Do tax incentives reduce investment quality?

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Abstract

This paper examines the effect of tax incentives in the form of bonus depreciation on the quality of investment. Using the expiration of tax incentives via bonus depreciation in East Germany and a representative panel of West German establishments, we show that bonus depreciation significantly lowers the quality of investment. The average quality of investments, measured by the responsiveness of future sales to current investment, reduces by 22.6–34.6%. This adverse effect of tax subsidies is greater for jurisdictions with higher tax rates as well as for large or high-productivity firms. Overall, while increasing investment quantity, as shown by prior literature, tax incentives such as bonus depreciation substantially reduce the quality of investments.

Keywords: Bonus depreciation, tax incentive, investment incentive, investment quality

JEL classification: G11, H25, H32, M41

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1. Introduction

Policymakers frequently use bonus depreciation to promote investment and foster economic growth. Examples include the 2017 U.S. tax reform, the Dutch bonus depreciation from 2009 to 2011, and the U.S. bonus depreciation from 2008 to 2010. Prior research shows that investment tax incentives in the form of bonus depreciation increase investment activities and capital stock (e.g., Desai and Goolsbee, 2004; House and Shapiro, 2008; Zwick and Mahon, 2017; Eichfelder and Schneider, 2018; Ohrn, 2018). Although such findings underline the effectiveness of the programs in increasing the *quantity* of investments, to the best of our knowledge, prior literature is silent about the impact of tax incentives on the *quality* of investment projects. Following the theory of Hall and Jorgenson (1967), we interpret investment *quality* as the ability of investments to generate future cash flows, that is, a positive marginal rate of return.[1] In this paper, we complement prior literature and examine the effect of bonus depreciation on investment quality.

According to neoclassic investment theory (e.g., Hall and Jorgenson, 1967; Auerbach, 1983; Chirinko et al., 1999), firms invest until the marginal return from capital investment is equal to the marginal cost of capital. Since investment tax incentives reduce the marginal cost of capital, firms increase investment activity. An implication of this consideration is that firms will invest in projects with lower average *quality*. In other words, firms accept a relatively small pretax return and, hence, investment quality decreases. In contrast, tax incentives could also help firms to overcome underinvestment problems that result from capital market inefficiencies and lack of access to capital. Tax incentives could then increase investment levels, as well as productivity (e.g., Liu and Mao, 2019). Hence, whether tax incentives increase or decrease investment quality is an unsolved

[1] We use the term *investment quality* for our concept of interest: how does current investment relate to future sales revenues? Alternatively, one can consider this productivity or profitability of investments. In contrast to other concepts of productivity, our measure does not capture the average productivity level of all production factors but the average *increase* in output resulting from one additional unit of investment.

empirical question. We complement prior literature by examining the effect of bonus depreciation incentives on the quality of investments. Given the widespread use of bonus depreciation and other tax incentives, it is important to understand the potential benefits (higher investment levels) and potential costs (lower investment quality) of bonus depreciation and other tax incentives. In this paper, we identify and quantify the effect on investment quality as a potential cost of investment tax incentives.

Our identification strategy exploits the expiration of a bonus depreciation program in Germany, the Development Area Law (*Fördergebietsgesetz*, hereafter DAL), at the end of 1998. This law was designed to promote investments in the five East German states and Berlin. The DAL included a bonus depreciation of up to 50% and was available for business establishments in East Germany, irrespective of the location of their headquarters within Germany. The expiration of the DAL raised the user costs of capital by restricting depreciation tax incentives and, thus, resulted in an increase in the effective tax burden on investments.

Using high-quality establishment data from the German *Amtliche Firmendaten in Deutschland* (AFiD) panel, we identify establishments that were subsidized by the DAL bonus depreciation and those not subject to the DAL. We then exploit the expiration of the DAL in a differences-in-differences (DiD) approach that compares the quality of investments in East German establishments versus those in West German establishments (first difference) around the expiration of the DAL (second difference). In 1995, the first year in our sample, the vast majority of the establishments in the East belonged to West German firms and thus had access to the same or at least similar technologies as their Western counterparts. This holds especially for the manufacturing firms in our sample.[2] We thus use West German establishments as our control group

[2] At the end of the 1980s, most industrial establishments in the East were owned by the state. After the reunification, almost all industrial establishments were privatized by the Treuhandstalt (THA), the privatization agency for former East Germany, or liquidated by the early 1990s (Paqué, 2009). In 1992, 1993, and 1994, 73.5%, 88.8%, and 95.4%,

for the treated East German establishments. Our prediction is that, relative to the sales revenues of establishments in the West, the sales revenues of establishments in the East exhibit significantly lower sensitivity to subsidized investments prior to 1999. Put differently, subsidized investments are expected to have a smaller effect on future sales as proxy for future cash flows at the establishment level (i.e., lower investment quality).

To test this prediction, we use rich administrative establishment-level data for a representative panel of 62,021 German manufacturing firm establishments between 1995 and 2008. The key advantage of the firm panel data is that, in contrast to financial accounting data from sources such as Amadeus or Compustat, these data provide detailed information at the *establishment* level for a *census of all* German establishments with at least 20 employees in the manufacturing sector. These data also entail information about the municipality in which the establishment is located and whether the establishment is eligible for bonus depreciation tax incentives. We use information on sales as a proxy of future cash flows or productivity to assess investment quality at the establishment level. Specifically, we measure investment quality as the sensitivity of future sales to current investments. In an alternative specification, we find similar results when using gross profit as an alternative measure for future cash flows. We build on the findings of Eichfelder and Schneider (2018), who show that investment activity significantly decreased in Eastern establishments after the expiration of the DAL in 1999. In graphical analyses, we observe a common trend of investment activity and quality in the treatment group (Eastern establishments) and the control group (Western establishments).

respectively, of the stock of all Treuhand firms in 1994 (12,926 firms) had been either privatized or liquidated (BvS, 2003). The THA's main privatization strategy was to find an experienced and established West German firm. Management buyouts were a secondary alternative (Paqué, 2009). The fraction of international investors was only about 6%, making firms in the West by far the most relevant investor group (BvS, 2003). This is confirmed by our data. Of all the observations of mixed firms with establishments in both parts of Germany, more than 94% are observations of firms with headquarters in the West.

Using our sample of German manufacturing firms and the DiD setting, we find empirical support for our hypothesis. While current investments increase future sales, this relation is significantly weaker for the investments of treated establishments prior to 1999. In particular, compared to the relation between investment in period t and sales in $t + 1$ ($t + 4$) for investments without tax subsidies, subsidized investments in the East before 1999 show a 22.6% (34.6%) lower sensitivity of future sales to investments. Our results are consistent with bonus depreciation significantly reducing investment quality. The economic magnitudes also indicate that tax incentives, while fostering investment, can lead to substantially lower investment quality.

An obvious concern about our identification strategy is that the effect is not driven by the availability of bonus depreciation, but by differences in local economic conditions or by differences in the availability of technology between the treatment group (Eastern establishments) and the control group (Western establishments). In our baseline tests, we account for this concern by including a comprehensive set of controls and fixed effects: 1) a DiD interaction term of investments and a dummy variable for Eastern establishments; 2) regional controls at the district level, such as the gross domestic product (GDP) per capita, capturing local economic conditions in both parts of Germany; 3) industry–year fixed effects capturing general and industry-specific economic trends and business cycles; and 4) establishments fixed effects that account for all time-invariant differences between establishments in East and West Germany.

Nevertheless, there could still be concern that our results are driven by alternative explanations, and not by DAL bonus depreciation. Thus, we perform additional and more specific empirical tests that aim to disentangle the effect of bonus depreciation from alternative explanations. In a first set of tests, we analyze whether the effect on investment quality is stronger in subsamples with a higher DAL tax incentive. Specifically, we test whether the effect of bonus depreciation on investment quality varies with the local business tax rate. In theory, depreciation tax incentives obviously

increase with tax rates. The German setting enables us to study variation in local business tax rates among municipalities. We show that the negative effect of bonus depreciation on investment quality increases with the tax rate. This finding supports our view that DAL tax incentives, and not economic differences between the two parts of Germany, are driving our results.

