry-forward (LCF)). These tax loss assets carry value (assuming the company becomes profitable or used to generate profits in the past) as they embody potential tax savings in other periods. Legislators aim to counter so-deemed abusive transactions with tax loss transfer restrictions where companies trade bankrupt corporate shells without economic prospects. Other profitable companies acquire these firms for no reason other than their LCFs. However, innovative start-ups can accumulate considerable losses until they turn profitable. Tax loss transfer restrictions are frequently triggered upon capital

increases or exits of VC investors (AVCAL, 2007) and can lead to the forfeiture of LCFs. Investors might refrain from strongly partaking in risky start-ups if valuable LCFs could be lost, decreasing the expected value of the firm's assets (Haufler et al., 2014).

Previous literature suggests that loss provisions discourage entrepreneurial risk-taking (Haufler et al., 2014; Langenmayr and Lester, 2018; Ljungqvist et al., 2017; Mehrmann and Sureth-Sloane, 2017). Young firms carry, on average, higher LCF and are less proficient in utilizing them than more mature companies (Cooper and Knittel, 2010, 2006; Zwick, 2021). High-risk start-ups thus seem likely to be disproportionally affected by restrictive tax loss rules. Nevertheless, Da Rin, Nicodano, and Sembenelli (2006) do not find a significant negative effect of temporal tax loss regulations on VC activity. However, anti-tax loss trafficking rules usually lead to the complete denial of LCFs at once, while temporal restrictions only affect part of the accumulated losses. Moore and Pruitt (1987) find that the tightening of loss transfer restrictions in the US lead to a decrease in the market valuation of loss-reporting companies.

Anecdotal evidence supports the notion that tax loss transfer restrictions negatively affect VC investment.[1] To the best of my knowledge, I am the first to analyze whether anti-tax loss trafficking rules impair VC funding volume in an empirical setting. I utilize data on European companies that received VC funding between 1999 and 2014, extracted from the VICO 4.0 database. Researchers compiled the dataset under the European Commission's "Research infrastructure for science and innovation policy studies" (RISIS) project. Other researchers have already used the data in several studies on the VC activity (e.g., Bertoni, Croce, & Guerini, 2015; Croce, D'Adda, & Ughetto, 2015; Croce, Martí, & Murtinu, 2013; Grilli & Murtinu, 2014; Guerini & Quas, 2016). I explore variation in the design of anti-tax loss trafficking rules in Europe. I show with a combination of a generalized event study and difference-in-differences

[1] E.g., NVCA (n.d.), FAZ (2020), BVK (2016).

(DiD) specification that anti-tax loss trafficking rules reduce VC funding volume, particularly for high-tech start-ups.

This paper attempts to inform policymakers of the adverse effects of anti-tax loss trafficking rules on the VC environment. Considering that the European market is still lacking behind the American VC industry (Hege et al., 2009), legislators could relax loss transfer restrictions to encourage investments in risky start-ups. Additionally, the current Corona crisis caused corporate losses to rise, enhancing the relevance of tax loss regulations.

The remainder of the paper proceeds as follows: In section 2, I develop my hypothesis based on the current literature. I then provide an overview of the European anti-tax loss trafficking rules. I describe my research strategy and data in the third section. Section 4 presents the main results, including heterogeneity analyses where I differentiate by age and industry of the start-ups. Section 5 contains robustness checks, including individual case studies for the different changes in legislation. I summarize and conclude in section 6.

2. Setting and hypothesis development

2.1. Venture capital investors and the expected value of loss carry-forwards

Start-ups accumulate losses during product development until they enter the market and generate sufficient revenue to break even. Most countries limit the offset of tax losses in other periods in time or amount. Temporal restrictions allow the carry-back or carry-forward of losses only for a specified number of years. Relative limitations (also referred to as minimum taxation) restrict the amount of losses that can be set off in a given year. Restrictive loss provisions aggravate the costs of bankruptcy for young and small firms. In contrast to diversified mature companies, they cannot offset losses stemming from a failed project with profits from other projects (Henrekson and Sanandaji, 2011).

Additionally, anti-tax loss trafficking rules can lead to the forfeiture of accumulated tax LCFs. While temporal and relative restrictions generally apply, only changes to the regular course of

business trigger tax loss transfer restrictions. Without regulations, profitable firms can acquire and merge with unprofitable corporations with high LCFs to offset the otherwise worthless losses. Legislators deem this loss trafficking abusive as the sole purpose is the transfer of the tax assets. Anti-tax loss trafficking rules aim to prevent such transactions and apply to all corporations, including start-ups. However, the systems rely on general criteria such as substantial changes in ownership to cover a broad spectrum of cases. Depending on the specific design, the limitations could also affect transactions with an economic justification, such as VC exits. IPOs or acquisitions can lead to substantial changes in ownership and depict the usual divestment strategies of VC investors (Schwienbacher, 2008).

While research shows that especially young and innovative firms such as start-ups are affected by tax loss restrictions, it is unclear whether these regulations influence venture capitalists' investment decisions. To the best of my knowledge, Da Rin et al. (2006) are the only authors considering the impact of temporal tax loss restrictions on VC activity. They do not find significant effects, indicating that taxes and loss regulations might not matter to VC investors. Particularly in the case of high-tech start-ups, they might concentrate on other aspects such as the nurture of novel ideas and technological progress.

However, while the forfeiture of LCFs due to time restrictions might not be considered in a VC context, this finding is not necessarily transferable to the loss of LCFs caused by anti-tax loss trafficking rules. Temporal and relative restrictions limit or delay the deduction of LCFs, while transfer restrictions lead to forfeiture in the total amount. Researchers (Parker, 1990) and practitioners[2] have criticized anti-tax loss trafficking rules to deter VC investment. If anti-tax loss trafficking rules are triggered when the VC investor exits, firms can potentially lose all built-up LCFs and turn these assets worthless for succeeding investors. Sellers incorporate tax loss

[2] E.g., in the US (NVCA, n.d.), in Germany (FAZ, 2020; BVK, 2016) or in New Zealand (Tax Working Group, 2018).

assets in their company valuation, as they still carry value before the divestment. At the same time, buyers exclude them, as they might be forfeited after the exit. This difference in valuation potentially leads to differences in asking and bidding price, decreasing prices, or preventing transactions altogether (Sureth-Sloane and Vollert, 2009). Overall, anti-tax loss trafficking rules can destroy significant value. Tax loss transfer restrictions thus increase the financial risk for investors. When the investment takes place, it is yet uncertain whether the start-up will be successful or fail. Especially in the latter case, accumulated tax losses are an asset that would allow VC investors to recoup at least part of their investment. If LCFs cannot be transferred, this asset does not carry any value, reducing ex-ante expected returns. In response, VC investors could reduce their investment or even refrain from funding a start-up at all, particularly if chances of failure are high.

Nevertheless, VC investors could weigh non-financial factors such as the business plan or the entrepreneur itself more than tax aspects. Also, expected gains from a successful IPO or trade sale could outweigh any considerations for LCFs, or over-confident investors could underestimate the downside risk. Suppose experienced professionals manage VC funds without or with minor personal stakes in the fund. In that case, agency problems could lead to decisions that disregarded the interests of the principals that finance the investments (Fleischer, 2003). Lastly, legislators already provide escape clauses to avoid punishing economically justified transactions. These exemptions can release companies that are in the process of financial rehabilitation, publicly quoted, part of a group, or carry hidden reserves. Some countries allow corporations to provide evidence of economic reasons for the transaction to refute the abuse assumption. Depending on the effectiveness of these escape clauses, loss provisions might not impact loss-making start-ups the way they are supposed to affect bankrupt companies. Nevertheless, for start-ups, often only the provision of evidence is viable, if available.

Overall, it is unclear whether anti-tax loss trafficking regulations impair VC funding. While the restrictions decrease potential returns, especially for investments with high chances of failure, investors could underestimate the risk or give more weight to other factors. I pose the hypothesis that investors reduce their investment in start-ups in response to the restrictions.

Several papers discuss the rationale behind anti-loss trafficking rules (Bührle and Spengel, 2020; Hoenig, 2014; Nijhawan, 2015; Poitevin, 2003). Moore and Pruitt (1987) investigate the change in stock prices after the revision of anti-tax loss trafficking rules in the US in 1984. They find that the change in legislation reduced the market value of loss-reporting companies because the present value of their loss carry-forwards declined. I am not aware of any study empirically investigating the effect of those restrictions in the context of VC funding.

2.2. Types of anti-tax loss trafficking rules

In 2018, 21 EU28 Member States had anti-tax loss trafficking regulations, with various designs across countries (Bührle and Spengel, 2020).[3] The provisions commonly refer to a significant change in ownership and/ or activity as triggering criteria. What constitutes such a significant change differs depending on the national legislation. In general, a change in ownership is considered harmful when the controlling majority of the corporation carrying the losses changes. The aim is to limit the benefits of LCFs to the shareholders that bore them. Changes in activity are often evaluated based on changes in assets, turnover, or targeted customer markets. The legislator ties the use of losses to profits generated by the activity that caused them in the first place.

The impact of tax loss transfer regulations will likely differ depending on the specific law (Bührle and Spengel, 2020). Stricter rules will make a company more likely to be affected by a

[3] Bührle and Spengel (2020) provide a more detailed discussion of the design and development of the regulations. While my analysis focuses on Europe, tax loss transfer restrictions are applied throughout the world, such as e.g., the Section 382 limitation of the American IRC or Section 111 of the Canadian ITA.

change in its structure, whereas a more lenient regime will impose lower risks. I categorize tax loss transfer restrictions into five groups based on their strictness (Table 1).

Table 1: Categories of anti-tax loss trafficking rules.

Category	Description
Category 0	No explicit anti-loss trafficking rule
Category 1	Denial of loss transfer after a change in ownership and activity (cumulative requirement)
Category 2	Denial of loss transfer after a change in activity
Category 3	Denial of loss transfer after a change in ownership
Category 4	Denial of loss transfer after a change in ownership or activity (fulfillment of one criteria sufficient)

Notes: Categories of anti-tax loss trafficking restrictions, ranked based on their strictness. Source: Bührle and Spengel (2020).

