The Value of a Loss: The Economic Impact of Restricting Tax Loss Transfers*

Anna Theresa Bührle† Elisa Casi‡ Barbara Stage§
Johannes Voget¶

This version: May 2022

- Preliminary version, please do not cite or distribute without permission of the authors -

Abstract

This paper examines the economic consequences of anti-loss trafficking rules, which disallow the use of loss carry-forwards after a substantial change in ownership or activity. For our empirical analysis, we exploit 17 changes in legislation and data on Merger and Acquisition (M&A) deals in the EU28 Member States and Norway from 1998 to 2019. Using a stacked cohort difference-in-differences design around a change in the anti-loss trafficking rule, we find that limiting the transfer of tax losses impacts the market for corporate control. We document that such rules affect the number of deals and the acquisition value of the targets, which is supported by the idea that limiting the loss transfer decreases the value of accumulated loss carry-forwards. Further, the detected impact on the market for corporate control has important economic consequences. We find that loosening restrictive anti-loss trafficking rules positively affects firm entrant survival rates and improves industry-level performance, measured by mean return on assets, average productivity and number of zombie firms. Further analysis suggest that the effect is mainly driven by anti-loss trafficking rules discouraging risk-taking and thus potentially innovative activities. Overall, our study offers important policy implications on the desirability of anti-loss trafficking rules.

JEL classification: G34, H25, H26

Keywords: M&A, loss carry-back/-forward, anti-loss trafficking rules, productivity

*Acknowledgements: We appreciate the valuable suggestions and comments from Jennifer Blouin, Philipp Dörrenberg, Mohammed Mardan, Martin Jacob, Steffen Juranek, the seminar participants at Norwegian Center for Taxation, NHH Norwegian School of Economics, WHU, the University of Mannheim, and the audience at the EAA Annual Congress, at the MannheimTaxation Campus Meeting, NTA Annual Conference, and XVI International Accounting Research Symposium. We gratefully acknowledge the financial support from the Graduate School of Economic and Social Sciences of the University of Mannheim and the Leibniz Science Campus MannheimTaxation.

†ZEW Mannheim and University of Mannheim; theresa.buehrle@zew.de

‡Norwegian School of Economics (NHH) and ZEW Mannheim; elisa.casi@nhh.no

§WHU - Otto Beisheim School of Management and ZEW Mannheim; barbara.stage@whu.edu

¶University of Mannheim; voget@uni-mannheim.de

1 Introduction

A well-functioning market for corporate control is an essential driver for economic growth. Ownership rights are frequently reallocated by means of mergers and acquisitions (M&As), potentially leading to the redesign of the target's organizational structure. An efficient allocation of control and performance monitoring can substantially shape firm productivity (Braguinsky et al. (2015); Cole et al. (2016); Harris and Robinson (2002); Li (2013)). For good or for bad, several countries around the world have implemented so-called anti-loss trafficking rules with the aim of preventing tax loss-driven M&As. In this paper, we exploit spatial and time series variation in anti-loss trafficking rules to assess the impact and economic consequence of such regulations, i.e., the effects on M&A activity and industry performance.

Loss firms form an

Overall, firms' investment decisions can be shaped by tax loss regulations in several ways. One reason is the asymmetric treatment of losses and profits in most tax systems. Profits are taxed immediately, whereas losses can only be deducted against past profits (loss carry-back, LCB) or future profits (loss carry-forward, LCF). Especially, relaxing the asymmetric treatment of tax losses has been found to encourage risky investments (Langenmayr and Lester (2018); Ljungqvist et al. (2017)), affect firm performance (Olbert (2021) and stimulate innovation (Guceri (2020)). At the same time, empirical findings suggest that allowing for LCBs could lead to over-investment (Bethmann et al. (2018)).

Losses are also relevant in the context of M&A deals. They represent a valuable asset to reduce the overall corporate tax burden post-deal (Auerbach and Reishus (1988)). In this regard, a well-established tax planning strategy is to acquire an unprofitable target with low to no economic activities but large loss carry-forwards. The target's accumulated losses are then offset against earnings from other, profitable companies within the acquirer's group. These tax-induced distortions might result in an inefficient allocation of ownership. This is why legislators aim to prevent tax-motivated transactions with rules that restrict the offset of losses if a substantial change in ownership and/or activity occurs.[1] Anecdotal evidence indicates that the enforcement of anti-loss trafficking rules, or their temporary suspension (such as during the financial crisis in the US), substantially affect M&A transaction values.[2] Not surprisingly, companies take real actions to avoid such rules as demonstrated by the existence of net operating loss (NOL) poison pills (also known as net operating loss preservation plan) which effectively limit the possibility of a ownership change if there is a risk of triggering the anti-loss trafficking rules (see Sikes et al. (2014)).[3]

[1] Substantial changes in ownership are often defined as ownership changes above 50 percent of equity or changes in control. Changes in activity can be tied to financial statement figures or target markets, or a general reference that often provides considerable room for interpretation.

[2] For some examples collected from the news and court cases, please refer to Appendix C.

[3] The interest around NOL poison pills increased substantially during the COVID pandemic given the combination of depressed stock prices and significant raise in NOL carryforwards, see Julie et al. (2020).

So far, empirical evidence shows that the tightening of such tax loss transfer restrictions reduces the market value of loss-carrying corporations (Moore and Pruitt (1987)) and can impair venture capitalist funding (Bührle (2021)). In this paper, we study how the existence of such rules affects the market for corporate control.

Despite the intuitive relevance of anti-loss trafficking rules for acquisition decisions, so far no systematic evidence has been provided on the importance of tax loss transfer restrictions as an inhibiting factor for M&A activity and industry productivity. One particular challenge has been the lack of institutional data, which are essential for an empirical analysis. Anti-loss trafficking rules constitute a narrow part of corporate tax law and are insufficiently documented in commonly used databases (e.g. PwC tax summaries or IBFD tax research platform), where they are usually described on a very general basis if mentioned at all. Instead, we rely on specific tax guides and the national tax codes themselves.[4] The collected data provides us with very detailed information on the anti-loss trafficking rules across the EU28 Member States and Norway for every legislative change from 1998 up to 2019. We exploit cross-country and time series variation in anti-loss trafficking rules to evaluate the importance of restricting the transfer of losses as a driver of takeover activity and related economic outcomes.

First, we study whether anti-loss trafficking rules impact M&A activities. Losses in an M&A target can in principle be used to reduce the overall corporate tax burden in the acquirer's group after the transaction (Auerbach and Reishus (1988)). If the transfer of accumulated losses is restricted in case of an ownership change, the tax asset does not carry any value for the acquirer. This reduces the price the acquirer is willing to pay for the target but not the reservation price of the seller. As a result, profitable deals might still take place but at lower acquisition prices and marginally profitable deals might be cancelled.

Second, we study the industry level economic effects of anti-loss trafficking rules. If the willingness to acquire a target with losses is reduced post tax loss transfer restriction, the related economic consequences are ambiguous. On the one hand, countries introduce anti-loss trafficking rules to prevent tax-motivated transactions which lack economic substance. Thus, the introduction or tightening of such rules can lead to higher quality M&As and, consequently, an improvement in the average productivity of the acquired firms post-deal. On the other hand, restricting the possibility of a loss transfer in case of ownership could lead firms in distress to liquidate too early. For example, loss transfer restrictions have been shown to deteriorate venture capital funding of start-ups (Bührle (2021)). Furthermore, discouraging ex-ante to the loss risk-taking (and thus potentially innovative activities) might lead to the reduction of the overall industry performance in a country. Model theoretically it can be shown that in the presence *and* the absence of anti-loss trafficking rules tax loss assets can distort MA decisions (Erickson et al. (2019)). Overall, the economic effect of anti-loss trafficking rules thus remains an empirical question, which we address

[4]See Bührle and Spengel (2020) for details of the regulatory framework.

in this study.

We begin our analysis by studying whether a country's decision to introduce or change anti-loss trafficking rules explains cross-country differences in M&A activity. For this purpose, we combine the institutional information with micro-level data from over 58,000 M&A deals in the EU28 member states and Norway in the period 1998-2019. To quantify the effect of anti-loss trafficking rules on takeover activities, we rely on a stacked cohort difference-in-differences research design exploiting major regulatory changes. Due to the staggered implementation of these reforms over the sample period and a comprehensive set of control variables,[5] our empirical identification resembles a quasi-experiment similar to the one in Baugh et al. (2018) or Fuest et al. (2018). This setup allows us to use country and year fixed effects to control for unobserved time- and location-specific effects. We find that the number of M&A deals is statistically and economically significantly affected by anti-loss trafficking rules (a change of about 17%). The results we document so far provide the first empirical evidence that limiting the transfer of losses represents an important factor for corporate M&As.

The second part of our analysis focuses on the consequence of anti-loss trafficking rules for overall industry productivity. On the one hand, if the regulations impede valuable M&A deals by deterring higher-risk investments (e.g., by start-up firms), they could lead to an overall decrease in industry productivity. On the other hand, if they hinder solely tax driven M&As, they could lead to increased industry productivity on average. To test the effect of anti-loss trafficking rules on industry productivity, we conduct an industry-level difference-in-differences analysis in two different country-industry data sets. Our specification includes country-industry and industry-year fixed effects. Therefore, differences in performance due to industry trends and time-invariant industry-country characteristics are eliminated. Our specification allows to compare the effect of a change in anti-loss trafficking rules within industries between treated countries and counterfactual industries from the same industry-year in non-treated countries. First, we rely on data on entrant survival rates from Eurostat for the years 2004-2019. We measure whether young entrants are more likely to exit or stay in the market with changes in loss regulation. We find that the survival rate decreases (increases) by about 6% (8%) after tightening (loosening) of loss transfer regulations. Second, we aggregate firm performance measures for the whole population of EU firms from Orbis for the years 1998-2019 at the industry level. Here, we evaluate the effect on industry productivity overall. We find significant changes in productivity, return on assets (ROA), and share of zombie firms at the industry level. Tightening of the regulations leads to a decrease in productivity by 70% and in ROA by 3% while loosening of the rules leads to an increase in productivity by 31% and a decrease in the share of zombie firms by 1%.

We proceed by restricting our sample to firms that are 5 or less years old and we split the sample into those that are more versus less innovative (captured by being in a high-tech industry or by

[5] We discuss possible confounding events in the appendix.

having above median level of R&D expenses). We show that the negative impact of changes in anti-loss trafficking rules is particularly strong for industries with high concentration of young innovative firms supporting the hypothesis that restricting the transfer of losses discourages risk-taking and thus potentially innovative activities.

Our study contributes to the rich literature on the determinants of M&A activity. Prior studies by Rossi and Volpin (2004), Erel et al. (2012), John et al. (2015), Cao et al. (2019), and Dessaint et al. (2017) show that economic and institutional factors such as international trade integration, financial reporting quality, political uncertainty and regulations on shareholder and employment protection can substantially shape the market for corporate control. We shed light on the impact of tax-related incentives on takeovers. We know that taxes affect the decision to acquire a target (e.g., Di Giovanni (2005); Arulampalam et al. (2019); Feld et al. (2016)) and deal values (e.g. Kaplan (1989); Ayers et al. (2003); Huizinga et al. (2012)). However, evidence on the effect of anti-loss trafficking rules is limited to the effect on the market value of listed corporations (Moore and Pruitt (1987)) and start-up financing (Bührle (2021)). We offer evidence on the broader economic outcomes of anti-loss trafficking rules.