In a second set of tests, we specifically address the concern that the production technologies and quality of investments could be structurally different for establishments in the two parts of Germany. Therefore, we concentrate on firms with headquarters in West Germany and establishments in *both* parts of Germany. This ensures that the establishments in both regions have access to the same technology, whereas only establishments in the East benefit from bonus depreciation. By further including fixed effects for each firm–year combination, we can further control for all changes in investment opportunities and productivity within a firm. Thus, we effectively run a within-firm analysis across establishments that captures DAL tax incentives on a very granular basis. In both specifications, we still find robust evidence that DAL bonus depreciation significantly reduces investment quality.

Third, we specifically address the concern that establishments and local economic conditions in the two parts of Germany could be structurally different and could bias our results. Therefore, we use propensity score matching to select a control group of establishments in West Germany that are as similar as possible to the treated establishments in East Germany. Our approach benefits from the much higher number of Western establishments that can be used to select an optimal match. In an additional test, we control for regional economic characteristics on a very granular basis. Specifically, we enrich the model by district–year fixed effects that control for economic shocks at the level of small regional administrative bodies, including counties (*Landkreise*) and urban districts (*kreisfreie Städte*). Since all the districts belong to either the Western part (control group) or the Eastern part (treatment group), adding district–year fixed effects also accounts for

any macroeconomic trends and shocks that affected both parts of Germany differently. These additional validation tests confirm our main result: subsidized investments in the East result in significantly lower future sales than investments by establishments that do receive tax subsidies.

To further corroborate these findings, we analyze how differences in firm productivity and size are associated with the impact of the DAL on investment quality. With respect to productivity, we argue and find that low-productivity firms experience a greater decline in investment quality when they benefit from bonus depreciation. This result implies that granting tax subsidies to low-productivity firms results in an especially high decline of the investment quality of such firms (see also Bethmann et al. (2018), and the case of tax refunds from loss carrybacks). Finally, we explore how firm size moderates the effect of tax incentives on investment quality. Consistent with evidence on the weaker investment reactions (Eichfelder and Schneider, 2018) and lower bonus depreciation take-up rates (Knittel, 2007; Kitchen and Knittel, 2011) of small firms, the results suggest that DAL-incentivized investments especially reduced the investment quality of larger firms. It thus seems as if fixed tax planning costs make it more costly for small firms to adjust their investment programs to investment tax incentives. Consequently, investment tax incentives have a weaker distortionary effect on smaller firms with less tax knowledge and higher tax planning costs.

Our paper contributes to the literature in three ways. By showing that bonus depreciation adversely affects investment quality, we contribute to the broad literature on taxes and business investment. In this line of research, most papers focus on the effect of corporate taxes (Cummins et al., 1996; Chirinko et al., 1999; Djankov et al., 2010; Bond and Xing, 2015; Giroud and Rauh, 2019), shareholder taxes (Becker et al., 2013; Yagan, 2015; Alstadsæter et al., 2017), or consumption taxes (Jacob et al., 2019) on investment levels. In addition, a more specific stream of the literature discusses the relevance of bonus depreciation and other forms of investment tax incentives to investment levels (e.g., House and Shapiro, 2008; Wielhouwer and Wiersma, 2017;

Zwick and Mahon, 2017; Ohrn, 2018). Therefore, our first contribution is to argue and empirically show that investment quality is an important but typically overlooked aspect of investment tax incentives and tax policy. The assessment of the effectiveness of tax policy measures thus generally requires *both* an analysis of the tax impact on the quantity *and* quality of investments.

As a second contribution, we provide a quantitative estimate of the impact of investment tax incentives on investment quality. Corresponding to our estimates, a 50% bonus depreciation has an economically strong adverse effect on investment quality, especially in the long run. We find that the sensitivity of future sales revenue to investments decreases by 22.6% in the case of subsidized investments for one-year-ahead sales and by 34.6% for four-year-ahead sales.

As a third contribution, we analyze how the impact of tax incentives on investment quality varies across firms. Thus, we also contribute to the relatively scant literature on how firm characteristics are related to the impact of tax incentives on the level of investment (Edgerton, 2010; Zwick and Mahon, 2017). We find that DAL bonus depreciation had a much stronger adverse effect on investment quality among large firms and firms with relatively low productivity. Since policy tends to support economic sectors during economic downturns when productivity is low, consideration of the effects of taxes on investment quality for the economy as a whole is critical in the evaluation of tax policy.

2. Institutional Background and Setting

Generally, the German tax system is similar to many other countries' corporate tax systems. Corporate profits are subject to corporate income tax, local business tax, and dividend taxes.[3] The German tax code defines the tax base, including depreciation schemes applicable to all firms in Germany. In addition, a special bonus deprecation was instituted to foster investment in East

[3] Around 2000, Germany also changed the dividend tax regime from an imputation system to a system as in the United States, with corporate and dividend taxation without tax credits. However, since all firms in Germany were similarly affected by this change, it should not affect the treatment and control groups differently.

Germany after reunification, which we examine in this paper. To promote economic growth and investment in the five East German states (Brandenburg, Mecklenburg-West Pomerania, Saxony, Saxony-Anhalt, and Thuringia) and in Berlin, German policymakers increased incentives for industrial investments in these areas. The two major programs were the DAL and the Investment Subsidy Law (*Investitionszulagengesetz*, hereafter ISL), which were both enacted in January 1991. In addition, firms could also apply for direct grants as part of the Joint Task Program "Enhancement of Regional Economic Structure", which supports investments in underdeveloped German areas (*Gemeinschaftsaufgabe "Verbesserung der regionalen Wirtschaftsstruktur"*, hereafter JTP). The DAL was among the most costly subsidies of the 1990s. In 1996, the DAL ranked first among all tax incentive programs, with tax revenue losses equivalent to €4.7 billion.

The DAL allowed firms to depreciate 50% of eligible investments immediately, while the remaining 50% of book value were depreciated over the useful asset life.[4] This applied to investments in the five East German states and in Berlin. The bonus depreciation could be easily claimed in the filing of the regular tax return. The subsidy was not restricted to specific branches or business types and was available for movable assets (except for aircrafts) and investments in structures, including the modernization of buildings. We exploit the expiration of the DAL in December 1998, which we interpret as an increase in the user costs of capital.

Firms could also apply for subsidies according to the ISL (expired in 2013) and the JTP (still ongoing). In contrast to the DAL, JTP and ISL required a formal application, resulting in higher compliance costs. The assessment base of both programs was smaller and funding criteria were more rigorous. Before 1999, ISL subsidies were restricted to new movable assets, with some exceptions (no low-value assets, cars, or aircraft). After 1999, ISL subsidies were expanded to

[4] As an alternative, bonus depreciation could also have been freely allocated over the first five years following the investment, if no other special depreciation schemes had been used.

investment in new structures, but only in the case of so-called "initial" investments, including the foundation or extension of an establishment, major modifications of products and production methods, and the acquisition of a business that would otherwise have been liquidated. In case of the JTP, fundable investments included movable and intangible assets. However, there was no legal entitlement for the provision of grants and funding rates depended on the individual decisions of administrative authorities. Further, received JTP grants were included in the income tax base.

Table 1 summarizes the most relevant features of the programs. The key changes occurred for bonus depreciation (DAL). Figure 1 shows the aggregate value of DAL ISL, and JTP subsidies by their present value (for the calculation of the present value of DAL benefits see Eichfelder and Schneider, 2018) from 1995 to 2008. Aggregate subsidy volumes (DAL, ISL, and JTP) as well as DAL subsidies dropped significantly around DAL expiration in 1998/1999, while the sum of ISL and JTP subsidies remained quite stable over time. The small DAL subsidies after 1998 resulted from delayed bonus depreciations. Taken together, Figure 1 clearly documents a decline in aggregate tax subsidies due to the expiration of the DAL bonus depreciation.

3. Theoretical Framework and Hypotheses

We develop our main prediction based on the theoretical framework of tax policy and business investment of Hall and Jorgenson (1967). According to their model, taxes and tax incentives have an impact on the cost of capital, expressed by the user cost of capital. Abstracting from adjustment costs, the user cost of capital in *t* can be described by

$$C_t = \varphi_t \cdot T_t \cdot \left(\rho_t + \delta_t - E\left(\Delta\varphi_t / \varphi_t \right) \right), \tag{1}$$

with price level φ_t, the after-tax cost of funds (debt and equity) ρ_t, and the economic rate of depreciation δ_t in *t*. The term $E\left(\Delta\varphi_t / \varphi_t \right)$ describes expected changes in the price of capital goods.