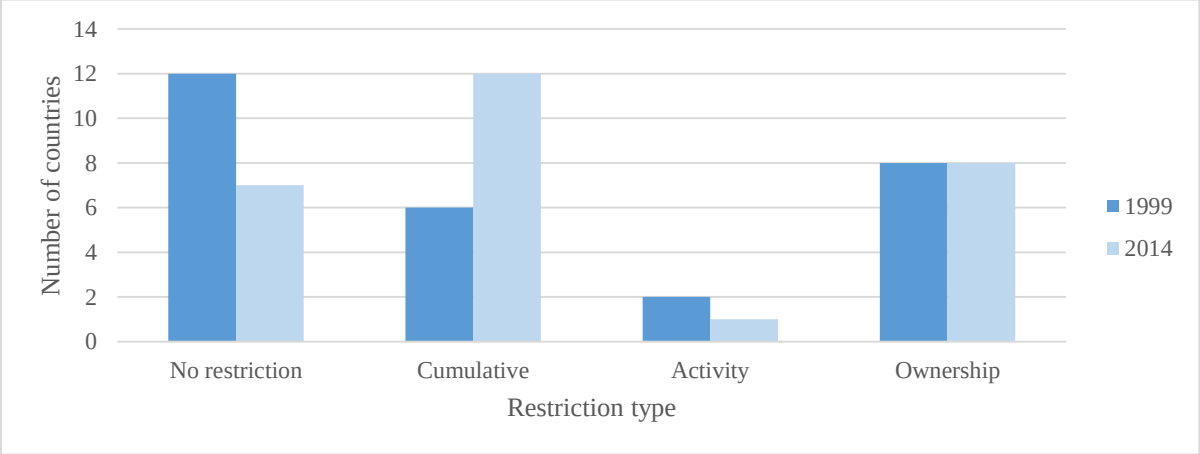
For specific regulations (Categories 1 to 4), abuse is blanketly assumed based on codified criteria. The burden of proof of the opposite rests upon the taxpayer. In those cases, the cumulative requirement of a change in activity and ownership is the least restrictive measure (Category 1). As a firm has to fulfill both criteria, the start-up can avoid the forfeiture of LCFs if it maintains (and adequately documents) its business activity for the required periods, even if a new investor enters or existing investors increase their stake in the enterprise. If there is either only a change in ownership or only a change in activity, this type of restriction is not triggered.

The forfeiture of losses after a change in activity imposes a more severe restriction on start-ups (Category 2). Especially in the initial stages, when the business plan is developed, or at later stages, when an existing business strategy is adjusted, substantial changes might lead to a shift of the company's focus. However, given no changes in activity, new VC investors can participate and provide funding without triggering the anti-abuse regulation.

Considering investors' exit strategy, anti-tax loss trafficking rules relying on a change in ownership as triggering criteria pose the biggest threat. If venture capitalists buy substantial shares

in a company and divest later, accumulated LCFs could be forfeited. With anti-abuse regulations that solely rely on a change in ownership (Category 3), any substantial VC divestment could threaten accumulated LCFs within a start-up. Category 4 includes countries that relate to either a change in ownership or a change in activity, where the fulfillment of either criterion is sufficient. This poses the most restrictive rule, as it includes all cases that would be covered by either Category 2 or 3.

Figure 1: Comparison of loss transfer categories in the EU28, 1999 to 2014.



Notes: Number of countries applying anti-tax loss trafficking rules in a given year. Categories as defined in Table 1. Source: Table A 2/ Bührle and Spengel (2020).

Figure 1 compares the number of anti-tax loss trafficking rules in the EU28, differentiated by restriction category from 1999 to 2014. Over the years, legislators implemented more restrictive legislation. I identify 13 changes in legislation in this period (see Table A 2).[4]

3. Research design

3.1. Identification strategy

In my empirical analysis, I investigate the effect of anti-tax loss trafficking rules on venture capital funding of start-ups in Europe. I focus on the intensive margin, i.e., the VC funding volume received by companies. I first explore the dynamics of the effect across time by estimating an event study following Schmidheiny and Siegloch (2019). This approach allows the

[4] The ownership-based regimes' overall number has not changed as three countries changed to an ownership-based regime (Germany, Greece and Portugal), while three countries relaxed their rules (Hungary, Latvia and the Netherlands).

analysis of multiple and repeated events of different treatment intensities. I note the regression equation as follows:

$$\log(VC\ funding_{f,c,t}) = \alpha_0 + \sum_{j}^{J} \beta_j * Treatment_{c,t}^{j} + \sum_{t-4}^{t-1} \gamma_n\, Lead_n + \sum_{t+1}^{t+4} \gamma_m\, Lag_m + \gamma\, C + \delta\, F + FE_f + FE_t + \varepsilon_{f,c,t} \quad (1)$$

$\log(VC\ funding_{f,c,t})$ is the logarithm of the VC funding volume company *f* in country *c* received in year *t*.[5]I derive the variable by summing up the equity raised by the company stemming from all funding rounds within one year, transforming the variables with the inverse hyperbolic sine function[6], and taking the logarithm. The treatment intensity $Treatment_{c,t}^{j}$ is the primary variable of interest. I define the treatment as a change in the restriction category in a country in a year (see chapter 2.2). I derive the treatment intensity by calculating the number of categories the restriction scheme dropped (if regulations were relaxed) or climbed (if rules were tightened).[7] I include the treatment at the event time and with four leads and lags, respectively. I bin treatment intensity at the ends of the event window in t-4 and t+4.[8] I normalize the coefficient in the period preceding the treatment, β_{t-1}, to zero.

Anti-tax loss trafficking rules are generally aimed at so-deemed abusive transactions and do not target VC divestments. Legislators usually implement changes out of tax avoidance concerns in the context of mergers of long-established corporations or in response to court decisions. Therefore, I do not expect reverse causality to pose a threat in my setting.

[5] E.g., Edwards and Todtenhaupt (2020) also employ the natural logarithm for their dependent variable, the amount of equity raised by a start-up.

[6] VC funding is set to zero in the years companies do not receive an investment. Unlike a normal log transformation, the inverse hyperbolic sine transformation is defined at zero. It is calculated as $\log\sqrt{((y+(y^2+1))}$. Employing the log transformation for positive and maintaining zero values instead leads to similar results (not reported).

[7] E.g., the introduction of a cumulative regime represents a move from Category 0 to 1, thus leading to a treatment of +1. The change from an ownership-based restriction to a cumulative scheme poses a move from Category 3 to Category 1, resulting in a treatment of -2.

[8] Binning the endpoints accounts for the limited effect window. It assumes that the effect stays constant before and after the period explicitly modelled. Thus, the estimate for t = 4 can be interpreted as a long-term effect.

To obtain a comprehensive measure of the effect of anti-tax loss trafficking rules on VC funding, I employ a generalized DiD approach. In contrast to the event study that illustrates dynamic effects over time, this approach highlights the average impact across all periods. The specification closely resembles the event study approach:

$$\log(VC\ funding_{f,c,t}) = \alpha + \beta\ Restriction\ category_{c,t} + \gamma\ C + \delta\ F + FE_f + FE_t + \varepsilon_{f,c,t} \quad (2)$$

The categorical variable $Restriction\ category$ ranges from zero to four, representing the different categories of anti-loss trafficking restrictions. Zero represents the least and four the most restrictive rule (as discussed in section 2.2).[9]

I employ the same set of fixed effects and control variables[10] in both specifications. I include year-fixed effects to control for general time trends in VC financing and the economic environment that similarly affect all companies. Additionally, firm fixed effects capture time-invariant company characteristics.[11]

The vector *C* contains different country-level controls. I account for exemptions from anti-tax loss trafficking rules with a dummy variable. If legislators exempt firms from tax loss transfer restrictions based on rehabilitation, quoted companies, group affiliation, hidden reserves, or evidence of economic justification, I set *Escape clause* to 1. As most of the exemptions are not viable for start-ups, I only expect a small positive effect, if any. All specifications include the number of years for which losses can be carried back (zero if unavailable) and forward to account for temporal loss restrictions.[12] I consider relative loss restrictions, in other words, size

[9] For more information, please refer to section 2.2 (Table 1), the appendix (Table A 2) and Bührle and Spengel (2020).
[10] Table A 1 provides an overview of all variables and their sources.
[11] Due to multicollinearity, I do not include country-year fixed effects. The changes in legislation considered here occur at the country level. Country-year fixed effects would be a perfect linear combination of the treatment variables.
[12] In case of an unlimited carryforward, following Langenmayr and Lester (2018), I set the variable to 20.

limitations, with *LCF limit*. The dummy is set to 1 if relative constraints apply and zero otherwise. I include the statutory corporate tax rate *(CIT)* [13] and the change in tax rates compared to the previous year *(Δ CIT).* Higher tax rates decrease the after-tax return for corporate VC investors. Also, the value of LCFs is contingent on the applicable tax rate at the time of the loss offset.[14] On the one hand, deducting LCFs in a high-tax country yields higher tax savings than offsetting an equal amount of LCFs in a low-tax country. On the other hand, a higher value of LCFs entails a greater loss in value if firms cannot use these tax assets. Furthermore, studies indicate that capital gains taxes at the investor level also influence VC investment(Edwards and Todtenhaupt, 2020). Thus, I include statutory capital gains (*CGT*) and dividend tax rates (*DT*). I also account for total income, profits, and capital gains tax levied in a country, *Tax level* (Cumming, 2014).

I rely on variables generally employed in the literature and control for a country's economic environment by utilizing its GDP and GDP growth (Bernoth and Colavecchio, 2014; Cherif and Gazdar, 2011; Félix et al., 2013; Li and Zahra, 2012) The set of controls also encompasses inflation, measured by changes in the consumer price index (Bernoth and Colavecchio, 2014; Langenmayr and Lester, 2018). I control for public research and development (R&D) expenditure (Da Rin et al., 2006). To account for the local labor market, I utilize the unemployment rate (Bernoth and Colavecchio, 2014; Cherif and Gazdar, 2011; Félix et al., 2013; Lüken, 2014). Government-funded investments influence the VC environment. Public VC investment should (in contrast to private VC investment) not react to local tax regulations. An increase in public funding increases the overall VC funding volume available in a country. One of the major players in the European VC market is the European Investment Fund (EIF). By working with local

[13] LCFs are deducted from the company's taxable income. Tax base effects such as e.g., depreciation, are not relevant in this case. Therefore, I do not use effective tax rates which include these effects.