Moreover, we provide results which have important policy implications. The Covid-19 crisis resulted in a massive negative economic shock, and triggered unprecedented quick policy responses from governments around the world.[6] Among the variety of measures introduced so far, tax incentives represent valuable tools to mitigate the immediate liquidity crunch firms and households are experiencing. Fiscal measures can also alleviate potential long-term economic crises resulting from the temporary shutdown of corporate activities and from the widespread restrictions on travel and mobility (Collier et al. (2020)). Specifically, one important policy tool at disposal of governments around the world is to change the rules related to tax loss deductions.[7] Besides increasing the generosity of the LCB, relaxing the restrictions on the transfer of tax losses in case of substantial changes in ownership could be considered. Indeed, M&A activities experienced a strong comeback in 2020.[8] One can expect that an important portion of such deals involves firms with losses. Evidence suggests that the introduction of anti-loss trafficking rules might have negative effect on entrepreneurship, when considering start-up funding (Bührle (2021)). We take a broader approach and test the economic consequences of such a policy tool on the market for corporate control as a whole. In this way, our study timely informs policymakers on the desirability of restricting the transfer of tax losses.

The remainder of this paper is organized as follows. Section 2 provides the institutional back-

[6] OECD (10 June 2020) Evaluating the initial impact of Covid-19 containment measures on economic activity, available at: https://read.oecd-ilibrary.org/view/?ref=126_126496 − $evgsi2gmqjtitle = Evaluating_the_initial_impact_of_COVID-19_containment_measures_on_economic_activity$

[7] see https://home.kpmg/xx/en/home/insights/2020/04/oecd-tax-developments-in-response-to-covid19.html

[8] see https://webcache.googleusercontent.com/search?q=cache:VH0D6DbmMWIJ:https://www.bloomberg.com/news/articles/2020-12-24/m-a-deals-come-roaring-back-as-executives-plot-post-covid-future+&cd=1hl=it&ct=clnk&gl=de&client=tfirefox-b-e

ground. Section 3 develops the hypotheses. Section 4 presents the research design, including empirical strategy, the data and sample selection. Section 5 describes the results. Section 6 concludes.

2 Institutional background

For tax purposes, the majority of the European countries treat losses asymmetrically.[9] Profits are subject to taxation, whereas losses do not immediately result in a tax refund. The offset of losses for tax purposes is subject to several restrictions. Intra-periodic offset can be restricted to the same source of income that generated the losses (so-called horizontal loss offset). This is often the case for capital losses. Business losses can usually also be offset against profits from other sources (so-called vertical loss offset).

If losses cannot be offset in the same period, they have to be carried over to other periods in the past (LCBs) or future (LCFs). 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 (Amir and Sougiannis (1999)). The value of these tax assets depends on the expected time needed to offset them against positive income. Longer time horizons embody higher risk and lower present values of current losses. Inter-periodic loss offset is also subject to several restrictions. First, temporal and/or absolute restrictions limit the amount of losses that can be offset in a given year. All countries that allow for a LCB limit the amount of years loss can be carried back to. The variation in temporal restrictions for LCFs ranges from five years to no time limit. Absolute restrictions are usually expressed in a specified percentage above an allowance. As a result, companies with large LCFs cannot reduce their full taxable income and are obliged to pay taxes on the residual (so-called minimum taxation). Second, events such as a change in ownership or activity trigger anti-loss trafficking rules which can lead to the forfeiture of accumulated tax LCFs. Absent tax loss transfer limitations, unprofitable corporations with high LCFs can be acquired and merged with profitable firms to set off the otherwise worthless losses. The restrictions aim to prevent loss trafficking; in other words, the acquisition of shell companies with significant LCFs but which lack any other economic rationale. Legislators deem these transactions abusive as the sole purpose is the transfer of the tax assets.

In 2019, 20 of the EU28 Member States had anti-loss trafficking rules, with substantial variation in design across countries (Bührle and Spengel (2020)). Abuse is blanketly assumed based on codified criteria. The burden of proof of the opposite rests upon the taxpayer. The provisions commonly refer to a significant change in ownership and/or a change in activity as triggering

[9] Exceptions are Estonia (already for decades) and Latvia (since 2018). In their tax systems, corporate tax is levied upon distributions only, thus rendering tax loss restrictions irrelevant. Also outside the European Union (EU), asymmetric treatment of profits and losses is the general rule (e.g. in large economies such as the United States, Canada or China).

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. We differentiate between different types of anti-loss trafficking rules. Cumulative regulations require a change in ownership and connected change in activity. If there is either only a change in ownership or only a change in activity, this type of restriction is not triggered. Alternatively rules can mandate the forfeiture of losses after a change in activity independent of any changes at the ownership level. A third type of anti-abuse regulation relies solely on a change in ownership. Fourth, countries that relate their loss transfer restrictions to either a change in ownership or a change in activity pose the most restrictive rules, as the fulfillment of either criterion is sufficient.

3 Hypotheses development

3.1 M&A activity

Losses in an M&A target can in principle be used to reduce the overall corporate tax burden in the acquirer's group after the transaction (Auerbach and Reishus (1988)). If accumulated losses are lost due to the change in ownership, the tax asset does not carry any value for the acquirer. Thus, the acquirer's willingness to pay is reduced. The reservation price of the seller on the other hand does not change, as the losses remain with the target as long as the M&A deal does not take place. The denial of loss transfer could lead to a negative difference in marginal prices preventing M&A deals in cases where the marginal price of the buyer is only slightly larger than the marginal price of the seller absent the tax loss transfer restriction (Sureth-Sloane and Vollert (2009)). If the expected synergies are sufficiently high for the acquirer, deals will still be conducted (Sikes et al. (2014)). Thus, we formulate our first hypothesis as follows:

Hypothesis 1: M&A activity in a country is reduced in response to the introduction or tightening of anti-loss trafficking rules.

3.2 Industry productivity

In the following we discuss how firms' investment decisions and ultimately industry productivity are affected by tax loss treatment in general and by anti-loss trafficking rules in particular. The seminal theoretical literature (Auerbach (1986), Auerbach and Poterba (1987)) demonstrates that firm's decision calculus varies depending on whether a firm did not experience a loss yet (ex-ante loss world) or it already experienced a loss (ex-post loss world).

In the ex-post loss world, anti-loss trafficking rules affect the matching of acquirers and targets with accumulated loss assets in M&As. M&As will increase industry productivity if they generate synergies, that is if they lead to improved capital allocation in the market. In the following, we argue why ex-post, both, tightening and loosening of anti-loss trafficking rules can either improve or distort capital allocation through M&As.

On the one hand, anti-loss trafficking rules prohibit purely tax-driven M&A transactions discouraging capital misallocation and, thus, improving industry productivity. Without anti-loss trafficking rules, losses constitute assets in the M&A deals (Auerbach and Reishus (1988)). Acquirers with more income to shelter against taxation will be able to use losses better than others, and thus will offer ceteris paribus higher prices. This can even apply for cases where pre-tax synergies between the acquirer and target may be lower. The acquirer with positive income can either use the target to shelter its own income or to hold passive investment income (Erickson et al. (2019)). With no limitation on the transfer of losses, even M&As with negative pre-tax synergies can be attractive for firms as long as the value of the losses to the acquirer is sufficiently high.[10] This affects industry productivity, since the high-income-low-synergy acquirer will operate the targets assets less efficiently than an acquirer with higher synergies. The ability to transfer losses may therefore reduce productivity when compared to the scenario without transferable losses. Bethmann et al. (2018) provide evidence consistent with the hypothesis that the alleviation of asymmetric tax loss treatment leads to overinvestment, capital misallocation and reduced industry productivity. This effect will be strongest if the ability to transfer losses implies a continued survival of firms that have less capable business's management and are generally financially constrained (Auerbach (1986), Bethmann et al. (2018)). Firms that are kept alive despite low productivity and high financial constraints and which cause congestion in the market for high productivity firms are sometimes referred to as zombie firms (see, e.g., Caballero et al. (2008), McGowan et al. (2017)).

On the other hand, anti-loss trafficking rules may equally apply to non-tax-driven acquisition and can then lead to reduced industry productivity. That is because anti-loss trafficking rules put a wedge between buyers and targets reservation prices which inhibits the realization of synergies via M&As.[11] Furthermore, the possibility of financing through acquisitions can, in well-governed

[10] This can be shown on a simple numerical example (taken with slight adaption from Erickson et al. (2019), who generalize this example in a parsimonious model in their appendix): Assume a target with $100 in usable net operating losses (NOLs) and poor future economic outlook that expects to generate $ 60 in net present value terms. Let the tax rate be 50%. If the corporation stays independent, it will generate taxable income of $0. While after tax profits will be $60, pre-tax income will be too small to use all its NOLs. Now, assume a buyer without NOLs with future taxable income of $80 and consequently after-tax income of $40. The combined after-tax income is therefore $100. In case of no limitations on NOL use, the acquisition would lead to an increase of combined after-tax income to $ 120 ($80+$60-($80+$60-$100) *0.5), if there are no synergies generated from the merger. Even if we assume negative synergies, i.e., value destruction, of -$20 the combined after tax income would be $110 ($120-($120-$100)*0.5). Thus, despite negative synergies the combined company will generate a larger after-tax income from the merger.

[11] We can show this again in a simple numerical example (taken with slight adaption from Erickson et al. (2019), who generalize this example in a parsimonious model in their appendix): Suppose a target has NOLs in amount of $100 and can use after a merger only 30% ($30) of such. Further, assume that the merger will generate synergies of

loss firms (i.e., that are subject to idiosyncratic losses), improve investment in high NPV-projects. This may be especially relevant for firms which invest in high risk-return projects, such as young and innovative start-ups. For example, Bührle (2021) demonstrates a negative effect of anti-loss trafficking rules on venture capital funding of start-ups and shows that the effect is especially strong for R&D intense companies. Young risk-prone firms (i.e., with higher probability of losses) represent a key driver for innovation, productivity growth and job creation (Decker et al. (2014) Haltiwanger et al. (2013); Adelino et al. (2017)). Therefore, the overall effect of anti-loss trafficking rules ex-post to the loss on industry productivity remains uncertain.

Moreover, ex-ante to the loss, anti-loss trafficking rules affect firms' decisions and, therefore, overall industry productivity. Ex-ante to the existence of a loss, firms will consider the effects of potential (tax) losses when making investment decisions, by considering the probability of a loss and its effect on investment returns (Auerbach (1986)). From the analytical and empirical literature, we know that tax loss treatment affects the risk-return profile of investments, such that (dis-)allowing the tax deductibility of losses encourages (discourages) risky investments (e.g., Langenmayr and Lester (2018); Ljungqvist et al. (2017)). Higher-risk investments mean higher return volatility, i.e., higher dependence of the expected return on the tax loss treatment. Therefore, the government discourages risky investments (relative to the no-tax scenario or neutral taxation) when disallowing tax deductibility of losses (see Domar and Musgrave (1944), Stiglitz (1969), Auerbach (1986)). By allowing the loss deductibility for tax purposes, the government shares the risk with the firm and thus encourages more risk taking when the firm is facing different investment decisions.[12] Consistent with this view, Ljungqvist et al. (2017) find that firms reduce risk-taking when carryback periods are shortened, and increase risk-taking when carryforward periods are extended. Langenmayr and Lester (2018) also show that allowing loss carryforwards and carrybacks increase risk-taking in large business. Similarly, one can expect that firms which may be future M&A targets consider the regulations on loss transferability when evaluating the risk-return profile of their investments (Auerbach and Reishus (1988)). Thus, ceteris paribus the presence of anti-loss trafficking rules should lead firms to choose lower-risk investment projects.