Therefore, $\delta_t - E\left(\Delta\varphi_t/\varphi_t\right)$ is the expected net economic rate of depreciation (Auerbach, 1983). The tax term T_t can be written as

$$T_t = \left(\frac{1-\tau_t \cdot Z_t - s_t}{1-\tau_t}\right). \tag{2}$$

Thus, T_t depends on the statutory corporate tax rate on profits, τ_t; the rate of direct subsidies for capital investment, s_t; and the present value of depreciation allowances, such as the DAL depreciation per euro invested, Z_t. Granting investment tax incentives by increasing the net present value of depreciation allowances Z_t (e.g., via a bonus depreciation program) or the value of direct subsidies s_t reduces T_t and, consequently, the user costs of capital C_t.

In a model without investment adjustment costs, the user cost of capital is equal to the marginal product of capital (Hall and Jorgenson, 1967). Thus, firms expand capital expenditures as long as the user cost of capital falls short of the marginal return to capital. Hence, a reduction of the after-tax user costs of capital could turn some investment projects that are not profitable before taxes into profitable investments after taxes. Investors will expand capital expenditures as long as the reduced user cost of capital is below the marginal return of the investment projects. Hence, lowering the user cost of capital results in a lower marginal and average return on capital and, ultimately, a lower quality of investment. From this, we derive our hypothesis as follows.

H1: Tax incentives in the form of bonus depreciation reduce the quality of investments.

An alternative theoretical consideration might be that tax incentives could help firms overcome underinvestment problems resulting from inefficiencies in the capital market and a lack of firm's access to capital. In such a scenario, tax incentives might not only increase investment levels but also productivity (e.g., Liu and Mao, 2019).

4. Empirical Research Design and Data

4.1. Identification Strategy

We exploit the DAL's expiration in 1999 as variation in the user cost of capital of investments. This setting provides us with a DiD design in which we use the expiration of bonus depreciation for identification purposes. First, we compare the quality of treated investments in Eastern establishments with untreated investments in Western establishments over the DAL funding period from 1995 to 1998.[5] Second, we compare the quality of treated investments in Eastern establishments with the quality of untreated investments after the DAL's expiration in 1998. Combining both dimensions yields our DiD design.

We measure the quality of investments by their ability to generate future cash flows. Thus, we follow Hall and Jorgenson (1967) and compare the costs of an investment (the investment expense in t) with the marginal return on investment (the cash flow in $t+x$). We rely on investment data at the establishment level, since DAL bonus depreciation was available to all business establishments in East Germany. Thus, the variation of DAL bonus depreciation is at the establishment level, and not at the firm level. Relying on firm-level data results in potential misclassification of treated investments, since Western firms can have establishments in the East. As our data does not provide information on cash flows or profits at the establishment level, we use information on sales as a proxy variable for future cash flows as incremental sales ceteris paribus increase cash flows from operations. In an alternative robustness test (see Table 8), we use gross profit, defined as sales minus wage costs at the establishment level, as an alternative proxy for future cash flows.

[5] For our empirical analysis, we disregard ISL and JTP subsidies for investments in Eastern establishments after 1998, since these were granted over the entire observation period for investments in East Germany. While some of the changes of these programs coincided with the expiration of the DAL after 1998, the aggregate subsidy volume of both programs remained stable over time (see also Figure 1).

For each establishment i, we regress the logarithm of sales revenue in future periods $t + x$ ($Sales_{it+x}$) as our proxy for the future return on investments on the logarithm of investments in the current period t ($Invest_{it}$) as our proxy for the current costs of investments.[6] A benefit of this logarithmic specification is that regression coefficients can be interpreted as elasticities. In addition, logarithmic models account for nonlinearity and are more robust to outliers than regressions with scaled investments as the dependent variable (Zwick and Mahon, 2017). The number of leads (x) ranges from one to four. Thus, we analyze in our regression models how current investments affect future cash flows as proxied by sales at the establishment level. We define investments as the net of gross investments minus disinvestments (e.g., the sale of equipment or buildings).

To arrive at our DiD approach, we interact investment with a dummy for the bonus depreciation period ($Bonus_t$) and a dummy for the treated establishments in East Germany ($East_i$).[7] Note that previous investments in t are exogenous from the perspective of the future period $t + x$. Our baseline specification is

$$\begin{aligned} Sales_{it+x} = {} & \beta_0 + \beta_1 \cdot Invest_{it} + \beta_2 \cdot Invest_{it} \times Bonus_t \\ & + \beta_3 \cdot Invest_{it} \times East_i + \beta_4 \cdot Invest_{it} \times Bonus_t \times East_i \\ & + \gamma_1 \cdot CE_{it} + \gamma_2 \cdot CD_{it+x} + \alpha_i + Y_t + IY_{it} + u_{it}. \end{aligned} \tag{3}$$

The interaction terms $Invest_{it} \times Bonus_t$ and $Invest_{it} \times East_i$ control for differences in investment quality before and after the variation in the bonus depreciation regime. The effect of the DAL on investment quality is captured by the interaction term $Invest_{it} \times Bonus_t \times East_i$. Consistent with our hypothesis, we expect β_4 to be negative. While investments generally increase future sales revenue

[6] We add one to the invested amount to avoid undefined logarithmic values in the case of zero investments.

[7] Our objective is to provide evidence that DAL affected the association between current investments and future sales as proxy for future cash flows. This requires an interaction of $Invest_{it}$ with the difference-in-differences interaction terms. In contrast, a reduced form standard difference-in-differences specification explaining future sales simply by $East_i$, $Bonus_t$, and the interaction term $Bonus_t \times East_i$ would only be able to capture the impact of the DAL on future sales *quantity*, which is mainly driven by investment *quantity*, but not on investment *quality*.

($\beta_1 > 0$), the increase in future sales is expected to be smaller if investments are subsidized by bonus deprecation ($\beta_4 < 0$). We make no predictions for the other interactions.

To account for time-invariant cross-sectional differences between establishments, we control for establishment fixed effects α_i. We further consider year fixed effects Y_t and industry–year fixed effects IY_{it} to account for (industry-specific) economic shocks (e.g., industry trends, business cycles). These fixed effects absorb the main effects of $East_i$ and $Bonus_t$. We further add two vectors of control variables at the establishment level (CE_{it}) and the district level (CD_{it+x}). Establishment controls CE_{it} account for the heterogeneity of establishments in the investment period t. We use the logarithm of *Capital Stock*$_{it}$ and the ratio of current sales to capital stock *Sales per Capital*$_{it}$ as a measure of productivity.[8] District controls CD_{it+x} account for the heterogeneity in economic conditions and capture region-specific economic shocks on future output in $t+x$. We include the unemployment rate in percentage points (*Unemployment rate*$_{it+x}$), the logarithm of the GDP per capita in a district (*GDP per capita*$_{it+x}$), and the logarithm of the population of a district (*Population*$_{it+x}$).

4.2. Data

We use the German AFiD panel for the manufacturing and mining industries from 1995 to 2008 at the establishment level (e.g. a branch, a production cite). With our data, we are able to identify exactly if an investment of a firm in executed in East Germany or West Germany. Our main data are two business surveys conducted by the Federal Statistical Office of Germany: the Investment Survey (*Investitionserhebung bei Betrieben des Verarbeitenden Gewerbes sowie der Gewinnung von Steinen und Erden*) and the Monthly Report (*Monatsbericht bei Betrieben des Verarbeitenden Gewerbes sowie der Gewinnung von Steinen und Erden*) for the manufacturing and

[8] For a definition and derivation of the capital stock, see Appendix B of Eichfelder and Schneider (2018).

mining industries. Both surveys are mandatory and comprise a full census of all business establishments with at least 20 staff members, including managers and working business owners.

Besides being census data, the data have advantages when compared to firm data such as that of Compustat or Amadeus. Unlike publicly available financial accounting data, the Investment Survey data provide very detailed information on investments at the establishment level, which is needed to identify DAL-treated investments in Eastern establishments. Financial accounting data do not provide the locations of establishments, since firms can have more than one establishment. Since our data do not report capital stocks at the establishment level and since this information is not available in the financial accounting data either, we approximate capital stocks at the establishment level using additional information from the Cost Structure Survey (*Kostenstrukturerhebung bei Unternehmen des Verarbeitenden Gewerbes sowie der Gewinnung von Steinen und Erden*) and extending the approach of Wagner (2010) as described by Eichfelder and Schneider (2018).