[14] The relevant tax rate to be considered is the tax rate of the residence country of the company that incurred the losses. For non-group companies, cross-border loss offset is generally not allowed based on current tax law.

VC funds as intermediaries, they distribute equity financing and guarantees provided by institutions like the European Commission or regional authorities. I include the amount of support (*EIF amount*) and the number of supported companies (*EIF number*) per country per year. I additionally account for public investment with the lagged amount of government-funded PE investment (*Lagged Public PE*).

The vector *F* entails firm-level controls. It consists of the firm's assets with a one-year lag to control for firm size and LCFs based on profit and losses before taxes reported in the preceding year. The LCFs account for the expected economic damage if transfer restrictions apply; the higher the losses accumulated in a company, the higher the value of future tax savings that are denied. I also control for the company's age.

3.2. Data and sample

I derive data of VC-backed European start-ups from the VICO 4.0-database. Multiple researchers have compiled the database as part of the European Commission's "Research Infrastructure for Science and Innovation Policy Studies" initiative. It contains information on European companies that received at least one round of VC financing from 1998 to 2015. The database is a combination of different proprietary databases that have been matched to provide a more comprehensive sample of VC-backed companies in the EU28. Additionally, financial statement information has been obtained from BvD's Orbis database. VICO 4.0 is unique in its coverage and combination of data on European companies' VC activity and features to the best of my knowledge.[15] The data has been used in several studies in other research areas (e.g., Bertoni, Croce, & Guerini, 2015; Croce, D'Adda, & Ughetto, 2015; Croce, Martí, & Murtinu, 2013; Grilli & Murtinu, 2014; Guerini & Quas, 2016).

[15] For detailed information on the VICO 4.0 database, the construction of the final sample, please refer to the online appendix. The section also provides information on the geographical and temporal distribution of the observations.

The initial sample consists of 140,534 observations of 11,665 distinct companies, of which 14,650 company-year observations report non-zero values of VC funding. Table 2 depicts the mean of VC funding received by companies across all countries in the initial sample in a given year. An apparent spike in 2000 and a subsequent drop afterwards marks the burst of the Dot-com bubble in 2001.[16] The financial crisis also resulted in a decline after 2008.[17] While average VC funding in the last decade is far from pre-Dotcom levels, it started to increase again.

Table 2: Development of VC funding in the EU28.

Year	1998	2000	2002	2004	2006	2008	2010	2012	2014
Average in th €	3,666	7,534	5,236	4,293	2,604	3,686	3,398	2,351	3,148
Change to t-2		106%	-31%	-18%	-39%	42%	-8%	-31%	34%

Notes: Winsorized at 1% and 99% level, excluding observations with zero VC funding. Coverage: 1998 to 2014, EU28 Member States. Source: Own depiction based on VICO 4.0.

I remove 2015 from my sample because a large drop in observations indicates incomplete data in the last year. Due to the use of one-year lagged control variables, I conduct the analyses from 1999 onwards. Accounting information is missing for around 74% of the companies,[18] reducing the final sample to 17,443 observations. The restriction to complete information on the firm-level controls employed excludes micro and young companies. Consequently, the results have to be evaluated in light of this limitation.

Table 3 summarizes the descriptive statistics for the dependent variable, VC funding, and the firm-level control variables, assets, LCFs, and age, which I employ in the following empirical analysis. The sample consists of many zeros for VC funding, as companies do not receive funding between different funding rounds. As a result, the median amounts to zero, while the mean is positive. Assets are highly skewed to the left and LCFs to the right, both towards zero. The

[16] Results are robust to excluding years before 2002 (not reported).

[17] I include time fixed effects to account for any time trends. Additionally, due to the DiD specification, confounding events across countries should not alter my results if treated and non-treated companies are similarly affected. In the online appendix, I show that my results still hold when including a financial crisis dummy.

[18] Depending on the national regulations, SMEs are not required to publish financial statements up to a certain size threshold, or do so in a shortened version. More than half of the companies report losses which presumably result in LCFs.

age variable is also left-skewed but less so than assets. As expected, VC-backed companies are relatively young: More than half are aged below ten years.

Table 3: Descriptive statistics.

Variable	Obs	Std. Dev.	Min	Mean	Median	Max
VC funding	17,443	2,094.37	0.00	348.88	0.00	120,946.05
Total Assets	17,443	13,895.81	0.00	418.43	3.33	1,206,064.00
LCF amount (1 yr)	17,443	375.97	-19,660.24	-15.14	0.00	0.00
Age	17,443	7.68	0.00	10.04	9.00	165.00

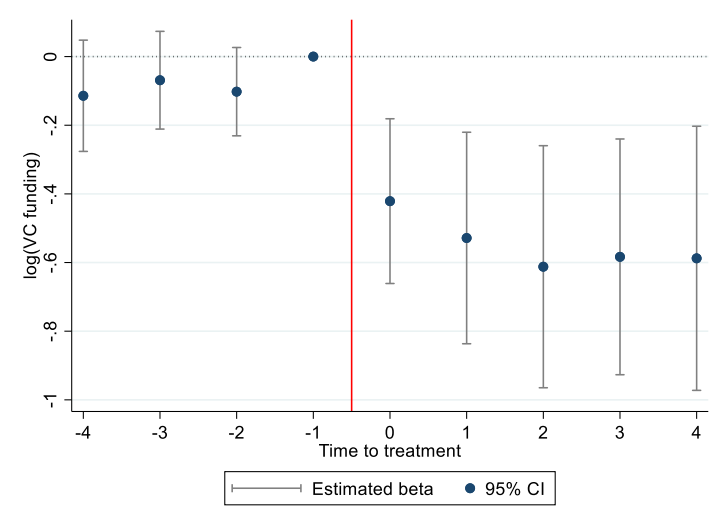
Notes: Summary statistics for the variables, as defined in Table A 1.

4. Results

4.1. Main analysis

First, Figure 2 (estimations based on equation (1)) graphically depicts the results of the event study design. The graph shows the difference in VC funding volume between affected and non-affected companies per period before and after the change in legislation, standardized to the year preceding the change.

Figure 2: Results event study, pooled analysis.



Notes: Event study results of treatment intensity on the logarithm of VC funding volume received (winsorized at 1%). "0": time of change in legislation. "-t": leads. "t": lags. 95% confidence intervals. Standard errors: Adjusted for clustering at the country level. Corresponding numerical estimates: Online appendix.

The estimates do not indicate significant pre-trends before introducing or changing anti-tax loss trafficking rules, validating that treated and non-treated companies behaved similarly before the events. In the years after the legislation changes, treated firms receive significantly lower VC

funding. The empirical findings thus indicate that more restrictive anti-tax loss trafficking rules impair VC investment. The negative effect persists over time.

Table 4: Results DiD, pooled analysis.

	log(VC funding)			
	(II-1)	(II-2)	(II-3)	(II-4)
Restriction category	-0.408***	-0.250**	-0.470***	-0.473***
Escape clause			0.040	0.066
LCF years			0.009	0.009
LCB years			0.084	0.076
LCF limit			0.316	0.320
CIT			-0.012	-0.015
ΔCIT			-0.010	-0.012
CGT			-0.233	-0.284
DIT			0.411	0.400
Tax level			-0.000***	-0.000***
GDP			0.000	0.000
GDP growth			-0.011	-0.012
Unemployment			-0.046**	-0.047**
Inflation			-0.072*	-0.072*
Public R&D			0.000	0.000
EIF amount			-0.000	-0.000
EIF number			0.000	0.000
Lagged Public PE			0.000	0.000
Lagged total assets				-0.000***
Age				-0.062***
LCF amount (1 yr)				0.000***
Firm FE	Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes
# Observations	17,443	17,443	17,443	17,443
Adj. R-squared	0.001	0.008	0.009	0.011

Notes: Results linear generalized DiD regression of restriction category (see Table 1) on the logarithm of VC funding volume received. Categories range from 0 to 4; a higher restriction category implies more restrictive anti-tax loss trafficking rules. Controls as indicated. Definition of variables: Table A 1. *, **, and *** indicate significance at the 10, 5, and 1% level. Standard errors: Adjusted for clustering at the country level.

Next, I estimate an average estimate of the impact of anti-tax loss trafficking rules on VC activity with the panel regression analysis (Table 4).[19] Column (1) displays the results when only including time-invariant firm characteristics. The findings indicate that anti-tax loss trafficking

[19] For the results to be valid, the common trend assumption requires treatment and control groups to behave similarly before the change in anti-tax loss trafficking regulations. This condition has already been established in the event study.

rules impair VC funding. The coefficient remains negative and highly significant when controlling for time trends (2) and time-varying country-level (3) and firm-level factors (4).

The event study estimates suggest a relatively stable impairment of VC funding throughout the years; consequently, the size of the average effect determined by the panel regression is close to the individual yearly estimates. The estimate in column (4) with all control variables implies that moving to more restrictive tax loss regulations decreases VC funding by 38%. Given the mean funding volume in the sample, this translates into an average reduction in VC funding of around -130.000€ in response to stricter anti-tax loss trafficking rules. Thus, the impairment is also economically significant. As the individual VC funding volume received varies greatly between the companies in my sample, start-ups towards the right end of the distribution could lose even larger amounts. To test whether a few companies with very high funding drive the results, I re-run all regressions with VC funding volume winsorized at 5% instead of 1%. I find similar results.[20]

The firm-level controls indicate that smaller and younger firms receive more funding. The amount of LCFs positively affects the level of investment; in other words, VC investors seem to value these tax assets' expected value, albeit the estimated effect size is relatively small. This finding supports my hypotheses, as considering LCFs in the decision-making process is necessary for anti-tax loss trafficking regulations.

4.2. Heterogeneity analysis

4.2.1. Age structure

Table 5: Descriptive statistics, different age groups.

Variable	Obs	Std. Dev.	Min	Mean	Median	Max
Panel 1: Age 0 to 5 years						
VC funding	4,616	2,007.87	0.00	506.97	0.00	28,603.67
Total Assets	4,616	17,803.29	0.00	397.22	0.95	1,206,064.00
LCF amount (1 yr)	4,616	452.74	-19,660.24	-24.63	-0.05	0.00
Age	4,616	1.39	0.00	3.24	3.00	5.00

[20] The corresponding estimates are reported in the online appendix.