Furthermore, young and growing firms that rely on equity investors (venture capitalists) should consider the anti-loss trafficking rules in their investment calculus ex-ante to incurring a loss. As highlighted above, ex-post to the loss, financing opportunities for start-ups will be limited if they can rely less on venture capitalist funding. Ex-ante to the loss, start-ups should therefore choose less risky investments to mitigate the probability of losses if anti-loss trafficking rules are in place.

\$20. The combined pre-tax income of target and acquirer as standalone firms shall be \$140. It will then be increased to \$160 due to the merger. Nevertheless, the merger is not beneficial, as the combined after tax income of the target and acquirer pre-merger would be \$100 (\$60+\$80-(\$80*0.5)), while after merger the NOLs will be lost and therefore combined after tax income will reduce to \$95 (\$160 - (\$160-\$30) * 0.5).

[12] Full neutrality of the income tax system with regard to losses would require immediate tax refunds in case of loss occurrence.

Tightening of anti-loss trafficking rules therefore affects entire business models inducing increases in exit and decreases in entry of such young innovative companies. Anti-loss trafficking rules could ultimately lead to underinvestment in new technologies, which carry higher risks. At the same time, the absence of anti-loss trafficking rules could lead to overinvestment, i.e., risky investments being made by less productive firms, if the expected future losses have the potential to increases the value of a company in an M&A deal with a profitable firm, although the firm anticipates that it will never be able to offset the losses against profits in other periods. We conclude that from the ex-ante perspective, anti-loss trafficking rules reduce firm risk taking, which may increase or decrease industry productivity.

Ultimately, we are interested in the overall productivity effects of anti-loss trafficking rules. Asset misallocation, changes in firm risk taking and the financing conditions of startups have economy wide effects. On the one hand, loosening of anti-loss trafficking rules can lead to improved capital allocation, more technology investments and start-up entry. This will also put incumbents under pressure to innovate and, thus, in total improve overall productivity (McGowan et al. (2017)). On the other hand, loosening of anti-loss trafficking rules might instead induce less productive firms to overinvest (ex-ante) and fosters the continued survival of losers (ex-post). The continued survival of losers leads to asset misallocation, which by occupying valuable capital from use in more productive firms (e.g., Ma et al. (2021)), inflating wages and reducing market prices (McGowan et al. (2017)) further indirectly induces decreased industry productivity. In so far, loosening of anti-loss trafficking rules may lead to misallocation in particular in economies with less investment opportunities or with a large presence of inefficient firms. Which effect is dominant is an empirical question.[13]

From these arguments we derive the following testable hypothesis:

Hypothesis 2a: Industry performance in a country changes in response to the introduction or tightening (loosening) of anti-loss trafficking rules.

Hypothesis 2b: In young R&D-intense firms performance changes more in response to the introduction or tightening (loosening) of anti-loss trafficking rules.

[13]Depending on the type of regulation, the effect on productivity could differ. Ownership-based regulation will prevent tax-driven transactions. However, the strict regulations could unintentionally obstruct economically justified transactions. Cumulative regimes could equally hinder some tax-motivated M&As, but provide more leniency for transactions where the acquired company maintains its business activities. In this case, transactions with sound economic reasons would be less affected. Yet, buyers could invest in firms only to benefit from the loss offset, as long as the activity of buyer and target firm is aligned. Thus it remains ambivalent, if tightening or introduction of anti-loss trafficking rules lead to an improvement of the overall industry performance in a country.

4 Empirical strategy

4.1 Empirical specification

To investigate the effect of anti-loss trafficking rules on M&A activity and industry performance, we implement a stacked cohort difference-in-differences design following the approach of Cengiz et al. (2019) (see also Baker et al. (2022)). The estimation datasets throughout our analysis are calculated as follows. We construct a separate cohort dataset for each treatment event, where the treatment event is defined at year-level. In each cohort dataset, the treated group is composed of countries that change the anti-loss trafficking rule in the year corresponding to the treatment event while the control group is composed of countries that change the anti-loss trafficking rule in subsequent years or never in our sample period. We restrict observations in each cohort dataset to the five years pre- and post-changes in the treated countries. In the following subsections, we provide a detailed explanation of the regression equation for each test, which we run on the stacked cohort dataset.

4.1.1 M&A activity

To estimate the effect of anti-loss trafficking rules on M&A activity (Hypothesis 1), we exploit 17 changes in the design of regulations within countries over time. The staggered implementation (or modification) of rules allows us to control for common unobserved confounding factors at the country level that do not change over time and observed time-variant country-specific factors and alleviates the effects of EU economy-wide events that may confound single country-changes.

First, we adopt a stacked difference-in-differences identification strategy to obtain a comprehensive measure of the average effect:

$$M\&A_{ct} = \alpha + \beta_1 * LossChange_{ct} + \rho * Controls_{ct} + \sigma * FE_c + \delta * FE_t + \epsilon_{ct}. \quad (1)$$

c stands for country and t for year. M&A is either the logarithm of the number of M&A deals, the logarithm of the sum of M&A deal values or the logarithm of the mean of M&A deal values, aggregated at the country level by year. In the spirit of Dessaint et al. (2017), we construct a treatment indicator that takes value of 1 (-1) if a country tightens (loosens) anti-loss trafficking rules. Thus, the indicator variable of interest, $LossChange_{ct}$, increases (decreases) by 1 if a country tightens (loosens) anti-loss trafficking rules. The value does not change the following years as long as the regulations stays in place.[14] Standard errors are clustered at the country-year-cohort level, the level of treatment variation. Our fixed effects include country and year fixed effects (within cohort). Our country-level control variables include the lagged log of GDP, lagged GDP growth,

[14] Alternatively, we calculate the effects of law tightening and loosening in two separate indicator variables ($LooseningATLT/LooseningATLT$). However, due to the limited number of observations in the country-level analysis, we prefer for reasons of statistical power to conduct our main tests with only one treatment.

the log of population, lagged inflation, a country's audit quality, a dummy for EU membership, the annual growth rate of value added of the services sector in percentage of GDP, trade openness and the corporate tax rate. We add controls for tax loss regulations, namely, a dummy for the presence of loss carry-forward or loss carry-back regulations (LCF, LCB), and a dummy that controls for escape rules present in the anti-loss trafficking rules.

Second, we investigate the dynamic effects over time in an event study, analyzing multiple and repeated events in the panel:

$$M\&A_{ct} = \alpha + \sum_{m=-4}^{4} \gamma_m * Treat_{cm} + \rho * Controls_{ct} + \sigma * FE_c + \delta * FE_t + \epsilon_{ct} \tag{2}$$

The variables are defined as in equation 1. We include the treatment at event time as well as three leads and lags of the treatment indicator ($Treat$). The treatment indicators are binned at endpoints, such that t-4 would indicate treatment at time t-4 and all previous years and t+4 would indicate treatment at t+4 and all following years.[15] Hence, we do not interpret the coefficients for t-4 and t+4. Coefficients are normalized to zero based on the level in the period preceding the treatment (t-1).

4.1.2 Industry performance

To estimate whether overall industry performance in a country does change in response to the introduction or tightening of anti-loss trafficking rules (Hypothesis 2), we take our analysis to the industry level (within country) and replace our outcome variables for indicators of industry performance.

The difference in differences specification takes the following form, where variables are as defined above and controls are the same as in Equation 1:

$$\begin{aligned} Performance_{ict} = \alpha + \beta_1 * LossChange_{ct} + \rho * Controls_{ct} \\ +\zeta * Controls_{ict} + \sigma * FE_{ic} + \delta * FE_t + \epsilon_{ict}. \end{aligned} \tag{3}$$

i stands for industry, all other indices are as defined in Equation 1. The indicator of interest is $LossChange_{ct}$ as defined in Equation 1. To show the effects separately for tightening and loosening of the regulation, we construct two separate treatment indicators, one that takes value of 1 if a country tightens anti-loss trafficking rules and the other takes value of 1 if a country loosens anti-loss trafficking rules, and zero otherwise ($Tightening, Loosening$). We use different measures for industry performance and productivity. To measure the performance of young entrants, we look at changes of the survival rate of entrants by industry where we consider as entrant, firms of four

[15] Binning is done to control for bias introduced by samples that are unbalanced in event time (in cases of staggered treatment dates).

(five) years of age and take the ratio of surviving entrants to all entrants of that age group in its logarithm. To measure the impact on industry productivity over the whole industry, we employ changes in the industry-country mean in return on assets (ROA), in productivity measured as residuals of a standard log-linear Cobb-Douglas production function (as in, e.g., Bethmann et al. (2018)) and in the share of zombie firms measured as in Adalet McGowan et al. (2018). We control for the logged sum of total, fixed and cash assets in addition to the country-level control variables used in Equation 1.[16] Our specification includes country-industry and industry-year fixed effects at the cohort level.

The fixed effects structure in this country-industry analysis allows estimating the performance effect on the country-industry pre- versus post-treatment (first difference) relative to counter factual industries from the same industry-year in countries that are not treated (second difference) (within cohort). Differences in performance due to industry trends and time-invariant industry-country characteristics are eliminated. Controlling for other time variant factors that influence the investment decisions in the same industry, any remaining change in the treated versus the control country should be attributable to the change in anti-loss trafficking rules.

As in Equation 2, to investigate the dynamic effects, we employ separate pre- and post treatment dummies for three periods, respectively, and bin at t=4/-4:

$$Performance_{ict} = \alpha + \sum_{m=-4}^{4} \gamma_m * Treat_{cm} + \rho * Controls_{ct} + \zeta * Controls_{ict} + \sigma * FE_{ic} + \delta * FE_{it} + \epsilon_{ict} \tag{4}$$

All variables are defined analogously to the ones in Equation 2 and Equation 3.

4.2 Data

Data on anti-loss trafficking rules: Information on anti-loss trafficking rules across the EU28 Member States and Norway is hand-collected using the IBFD tax research platform as well as the respective country's tax code. While the specific design of the restrictions differs across countries, the regulations can be broadly categorized based on their reliance on changes in ownership and activity and ranked by strictness (Bührle and Spengel (2020)). Ownership-based regimes that apply after a substantial change in the shareholder structure are the harshest types of regimes. Cumulative regimes, where in addition to the ownership criteria a substantial change in activity has to occur for losses to be denied, are less restrictive. Table 1 in the appendix provides an overview over the different regulations. During the period considered in our analysis, we observe a total of 17 changes in legislation in eleven countries. Eight times regulations were tightened and nine times restrictions were relaxed. On the one hand, more countries introduced anti-loss trafficking rules

[16] We cannot control for total, fixed and cash assets when testing the survival rate because of data restrictions from EUROSTAT.

over the years. On the other hand, existing regulations became less restrictive, in other words the bar for losses to be denied after a transaction was set higher.

Data on M&A deals: The sample for the first part of our analysis is based on observations drawn from Zephyr over the years 1998-2019. We begin with a sample comprising 183,444 M&A deals in the EU28 Member States and Norway. Given the restrictions on anti-loss trafficking rules application, we exclude listed target companies and takeovers where the total acquired stake is below 50%. Our final sample consist of 58,394 M&A deals for 54,391 unique targets. For the purpose of our analysis, we aggregate deals at country level and drop countries in which we observe only less or equal to 3 deals over our sample period, [17] resulting in a total of 440 country-level observations. Finally we build a stacked sample as described above with 1,704 country-level observations. The sample selection steps are displayed in Table 2.