The full data set comprises 691,822 observations between 1995 and 2008 of business establishments that participated in the Investment Survey and the Monthly Report and reported both firm and establishment IDs. Due to Berlin's special status, we omit 13,394 observations on establishments located there. Since our focus is on the manufacturing industry, we also exclude 21,019 observations of mining companies. We also drop 164,054 observations with missing data on the primary variables of interest. After these adjustments, our sample comprises 493,355 observations for 62,021 business establishments. We also collect data for regional variables from RegioStat[9] to account for regional economic conditions. Hence, we have a comprehensive panel of establishment–year observations covering the period between 1995 and 2008.

[9] See https://www.destatis.de/DE/Publikationen/Thematisch/Regionales/Regiostatkatalog.html.

4.3. Descriptive Statistics

Table 2 presents descriptive statistics for the final sample, the treatment group, and the control group. We adjust all variables for inflation using the German producer price index for the manufacturing industry (German Council of Economic Experts, 2011, p. 409). Since the Federal Statistical Office of Germany does not publish regional producer price indexes, we assume that the equipment prices are similar for all firms. This assumption can be justified by the high level of economic integration, implying low transportation and transaction costs for movable assets. Building prices, however, can depend on local economic conditions. In addition, a regional subsidy such as bonus depreciation could increase not only regional investment, but also regional prices (e.g., House and Shapiro, 2008).[10] We therefore use state-level building price indexes for the manufacturing industry to calculate the price adjustment of building investment volumes.[11]

Although Western and Eastern establishments' average investments (€1.14 million and €1.08 million, respectively) and capital stocks (€4.87 million and €4.34 million, respectively) are quite similar, the control group's average sales (€35.30 million) and wages (€5.62 million) are significantly higher than the treatment group's (€16.18 million in sales, €2.07 million in wages). At least in part, this should be due to differences in industries, which will be captured by the establishment fixed effects and the industry-year fixed effects in our regression models. In addition, unemployment rates in the East German districts are higher and the GDP-per-capita ratios are lower than in West Germany. We further address concerns about whether these differences are driving our main findings by three additional validation tests in Section 5.2.

[10] This argument does not hold for movable assets that are traded globally. Since the East German economy is small, the impact of local subsidies on the prices of such goods will be small. Further, due to limited transaction and transportation costs, the differences in prices for such assets between East Germany and West Germany are small.

[11] The corresponding price indexes are provided by the statistical offices of 10 major German states. For the federal states Bremen, Hamburg, Mecklenburg-West Pomerania, Rhineland-Palatinate, and Schleswig-Holstein, we rely on the average building price indexes for West and East Germany. These average price indexes are calculated by the GDP-weighted average of the price indexes for states in West and East Germany.

4.4. Common Trends Assumption

One key assumption critical to our identification strategy is the common trends assumption, such that, apart from the treatment effect, the trends of the two samples (the treatment group and the control group) should not differ from each other. In our study, we examine the expiration of a bonus depreciation regime. We interpret the DAL's expiration as a policy change that *increases* the user cost of capital of investments in East Germany, if compared to West Germany as our point of reference. Consistent with standard DiD estimation, we expect a common trend of investment activity in both parts of Germany prior to the change in user costs. After the DAL's expiration, H1 suggests a negative treatment effect on the volume and a positive treatment effect on the quality of investments in Eastern establishments.

We compare the investments for the treatment and control groups over 1995–2008, as Eichfelder and Schneider (2018). Since we are only interested in differences in trends for both groups and not in differences in means, we demean the variables with their average value in the period after 1999 and subtract the mean of the logarithm of investments from 1999 to 2008 for each establishment. Hence, we calculate yearly deviations from the "normal" average investment activity from 1999 to 2008. Figure 2 shows the average price-adjusted and demeaned investments for the treatment and control groups. Prior to 1999, the treated establishments have a higher level of investment, as one would expect, because of the bonus depreciation regime. In addition, the graphical analysis suggests a common trend of investment activity within the DAL period for both groups. After 1998, investment activity strongly declines in the treatment group, bringing investment activity down to the level of the control group within an adjustment period of two years (1999 until 2000). Thus, we find that the investment reaction to DAL expiration takes some time. This delayed investment reaction is not surprising considering that investments in buildings and machinery (especially large, permanently installed machinery) in the manufacturing sector are

associated with time-consuming construction works and that delays in construction works are a common problem. Therefore, it should have taken some time until the expiration of tax incentives reduced investment activity. From 2000 on, we again observe strong graphical evidence of a common trend of both groups. In sum, the graphical evidence suggests a common trend for investments of both groups before and after the expiration of the DAL, as well as a strong decline in the investment activity of the treatment group in the two years after the DAL's expiration.

As our focus is on investment *quality*, we next calculate the logarithm of the ratio of future sales to the aggregate sum of investments over four years.[12] This is consistent with our regression approach in equation (3) and implies that investments have a long-term effect on future sales as our proxy for cash flows over at least four years, which is also confirmed by the results in Section 5. As in Figure 2, we demean this proxy of investment quality by its mean value in the post-DAL period. Figure 3 presents results. Due to the lead-lag structure[13] our final year in Figure 3 is 2004. In line with H1, we find lower values of investment quality for DAL-funded investments in Eastern establishments (1995–1998). In contrast, we observe a common trend of investment quality for non-DAL-funded investments of establishments in both regions after 1998. The convergence of both trends from 1995 to 1998 is consistent with the fact that the weight of "low quality" investments decreases over time. While DAL-induced investments in 1995 (low quality) are followed by three years of low-quality investments, DAL-induced investments in 1998 (still low quality) are followed by "high-quality" investments of the subsequent years. As a consequence, the weight of the DAL subsidies for future cash flows diminishes over time, which is exactly what we find in Figure 3. Overall, Figure 3 suggests that DAL reduced the average quality of investments

[12] Results remain qualitatively unchanged if we calculate the ratio of future sales to investments over one to three periods.
[13] This can be explained by the year 1996 as an example. For this year, we compare four-years-ahead sales in 2000 to the sum of investments over the period 1996–1999.

in Eastern establishments and that apart from DAL effects investment quality follows a common trend for the treatment and the control group. Thus, graphical analyses support our assumption that Western establishments are well-suited as a control group for the treated Eastern establishments.

As mentioned above, to address concerns that differences between Eastern and Western establishments are driving our results, in Section 5.1, we enrich our baseline model with a comprehensive set of control variables accounting for the macroeconomic environment and establishment characteristics. In addition, we perform three sets of additional validation tests in Section 5.2 to provide additional evidence that the increase in investment quality after 1998 resulted from expiration of the DAL, and not from other economic shocks or trends.

5. Results

5.1. Baseline Results

In this section, we present the results of baseline model estimation. The coefficient estimates are reported in Table 3. We use up to four leads, which reduces the sample to 295,545 observations in tests with four leads (Columns (4) and (8)). The model in Columns (1) to (4) includes the main variables of interest, as well as firm and year fixed effects. Establishment controls, district controls, and industry–year fixed effects are added in Columns (5) to (8).

Consistent with the notion that investments translate into higher future sales revenue, we find investments to have a positive effect on future sales. The average effect of investments on sales revenue is greater for the investments of Eastern establishments ($Invest_{it} \times East_i$) and lower for investments from 1995 to 1998 ($Invest_{it} \times Bonus_t$). Our main variable of interest is the interaction term $Invest_{it} \times Bonus_t \times East_i$. Consistent with our hypothesis, we obtain a negative and statistically significant coefficient in all specifications. Table 3 implies a negative effect of the DAL bonus depreciation on investment quality. Thus, reduction of the user cost of capital via tax subsidies reduces the average quality of investments. This finding is robust to the inclusion or exclusion of

control variables and is persistent over time, as suggested by the significant and negative coefficients across all columns.

To provide a quantitative interpretation of the effect of bonus depreciation on investment quality in Table 3, we compare the effects of investments in Eastern establishments on future sales as proxy for cash flows (captured by the coefficients of $Invest_{it}$ and $Invest_{it} \times East_i$) with the treatment effect (captured by the coefficient of $Invest_{it} \times Bonus_t \times East_i$) using the models with all controls (Columns (5) to (8)). We find that bonus depreciation reduced the average quality of investments compared to the average quality in Western establishments by 22.6% (= -0.00747/(0.0229 + 0.0101), in Column (5)), to 34.4% (= 0.00363/(0.0071+0.00344), in Column (8)). Therefore, although bonus depreciation could have a substantial and significant effect on firms' decisions to invest, as suggested by prior literature (e.g., House and Shapiro, 2008; Zwick and Mahon, 2017; Eichfelder and Schneider, 2018; Ohrn, 2018), our results suggest that bonus deprecation results in economically less valuable investments, since they yield significantly lower future sales.