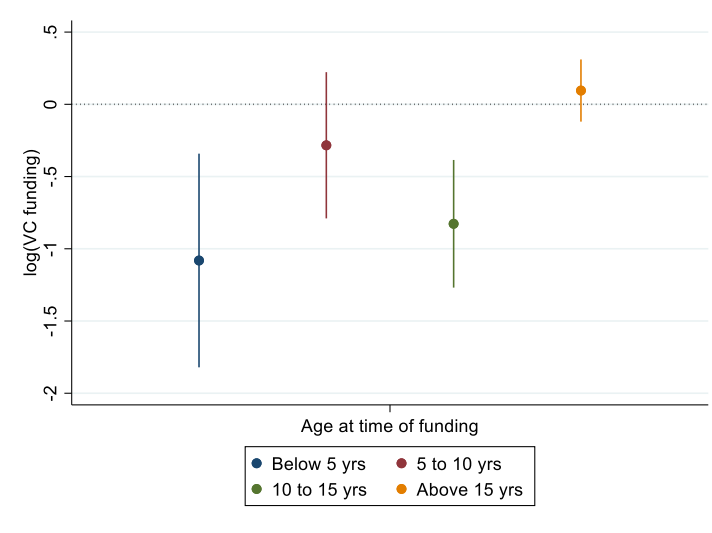
Panel 2: Age 5 to 10 years						
VC funding	7,137	2,577.98	0.00	429.42	0.00	120,946.05
Total Assets	7,137	1,226.90	0.00	100.95	2.83	42,751.00
LCF amount (1 yr)	7,137	405.88	-16,289.00	-17.09	-0.01	0.00
Age	7,137	1.65	5.00	7.45	7.00	10.00
Panel 3: Age 10 to 15 years						
VC funding	5,034	1,794.89	0.00	223.61	0.00	55,000.00
Total Assets	5,034	976.81	0.00	91.27	5.08	28,420.00
LCF amount (1 yr)	5,034	145.48	-9,784.51	-4.58	0.00	0.00
Age	5,034	1.67	10.00	12.19	12.00	15.00
Panel 4: Age above 15 years						
VC funding	3,400	1,132.63	0.00	159.77	0.00	20,145.96
Total Assets	3,400	23,584.67	0.00	1,354.65	9.16	676,747.00
LCF amount (1 yr)	3,400	430.93	-15,642.50	-14.76	0.00	0.00
Age	3,400	10.23	15.00	20.73	18.00	165.00

Notes: Summary statistics for firm-level variables, as defined in Table A 1. Panel 1: Companies aged up to five years. Panel 2: Companies aged between five and ten years. Panel 3: Companies aged between ten and 15 years. Panel 4: Companies aged above 15 years.

The negative coefficients for the age variable in previous regressions already indicate that, on average, older companies receive less funding. Therefore, I subdivide the sample into four categories based on five-year age groups. Table 5 depicts the descriptive statistics. A small number of manufacturing and high-tech companies that have been founded in the time preceding the Dotcom crisis drive the large difference in average size between the first and the following age groups.[21] The less outlier-sensitive medians align with expectations. As already found in previous specifications, younger companies are smaller and receive, on average, higher VC funding and carry higher losses.

[21] Employing the logarithm of assets or dropping the firms with the top 1% assets within each age group in the regressions only leads to minor changes in the coefficients (results available upon request from the author).

Figure 3: Results DiD, sample split based on age.



Notes: Results linear generalized DiD regressions of restriction category on the logarithm of VC funding volume received based on specification II-4. Categories range from 0 to 4; a higher restriction category implies more restrictive anti-tax loss trafficking rules (see Table 1). Sub-samples: Split based on age as indicated. 95% confidence intervals. Standard errors: Adjusted for clustering at the country level. Descriptive statistics: Table 5. Corresponding numerical results: Online appendix.

The results suggest that the age of a company influences the severity of VC funding impairment due to anti-**tax loss** trafficking rules (Figure 3). Estimates for *Restriction category* are all negative but vary in size and significance between the age groups. I find the strongest effect for the age groups below five years and between ten and 15 years. Younger companies are likely in earlier development stages. Expectations of potential future losses and success likelihood are highly uncertain. If tax loss restrictions are present, the expected return, especially in case of failure, decreases. The results suggest that investors respond to the risk increase by reducing the funding volume. For older companies, the exit time is likely near,[22] the issue of loss forfeiture becomes more concrete. Investors have a track record and more reliable data on accumulated LCFs. Existing and interested new investors can include this information for firm valuations in light of anti-tax loss trafficking rules when deciding on capital increases and acquisitions, respectively.

[22] In my sample, the time between the year of the first investment and the last recorded investment ranges from one to 16 years with a mean (median) of around seven (six) years. The average (median) age at which the first investment is received amounts to five (four) years. Taken these statistics together, firms aged up to five years usually receive their first funding, while firms between ten to 15 years are close to the exit.

4.2.2. Industry heterogeneity

Table 6 : Descriptive statistics, low- vs. high-tech industries.

Variable	Obs	Std. Dev.	Min	Mean	Median	Max
Panel 1: Low-tech companies						
VC funding	9,380	1,753.09	0.00	315.54	0.00	33,896.11
Total Assets	9,380	18,914.28	0.00	699.65	4.17	1,206,064.00
LCF amount (1 yr)	9,380	374.75	-19,660.24	-13.66	0.00	0.00
Age	9,380	8.70	0.00	10.66	9.00	165.00
Panel 2: High-tech companies						
VC funding	7981	2,443.47	0.00	391.29	0.00	120,946.05
Total Assets	7981	1,173.59	0.00	91.80	2.64	42,751.00
LCF amount (1 yr)	7981	379.33	-16,289.00	-17.03	-0.02	0.00
Age	7981	6.24	0.00	9.31	8.00	86.00

Notes: Summary statistics for firm-level variables, as defined in Table A 1. Panel 1: Companies in low-tech industries. Panel 2: Companies in high-tech industries. Classification of industries based on Eurostat.

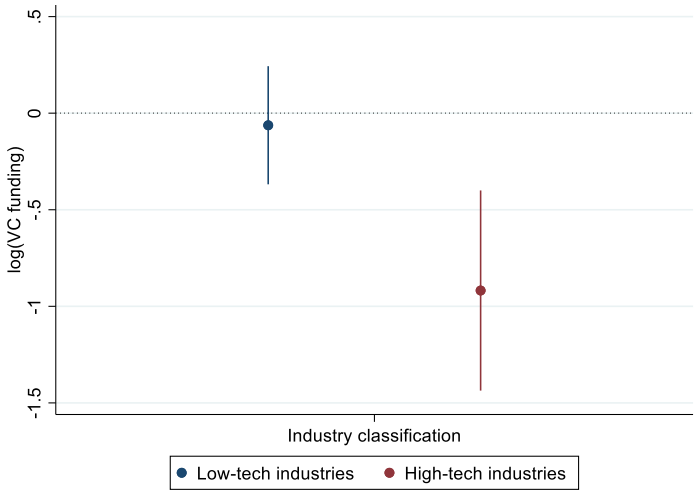
So far, I have considered the impact of tax loss restrictions across all sectors. Research shows that industries differ in loss probabilities and the use of LCFs. The proprietary data used in Cooper and Knittel (2010) shows differences between reported tax losses and their utilization. Dreßler and Overesch (2013) find cyclical effects in the probability of making losses, which is more pronounced in some sectors (e.g., data processing) compared to others (e.g., food). Overall, the literature suggests that anti-tax loss regulations will have different effects, depending on the industry-specific relevance of LCFs. Especially high-tech start-ups are considered to be more risky and uncertain (Baum and Silverman, 2004).

Although the firm fixed effects employed in all specifications should account for industry-specific characteristics, it could still be worthwhile to investigate the diverging impact on a broader basis. For this purpose, I employ Eurostat's high-tech aggregation system to differentiate between low- and high-tech industries. I define high- and medium-high-technology manufacturing sectors and high-tech knowledge-intensive services as high-tech industries.[23] I classify all other companies as part of low-tech sectors. Comparing the means in the low- to the high-tech

[23] The assignment of NACE codes to the high-tech category is summarized in the online appendix.

sample (Table 6) shows that start-ups in high-tech industries are, on average, considerably smaller, younger, carry higher estimated LCFs, and receive more VC funding.

Figure 4: Results DiD, sample split based on industry.



Notes: Results linear generalized DiD regressions of restriction category (see Table 1) on the logarithm of VC funding volume received based on specification I-4. Categories range from 0 to 4; a higher restriction category implies more restrictive anti-tax loss trafficking rules. Sub-samples: Split based on categorization into low- and high-tech industries (according to the Eurostat classification) as indicated. 95% confidence intervals. Standard errors: Adjusted for clustering at the country level. Descriptive statistics: Table 6. Corresponding numerical results: Online appendix.

Figure 4 depicts the regression results for the low- and high-tech sample. The low-tech industry coefficient is insignificant, while the high-tech estimation is larger and highly significant. In other words, firms in technologically more advanced industries are the ones that are severely affected. One interpretation of this finding is that in response to more restrictive anti-tax loss trafficking rules, VC investors invest less in start-ups with uncertain prospects to limit their risk exposure. The high-tech sector results exceed the impairment estimated in the main specification (Table 4), suggesting a decrease in funding of around -60%. Within the high-tech sample, this effect translates into an average absolute reduction in VC funding of around -240.000€. Anecdotal evidence confirms that tax loss transfer restrictions lead to a clear competitive disadvantage for investors in innovative sectors.[24]

[24] Research in areas such as biotechnology commonly requires large up-front investment and entails high risk. Throughout the investment stages, the start-ups are generally in a loss position, triggering anti-tax loss trafficking rules when ownership changes during fundraising rounds or investor exits: NVCA (n.d.). In addition, if projects

5. Robustness checks

I conduct several tests to confirm my results: I repeat the main analysis with two alternative empirical approaches: First, I employ a non-linear model, the Poisson pseudo maximum likelihood (PPML) estimator (section 5.1). Second, I utilize a stacked cohort DiD design (section 5.2). I follow up with alternative approximation methods for a firm's LCFs (section 5.3). Finally, I relax the requirements for accounting data investigate the individual legislative changes with country case studies (section 5.4)

5.1. Alternative model: Poisson

The data employed for the empirical analysis contains, by construction, a high share of zeros recorded for VC funding (89.89% of the company-year observations). To address the highly skewed distribution, I employ the PPML estimator proposed by Silva and Tenreyro (2006).[25]

Table 7 depicts the results for the generalized DiD. The number of observations amounts to roughly half compared to the linear model. The coefficients for the restriction categories are negative and highly significant. However, estimates are larger than in the corresponding linear estimate (Table 4). Moving from a lower to a higher restriction category translates into a decrease of around -44% in VC funding. The Poisson estimates for the event study also align with the coefficients obtained with the linear specification (reported in the online appendix, Table OA 7).

fail, large companies can offset their losses with other profits. By contrast, VC investors cannot recover their losses from investments in small start-ups: FAZ (2020).