Data on industry-country variables: We construct an industry-country panel for the whole population of EU firms combining data from Orbis for the years 1998-2019 and Eurostat for the years 2004-2019. For the Orbis data, we gather information from discs 2008-2019. We begin our sample by selecting all firms located in the EU28 Member States and Norway. We consider both listed and unlisted firms and obtain financial statement information at unconsolidated level. We exclude companies from financial and extracting industries or with negative total assets, employees, sales or tangible fixed assets, and drop missing observations. We then collapse our data at country-industry-year level. We drop all country-industries with less than 50 firms. Then, we build the stacked data set as described above.[18] Our final stacked sample consist of 18,658 country-industry-year observations, where industry level is at the NACE 2 digit level. For Eurostat, the data are gathered from the Business Demography Database.[19] From this data set, we obtain data on the survival rate for the total population of firms in each EU country aggregated by country-industry-year (also at the NACE 2 digit level).

Data on control variables: The control variables are collected from various sources. Macro data on GDP, inflation, trade and value added are taken from the World Bank. Population data stems from the United Nations. Moreover, statutory corporate tax rates are obtained from the European Commission. Finally, the audit and reporting quality indicator is taken from the Global Competitiveness Report conducted by the World Economic Forum. We define a dummy equal to one if a country is an official member of the EU in a given year and zero otherwise.

We present the summary statistics for the key variables in Table 3 (at country level) and Table 4 (at industry level).

[17] The country with least deals in our final sample is Norway, in which we observe 48 deals over the entire sample period. In unreported analysis, we keep all countries. In this less conservative approach results are more significant and the coefficient size is larger.

[18] For countries with changes outside our sample period, we drop the first five years after a change from our sample.

[19] For more information on the data, see https://ec.europa.eu/eurostat/databrowser/view/bd$_9$bd$_s$z$_c$l$_r$2/$default/table?lang = en$.

5 Main empirical results

Considering the effects on M&A deals, we first show the average effect on the treated in the corresponding difference-in-differences analysis. On the extensive margin, column 1 of Table 5 indicates that the number of deals changes within treated countries relative to within control countries after treatment by about 17%.[20] Column 2 of Table 5 decomposes this effect into the effects from tightenting and loosening of anti-loss trafficing rules. Although coefficients are not statistically different from zero, the results provide suggestive evidence that the effect is driven by changes in both directions; A tightening of anti-loss trafficing rules appears to lead to less deals being concluded while a loosening appears to lead to an increase in deal numbers.

Next, we present the results of the event study analysis displayed in Figure 1. We find no pre-treatment trends in number of deals concluded in treated countries. This observation gives us confidence in the validity of the central parallel-trends assumption, although we cannot test the parallel-trends assumption directly in a difference-in-differences setting. After treatment, we see that the number of deals decreases in years post-treatment within treated countries relative to within control countries, after controlling for observable country factors that affect M&A activity.

We next turn to analysing the effect of the anti-loss trafficking rules on the overall industry performance. The difference-in-differences analysis demonstrates that the average performance effects on treated industries versus control industries is substantial across all outcome variables (see Tables 6 and 7). In table 6, we find a strong impact of changes in anti-loss trafficking rules on survival rates. We decompose the regression coefficient to study the differential effect of tightening and loosening the anti-loss trafficking rules on firm performance. Survival rates of entrants drop by about 6% (increase by about 8%) after tightening (loosening) of regulations in treated industries versus peer control industries in other countries (Table 6). Table 7 shows that the industry level productivity declines by 70% (increases by 31%) after tightening (loosening) of regulations in treated industries versus peer control industries in other countries. The mean ROA declines by 3% after tightening of regulations in treated industries versus peer control industries in other countries but the corresponding results for loosening of the regulations are not significant. Finally, the share of zombies declines by 1% after loosening of regulations in treated industries versus peer control industries in other countries but the corresponding results for tightening of the regulations are not significant.

The dynamic event study analysis shows that changes in anti-loss trafficking rules strongly impact survival of new industry entrants (four or five years of age, Figure 2) and overall industry performance (Figure 3). This effect is immediate and significant in all three post-treatment years. The absence of pre-treatment trends speaks towards the validity of the parallel trends assumption.

In Table 8, we restrict our industry-level analysis to firms that are less than 5 years old (young

[20] $EffectSize = e^{\beta} - 1$.

firms) and study the effect of anti-loss trafficking rules on young firms that are in more versus less innovative industries (capture by being in a high-tech industry or in having high to medium-high levels of R&D intensity[21]). We have no prior on whether the overall effect of the regulation on young firms should be stronger or weaker. In column 1 of Table 8 we find that the coefficient on productivity is only slightly larger for the sub-sample of young firms compared to the full sample. Yet, when further dividing our sample on the level of innovation within an industry, we find that the coefficients of the effect of the changes in regulation on productivity is larger for high-tech and R&D intensive industries compared to those which are not (the difference in coefficients is however not-statistically significant). We confirm the DiD results in a dynamic event study analysis presented in Figure 4. Overall, results suggests that the negative impact of anti-loss trafficking rules on industry performance is driven by the fact that limiting the transfer of losses discourages risk-taking, thus penalizing especially young innovative firms.

6 Conclusion

In this paper, we analyze the economic impact of anti-loss trafficking rules. Our analysis provides evidence that introducing a limitation on the transfer of tax losses reduces the volume and the value of MA deals. Moreover, we find that introducing anti-loss trafficking rules decreases overall industry performance. We find that changes in anti-loss trafficking rules strongly affect firm entrant survival rates, average industry productivity, ROA and the industry share of zombie firms. We find that the negative impact of limiting the transfer of losses is caused by the effect of the regulation on corporate risk taking since results are stronger when exclusively considering young innovative firms.

Overall, our study offers important policy implications on the desirability of anti-loss trafficking rules. This topic is particularly relevant due to the recent strong comeback of MA activities, which likely involves many firms with losses given the damages of the global COVID-19 pandemic.

[21] We define high-tech industry following Kile and Phillips (2009) and R&D intensity based on Galindo-Rueda and Verger (2016).

References

Adalet McGowan, M., Andrews, D., and Millot, V. (2018). The walking dead? zombie firms and productivity performance in oecd countries. *Economic Policy*, 33(96):685–736.

Adelino, M., Ma, S., and Robinson, D. (2017). Firm age, investment opportunities, and job creation. *The Journal of Finance*, 72(3):999–1038.

Amir, E. and Sougiannis, T. (1999). Analysts' interpretation and investors' valuation of tax carryforwards. *Contemporary Accounting Research*, 16(1):1–33.

Arulampalam, W., Devereux, M. P., and Liberini, F. (2019). Taxes and the location of targets. *Journal of Public Economics*, 176:161–178.

Auerbach, A. (1986). The dynamic effects of tax law asymmetries. *Review of Economic Studies*, 53(2):205–225.

Auerbach, A. J. and Poterba, J. M. (1987). Tax Loss Carryforwards and Corporate Tax Incentives. In *The Effects of Taxation on Capital Accumulation*, NBER Chapters, pages 305–342. National Bureau of Economic Research, Inc.

Auerbach, A. J. and Reishus, D. (1988). The effects of taxation on the merger decision. pages 157–190.

Ayers, B. C., Lefanowicz, C. E., and Robinson, J. R. (2003). Shareholder taxes in acquisition premiums: The effect of capital gains taxation. *The Journal of Finance*, 58(6):2783–2801.

Baker, A. C., Larcker, D. F., and Wang, C. C. (2022). How much should we trust staggered difference-in-differences estimates? *Journal of Financial Economics*, 144(2):370–395.

Baugh, B., Ben-David, I., and Park, H. (2018). Can taxes shape an industry? evidence from the implementation of the "amazon tax". *The Journal of Finance*, 73(4):1819–1855.

Bethmann, I., Jacob, M., and Müller, M. A. (2018). Tax loss carrybacks: Investment stimulus versus misallocation. *The Accounting Review*, 93(4):101–125.

Braguinsky, S., Ohyama, A., Okazaki, T., and Syverson, C. (2015). Acquisitions, productivity, and profitability: Evidence from the Japanese cotton spinning industry. *American Economic Review*, 105(7):2086–2119.

Bührle, A. T. (2021). Do tax loss restrictions distort venture capital funding of start-ups? *ZEW Working Paper 21-008*.

Bührle, A. T. and Spengel, C. (2020). Tax law and the transfer of losses: A european overview and categorization. *Intertax*, 48(6/7):564–581.

Caballero, R. J., Hoshi, T., and Kashyap, A. K. (2008). Zombie lending and depressed restructuring in japan. *American Economic Review*, 98(5):1943–77.

Cao, C., Li, X., and Liu, G. (2019). Political uncertainty and cross-border acquisitions. *Review of Finance*, 23(2):439–470.

Cengiz, D., Dube, A., Lindner, A., and Zipperer, B. (2019). The effect of minimum wages on low-wage jobs. *The Quarterly Journal of Economics*, 134(3):1405–1454.

Cole, H. L., Greenwood, J., and Sanchez, J. M. (2016). Why doesn't technology flow from rich to poor countries? *Econometrica*, 84(4):1477–1521.

Collier, R., Pirlot, A., and Vella, J. (2020). Tax policy and the COVID-19 crisis. *Intertax*, 48(8):794–804.

Decker, R., Haltiwanger, J., Jarmin, R., and Miranda, J. (2014). The role of entrepreneurship in us job creation and economic dynamism. *Journal of Economic Perspectives*, 28(3):3–24.

Dessaint, O., Golubov, A., and Volpin, P. (2017). Employment protection and takeovers. *Journal of Financial Economics*, 125(2):369–388.

Di Giovanni, J. (2005). What drives capital flows? The case of cross-border M&A activity and financial deepening. *Journal of international Economics*, 65(1):127–149.

Domar, E. D. and Musgrave, R. A. (1944). *The Quarterly Journal of Economics*, 58(3):388–422.

Erel, I., Liao, R. C., and Weisbach, M. S. (2012). Determinants of cross-border mergers and acquisitions. *The Journal of finance*, 67(3):1045–1082.

Erickson, M. M., Ton, K., and Wang, S.-w. (2019). The effect of acquirer net operating losses on acquisition premiums and acquirer abnormal returns. *The Journal of the American Taxation Association*, 41(2):103–124.

Feld, L. P., Ruf, M., Scheuering, U., Schreiber, U., and Voget, J. (2016). Repatriation taxes and outbound M&As. *Journal of Public Economics*, 139:13–27.

Fuest, C., Peichl, A., and Siegloch, S. (2018). Do higher corporate taxes reduce wages? micro evidence from germany. *American Economic Review*, 108(2):393–418.

Galindo-Rueda, F. and Verger, F. (2016). Oecd taxonomy of economic activities based on ramp;d intensity.

Guceri, I. (2020). Quantifying and alleviating financing constraints: Structural evidence from a policy experiment. *Working Paper*.

Haltiwanger, J., Jarmin, R. S., and Miranda, J. (2013). Who creates jobs? small versus large versus young. *Review of Economics and Statistics*, 95(2):347–361.

Harris, R. and Robinson, C. (2002). The effect of foreign acquisitions on total factor productivity: Plant-level evidence from UK manufacturing, 1987–1992. *Review of Economics and Statistics*, 84(3):562–568.

Huizinga, H., Voget, J., and Wagner, W. (2012). Who bears the burden of international taxation? Evidence from cross-border M&As. *Journal of International Economics*, 88(1):186–197.

John, K., Knyazeva, A., and Knyazeva, D. (2015). Employee rights and acquisitions. *Journal of Financial Economics*, 118(1):49–69.

Julie, H. R., Andrew, B., Benjamin C., K., Wilmer, C. P. H., and LLP, D. (2020). Renewed interest by public companies in NOL rights plans. https://corpgov.law.harvard.edu/2020/06/15/renewed-interest-by-public-companies-in-nol-rights-plans/. Accessed on 04 April 2022.

Kaplan, S. (1989). The effects of management buyouts on operating performance and value. *Journal of financial economics*, 24(2):217–254.