5.2. Mechanism and Identification Concerns

In this section, we provide evidence of the mechanism—the value of bonus depreciation reducing the user cost of capital—behind the effect on investment quality. Our hypothesis is rooted in the theoretical consideration that bonus depreciation tax incentives increase the after-tax net present value of investments. Consequently, firms increase their investments and, at the margin, choose investment projects with lower pretax rates of return. To verify this underlying economic mechanism and to provide additional evidence on the causal effect of bonus depreciation on investment quality, we consider three types of additional tests. First, we use the variation of local tax rates to show that the impact of the DAL on investment quality increases with investment tax incentives (Section 5.2.1). Second (Section 5.2.2), we focus on a sample of West German firms

with establishments in both parts of Germany and control for firm–year fixed effects to control for potential differences in production technologies between the two parts of Germany. Third (Section 5.2.3), we use propensity score matching and district–year fixed effects to account for potential economic differences between the two parts of Germany.

5.2.1 Variation in Tax Rates

Neoclassic investment theory suggests that higher subsidies have a stronger (negative) impact on investment quality. As stated in equation (2), the effect of bonus depreciation on investment is a function of the effective marginal corporate tax rate. If the tax rate increases, bonus depreciation has a stronger effect on the user costs and, thus, the investment tax incentive of the subsidy increases. To test this mechanism in our empirical setting, we use the variation of local business tax rates across German municipalities. Support for this mechanism would also address concerns that economic differences between East and West Germany, and not bonus depreciation, could drive our results. If differences between East and West are driving our findings, we should not find evidence that the level of the local business tax rate, which differs across municipalities, is related to the adverse effect of bonus deprecation on investment quality.

The domestic business profits of German manufacturing firms are subject to local business tax. In addition to the federal corporate tax, each German municipality has the authority to set the local business tax rate. This local tax rate is relevant to all business establishments in a municipality. In the case of firms with more than one establishment, the profits are allocated via a formula apportionment system, with wages as the sole apportionment factor (for more detail, see Eichfelder et al., 2018). The large number of municipalities (12,266 over our sample period) guarantees sufficient variation in tax rates for our analysis. Figure 4 provides an overview of local business tax rates in Germany in 1998.

We expect bonus depreciation to have a stronger negative effect on investment quality for establishments in high-tax municipalities vis-à-vis low-tax municipalities. To test this empirically, we extend our baseline model to a triple-difference specification, where the third difference compares establishments in low-tax municipalities to establishments in high-tax municipalities. We obtain the following triple-difference model

$$\begin{aligned} Sales_{it+x} = {} & \beta_0 + \beta_1 \cdot Invest_{it} + \beta_2 \cdot Invest_{it} \times Bonus_t + \beta_3 \cdot Invest_{it} \times East_i \\ & + \beta_4 \cdot Invest_{it} \times Bonus_t \times East_i + \beta_5 \cdot Invest_{it} \times Hightax_i \\ & + \beta_6 \cdot Invest_{it} \times Bonus_t \times Hightax_i + \beta_7 \cdot Invest_{it} \times East_i \times Hightax_i \\ & + \beta_8 \cdot Invest_{it} \times Bonus_t \times East_i \times Hightax_i \\ & + \gamma_1 \cdot CE_{it} + \gamma_2 \cdot CD_{it+x} + \alpha_i + Y_t + IY_{it} + u_{it}. \end{aligned} \tag{4}$$

All variables are defined as above and $Hightax_i$ is a dummy variable equal to one if the establishments' average local business tax rate in the DAL period (1995 to 1998) is above the median tax rate of the corresponding average local business tax rates in either East Germany, for Eastern establishments, or West Germany, for Western establishments. We do not include $Hightax_i$, since this variable is time invariant at the establishment level and captured by establishment fixed effects α_i. Our triple-difference interaction term $Invest_{it} \times Bonus_t \times East_i \times Hightax_i$ identifies the incremental impact of bonus depreciation in high-tax municipalities in DAL-treated establishments relative to those with lower tax rates.

We report regression results in Table 4. In Columns (5) to (8), we also report the results for an alternative empirical specification, where we include a standardized[14] local business tax rate ($Taxrate_{it}$) and corresponding triple-difference interaction terms instead of the triple-difference indicator with the dummy $Hightax_i$. Consistent with our hypothesis, we still obtain negative and—except for Column (4)—statistically significant coefficients for $Invest_{it} \times Bonus_t \times East_i$, indicating that bonus depreciation has a negative effect on investment quality in lower-tax jurisdictions as

[14] We demean the local business tax rate in these specifications to simplify the interpretation.

well. Consistent with our theory that the value of bonus depreciation is driving investment quality, the negative effect of bonus depreciation on investment quality is, however, significantly stronger if establishments are located in a high-tax municipality. This result is indicated by the negative and statistically significant coefficients on $Invest_{it} \times Bonus_t \times East_i \times Hightax_i$ in Columns (1) to (4) and on $Invest_{it} \times Bonus_t \times East_i \times Taxrate_{it}$ in Columns (5) to (8). Hence, Table 4 provides robust empirical evidence that the causal DAL effect on investment quality increases with the size of the subsidy (as determined by higher local business tax rates). Since the triple-difference approach in equation (4) controls for general differences in investment quality between high- and low-tax municipalities, this finding is driven by the impact of the local business tax on the value of the bonus depreciation tax incentives. At the same time, this result helps us to rule out that economic differences between East Germany and West Germany are driving our findings.

5.2.2 Within-Analysis of West German Firms

We further address the concern that establishments in East and West Germany differ in their access to technology or availability of knowledge. We run a subsample analysis of firms that have their headquarters in the West and establishments in the West, as well as in the East. Knowledge and technology are available to all the establishments of such firms. Columns (1) to (4) of Table 5 present the results of estimating equation (3) for this subsample of firms. We continue to find evidence of a lower investment quality of subsidized investments, namely, investments benefiting from the DAL. In Columns (5) to (8), we go one step further by including firm–year fixed effects. This ensures that the comparison of establishments in East and West Germany is *within* firms but *across* establishments. In other words, the counterfactual establishment is an establishment of the same firm that is not subject to the DAL. The results of this within-firm, across-establishment test support our main findings. Due to the loss of observations from restricting the sample, the statistical significance levels are somewhat lower ($1.94 < t\text{-stat.} < 2.50$), but the results are still statistically

significant. Importantly, the economic magnitude of the coefficients of $Invest_{it} \times Bonus_t \times East_i$ are comparable to those in our baseline estimate in Columns (5) to (8) of Table 3.

5.2.3 Local Fixed Effects and Matching

We finally address a potential concern that the results are driven by regional economic shocks, diverging trends in East and West Germany, or differences in the characteristics of the treatment and control groups by conducting two additional tests. First, we enrich the model by fixed effects at the district–year level. Districts are regional administrative bodies, including counties and urban districts. In 1995, at the beginning of our sample period, there were 328 districts (237 counties and 91 urban districts) in West Germany and 118 districts in East Germany (92 counties and 24 urban districts). By including district–year fixed effects, we control for local economic trends and shocks in both parts of Germany on a very granular basis. If our results are driven by regional economic trends (e.g., Eastern regions catching up to the West), this will be accounted for by district–year fixed effects. Still, we find robust and strong empirical evidence supporting our hypothesis (Table 6, Columns (1) to (4)).

To further support our choice of West German establishments as the control group, we use propensity score matching (Caliendo and Kopeinig, 2008) to ensure that our control and treatment groups are similar in terms of observable characteristics. We use one-to-one matching with replacement, using investments (the logarithm of investment increased by one to avoid undefined values), establishment size (measured by the logarithm of sales revenue or the logarithm of the number of employees), industry, firm type (single-establishment firm, multi-establishment firm, multinational firm, or a foreign firm), and the type of goods produced (input goods, investment goods, durables, or commodities) as matching variables. We select 1999 as our base year for matching, but we also consider the outcome values from future periods (2000–2008) for our time-variant matching variables. To ensure minimum common support, we drop establishments with

propensity scores above the maximum (and below the minimum) propensity score in our control group. We thus obtain a final sample of 97,867 observations from 7,440 establishments. There are 43,759 observations for West German establishments (control group) and 54,108 observations for East German establishments (treatment group). Using this matched sample (Table 6, Columns (5) to (8)), we confirm our earlier results for the unmatched sample. The regression coefficients of $Invest_{it} \times Bonus_t \times East_i$ are all negative and, apart from one specification, statistically significant.