[25] Poisson models are generally chosen in a setting with count variables on the left hand side of the equation, whereas the application of a pseudo-maximum likelihood estimator allows for a more general application (Shepherd, 2016).

Table 7: Results DiD, pooled analysis – Poisson model.

	log(VC funding)			
	(II-1)	(II-2)	(II-3)	(II-4)
Restriction category	-0.590***	-0.371***	-0.664***	-0.583***
Escape clause			0.132	0.209
LCF years			0.010	0.027
LCB years			0.076	0.008
LCF limit			0.548*	0.449*
CIT			-0.006	-0.004
ΔCIT			-0.025	-0.025
CGT			-1.042	-0.773
DIT			0.613	0.251
Tax level			-0.000***	-0.000***
GDP			0.000	0.000
GDP growth			-0.011	-0.016
Unemployment			-0.077***	-0.076***
Inflation			-0.135**	-0.129**
Public R&D			0.000	0.000
EIF amount			-0.001*	-0.001*
EIF number			0.000**	0.000**
Lagged Public PE			0.000	0.000
Lagged total assets				-0.000
Age				-6.206***
LCF amount (1 yr)				-0.001
Firm FE	Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes
# Observations	8,953	8,899	8,899	8,899
Pseudo R-squared	0.091	0.108	0.114	0.124

Notes: Results Poisson pseudo-maximum likelihood regressions of restriction category (see Table 1) on the VC funding volume received in its logarithm. Categories range from 0 to 4; a higher restriction category implies more restrictive anti-tax loss trafficking rules. Controls as indicated. Definition of variables: Table A 1. *, **, and *** indicate significance at the 10, 5, and 1% level. Standard errors: Adjusted for clustering at the country level.

5.2. Stacked cohort difference-in-differences research design

Two-way fixed effects regressions have been show to face shortcomings in settings with treatment at different points in time (e.g., Baker et al., 2022; de Chaisemartin and D'Haultfœuille, 2020; Sun and Abraham, 2021), such as with the staggered changes in anti-tax loss trafficking rules investigated in this paper.

To account for potential problems, following Cengiz et al. (2019) I implement a stacked cohort DiD design (see also Baker et al. (2022)). For each change in legislation, I construct an individual cohort dataset with treated and control firms. Treated firms are defined as firms located in the country that changed legislation. Control firms are defined as firms located in countries

that did not experience a change in tax loss transfer restrictions within a four-year window before or after the treatment event. I then restrict each dataset to the four years before and after the treatment event. As apparent in Table 8, I obtain similar results (reported in the online appendix, Table OA 8).

Table 8: Results stacked cohort DiD, pooled analysis.

	log(VC funding)			
	(II-1)	(II-2)	(II-3)	(II-4)
Restriction category	-0.221	-0.221	-0.511***	-0.514***
Escape clause			-0.079	-0.048
LCF years			0.004	0.004
LCB years			0.173***	0.169***
LCF limit			0.399***	0.409***
CIT			-0.001	-0.004
ΔCIT			-0.008	-0.009
CGT			0.495	0.430
DIT			0.497	0.510
Tax level			-0.000***	-0.000***
GDP			0.000***	0.000***
GDP growth			-0.015	-0.016
Unemployment			-0.055***	-0.055***
Inflation			-0.070***	-0.069***
Public R&D			0.000**	0.000**
EIF amount			-0.000***	-0.000***
EIF number			0.000***	0.000***
Lagged Public PE			0.000*	0.000*
Lagged total assets				-0.000
Age				-0.064***
LCF amount (1 yr)				0.000
Firm FE	Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes
# Observations	94,446	94,446	94,446	94,446
Adj. R-squared	0.005	0.005	0.007	0.008

Notes: Results stacked cohort DiD regression of restriction category (see Table 1) on the logarithm of VC funding volume received. Categories range from 0 to 4; a higher restriction category implies more restrictive anti-tax loss trafficking rules. Controls as indicated. Definition of variables: Table A 1. *, **, and *** indicate significance at the 10, 5, and 1% level. Standard errors: Adjusted for clustering at the country level.

5.3. Alternative loss carry-forward definitions

So far, LCFs have been calculated based on the preceding year's profits *(LCF amount (1 yr)*). Alternatively, LCFs can be calculated incorporating more periods. Also, instead of including the amount of LCFs available, a dummy variable set equal to one if a LCF is available and zero

otherwise can be defined. Rechbauer (2017) investigates the LCF proxies employed in the literature and shows that methods relying on accounting data might not identify the true amount. She demonstrates that the rate of correct predictions is higher if she approximates LCFs with a 0/1 dummy. Calculating the actual amount of LCFs instead of only defining their existence is subject to greater estimation error. Most empirical studies basing LCF variables on financial statement information use a dummy predicted from the preceding year's earnings (Haring et al., 2012; Krämer, 2015; Merz and Overesch, 2016). I construct LCF amounts and dummies based on the preceding two and four years and re-run the main specification in alternative specifications. My calculations follow Bernasconi, Marenzi, and Pagani's (2005) method.[26]

Table 9: Results DiD, pooled analysis – alternative LCF* definitions.

	log(VC funding)		
	(II-4)	# Observations	Adj. R2
Panel 1: One year			
LCF amount	-0.473***	17,443	0.011
LCF dummy	-0.473***	17,443	0.011
Panel 2: Two years			
LCF amount	-0.256*	12,611	0.007
LCF dummy	-0.252*	12,611	0.006
Panel 3: Four years			
LCF amount	0.236	6,975	0.008
LCF dummy	0.248	6,975	0.005

Notes: Results linear generalized DiD regressions of anti-tax loss trafficking rules on the VC funding volume received. "Restriction category": As defined in Table 1. Categories range from 0 to 4, a higher restriction category implies more restrictive anti-tax loss trafficking rules. Complete set of controls included. Definition of variables: Table A 1. Panel 1: 1-year-based LCF measures. Panel 2: 2-year-based LCF measures. Panel 3: 4-year based LCF measures. *, **, and *** indicate significance at the 10, 5, and 1% level. Standard errors: Adjusted for clustering at the country level.

Table 9 presents the results for estimated LCF amounts and the related LCF dummies. For reference, the first group in Panel 1 shows the main regression results (as stated in Table 4). In neither panel, the results change when exchanging the amount of LCFs for a binary dummy variable. Choosing between the presence of LCFs instead of their size only marginally affects the results. Extending the time horizon decreases the estimate for two-year-based measures

[26] Please refer to online appendix OA3 for a calculation example.

(Panel 2). The coefficients turn positive and insignificant when taking four years into account (Panel 3).

However, this change in results is not attributable to imprecise predictions of LCFs, but the reduction in sample size. The main analysis already shows that including firm-level controls (moving from specification (3) to (4), Table 4) only marginally alters the results in the same sample. In a sample restricted to companies with enough data to construct four-year LCF measures, the results also do not substantially change when varying the LCF measure.[27] Firm-fixed effects should already account for a large portion of the firm-specific loss probability related to its industry affiliation and business model. In addition, the country-level variables control for general economic conditions. Extending the period for LCF calculations substantially decreases the sample size. The measures' construction necessitates two respective four years of non-missing information on profits and losses before taxes. Around 20% of the companies observed are younger than five years. If especially newly created companies carry losses (since they are yet not profitable), anti-tax loss trafficking rules will be particularly relevant for younger companies. Extending the requirements for the availability of accounting information will exclude precisely those cases. Also, if there are shifting effects from recently established to older companies or vice versa, extending the required number of years and contiguous non-missing accounting information could bias the results.

5.4. Country case studies

As a final robustness check, I investigate each change in legislation separately in individual country case studies. First, the case studies shed light on which type of change exerts the biggest influence on the overall inferences drawn in the main analysis. The division into categories for my anti-tax loss trafficking measure assumes that, e.g., the introduction of a cumulative regime has a similar effect as the change from a cumulative to an ownership-based regime. I relax this

[27] The corresponding estimates are reported in the online appendix.

assumption by separately exploring different types of changes. Second, focusing on the individual changes allows me to construct samples for each event. Instead of employing time-varying firm-level controls as in the pooled sample to satisfy the common trends assumption, I rely on a matching approach that imposes minimal restrictions on my sample and increases the number of start-ups considered in my analysis.

I again use an event study and a DiD approach as in the main analysis, slightly adjusted for the case studies. For the event study, I replace the treatment intensity with a treatment dummy $Event_{c,t}^{j}$. The dummy equals one at the time of change in legislation in the treatment country and zero otherwise. For the DiD specification, I substitute the restriction category variable with a dummy $Post\_Reform_{c,t}$, which equals one in the treated country in the year of change in legislation and subsequent years, and zero otherwise. I employ the same fixed effects and control variables, except for firm-level controls.