Kile, C. O. and Phillips, M. E. (2009). Using industry classification codes to sample high-technology firms: Analysis and recommendations. *Journal of Accounting, Auditing & Finance*, 24(1):35–58.

Langenmayr, D. and Lester, R. (2018). Taxation and corporate risk-taking. *The Accounting Review*, 93(3):237–266.

Li, X. (2013). Productivity, restructuring, and the gains from takeovers. *Journal of Financial Economics*, 109(1):250–271.

Ljungqvist, A., Zhang, L., and Zuo, L. (2017). Sharing risk with the government: How taxes affect corporate risk taking. *Journal of Accounting Research*, 55(3):669–707.

Ma, S., Murfin, J., and Pratt, R. (2021). Young firms, old capital. *Journal of Financial Economics*.

McGowan, M. A., Andrews, D., and Millot, V. (2017). Insolvency regimes, zombie firms and capital reallocation. OECD Economics Department Working Papers 1399, OECD Publishing.

Moore, N. H. and Pruitt, S. W. (1987). The market pricing of net operating loss carryforwards: Implications of the tax motivations of mergers. *Journal of Financial Research*, 10(2):153–160.

Olbert, M. (2021). The impact of tax shields on bankruptcy risk and resource allocation. *Available at SSRN 3467669*.

Rossi, S. and Volpin, P. F. (2004). Cross-country determinants of mergers and acquisitions. *Journal of Financial Economics*, 74(2):277–304.

Sikes, S. A., Tian, X., and Wilson, R. (2014). Investors' reaction to the use of poison pills as a tax loss preservation tool. *Journal of Accounting and Economics*, 57(2/3):132–148.

Stiglitz, J. (1969). The effects of income, wealth, and capital gains taxation on risk-taking. *The Quarterly Journal of Economics*, 83(2):263–283.

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

Todtenhaupt, M. and Voget, J. (2021). International taxation and productivity effects of M&As. *Journal of International Economics*, 131:103438.

Todtenhaupt, M., Voget, J., Feld, L. P., Ruf, M., and Schreiber, U. (2020). Taxing away M&A: Capital gains taxation and acquisition activity. *European Economic Review*, 128:103505.

Tables and Figures

Table 1: Anti-loss trafficking rules in the EU28, 1999-2019

ISO2	Intro	Year	Regulation
AT	1988	1999-2019	Cumulative: change in ownership >75% and change in activity
BE	1997	1999-2019	Ownership: change in control
BG	1998	1999-2019	Ownership: change in ownership >50%
CY		1999-2019	Cumulative: change in ownership >50% and change in activity
CZ		1999-2003	-
	2004	2004-2019	Cumulative: change in ownership >25% and change in activity (offset only against profits from similar activities)
DE	1991	1999-2007	Cumulative: change in ownership >50% and change in activity
		2008-2015	Cumulative: change in ownership >50%, pro-rata after change in ownership between 25%-50%
		2016-2019	Ownership: change in ownership >50%
DK	1988	1999-2019	(regulations only apply to capital losses)
EE		1999-2014	Distribution tax, no LCF available
ES	1996	1999-2014	Ownership: change in majority
		2015-2019	Cumulative: change in majority
FI	1993	1999-2019	Ownership: change in ownership >50%
FR	1985	1999-2019	Activity: change of activity
GB	1988	1999-2019	Cumulative: change of ownership >50% and change in activity
GR		1999-2013	-
	2014	2014-2017	Ownership: change in ownership >33%
		2018-2019	Cumulative: change in ownership >33%
HU	1997	1999-2000	Ownership: change in ownership >50%
		2001-2011	-
	2012	2012-2019	Cumulative: change in majority
HR		1999-2009	-
	2010	2010-2019	Cumulative: change in ownership >50% and change in activity
IE	1976	1999-2019	Cumulative: change in ownership >50% and change in activity
IT	1998	1999-2019	Cumulative: change in majority and change in activity
LT		1999-2001	-
	2002	2002-2019	Cumulative: change in ownership >66% (from 2007: control) and change in activity
LU		1999-2019	-
LV	1995	1999-2000	Ownership: Change in ownership >50%
		2001-2017	Cumulative: Change in control and change in activity
		2018-2019	Distribution tax, no LCF available
MT		1999-2014	-
NL	1970	1999-2000	Ownership: Change in ownership >30%
		2001-2019	Cumulative: Change in ownership >30% and change in activity
PL		1999-2019	-
PT	1995	1999-2005	Activity: change in activity

Continued on next page

Table 1: Anti-loss trafficking rules in the EU28, 1998-2019 - continued

Country	Year	Regulation	
		2006-2013	Ownership/activity: change in ownership >50% or change in activity
		2014-2019	Ownership: change in ownership >50%
RO		1999-2019	-
SE	1983	1999-2019	Ownership: change in control
SI		1999-2004	-
	2005	2005-2006	Ownership: change in ownership >25%
		2007-2019	Cumulative: change in ownership >50% and change in activity
SK		1999-2019	-
NO	1989	1999-2003	-
	2004	2004-2019	Ownership: change in control

Notes: Treatment of tax losses after an acquisition. Retro-actively applicable rules are disregarded. Ownership-based are more restrictive than activity-based regulations. Cumulative rules are the least restrictive type of anti-loss trafficking rules. *Source:* Update of Bührle and Spengel (2020).

Table 2: Sample selection process country level M&A activity analysis

	Total number of deals	Unique targets
Zephyr (completed deals in EU28 + NO)	183,444	75,267
- Excluding listed companies	119,308	71,471
Aggregation per target per year	93,945	71,471
- Acquired stake above 50%	58,394	54,391
	Observations at country level	
Aggregation at country level	638	-
- Countries with only 1-3 deals	440	-
Stacked sample at country level	1,704	-

Table 3: Descriptive statistics - Country-Level Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Deal Number	1704	3.106	2.221	0	8.582
Escape clause	1704	0.667	0.472	0	1
Lagged GDP Growth	1704	2.123	3.260	-14.193	25.163
Lagged GDP (log)	1704	26.588	1.379	23.692	29.123
Audit Quality	1704	5.562	0.730	3.887	6.619
Value Added, service sector	1704	64.284	6.243	48.159	79.332
Population, log	1704	9.069	1.370	6.054	11.333
Lagged Inflation	1704	2.849	25.668	-4.478	1058.374
Trade, log	1704	4.587	0.510	3.744	6.012
CIT	1704	26.006	8.462	10	56.046
LCB	1704	0.724	0.447	0	1
Back d	1704	0.235	0.424	0	1
EU Membership	1704	0.958	0.200	0	1

Table 4: Descriptive statistics - Industry-Level Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Entrant Survival Rate, 4 Y.	23,588	3.998	0.289	0	4.615
Entrant Survival Rate, 5 Y.	23,588	3.886	0.318	0	4.615
Productivity	18,658	9.934	1.693	-3.191	13.831
Mean ROA	18,658	0.068	0.070	-0.377	0.712
Zombie Share	18,658	0.047	0.055	0	0.452
Fixed Assets (log)	18,658	19.65	1.583	11.864	24.245
Total Assets (log)	18,658	20.712	1.641	13.953	25.766
Cash (log)	18,658	18.251	1.515	11.887	23.28
Escape Clause	18,658	0.563	0.496	0	1
Lagged GDP growth	18,658	3.041	3.217	-14.434	25.163
Lagged GDP (log)	18,658	26.889	1.317	23.255	29.123
Audit Quality	18,658	5.274	0.812	3.86	6.619
Valued Added, Service Sector	18,658	61.669	6.520	42.963	79.332
Population (log)	18,658	9.54	1.206	6.015	11.328
Lagged Inflation	18,658	2.581	4.601	-4.478	59.097
Trade (log)	18,658	4.529	0.432	3.816	6.012
CIT	18,658	24.634	7.260	10	56.046
EU Membership	18,658	0.973	0.163	0	1
LCF	18,658	0.597	0.490	0	1
LCB	18,658	0.167	0.373	0	1

Table 5: Loss transfer and M&A deals

	(1)	(2)
	Deal Number	
Loss Change	-0.1914*	
	(0.1158)	
Tightening of ATLT		-0.2813
		(0.2090)
Loosening of ATLT		0.1720
		(0.1199)
Escape Clause	-0.2347**	-0.1853**
	(0.1130)	(0.0720)
Lagged GDP growth	-0.0018	-0.0018
	(0.0033)	(0.0033)
Lagged GDP (log)	0.2732*	0.2717*
	(0.1512)	(0.1511)
Audit Quality	0.1752***	0.1755***
	(0.0364)	(0.0366)
Value Added, Service Sector	-0.0038	-0.0036
	(0.0050)	(0.0050)
Population (log)	2.2636***	2.2312***
	(0.4610)	(0.4600)
Lagged inflation	-0.0001	-0.0001
	(0.0001)	(0.0001)
Trade (log)	0.3134**	0.3224**
	(0.1501)	(0.1519)
CIT	0.0082***	0.0084***
	(0.0030)	(0.0029)
EU Membership	0.0316	0.0269
	(0.0492)	(0.0496)
LCF	0.0611*	0.0618*
	(0.0356)	(0.0358)
LCB	1.4813***	1.5047***
	(0.3046)	(0.3109)
Observations	1,704	1,704
Adjusted R-squared	0.9843	0.9843
FE	Year, Country	Year, Country
Clustering	Country x Year	Country x Year

Notes: The table shows the results for the DiD regressions of change in anti-loss trafficking rules on logarithm of number of deals (1), sum of deal values (2), mean of deal values (4). The analysis is at country level. Specification:
$M\&A = \alpha + \beta_j * LossChange_{ct} + \rho * Controls_{ct} + \sigma * FE_c + \delta * FE_t$. *, **, and *** indicate significance at the 10, 5 and 1% level. Standard errors: Clustered at country-year level.

Table 6: Loss transfer and industry entrant survival

	(1)	(2)	(3)	(4)
	Entrant Survival Rate (4 Years)		Entrant Survival Rate (5 Years)	
Loss Change	-0.0834***		-0.0860***	
	(0.0118)		(0.0147)	
Tightening ATLT		-0.0633***		-0.0602***
		(0.0213)		(0.0205)
Loosening ATLT		0.0834***		0.0860***
		(0.0118)		(0.0147)
Escape Clause	0.0200		0.0259	
	(0.0243)		(0.0256)	
Lagged GDP Growth	-0.00251*	-0.00251*	-0.00387***	-0.00387***
	(0.00130)	(0.00130)	(0.00114)	(0.00114)
Lagged GDP (log)	0.617***	0.617***	0.506***	0.506***
	(0.0717)	(0.0717)	(0.0661)	(0.0661)
Audit Quality	0.0364***	0.0364***	0.0220**	0.0220**
	(0.00847)	(0.00847)	(0.00922)	(0.00922)
Value Added, Service Sector	-0.00478***	-0.00478***	-0.00263	-0.00263
	(0.00170)	(0.00170)	(0.00198)	(0.00198)
Population (log)	-0.318***	-0.318***	-0.296**	-0.296**
	(0.115)	(0.115)	(0.133)	(0.133)
Lagged Inflation	-0.0118***	-0.0118***	-0.0190***	-0.0190***
	(0.00217)	(0.00217)	(0.00249)	(0.00249)
Trade (log)	-0.0767	-0.0767	-0.227***	-0.227***
	(0.0545)	(0.0545)	(0.0583)	(0.0583)
CIT	-0.00184*	-0.00184*	0.00450***	0.00450***
	(0.000976)	(0.000976)	(0.00118)	(0.00118)
LCF	-0.0245**	-0.0245**	-0.0265***	-0.0265***
	(0.00989)	(0.00989)	(0.00716)	(0.00716)
Observations	23,588	23,588	23,588	23,588
Adjusted R-squared	0.456	0.456	0.491	0.491
FE	Industry-Year, Country-Industry			
Clustering	Country-Industry			

Notes: The table shows the results for the DiD regressions of change in anti-loss trafficking rules on the log of Survival Rate of 4-year old entrants (1-2) and the log of Survival Rate of 5-year old entrants (3-4). The analysis is at country-industry level. Specification: $SurvivalRate_{ict} = \alpha + \beta_1 * LossChange_{ct} + \rho * Controls_{ict} + \sigma * FE_{ic} + \delta * FE_t + \epsilon_{ict}$. *, **, and *** indicate significance at the 10, 5 and 1% level. Standard errors: Clustered at country-industry level.