5.3. Heterogeneity Analysis: Productivity and Size

In this section, we examine whether and how the negative DAL effect on investment activity is related to two key business characteristics: productivity and size. First, we examine how the effect of bonus depreciation on investment quality differs across firms with different levels of productivity. Firms with particularly low levels of productivity could experience a greater decline in the quality of their investment quality because of bonus depreciation. To see why, consider the cost of capital in our model. Low-productivity firms could find it harder to fund investments because they have higher financing costs (ρ_t in our model). Since the tax savings from bonus depreciation are multiplied by the cost of financing and economic depreciation (i.e., the pretax user cost of capital), tax benefits are more relevant for firms with low average productivity. Thus, we expect a stronger effect of bonus depreciation on low-productivity firms and their projects.

Second, we analyze how the effect of bonus depreciation on investment quality differs with firm size. Prior research on tax complexity and compliance costs (for a review, see Eichfelder and Vaillancourt, 2014) argues that the costs of tax planning are quasi-fixed. Thus, the costs of tax planning relative to firm size decrease as firms grow. Put differently, the cost of tax planning is much more burdensome for small firms. Survey evidence suggests that planning and compliance costs as a fraction of sales revenue can be 10 times and even up to 100 times larger for small firms (Gunz et al., 1995; Eichfelder and Vaillancourt, 2014). Therefore, larger firms tend to spend more

resources on tax planning. Consistently, Knittel (2007) and Kitchen and Knittel (2011) observe lower take-up rates of bonus depreciations and accelerated depreciations by small U.S. businesses. For DAL bonus depreciation, Eichfelder and Schneider (2018) provide evidence that large firms have a stronger investment response to DAL investment tax incentives. We thus expect DAL bonus depreciation to have a weaker impact on the investment decisions and investment quality of small firms relative to large firms.

To test both predictions empirically, we perform triple-difference regressions similar to equation (4). We interact our variables of interest with an indicator for high-productivity establishments or, alternatively, large establishments. We expect the DAL effect on investment quality to be smaller for high-productivity establishments and for large establishments. In both cases, we measure the average level of productivity (size) over the DAL period, that is, prior to 1999. The dummy variable $Highprod_i$ takes a value of one if the average ratio of gross profit (i.e., sales revenue minus wage costs) over total wages for establishment i within the DAL period (1995 to 1998) exceeds the median of the corresponding average ratio over that period in the respective group (treatment or control group). The variable $Large_i$ takes a value of one if the average establishment size (measured by wages paid) within the DAL period exceeds the median establishment size in the respective group.

In Table 7, we present the results for productivity (Columns (1) to (4)) and size (Columns (5) to (8)). The coefficient on $Invest_{it} \times Bonus_t \times East_i$ is negative and significant in all specifications, indicating that establishments with low productivity (or small size) experience a decline in their investment quality. We find a positive and statistically significant coefficient for the interaction term $Invest_{it} \times Bonus_t \times East_i \times Highprod_i$ in Columns (1) to (4). This result indicates that high-productivity firms experience a lower decline in investment quality than low-productivity firms. Columns (5) to (8) present the results using establishment size in the regression. We find a negative

coefficient for $Invest_{it} \times Bonus_t \times East_i \times Large_i$, which is significant in most specifications. In a robustness check presented below, we find quantitatively stronger and always statistically significant evidence for $Invest_{it} \times Bonus_t \times East_i \times Large_{it}$ if we restrict $Large_i$ to the top quintile of large establishments (as measured by wage payments). Consistent with our expectations, these findings suggest a stronger impact of the DAL on the investment quality of larger firms with lower costs of tax planning, while the effect of the DAL on the investment quality of smaller firms is weaker.

5.4. Robustness and Sensitivity Analyses

Finally, we perform additional analyses to address potential concerns about design choices in our analysis. First, we use the logarithm of gross profit (i.e., the difference between sales revenue and wage payments) as an alternative measure of future performance instead of future sales revenue (Table 8, Columns (1)–(4)). Confirming our baseline estimates even quantitatively, results suggest that DAL bonus depreciation reduced investment quality by 23.1–30.2%. Second, we use a reduced sample observation period from 1995 to 2006 (Table 8, Columns (5)–(8)) to obtain a more balanced sample of years with and without bonus depreciation. This approach addresses the concern that firms entering or exiting the sample could affect our results. Third, in an untabulated test, we include the logarithm of wage costs as an additional control variable. All these tests support our baseline estimates.

In Table 9, we present robustness tests using alternative definitions of the cross-sectional split measures of our heterogeneity tests from Table 7. In Columns (1) to (4) of Table 9, $Highprod_i$ takes a value of one if the average ratio of gross profit (i.e., sales revenue minus wage costs) to sales revenue of establishment *i* within the DAL period exceeds the median of the corresponding average ratio over that period. In Columns (5) to (8), $Large_i$ takes the value of one if the average establishment size (measured by wages paid) within the DAL period is higher than that of the top

quintile. With this more polarized specification, we intend to identify differences in DAL effects on the investment quality of very large establishments compared to the typically small establishments in our sample. In all specifications, we find a positive and significant coefficient for $Invest_{it} \times Bonus_t \times East_i \times Highprod_i$ and a negative and significant coefficient for $Invest_{it} \times Bonus_t \times East_i \times Large_i$. In line with Section 5.3, these findings suggest that the DAL had a stronger impact on large firms and on firms with low productivity.

6. Conclusion

This paper examines the effect of bonus depreciation on the quality of investment. Using the expiration of tax incentives via bonus depreciation in East Germany and a representative panel of both East and West German establishments, we show that investments eligible for bonus depreciation resulted in lower future sales and gross profits than investments not subject to bonus depreciation. This adverse effect of tax subsidies is stronger for jurisdictions with higher tax rates, for low-productivity firms, and for larger firms. Our results suggest that bonus depreciation significantly lowers the quality of investment. This effect is economically substantial: in our baseline model, bonus depreciation reduces the average quality of investments by 22.6–34.6%.

Our results are informative and important for policymakers, who frequently use bonus depreciation and other tax subsidies to promote investment and economic growth. Our results uncover an important potential cost of tax subsidies. Even though firms are inclined to invest more (e.g., Desai and Goolsbee, 2004; House and Shapiro, 2008; Zwick and Mahon, 2017; Ohrn, 2018), the average quality of investments is significantly reduced when investments are subsidized by bonus depreciation. Our results also contribute to empirical research on the effect of taxation on investment in general, because the focus of prior literature is often on the quantity but not on the quality of investments.

Finally, we also acknowledge two limitations of our analysis. First, despite the benefits of our data (census data with detailed establishment information), our analysis is limited to the German manufacturing industry. While the manufacturing sector is one of the most relevant industries in Germany, our results are not necessarily representative of other industrial sectors or other countries. Note that long-term business investments in machinery are especially an issue in the manufacturing sector, and the investment cycles of other sectors could be different. Second, we provide robust evidence on the impact of bonus depreciation tax incentives on investment quality, but do not perform a welfare analysis. Thus, we leave the question of how corresponding investment tax incentives affect economic welfare in the short and long run to future research.