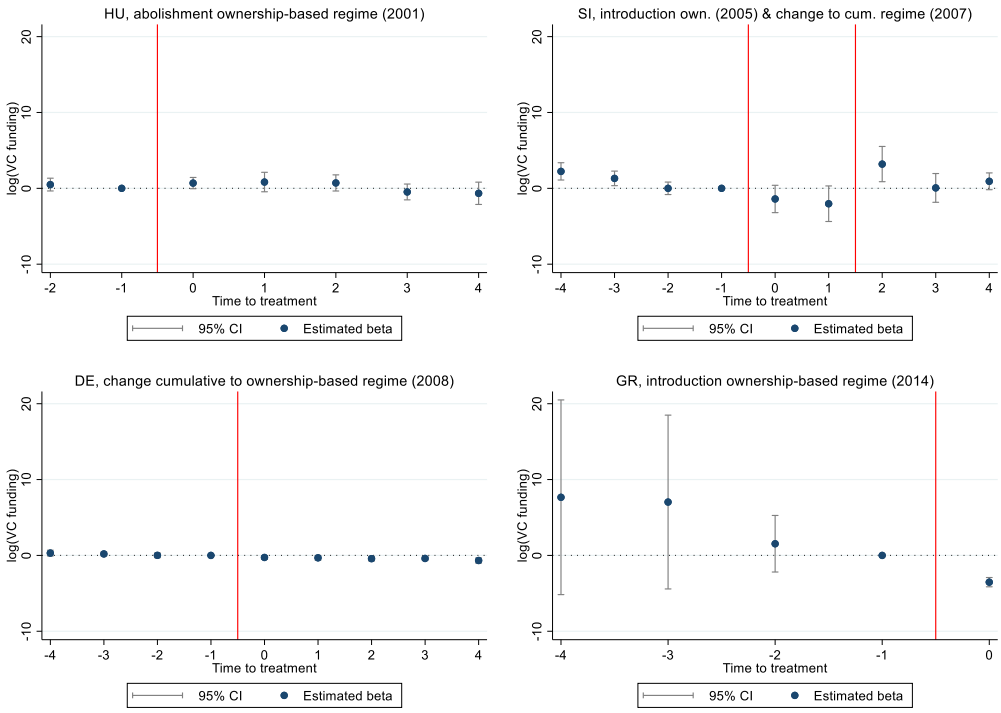
To ensure comparability between the treated and non-treated firms, I employ coarsened exact matching (CEM). With CEM, similar values of the matching parameters are grouped; in other words, coarsened. Each group is then assigned a numerical value. Treated and control companies are matched based on these parameter groups instead of the individual parameter value (Iacus et al., 2012, 2011).[28] I match on the age and total amount of assets of a company in the three years preceding the treatment.[29] I match with replacement and exclude companies without a match. All companies are subject to anti-tax loss trafficking rules within a country and, therefore, considered treated. Consequently, the control group has to consist of companies from other countries. To construct a comparable sample, I restrict the selection of countries that I consider:

[28] CEM also defines missing values as a group. In my setting, this poses an advantage compared to e.g., propensity score matching, which requires full information on all chosen matching parameters. In my sample, accounting information is unavailable for around 74% of the company-year observations. Requiring non-missing values for assets over a period of three years would pose a binding restriction and introduce severe sample selection bias.

[29] I match on pre-treatment covariates instead of outcome variables, as the latter could increase bias (Chabé-Ferret, 2017). In my regressions, the coefficients for age and firm size are a statistically significant predictor of VC funding volume.

First, I exclude countries with changes in legislation within a four-year window before and after the event in the treatment country. Second, I limit the choice set to control countries similar to the treatment country in GDP and CIT level. I then match treated companies with non-treated companies chosen from the constrained control country set.

Figure 5: Results case studies, introduction of or change to ownership-based regime.



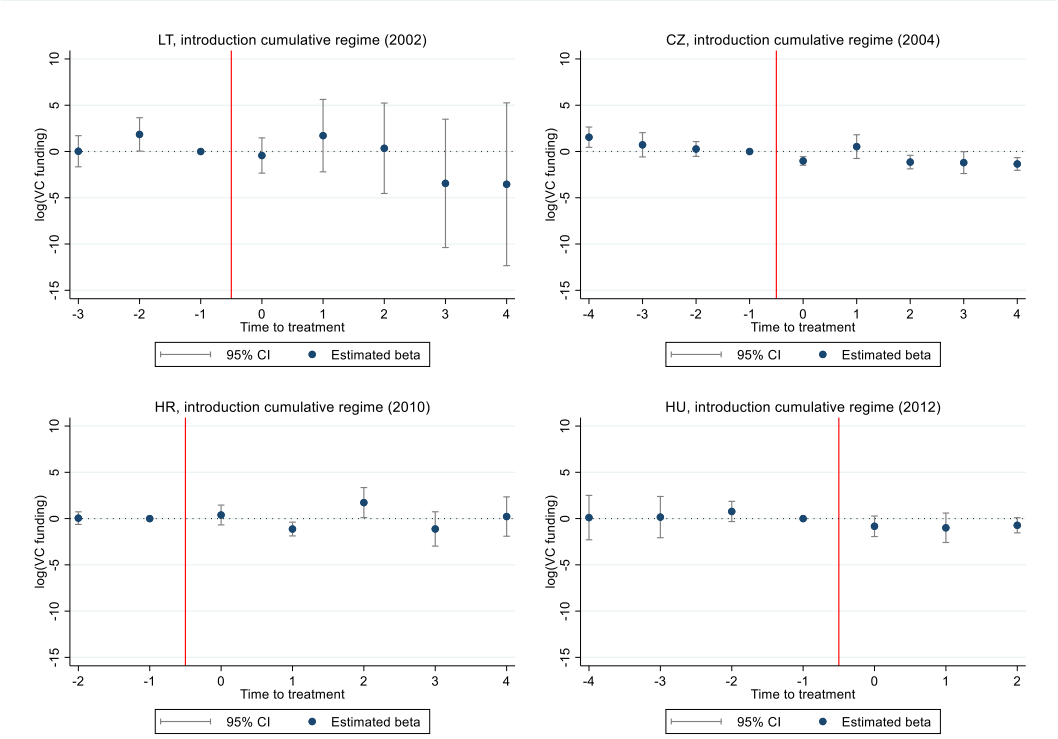
Notes: Dependent variable: Firm-level VC funding volume. Time dummies: "0": time of change in legislation. "-t": leads. "t": lags. 95% confidence intervals. Standard errors: Adjusted for clustering at the country level. Upper left: Hungary. Upper right: Slovenia. Lower left: Germany. Lower right: Greece. Information on the specific changes: Table A 2. Sample composition, descriptive statistics, and numerical event study results are placed in the online appendix.

Figure 5 displays the results for changes from and to ownership-based regimes. Figure 6 covers the introduction of cumulative rules. Latvia, the Netherlands, and Portugal are missing from the complete set of legislation changes available for analysis (see Table A - 2). For these countries, it was not possible to construct control groups that satisfied the common trends assumption.

The event study graphs in Figure 5 paint a mixed picture regarding the effect of an ownership-based regime: On the one hand, abolishing ownership-based rules in Hungary (upper left) did

not seem to have affected VC funding significantly. The coefficients suggest a short-run positive effect of the abolishment, albeit not statistically significant. On the other hand, for Slovenia (upper right), the results indicate that VC funding dropped in response to the introduction of ownership-based loss transfer restriction. Two years later, when the regulation was relaxed by introducing a cumulative requirement, the coefficient estimate turns significant and positive. Also, the event study shows a clear negative trend in VC funding after the tightening of the German regulations (lower left) and the introduction of ownership-based restrictions in Greece (lower right). However, as the sample ends in 2014, no post periods are available for the change in Greek legislation.

Figure 6: Results case studies, introduction of or change to cumulative regime.



Notes: Dependent variable: Firm-level VC funding volume. Time dummies: "0": time of change in legislation. "-t": leads. "t": lags. 95% confidence intervals. Standard errors: Adjusted for clustering at the country level. Upper left: Lithuania. Upper right: Czech Republic. Lower left: Croatia. Lower right: Hungary. Information on the specific changes: Table A 2. Sample composition, descriptive statistics, and numerical event study results are placed in the online appendix.

I find evidence that introducing cumulative regimes impairs VC funding for two out of the four event studies (Figure 6). Czech and Croatian companies receive significantly less VC funding

than their counterfactual peers in other countries (upper right and lower left). In Lithuania (upper left) and Hungary (lower right) the estimates do not indicate a clear impairment.

Table 10 displays the average coefficients estimated in the DiD approach, assessing the combined effect for all periods after legislation changed. Panel 1 displays the numbers for the case studies involving ownership-based regimes (corresponding to Figure 5), Panel 2 the estimates for the introduction of cumulative rules (corresponding to Figure 6).

In most cases, the overall effect matches the findings from the case studies. The positive effect of the change to a cumulative rule does not fully offset the impairment due to the previously introduced ownership-based regime, leading to an overall negative effect in Slovenia. In Croatia, the initial negative effect of the newly introduced cumulative regime indicated in the first years in the event study does not seem to persist over time. Overall, the results suggest that ownership-based restrictions are particularly harmful to VC funding (panel 1), indicating significant and large impairment in most of the case studies. Cumulative regimes also seem to reduce VC funding, but the effects are, on average, smaller and less clear (panel 2).

Table 10:Results DiD, treatment dummy, case studies.

	log(VC funding)		
	(II-4)	# Observations	Adj. R2
Panel 1: Introduction, abolishment, or change to ownership-based regime			
HU (2001)	0.555	1,392	0.103
SI	-1.137*	386	0.078
DE	-0.620**	61,747	0.071
GR	-2.477**	254	0.113
Panel 2: Introduction of cumulative regimes			
LT	-0.382	538	0.070
CZ	-0.861*	3,360	0.030
HR	-0.305	672	0.064
HU (2012)	-0.987	2,319	0.061

Notes: Results linear DiD regressions of treatment dummy on the logarithm of VC funding volume received. Treatment dummy equals 1 in the year of change in legislation and all following years, and zero otherwise. Complete set of controls included. Definition of variables: Table A 1. *, **, and *** indicate significance at the 10, 5, and 1% level. Standard errors: Adjusted for clustering at the country level.

As already mentioned, the restriction to complete information on the firm-level control variables poses a severe limitation. The effects in the case studies are in line with the main results,

but are larger compared to the estimates derived in the pooled analysis. The excluded companies are relatively young (42% are aged up to five years, 71% up to ten years). Based on the data, it is impossible to determine any other differences in characteristics between the selected and the excluded companies beyond this aspect. Any conclusions drawn from the pooled analysis results have to be evaluated in light of this limitation.