Table 7: Loss transfer and industry productivity

	(1)	(2)	(3)	(4)	(5)	(6)
	Productivity t+1		Mean ROA t+1		Zombie Share t+1	
Loss Change	-0.445***		-0.00533*		0.00973***	
	(0.102)		(0.00296)		(0.00320)	
Tightening ATLT		-1.244***		-0.0301***		-0.00496
		(0.234)		(0.00691)		(0.00490)
Loosening ATLT		0.274***		4.64e-05		-0.0129***
		(0.102)		(0.00301)		(0.00364)
Fixed asses (log)	-0.423***	-0.438***	0.00453	0.00406	0.00612	0.00584
	(0.134)	(0.134)	(0.00489)	(0.00491)	(0.00417)	(0.00417)
Total assets (log)	0.255	0.281	-0.0313***	-0.0305***	-0.000471	-7.68e-06
	(0.197)	(0.197)	(0.00618)	(0.00620)	(0.00555)	(0.00555)
Cash (log)	-0.197**	-0.202**	0.0161***	0.0160***	-0.000756	-0.000844
	(0.0913)	(0.0914)	(0.00324)	(0.00324)	(0.00284)	(0.00285)
Escape Clause	0.387	1.149***	-0.0275***	-0.00392	0.00637	0.0204***
	(0.247)	(0.301)	(0.00810)	(0.00959)	(0.00597)	(0.00680)
Lagged GDP Growth	0.00176	0.00199	0.000551***	0.000558***	1.94e-05	2.36e-05
	(0.00577)	(0.00578)	(0.000174)	(0.000174)	(0.000163)	(0.000163)
Lagged GDP (log)	0.631*	0.609*	-0.0260**	-0.0267**	-0.0327***	-0.0331***
	(0.349)	(0.349)	(0.0111)	(0.0111)	(0.0113)	(0.0113)
Audit Quality	-0.176**	-0.189***	0.00160	0.00119	-0.00820***	-0.00844***
	(0.0694)	(0.0694)	(0.00207)	(0.00207)	(0.00226)	(0.00226)
Value Added, Service Sector	0.0125	0.0128	-0.00174***	-0.00173***	0.00113***	0.00113***
	(0.0112)	(0.0112)	(0.000305)	(0.000305)	(0.000342)	(0.000341)
Population (log)	4.928***	4.800***	-0.0712*	-0.0752**	-0.129***	-0.132***
	(1.280)	(1.280)	(0.0379)	(0.0377)	(0.0437)	(0.0437)
Lagged Inflation	0.0256***	0.0277***	0.00108***	0.00115***	0.000647***	0.000687***
	(0.00561)	(0.00562)	(0.000190)	(0.000191)	(0.000195)	(0.000196)
Trade (log)	0.580*	0.786**	0.0161*	0.0225**	-0.0313***	-0.0275***
	(0.329)	(0.333)	(0.00938)	(0.00944)	(0.00976)	(0.00990)
EU Membership	1.429***	1.391***	0.0334***	0.0322***	0.00301	0.00232
	(0.114)	(0.115)	(0.00360)	(0.00361)	(0.00290)	(0.00292)
CIT	-0.0551***	-0.0588***	0.00287***	0.00275***	0.000636***	0.000567***
	(0.00719)	(0.00727)	(0.000234)	(0.000234)	(0.000213)	(0.000217)
LCF	0.0974	0.0345	-0.0106***	-0.0125***	-0.00468**	-0.00584***
	(0.0688)	(0.0695)	(0.00190)	(0.00194)	(0.00209)	(0.00216)
LCB	1.725**	1.730**	-0.0346**	-0.0344**	-0.0114	-0.0113
	(0.732)	(0.738)	(0.0142)	(0.0143)	(0.0111)	(0.0112)
Observations	18,658	18,658	18,658	18,658	18,658	18,658
Adjusted R-squared	0.666	0.666	0.839	0.839	0.678	0.678
FE			Industry-Year, Country-Industry			
Clustering			Country-Industry			

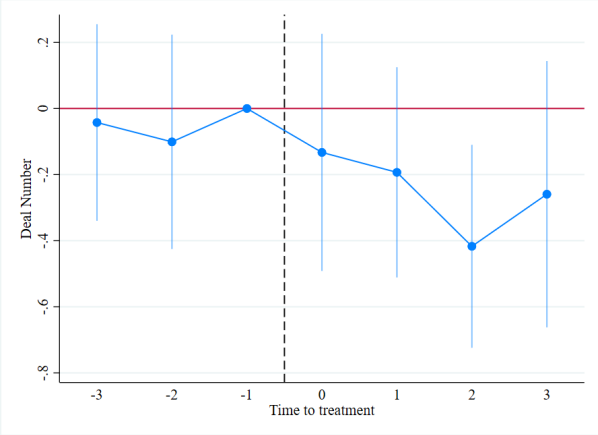
Notes: The table shows the results for the DiD regressions of change in anti-loss trafficking rules on productivity (1-2), mean ROA (3-4) and the share of Zombie firms (5-6). Productivity is calculated as the residuals of a log-linear Cobb-Douglas production function that we estimate for every country-industry-year based on EBIT, overall wage expenses and fixed assets. Zombie firms are defined as firms that have an interest coverage ratio (the ratio of operating income to interest expenses) less than one for three consecutive years and are older than 10 years. The analysis is at country-industry level. Specification:
$Performance_{ict} = \alpha + \beta_1 * LossChange_{ct} + \rho * Controls_{ict} + \sigma * FE_{ic} + \delta * FE_t + \epsilon_{ict}$. *, **, and *** indicate significance at the 10, 5 and 1% level. Standard errors: Clustered at country-industry level.

Table 8: Young Firms and R&D split

	(1)	(2)	(3)	(4)	(5)
	Productivity t+1				
Split	All Young Firms	High Tech	Low Tech	High R&D	Low R&D
Loss Change	-0.449***	-1.073**	-0.424***	-0.618*	-0.440***
	(0.117)	(0.488)	(0.121)	(0.368)	(0.128)
Fixed Assets (log)	-0.0926	-0.321	-0.0926	-0.284	-0.00832
	(0.0769)	(0.355)	(0.0786)	(0.218)	(0.0833)
Total Assets (log)	0.00240	0.0903	-0.00949	0.713**	-0.0776
	(0.106)	(0.480)	(0.108)	(0.305)	(0.114)
Cash (log)	-0.0853	0.275	-0.0902	-0.648***	-0.0703
	(0.0713)	(0.316)	(0.0731)	(0.194)	(0.0791)
Lagged GDP Growth	0.00656	-0.0328	0.00740	-0.0449***	0.0116
	(0.00712)	(0.0318)	(0.00730)	(0.0174)	(0.00829)
Lagged GDP (log)	0.278	-2.120	0.449	1.470	0.102
	(0.409)	(1.779)	(0.419)	(1.116)	(0.443)
Audit Quality	0.528***	1.921***	0.455***	0.0566	0.588***
	(0.0909)	(0.360)	(0.0931)	(0.222)	(0.104)
Value Added, Service Sector	0.0397***	-0.00858	0.0407***	0.0617*	0.0393***
	(0.0123)	(0.0568)	(0.0126)	(0.0326)	(0.0138)
Population (log)	-0.968	5.455	-1.163	-2.896	-0.845
	(1.652)	(7.620)	(1.693)	(4.664)	(1.811)
Lagged Inflation	0.0353***	0.0691***	0.0348***	0.0452***	0.0344***
	(0.00421)	(0.0220)	(0.00427)	(0.0121)	(0.00447)
Trade (log)	1.619***	2.153	1.635***	-0.521	1.966***
	(0.334)	(1.656)	(0.340)	(1.055)	(0.353)
CIT	-0.0242***	-0.0447	-0.0225***	-0.00446	-0.0253***
	(0.00685)	(0.0271)	(0.00704)	(0.0218)	(0.00734)
LCF	-0.0854	-0.139	-0.0791	-0.263	-0.0677
	(0.102)	(0.269)	(0.106)	(0.206)	(0.120)
LCB	0.631		0.652	-3.009***	0.561
	(0.684)		(0.682)	(0.801)	(0.443)
Observations	15,152	779	14,373	1,704	12,641
Adjusted R-squared	0.452	0.466	0.449	0.416	0.461
Equiv. P-Val.	-	0.204	0.204	0.537	0.537
FE	Industry-Year, Country-Industry				
Clustering	Country-Industry				

Notes: The table shows the results for the DiD regressions of change in anti-loss trafficking rules on productivity. Productivity is calculated as the residuals of a log-linear Cobb-Douglas production function estimated for every country-industry-year based on EBIT, overall wage expenses and fixed assets. The analysis is at country-industry level and the sample includes only firms that are max. 5 years old. Specification:
$Performance_{ict} = \alpha + \beta_1 * *LossChange_{ct} + \rho * Controls_{ict} + \sigma * FE_{ic} + \delta * FE_t + \epsilon_{ict}$. *, **, and *** indicate significance at the 10, 5 and 1% level. Standard errors: Clustered at country-industry level.

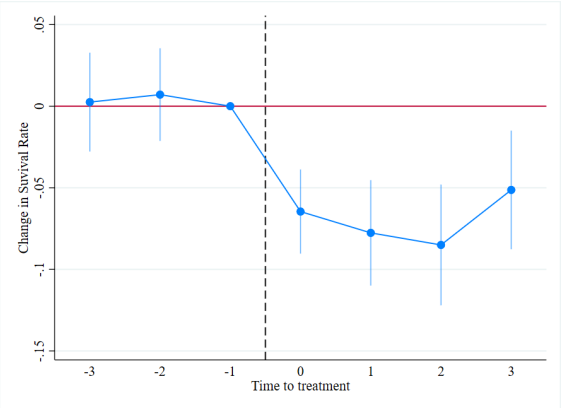
Figure 1: Loss transfer and M&A deals



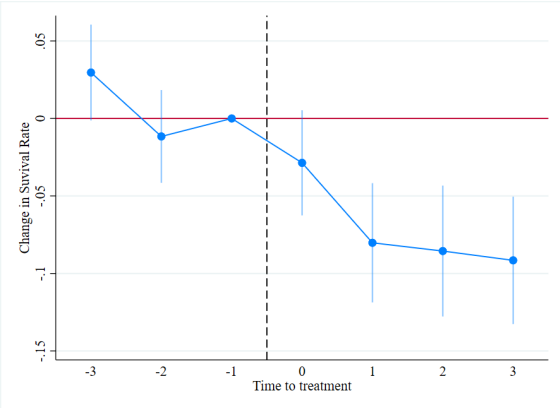
Panel A: Deal Number

Note: The figure plots the time-trends regression coefficients (the blue dots), $\beta_k s$, and 95 percent confidence intervals (the vertical lines) based on cluster robust standard errors (country) from the following specification: $M\&A = \alpha + \sum_{n=-4}^{4} \beta * Losschange_m + \rho * Controls_{ct} + \sigma * FE_c + \delta * FE_t$. M&A is the logarithm of the number of M&A deals. The treatment indicator takes value of 1 (-1) if a country tightens (loosens) anti-loss trafficking rules and the following years and zero otherwise. We include the treatment at the event time as well as five leads and four lags of the treatment indicator. The lead and lag dummies are binned at the beginning and end of the event window. Binned coefficients are not displayed. Coefficients are normalized to zero based on the level in the period preceding the treatment. Fixed effects include country and year fixed effects and control variables include lagged log of GDP, lagged GDP growth, the log of population, lagged inflation, a countries' audit quality, a dummy for EU membership, the annual growth rate of value added of the services sector in percentage of GDP, and the corporate tax rate. The analysis is at country level. The standard errors are clustered at country-year level.