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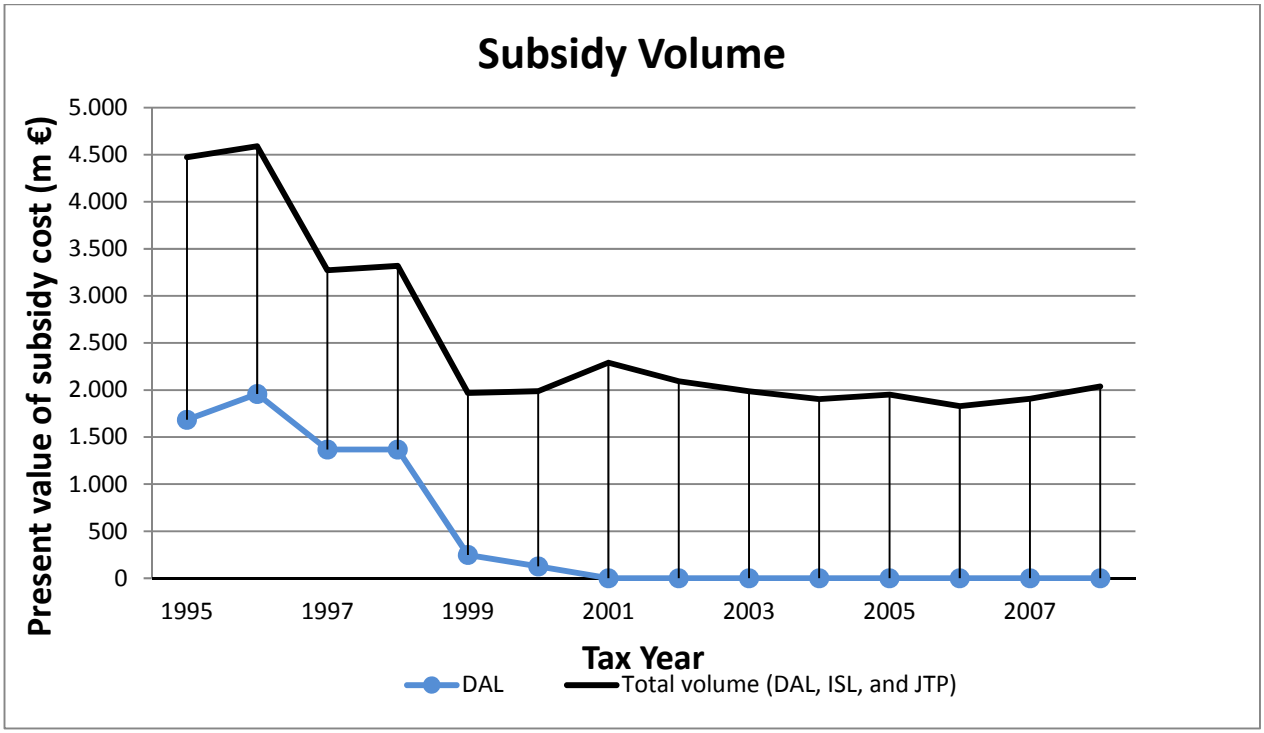
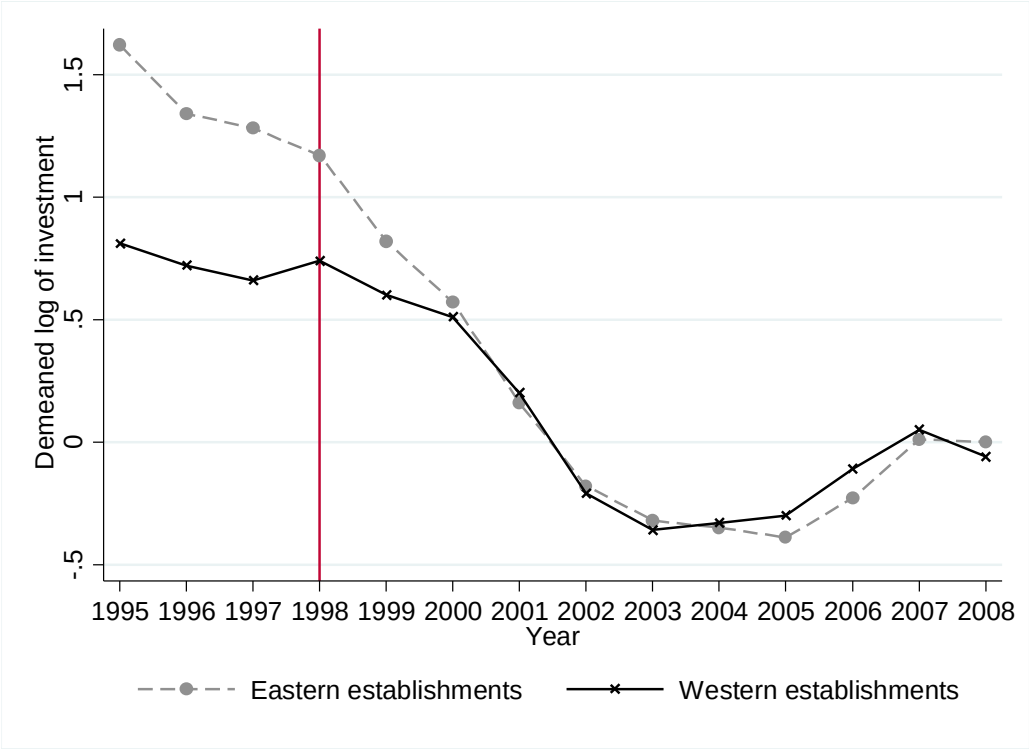
Figure 1: Subsidy volume of the DAL, the ISL, and the JTP



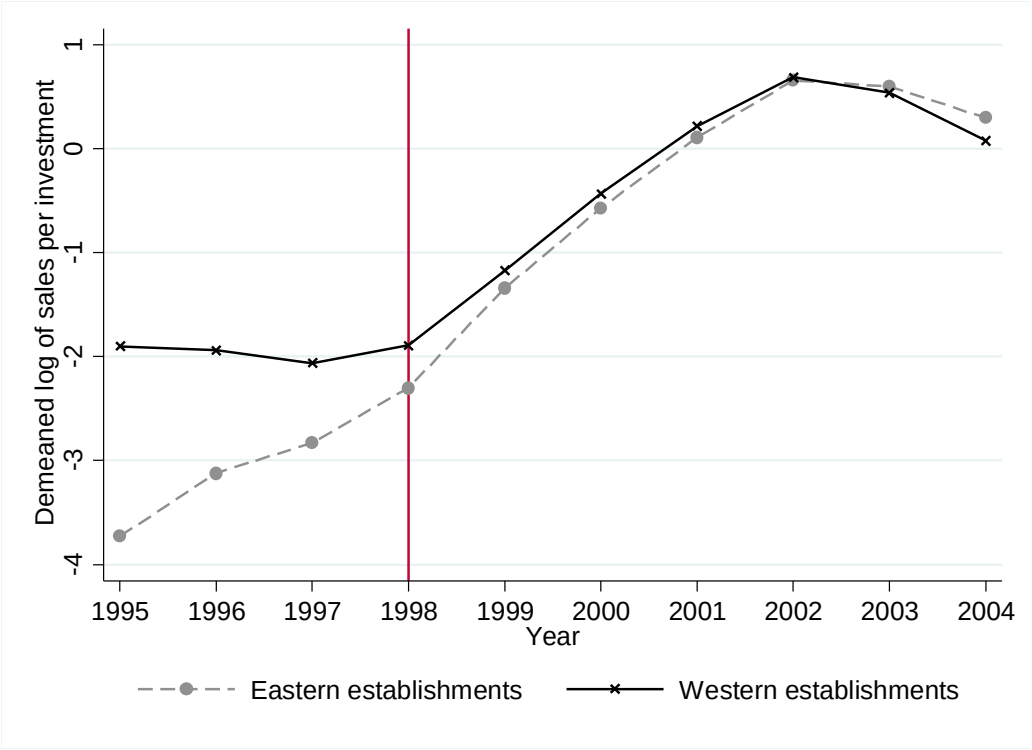
Note: This figures plots the present value volumes of subsidy costs for the DAL program and the sum of the DAL and ISL programs, based on German government reports on subsidies (Deutscher Bundestag, Drucksache 12/1525, Drucksache 13/2230, Drucksache 14/1500, Drucksache 15/1635, Drucksache 16/6275). For calculations, see also Appendix A of Eichfelder and Schneider (2018).