6. Conclusion and outlook on future research

In this study, I have investigated whether restrictions on the transfer of tax losses after a change in ownership or activity impair VC funding volume. My results confirm this hypothesis, especially for high-tech firms and firms at the beginning or end of the funding life cycle. While my analysis focuses on Europe, similar restrictions exist worldwide. Relaxing anti-tax loss trafficking regulations could support young companies considering the significant adverse effects. Especially in light of the Corona crisis and rising losses, the tax treatment of LCFs will be increasingly relevant. Suppose losses can be carried forward as long as the activities are maintained. In that case, anti-tax loss trafficking rules won't cut as hard when investors increase capital or exit a successful start-up. Moreover, legislators could consider exempting start-ups from the regulations to encourage risky investments. Countries like Portugal and New Zealand have already taken steps to relax their anti-tax loss trafficking rules, with the explicit aim to support start-ups and small businesses.

Data availability limits my analyses. More information on the percentage of shares held by VC and firm-level accounting variables is required to understand better the heterogeneous effects of anti-tax loss trafficking rules and consequences for downstream aspects such as start-up performance or exit choice. Beyond the impairment of VC funding volume, an investigation in the whole population of start-ups and the impact on the number of overall funded firms would shed more light on the topic. Future studies could also focus on the VC investors rather than the

funded start-up, investigating whether tax loss transfer restrictions affect certain types of investors (such as corporate VCs) more than others.

Appendix

Table A 1: Variable definition.

Variable	Description
Dependent variable	
$\log(VC\ funding)$	Logarithm of VC funding received, measured in thousand €, winsorized at the 1 and 99 percent level (Source: VICO 4.0)
Main variables of interest	
$Event$	Dummy that takes the value 1 in the period loss transfer restrictions are changed; 0 otherwise. Type of change as indicated in the text (Source: Bührle & Spengel (2020))
$Treatment$	Treatment intensity; defined as the difference between the old and new restriction category after a change in legislation (Source: Bührle & Spengel (2020))
$Restriction\ category$	Loss transfer restriction category; Category 0 = No explicit anti-loss trafficking rule, 1 = Denial of loss transfer after a change in ownership and activity (cumulative), 2 = Denial of loss transfer after a change in activity, 3 = Denial of loss transfer after a change in ownership, 4 = Denial of loss transfer after a change in ownership or activity (see Table 1; Source: Bührle & Spengel (2020))
Country-level controls	
$Escape\ clause$	Dummy that takes the value 1 in the period anti-loss trafficking rules incorporate escape clauses for listed companies, group restructuring, recovery plans, hidden reserves, or the provision of evidence for economic reasons; 0 otherwise (Source: Bührle & Spengel (2020))
$LCF\ years$	Number of years a LCF is available, 50 if unlimited (Source: IBFD, tax guides)
$LCB\ years$	Number of years a LCB is available, 0 if not available (Source: IBFD, tax guides)
$LCF\ limit$	Dummy that takes the value 1 if relative restrictions apply to LCFs, 0 otherwise (Source: IBFD, tax guides)
CIT	Statutory corporate income tax rate in % (Source: European Commission)

$\Delta\, CIT$	Change in CIT, i.e., CIT in t minus CIT in t-1
CGT	Statutory capital gains tax rate in % (Source: European Commission)
DT	Statutory dividend income tax rate in % (Source: European Commission)
$Tax\ Payment$	Taxes on income, profits, and capital gains in current local currency unit (Source: World Bank)
GDP	GDP in thousand dollars, based on purchasing power parity and constant 2011 dollar (Source: World Bank)
$GDP\ growth$	Percentage growth rate of GDP at market prices, based on constant 2010 dollar (Source: World Bank)
$Unemployment$	Total unemployment, measured as percentage of total labor force (Source: World Bank)
$Inflation$	Inflation, measured as percentage change in consumer price index (Source: World Bank)
$Public\ R\&D$	Government-funded intramural R&D expenditure, purchasing power parity at 2005 prices (Source: OECD)
$EIF\ amount$	Amount of support provided by the EIF, all business lines (Source: EIF)
$EIF\ number$	Number of supported SMEs by the EIF, all business lines (Source: EIF)
$Lagged\ PublicPE$	Amount of public PE investments with a one-year lag (Source: InvestEurope)
Firm-level controls	
$Lagged\ total\ assets$	Total assets recorded in the balance sheet, in million € and with a one-year lag (Source: VICO 4.0, Orbis)
$LCF\ amount\ (1\ year)$	LCF of company based on losses of the previous year (Source: VICO 4.0, Orbis)
Age	Age of the company (Source: VICO 4.0, Orbis)

Notes: Definition and source of variables employed in empirical specifications.

Table A 2: Anti-tax loss trafficking rules in the EU28, 1999-2014.

Country	Year	Regulation
AT	1999-2014	Cumulative: change in ownership > 75% and change in activity
BE	1999-2014	Ownership: change in control
BG	1999-2014	Ownership: change in ownership > 50%
CY	1999-2014	Cumulative: change in ownership > 50% and change in activity
CZ	1999-2003	-
	2004-2014	Cumulative: change in ownership > 25% and change in activity (offset only against profits from similar activities)
DE	1999-2007	Cumulative: change in ownership > 50% and change in activity
	2008-2014	Ownership: change in ownership > 50%, pro-rata after change in ownership between 25%-50%
DK	1999-2014	*(regulations only apply to capital losses)*
EE	1999-2014	Distribution tax, no LCF available
ES	1999-2014	Ownership: change in majority
FI	1999-2014	Ownership: change in ownership > 50%
FR	1999-2014	Activity: change of activity
GB	1999-2014	Cumulative: change of ownership > 50% and change in activity
GR	1999-2013	-
	2014	Ownership: change in ownership > 33%
HU	1999-2000	Ownership: change in ownership > 50%
	2001-2011	-
	2012-2014	Cumulative: change in majority
HR	1999-2009	-
	2010-2014	Cumulative: change in ownership > 50% and change in activity
IE	1999-2014	Cumulative: change in ownership > 50% and change in activity
IT	1999-2014	Cumulative: change in majority and change in activity
LT	1999-2001	-
	2002-2014	Cumulative: change in ownership > 66% (from 2007: control) and change in activity
LU	1999-2014	-
LV	1999-2000	Ownership: Change in ownership > 50%
	2001-2014	Cumulative: Change in control and change in activity
MT	1999-2014	-
NL	1999-2000	Ownership: Change in ownership > 30%
	2001-2014	Cumulative: Change in ownership > 30% and change in activity
PL	1999-2014	-
PT	1999-2005	Activity: change in activity, exemption for economic reasons
	2006-2013	Ownership/activity: change in ownership > 50% or change in activity
	2014	Ownership: change in ownership > 50%
RO	1999-2014	-
SE	1999-2014	Ownership: change in control
SI	1999-2004	-
	2004-2005	Ownership: change in ownership > 25%
	2006-2014	Cumulative: change in ownership > 50% and change in activity
SK	1999-2014	-

Notes: Retro-actively applicable rules are disregarded. Source: Bührle and Spengel (2020).

Online appendix

The online appendix can be accessed at https://drive.google.com/file/d/17Zzn7mspjx-PelaTGBsv2qo5I8dJPHgP2/view?usp=sharing.

References

Literature

AVCAL, 2007. Private Equity in Australia. Submission to the Senate Standing Committee on Economics.

Baker, A.C., Larcker, D.F., Wang, C.C.Y., 2022. How much should we trust staggered difference-in-differences estimates? J. financ. econ. 144, 370–395. https://doi.org/10.1016/j.jfineco.2022.01.004

Baum, J.A.C., Silverman, B.S., 2004. Picking winners or building them ? Alliance , intellectual , and human capital as selection criteria in venture financing and performance of biotechnology startups. J. Bus. Ventur. 19, 411–436. https://doi.org/10.1016/S0883-9026(03)00038-7

Bernasconi, M., Marenzi, A., Pagani, L., 2005. Corporate financing decisions and non-debt tax shields: Evidence from Italian experiences in the 1990s. Int. Tax Public Financ. 12, 741–773. https://doi.org/10.1007/s10797-005-2914-1

Bernoth, K., Colavecchio, R., 2014. The macroeconomic determinants of private equity investment: A European comparison. Appl. Econ. 46, 1170–1183. https://doi.org/10.1080/00036846.2013.866306

Bertoni, F., Croce, A., Guerini, M., 2015. Venture capital and the investment curve of young high-tech companies. J. Corp. Financ. 35, 159–176. https://doi.org/10.1016/j.jcorpfin.2015.08.012

Bührle, A.T., Spengel, C., 2020. Tax Law and the Transfer of Losses: A European Overview and Categorization. Intertax 48, 564–581.

BVK, 2016. Stellungnahme des Bundesverbandes Deutscher Kapitalbeteiligungsgesellschaften e.V. (BVK) zum Gesetzentwurf der Bundesregierung „Entwurf eines Gesetzes zur Weiterentwicklung der steuerlichen Verlustverrechnung bei Körperschaften“ BT-Drucksache 18/9986.

Carpenter, R.E., Petersen, B.C., 2002a. Is the Growth of Small Firms Constrained By Internal Finance? Rev. Econ. Stat. 84, 298–309.

Carpenter, R.E., Petersen, B.C., 2002b. Capital Market Imperfections, High-Tech Investment, and New Equity Financing. Econ. J. 112, F54–F72.

Cengiz, D., Dube, A., Lindner, A., Zipperer, B., 2019. The Effect of Minimum Wages on Low-Wage Jobs. Q. J. Econ. 134, 1405–1454. https://doi.org/10.1093/qje/qjz014

Chabé-Ferret, S., 2017. Should We Combine Difference In Differences with Conditioning on Pre-Treatment Outcomes?

Cherif, M., Gazdar, K., 2011. What drives venture capital investments in Europe? New results from a panel data analysis. J. Appl. Bus. Econ. 12, 122–139.

Coad, A., Segarra, A., Teruel, M., 2016. Innovation and firm growth: Does firm age play a role? Res. Policy 45, 387–400. https://doi.org/10.1016/j.respol.2015.10.015

Colombo, M.G., Murtinu, S., 2017. Venture Capital Investments in Europe and Portfolio Firms’ Economic Performance: Independent Versus Corporate Investors. J. Econ. Manag. Strateg. 26, 35–66. https://doi.org/10.1111/jems.12170

Cooper, M., Knittel, M.J., 2010. The implications of tax asymmetry for U.S. corporations. Natl. Tax J. 63, 33–62.

Cooper, M., Knittel, M.J., 2006. Partial Loss Refundability : How Are Corporate Tax Losses Used? Natl. Tax J. 59, 651–663.