Figure 2: Loss transfer and industry entrant survival



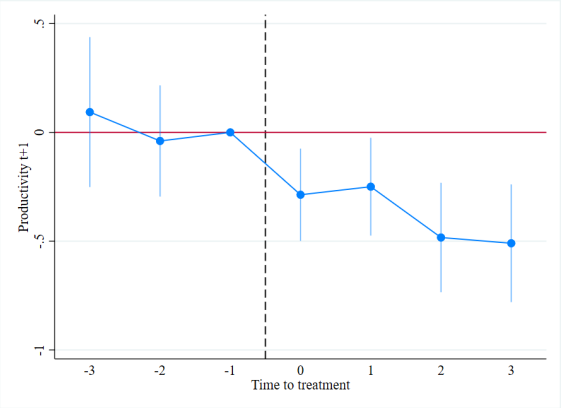
Panel A: Entrant Survival Rate (4 Years)



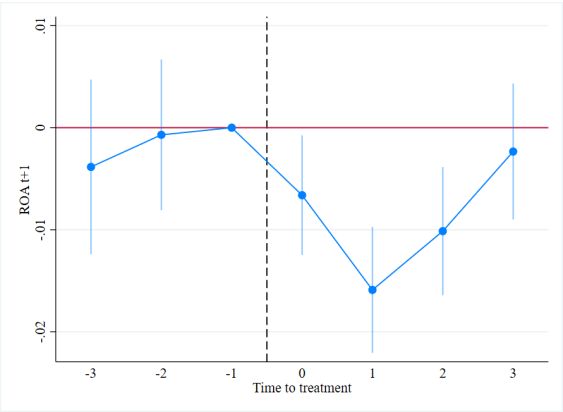
Panel B: Entrant Survival Rate (5 Years)

Note: The figure plots the time-trends regression coefficients (the blue dots), $\beta_k s$, and 95 percent confidence intervals (the vertical lines) based on cluster robust standard errors (country) from the following specification: $SurvivalRate_{ict} = \alpha + \sum_{n=-4}^{4} \beta * Losschange_m + \rho * Controls_{ict} + \sigma * FE_{ic} + \delta * FE_{it} + \epsilon_{ict}$. Survival rate is the log of the rate of survival of 4 or 5 year old entrants. The treatment indicator takes value of 1 (-1) if a country tightens (loosens) anti-loss trafficking rules and the following years and zero otherwise. We include the treatment at the event time as well as four leads and four lags of the treatment indicator. The lead and lag dummies are binned at the beginning and end of the event window (after 3 years). Binned coefficients are not displayed. Coefficients are normalized to zero based on the level in the period preceding the treatment. Fixed effects include country-industry and year-industry fixed effects and control variables include lagged log of GDP, lagged GDP growth, the log of population, lagged inflation, a countries' audit quality, a dummy for EU membership, the annual growth rate of value added of the services sector in percentage of GDP. The analysis is at country-industry level. The standard errors are clustered at country-year level.

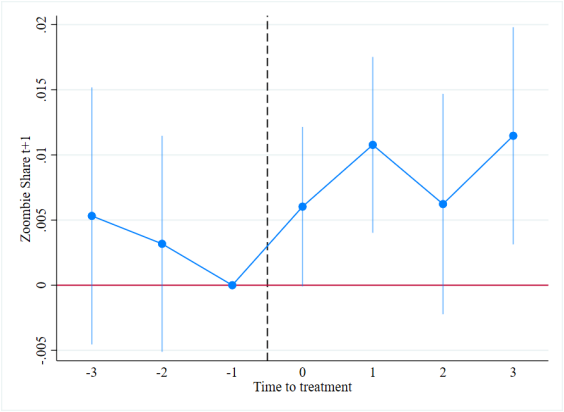
Figure 3: Loss transfer and industry performance effects



Panel A: Mean Productivity



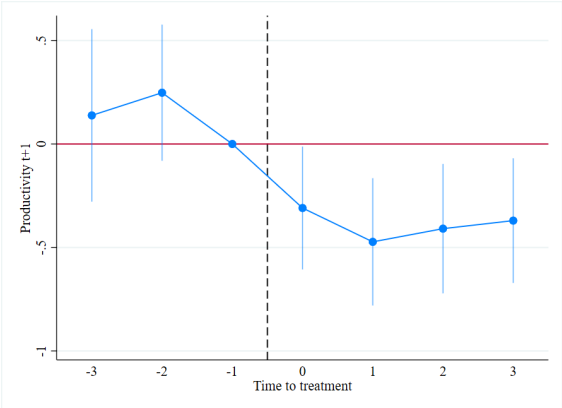
Panel B: Mean ROA



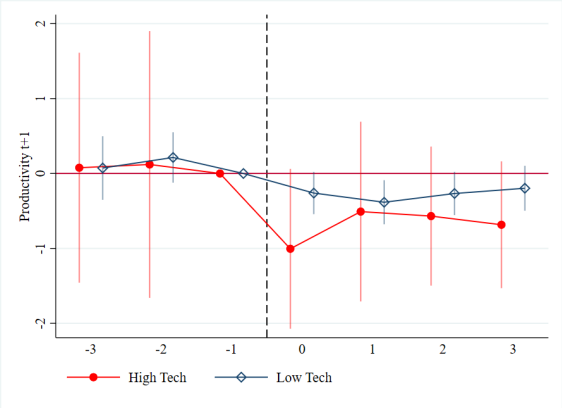
Panel C: Zombie Share

Note: The figure plots the time-trends regression coefficients (the blue dots), $\beta_k s$, and 95 percent confidence intervals (the vertical lines) based on cluster robust standard errors (country) from the following specification: $Performance_{ict} = \alpha + \sum_{n=-4}^{4} \beta * Losschange_m + \rho * Controls_{ict} + \sigma * FE_{ic} + \delta * FE_{it} + \epsilon_{ict}$. Performance is defined as productivity (panel A), mean ROA (panel B) or the share of Zombie firms (panel C). Productivity is calculated as the residuals of a log-linear Cobb-Douglas production function estimated for every country-industry-year based on EBIT, overall wage expenses and fixed assets. Zombie firms are defined as firms that have an interest coverage ratio (the ratio of operating income to interest expenses) less than one for three consecutive years and are older than 10 years. The treatment indicator takes value of 1 (-1) if a country tightens (loosens) anti-loss trafficking rules and the following years and zero otherwise. We include the treatment at the event time as well as four leads and four lags of the treatment indicator. The lead and lag dummies are binned at the beginning and end of the event window (after 3 years). Binned coefficients are not displayed. Coefficients are normalized to zero based on the level in the period preceding the treatment. Fixed effects include country-industry and year-industry fixed effects and control variables include lagged log of GDP, lagged GDP growth, the log of population, lagged inflation, a countries' audit quality, a dummy for EU membership, the annual growth rate of value added of the services sector in percentage of GDP. The analysis is at country-industry level. The standard errors are clustered at country-year level.

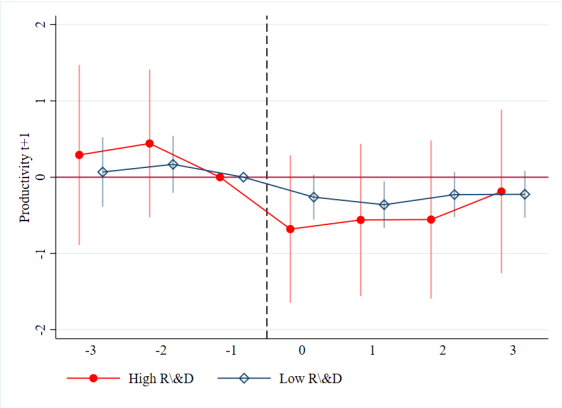
Figure 4: Loss transfer and industry performance effects for young firms



Panel A: Mean Productivity - Average



Panel B: Mean Productivity - High/low Technology Industries



Panel C: Mean Productivity - High/low R&D Intensive Industries

Note: The figure plots the time-trends regression coefficients (the blue dots), $\beta_k s$, and 95 percent confidence intervals (the vertical lines) based on cluster robust standard errors (country) from the following specification: $Performance_{ict} = \alpha + \sum_{n=-4}^{4} \beta * Losschange_m + \rho * Controls_{ict} + \sigma * FE_{ic} + \delta * FE_{it} + \epsilon_{ict}$. Productivity is calculated as the residuals of a log-linear Cobb-Douglas production function that we estimate for every country-industry-year based on EBIT, overall wage expenses and fixed assets. The treatment indicator takes value of 1 (-1) if a country tightens (loosens) anti-loss trafficking rules and the following years and zero otherwise. We include the treatment at the event time as well as four leads and four lags of the treatment indicator. The lead and lag dummies are binned at the beginning and end of the event window (after 3 years). Binned coefficients are not displayed. Coefficients are normalized to zero based on the level in the period preceding the treatment. Fixed effects include country-industry and year-industry fixed effects and control variables include lagged log of GDP, lagged GDP growth, the log of population, lagged inflation, a countries' audit quality, a dummy for EU membership, the annual growth rate of value added of the services sector in percentage of GDP. The analysis is at country-industry level and the sample includes only firms that are max. 5 years old. The standard errors are clustered at country-year level.

Appendices

A Variable Definitions

Loss Change	Loss Change increases (decreases) by 1 if a country tightens (loosens) anti-loss trafficking rules. The value does not change the following years as long as the regulation stays in place. Source: hand-collected.
Tightening ALT	Tightening ALT takes value of 1 if a country tightens anti-loss trafficking rules and in the following years. Source: hand-collected.
Loosening ALT	Loosening ALT takes the value of 1 if a country loosens anti-loss trafficking rules and in the following years. Source: hand-collected.
Deal Number	The logarithm of the number of M&A deals aggregated at country level by year. Source: BVD's Zephyr.
Sum of Deal Value	The logarithm of the sum of M&A deal values aggregated at country level by year. Source: BVD's Zephyr.
Mean of Deal Value	The logarithm of the mean of M&A deal values aggregated at country level by year. Source: BVD's Zephyr.
Survival Rate (4 (5) Years)	The log of the survival rate of the sum of entrants by industry where we consider as entrant, firms of four (five) years of age and take the ratio of surviving entrants to all entrants of that age group. Source: Eurostat.
Mean ROA	The industry-country mean in return on assets, winsorized yearly at 1 percent and 99 percent. Source: BVD's Orbis.
Productivity	The industry-country mean productivity, where productivity is defined as in Bethmann et al. (2018) and it is the residuals of the following function estimated for every country-industry: $ln(ValuesAdded)_{it} = \alpha_0 + \beta_1 * ln(Labor)_i t + \beta_2 * ln(Capital)_i t + \epsilon_{it}$. Source: BVD's Orbis. Where Value Added is defined as a firm's earnings before interest and tax (EBIT), depreciation, and amortization (EBITDA); labor expense, Labor, is defined as a firm's overall wage expense; Capital is defined as fixed assets, winsorized yearly at 1 percent and 99 percent
Zombie Share	The industry-country ratio of zombie firms to total firms, where zombie firm firms id defined as in Adalet McGowan et al. (2018) and it is the number of firms that are at least 10 year old and have an interest coverage ratio (i.e. the ratio of operating income to interest expenses) less than one for three consecutive years. Source: BVD's Orbis.
Escape clause	A dummy for anti-loss trafficking rules that offer an escape clause. Source: hand-collected.