Cosh, A., Cumming, D.J., Hughes, A., 2009. Outside entrepreneurial capital. Econ. J. 119, 1494–1533. https://doi.org/10.1111/j.1468-0297.2009.02270.x

Croce, A., D'Adda, D., Ughetto, E., 2015. Venture capital financing and the financial distress risk of portfolio firms: How independent and bank-affiliated investors differ. Small Bus. Econ. 44, 189–206. https://doi.org/10.1007/s11187-014-9582-4

Croce, A., Martí, J., Murtinu, S., 2013. The impact of venture capital on the productivity growth of European entrepreneurial firms: "Screening" or "value added" effect? J. Bus. Ventur. 28, 489–510. https://doi.org/10.1016/j.jbusvent.2012.06.001

Cumming, D.J., 2014. Public economics gone wild: Lessons from venture capital. Int. Rev. Financ. Anal. 36, 251–260. https://doi.org/10.1016/j.irfa.2013.10.005

Da Rin, M., Nicodano, G., Sembenelli, A., 2006. Public policy and the creation of active venture capital markets. J. Public Econ. 90, 1699–1723. https://doi.org/10.1016/j.jpubeco.2005.09.013

de Chaisemartin, C., D'Haultfœuille, X., 2020. Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects. Am. Econ. Rev. 110, 2964–2996. https://doi.org/10.1257/aer.20181169

Dreßler, D., Overesch, M., 2013. Investment impact of tax loss treatment-empirical insights from a panel of multinationals. Int. Tax Public Financ. 20, 513–543. https://doi.org/10.1007/s10797-012-9240-1

Edwards, A., Todtenhaupt, M., 2020. Capital Gains Taxation and Funding for Start-Ups. J. financ. econ. 138, 549–571.

Félix, E.G.S., Pires, C.P., Gulamhussen, M.A., 2013. The Determinants of Venture Capital in Europe - Evidence Across Countries. J. Financ. Serv. Res. 44, 259–279. https://doi.org/10.1007/s10693-012-0146-y

Fleischer, V., 2003. The Rational Exuberance of Structuring Venture Capital Startups. Tax Law Rev. 57, 137–186. https://doi.org/10.2139/ssrn.432840

Gans, J.S., Stern, S., 2003. The product market and the market for "ideas": commercialization strategies for technology entrepreneurs. Res. Policy 32, 333–350.

Grilli, L., Murtinu, S., 2014. Government, venture capital and the growth of European high-tech entrepreneurial firms. Res. Policy 43, 1523–1543. https://doi.org/10.1016/j.respol.2014.04.002

Guerini, M., Quas, A., 2016. Governmental venture capital in Europe: Screening and certification. J. Bus. Ventur. 31, 175–195. https://doi.org/10.1016/j.jbusvent.2015.10.001

Haltiwanger, J., Jarmin, R.S., Miranda, J., 2013. Who creates jobs? Small versus large versus young. Rev. Econ. Stat. 95, 347–361. https://doi.org/10.1162/REST_a_00288

Haring, M., Niemann, R., Runger, S., 2012. Corporate Financial Policy and Individual Income Taxation in Austria. Betriebswirtschaft/bus. Adm. Rev. 72, 473–486.

Haufler, A., Norbäck, P.J., Persson, L., 2014. Entrepreneurial innovations and taxation. J. Public Econ. 113, 13–31. https://doi.org/10.1016/j.jpubeco.2014.03.002

Hege, U., Palomino, F., Schwienbacher, A., 2009. Venture Capital Performance: The Disparity Between Europe and the United States. Finance 30, 7–50. https://doi.org/10.3917/fina.301.0007

Hellmann, T., Puri, M., 2002. Venture Capital and the Professionalization of Start-up Firms : Empirical Evidence. J. Finance 57, 169–197. https://doi.org/10.2307/2697837

Henrekson, M., Sanandaji, T., 2011. Entrepreneurship and the theory of taxation. Small Bus. Econ. 37, 167–185. https://doi.org/10.1007/s1118700992422

Hoenig, M., 2014. Trafficking in Net Operating Losses: What's So Bad. Tax Notes Spec. Rep. 149, 919–939.

Iacus, S.M., King, G., Porro, G., 2012. Causal inference without balance checking: Coarsened exact matching. Polit. Anal. 20, 1–24. https://doi.org/10.1093/pan/mpr013

Iacus, S.M., King, G., Porro, G., 2011. Multivariate matching methods that are monotonic imbalance bounding. J. Am. Stat. Assoc. 106, 345–361. https://doi.org/10.1198/jasa.2011.tm09599

Kaplan, S.N., Strömberg, P., 2001. Venture Capitalists as Principals: Contracting, Screening, and Monitoring. Am. Econ. Rev. 91, 426–430. https://doi.org/10.1257/aer.91.2.426

Krämer, R., 2015. Taxation and Capital Structure Choice: The Role of Ownership. Scand. J. Econ. 117, 957–982. https://doi.org/10.1111/sjoe.12107

Langenmayr, D., Lester, R., 2018. Taxation and corporate risk-taking. Account. Rev. 93, 237–266. https://doi.org/10.2308/accr-51872

Lawless, M., 2014. Age or size? Contributions to job creation. Small Bus. Econ. 42, 815–830. https://doi.org/10.1007/s11187-013-9513-9

Li, Y., Zahra, S.A., 2012. Formal institutions, culture, and venture capital activity: A cross-country analysis. J. Bus. Ventur. 27, 95–111. https://doi.org/10.1016/j.jbusvent.2010.06.003

Ljungqvist, A., Zhang, L., Zuo, L., 2017. Sharing Risk with the Government: How Taxes Affect Corporate Risk Taking. J. Account. Res. 55, 669–707. https://doi.org/10.1111/1475-679X.12157

Lüken, J., 2014. Innovationen und asymmetrische Besteuerung. Springer Gabler, Wiesbaden. https://doi.org/10.1007/978-3-658-13600-0

Mehrmann, A., Sureth-Sloane, C., 2017. Tax Loss Offset Restrictions and Biased Perception of Risky Investments.

Merz, J., Overesch, M., 2016. Profit shifting and tax response of multinational banks. J. Bank. Financ. 68, 57–68. https://doi.org/10.1016/j.jbankfin.2016.03.015

Moore, N.H., Pruitt, S.W., 1987. The Market Pricing of Net Operating Loss Carryforwards: Implications of the Tax Motivations of Mergers. J. Financ. Res. 10, 153–161.

Nijhawan, A., 2015. When Is " Loss Trading " Permissible ? A Purposive Analysis of Subsection 111 (5), in: Canadian Tax Foundation Conference Report. pp. 1–26.

Parker, R.L., 1990. The Innocent Civilians in the War against NOL Trafficking: Section 382 and High-Tech Start-up Companies. Virginia Tax Rev. 9, 625–710.

Poitevin, M., 2003. Effects of the Fiscal Treatment of Tax Losses on the Efficiency of Markets and the Incidence of Mergers.

Puri, M., Zarutskie, R., 2012. On the Life Cycle Dynamics of Venture-Capital- and Non-Venture-Capital-Financed Firms. J. Finance 67, 2247–2293. https://doi.org/10.1111/j.1540-6261.2012.01786.x

Rechbauer, M., 2017. Identifying Firms‘ Tax Loss Carry-Forward Status - The Accuracy of Database-Driven Methods.

Schmidheiny, K., Siegloch, S., 2019. On Event Study Designs and Distributed- Lag Models: Equivalence , Generalization and Practical Implications (No. 12079), IZA Discussion Paper.

Schwienbacher, A., 2008. Innovation and Venture Capital Exits. Econ. J. 118, 1888–1916.

Shepherd, B., 2016. The Gravity Model of International Trade: A User Guide (An updated version). United Nations publication.

Silva, J.M.C.S., Tenreyro, S., 2006. The log of gravity. Rev. Econ. Stat. 88, 641–658.

Sun, L., Abraham, S., 2021. Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. J. Econom. 225, 175–199. https://doi.org/10.1016/j.jeconom.2020.09.006

Sureth-Sloane, C., Vollert, P., 2009. Verschärfung der Verlustabzugsbeschränkung durch § 8c KStG und deren Einfluss auf den Erwerb von Anteilen an Kapitalgesellschaften.

Tax Working Group, 2018. Future of Tax. Interim Report.

Van Praag, C.M., Versloot, P.H., 2007. What is the value of entrepreneurship? A review of recent research. Small Bus. Econ. 29, 351–382. https://doi.org/10.1007/s11187-007-9074-x

Ward, F., McVeagh, R., Young-chan, J., 2021. New Zealand set to introduce new business continuity test for tax loss carry-forward rules. Int. Tax Rev.

Zwick, E., 2021. The Costs of Corporate Tax Complexity. Am. Econ. J. Econ. Policy 13, 467–500. https://doi.org/10.1257/pol.20180406

Web References

FAZ (19.10.2020), Impfen gegen Corona. „Das wird noch einige Jahre dauern, fürchte ich“, available online at https://www.faz.net/aktuell/wirtschaft/unternehmen/wie-helmut-jeggle-ueber-die-biontech-aktie-denkt-17007068.html (22.12.2021).

NVCA (n.d.), NVCA Cheers Prioritization of Startup Loss Carryforward Rule Reforms, available online at https://nvca.org/pressreleases/nvca-cheers-prioritization-startup-loss-carryforward-rule-reforms/ (22.12.2021).

Databases

[dataset] InvestEurope (2019). Annual European private equity activity statistics, update April 2019. Available upon request from www.investeurope.eu/research (31.07.2019).

[dataset] EIF (2020). EIF for SMEs. Small and medium-sized enterprises supported by the European Union. Freely available from https://www.eif4smes.com/ (30.10.2020).

Download ZEW Discussion Papers:

https://www.zew.de/en/publications/zew-discussion-papers

or see:

https://www.ssrn.com/link/ZEW-Ctr-Euro-Econ-Research.html
https://ideas.repec.org/s/zbw/zewdip.html

IMPRINT

ZEW – Leibniz-Zentrum für Europäische Wirtschaftsforschung GmbH Mannheim
ZEW – Leibniz Centre for European Economic Research

L 7,1 · 68161 Mannheim · Germany
Phone +49 621 1235-01
info@zew.de · zew.de