Lagged GDP Growth	lagged annual GDP growth in %. Source: World Bank
Lagged GDP, log	log of lagged GDP, PPP (constant 2017 international $). Source: World Bank.
Audit Quality	Strength of auditing and reporting standards index (1-7, best). Source: Global Competitiveness Report.
Value Added, service sector	The annual growth rate of value added of the services sector in percentage of GDP. Source: World Development Indicators.
Population, log	The log of total population in thousands. Source: United Nations.
Lagged Inflation	Lagged inflation. Source: World Development Indicators.
Trade, log	Lagged logarithm of sum of exports and imports (as % of GDP). Source: World Development Indicators.
CIT	Statutory corporate income tax rate. Source: European Commission.
LCF	A dummy equal to 1 for a loss carry-forward available for more than five years in a country and 0 otherwise. Source: hand-collected.
LCB	A dummy equal to 1 for a loss carry-back available in a country and 0 otherwise. Source: hand-collected.
EU Membership	A dummy for country EU Membership. Source: hand-collected.
Fixed Assets, log	The log of the industry-country sum of fixed assets. Source: BVD's Orbis.
Total Assets, log	The log of the industry-country sum of total assets. Source: BVD's Orbis.
Cash Assets, log	The log of the industry-country sum of cash assets. Source: BVD's Orbis.

B Confounding events

Oftentimes, changes in tax loss transfer restrictions are part of bigger tax law packages than include other, potentially confounding, legislative measures. More restrictive general LCF legislation, i.e. shorter time horizons and absolute limits, decreases the value of accumulated LCFs and thus acquisition prices (e.g. Erickson et al. (2019)). Consequently, one would expect stricter temporal and absolute loss restrictions exerting an opposing effect to stricter anti-loss trafficking rules. Lower corporate taxes are associated with higher acquisition activity (e.g. Arulampalam et al. (2019),Todtenhaupt and Voget (2021)). However, in the tax loss setting higher taxes also imply higher tax savings if LCFs can be set off and thus increases in expected values of the tax assets. The direction of potentially confounding effects is unclear. Lower taxes on capital gains from the sale of shares in subsidiaries decreases the costs imposed on sellers and thus the required acquisition premium (e.g. Todtenhaupt et al. (2020)), leading to a positive effect on acquisition activity. In our empirical specification, we specifically control for the time-variant country-specific aspects by including variables for tax rates as well as LCB and LCF provisions in the estimation equation. Nevertheless, in the following we discuss concurrent changes in tax law that fall together with the changes in anti-loss trafficking rules we use for our identification.

Table 9 presents and overview over relevant tax changes at the time of change in anti-loss trafficking rules. At the time of change in anti-loss trafficking rules (column ATLT), we list changes in temporal and absolute restrictions of LCFs (columns LCF time and limit), statutory corporate income tax (column CIT) and capital gains taxes levied on the sales of shares of substantial holdings in non-listed subsidiaries (column Cap. Gains). For each column, changes in legislation are indicated with the status before and after the change; if there was no change the space is left blank. Around half of the changes in tax loss transfer restrictions were accompanied by additional changes in legislation in the same year.

Table 9: Concurrent changes in tax law

Country	Year	ATLT	LCF time	LCF limit	CIT	Cap. Gains
CZ	2003	-	7		0.31	
	2004	cum	5		0.28	
DE	2007	cum			0.25	
	2008	own			0.15	
DE	2015	own				
	2016	cum				
ES	2014	own	18		0.30	
	2015	cum	inf		0.28	
GR	2013	-			0.20	
	2014	own			0.26	
GR	2017	own				
	2018	cum				
HR	2009	-				
	2010	cum				
HU	2000	own				
	2001	-				
HU	2011	-		-		
	2012	cum		x		
LT	2001	-			0.24	
	2002	cum			0.15	
LV	1999	own				
	2000	cum				
LV	2017	cum	inf	x	0.15	
	2018	no deduction of losses			0.25	
NL	2000	own				
	2001	cum				
PT	2005	act				
	2006	act/own				
PT	2013	act/own	5		0.25	50% exemption
	2014	own	12		0.23	full exemption
SI	2004	-				
	2005	own				
SI	2006	own	7		0.25	no exemption
	2007	cum	inf		0.23	50% exemption
NO	2003	-				no exemption
	2004	own				full exemption

Notes: The table shows concurrent changes in tax legislation at the time of change in anti-loss trafficking rules (ATLT). Listed are changes in loss carry-forward (LCF) time and limit, statutory corporate income tax (CIT) and capital gains taxes on sales of shares of substantial holdings in non-listed subsidiaries. *Sources:* IBFD Country Analyses, EY Worldwide Corporate Tax Guides.

C Anecdotal evidence for loss trafficking

E.g. Erickson et al. (2019) provide anecdotal evidence in their appendix that losses can be considered an important factor in acquisitions. In the following, we additionally present some cases where anti-loss trafficking rules also played an important role.

C.1 Acquisition of Wachovia (USA)

Due to the financial crisis, the banking group Wachovia incurred substantial losses. Citigroup agreed to purchase the company for around 2 billion dollars. Just a few days later, Wells Fargo declared interest as well and offered a multiple of the amount, approximately 15 billion dollar. [22]

The cause for this substantial increase in perceived value of Wachovia was generally perceived to be a tax rule clarification that was issued by the US Internal Revenue Service just a day after Citigroup had announced the deal (and was revoked a few months later).[23] Based on the notice, losses and deductions attributable to loans of a bank were not subject to the Section 382 limitations after changes in ownership. Any buyer of Wachovia was thus able to utilize the accumulated losses to offset taxable income even after the acquisition.[24]

C.2 Urban Redevelopment Corporation v. C.I.R (USA)

Urban Redevelopment Corporation (Urban) was a New York corporation established in 1949 and dealing with real and personal property. The corporation incurred substantial losses in 1950 and 1951 and was inactive during 1952. In 1953, the sole owner, Fred F. Stoneman sold the corporation to Randolph Rouse (Rouse), a Virginian land developer and builder. The place of business of Urban was consequently moved to Virginia. The stated purpose for the acquisition were plans, drawings and specifications belonging to the corporation. However, Rouse failed to obtain these items after some ineffectual efforts, refraining from taking legal action against the former director that supposedly had them in their possession. In 1954 and 1955 Urban constructed and sold residential properties in Virginia, generating substantial profits. The resulting income taxes were reduced by offsetting the previously accumulated LCFs, claiming deductions of roughly USD 46,000.

The tax court considered the avoidance of income tax Rouse's principal purpose in acquiring Urban's stock and denied the loss offset. The court found that, while Rouse had his certified public accountant thoroughly verify Urban's LCFs, he failed to check the existence of the plans he claimed seeking to acquire. Overall, the court assessed Route's stated economic reasons as "inherently improbable".

[22] See Crowell (6 Oct 2008), Tax Notice Drives Wachovia Takeover Turmoil, available online at https://www.crowell.com/NewsEvents/AlertsNewsletters/all/Tax-Notice-Drives-Wachovia-Takeover-Turmoil [Accessed 4 April 2022].

[23] See Crowell (6 Oct 2008), Tax Notice Drives Wachovia Takeover Turmoil, available online at https://www.crowell.com/NewsEvents/AlertsNewsletters/all/Tax-Notice-Drives-Wachovia-Takeover-Turmoil [Accessed 4 April 2022]; The Paypers (06 Oct 2008), Wachovia abandons Citi for surprise Wells Fargo deal, available online at https://thepaypers.com/payments-general/wachovia-abandons-citi-for-surprise-wells-fargo-deal–735571 [Accessed 4 April 2022]; The Street (10 Nov 2011), How Wells Fargo Won the Tax-Dodging Trophy, available online at https://eu.wickedlocal.com/story/bulletin-tab/2011/11/10/how-wells-fargo-won-tax/65157599007/ [Accessed 4 April 2022].

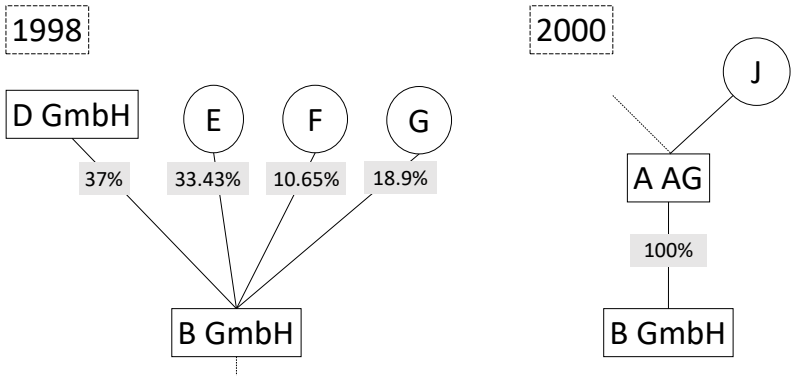
[24] IRS (2008), Application of Section 382(h) to banks. Notice 2008-83, available online at https://www.irs.gov/pub/irs-drop/n-08-83.pdf [Accessed 4 April 2022].

C.3 Case 3 K 65/08 (Germany)

B GmbH (B) was founded in 1991 and was conducting business as holding of the B-Group with ten to eleven employees. The B-Group traded in computer games and accessories and sometimes also manufactures them; B itself particiapted in some computer game trades. The firm was incurring losses from 1996 to 1998 due to partial depreciation of the holdings in its subsidiaries. At the end of 1998, business was discontinued by selling the subsidiaries to a third party and laying off all employees. B's assets were mainly consistent of liquid assets. At this point, the company had accumulated LCFs for corporate tax purposes up to around DM 35 million. In 2000, A AG (A) bought the shares in B GmbH from the previous owners. The purchase agreements included a section stating that an additional purchase price was to be paid in case the LCFs could be offset against taxable income of B earned after the acquisition. B changed its focus to the investment in high-tech start-ups, effectively changing its business activity from an executive holding of an entertainment software group to a venture capital firm, acquiring substantial shareholdings in start-ups in the "new economy". B was later merged with A in 2001.

The court denied the offset of B's LCFs with profits from the new business activities, stating that the plaintiff's only aim when acquiring the shares in B was to take advantage of its LCFs. This inference arises in particular from the remuneration agreed specifically for the transfer of the LCFs.The plaintiff did not intend to operate in the former business area of B, entertainment software. A acquired a company whose assets consisted almost exclusively of liquid receivables and investments, i.e. a cash box, at a price that corresponded exactly to this value. The visible reason for the acquisition instead of liquidation of B were the use of the existing LCFs. The fact that B was merged with the plaintiff in 2000 to simplify the corporate structure also shows that B was active in the same business area as the plaintiff that B, as an independent company, was of no use to the plaintiff and that the latter was only striving to transfer the LCFs to itself.

Figure 5: Schematic representation shareholdings B GmbH



Note: Schematic representation of the shareholdings in the case 3 K 65/08 at the financial court Hamburg, judgement from 20.04.2010. The court denied the use of accumulated losses of around DM 35 Mio after the company had been sold to the A AG, having assessed the transaction as an abusive trade in losses.