Figure 2: Demeaned investments



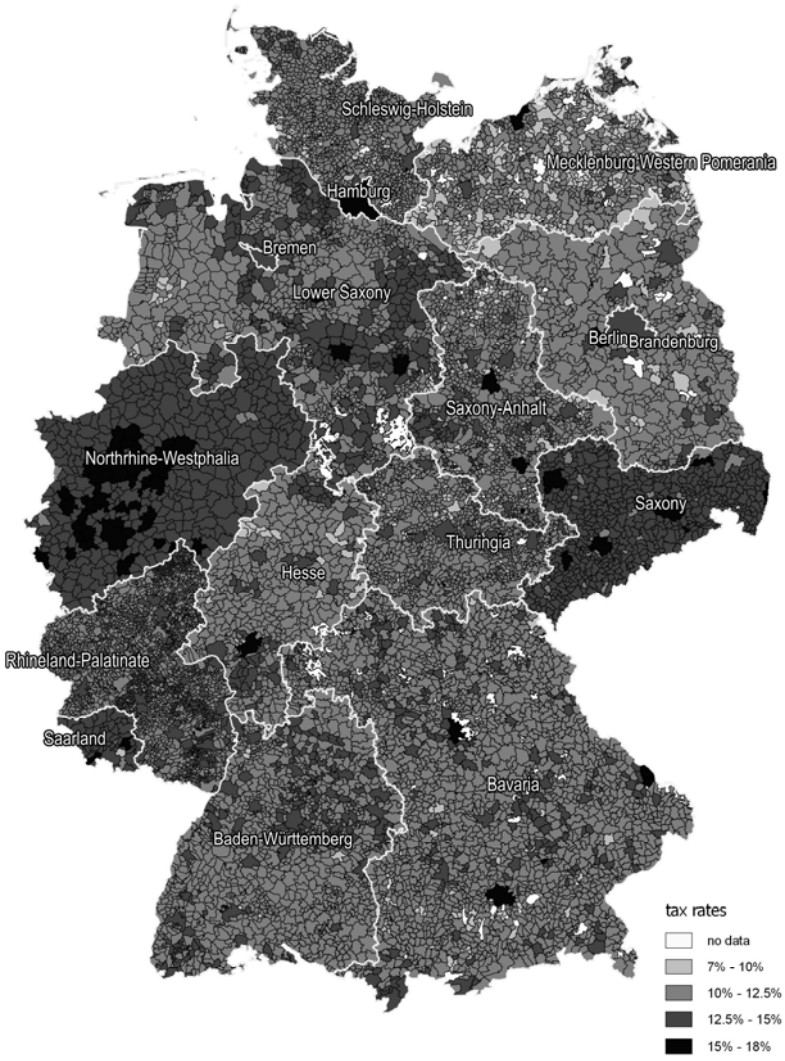
Notes: This figure plots the demeaned value of the logarithm of investments in the manufacturing sector for the treatment group (East German establishments) and the control group (West German establishments). The figure highlights the common trend in the investment activity of both groups in the DAL period (1995–1998) and following years. A clear break in trends is documented in the two years after 1998, shortly after the DAL bonus depreciation expired. Thus, the figure supports our view that the DAL's expiration had a strong negative effect on investment activity in East German establishments.

Figure 3: Demeaned logarithm of the sales per investment ratios



Notes: This figure plots the demeaned logarithm of the ratio of future sales to the aggregate sum of investments over four years in the manufacturing sector for the treatment group (East German establishments) and the control group (West German establishments). The figure highlights the common trend in the investment quality after the effects of the DAL have been leveled out. In contrast, we find a lower sales per investment ratio in years shortly after the expiration of the DAL suggesting a lower investment quality of DAL-induced investments.

Figure 4: Local business tax rates, 1998



Notes: This figure shows the local business tax rates in German municipalities in 1998. The local business tax rate depends on the general rate (typically 5% in 1998) and a local business tax multiplier determined at the municipality level. In addition, until 2007, the local business tax was deductible as a business expense. Local business tax multipliers typically vary between two and about five.

Table 1: Regional investment subsidies for establishments in Eastern Germany, 1995–2008

	DAL	ISL	JTP
Validity period	Until December 31, 1998	Whole observation period	Whole observation period
Subsidy form	Bonus depreciation	Direct and tax-exempt subsidy	Direct and taxable grant
General rates	50% (1995–1996), 40% (1997–1998)	5% (1995–1998),[c] 10% (1999), 12.5% (since 2000)	Maximum rates (actual grants depend on authority decision and overall funding level): 35% (1995–1996); 28–35% (1997–2006); 30% (since 2007)
Increased rates	N.A.	+ 5% (Small and medium-sized enterprises, SME, 1995–1998), twice the general rate for initial equipment investment (SME, since 1999); + 2.5% (border areas, since 2001)	Additional maximum rates for small and medium-sized enterprises: +15% (1995–2006); +10–20% (since 2007)
Special regional regulations	N.A.	Berlin: reduced validity periods (West Berlin) and reduced rates under certain conditions	Maximum rates and detailed regulations depend on the regional area; reduced rates for Berlin area (since 2000)
Assessment base	Movable assets (excluding aircraft), immovable assets, modernization of buildings	New and movable assets (excluding low-grade assets, aircraft, cars), new and immovable assets (since 1999), restriction to initial investments (since 1999)	Movable assets and intangible assets; fundable investments depend on minimum investment volumes, employment effects, and authority decisions
Formal requirements	Tax return with legal entitlement	Formal application with legal entitlement	Formal application without legal entitlement

Notes:
[a] The last amendment of the law (ISL 2010) had run out by the end of 2013.
The investment subsidy rate is up to 8% until the end of 1996 for investments that started before July 1994.

Table 2: Descriptive statistics by region

Panel A: Full sample (N = 493,355)	Mean	Standard Deviation	Median
Sales (€1,000,000s)	32.09	321.05	6.17
Investment (€1,000s)	1,117.05	11,256.07	111.49
Capital stock (€1,000s)	4,779.73	39,772.72	1,086.28
Wages (€1,000s)	5,041.51	31,121.98	1,473.40
GDP per capita (€1,000s)	25.49	9.81	23.56
Population (1,000s)	274.14	238.16	203.83
Unemployment rate (%)	10.38	4.65	9.20
Panel B: Control group (N = 412,898)	Mean	Standard Deviation	Median
Sales (€1,000,000s)	35.30	348.84	6.71
Investment (€1,000s)	1,138.42	11,641.19	113.59
Capital stock (€1,000s)	4,866.87	41,015.04	1,051.37
Wages (€1,000s)	5,621.03	33,900.80	1,622.06
GDP per capita (€1,000s)	26.99	9.87	24.55
Population (1,000)	297.75	250.34	243.79
Unemployment rate (%)	8.85	3.01	8.40
Panel C: Treatment group (N = 80,457)	Mean	Standard Deviation	Median
Sales (€1,000,000s)	15.61	84.80	4.07
Investment (€1,000s)	1,007.34	9,023.97	100.48
Capital stock (€1,000s)	4,338.53	32,658.60	1,264.55
Wages (€1,000s)	2,067.53	5,547.29	905.75
GDP per capita (€1,000s)	17.83	4.43	16.76
Population (1,000)	152.99	92.95	131.57
Unemployment rate (%)	18.25	3.49	18.30

Notes: This table presents descriptive statistics for business establishments in the manufacturing sector for the control group (West German establishments) and the treatment group (East German establishments). Establishment characteristics (sales, investment, capital stock, wages) are defined at the establishment level, and district characteristics (GDP per capita, population, unemployment rate) at the district level. Sales is sales revenue, investment is the sum of gross investments minus disinvestments, and wages are all payments to employees. Source: AFiD panel industrial units (pre-matched sample) for the manufacturing industry; own calculations.

Table 3: Baseline tests

Dependent variable	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Invest	0.0239***	0.0138***	0.0102***	0.00727***	0.0229***	0.0131***	0.00971***	0.00705***
	(0.000439)	(0.000390)	(0.000421)	(0.000428)	(0.000434)	(0.000386)	(0.000419)	(0.000427)
$Invest_t \times Bonus$	-0.0142***	-0.0117***	-0.00968***	-0.00779***	-0.0128***	-0.0107***	-0.00917***	-0.00766***
	(0.000595)	(0.000588)	(0.000599)	(0.000622)	(0.000591)	(0.000586)	(0.000601)	(0.000625)
Invest ×*East*	0.00982***	0.00470***	0.00347***	0.00358***	0.0101***	0.00488***	0.00358***	0.00344***
	(0.00102)	(0.000884)	(0.000956)	(0.00104)	(0.00101)	(0.000875)	(0.000952)	(0.00104)
Invest*×*East*×*Bonus	**-0.00738*** **	**-0.00648*** **	**-0.00591*** **	**-0.00548*** **	**-0.00747*** **	**-0.00540*** **	**-0.00422*** **	**-0.00363*** **
	(0.000641)	**(0.000658)**	**(0.000648)**	**(0.000639)**	**(0.000624)**	**(0.000647)**	**(0.000646)**	**(0.000642)**
Sales per Capital					0.0966***	0.109***	0.0825***	0.128
					(0.0282)	(0.0180)	(0.0187)	(0.0783)
Capital stock					0.0814***	0.0616***	0.0443***	0.0298***
					(0.00177)	(0.00173)	(0.00169)	(0.00170)
Unemployment					-0.0161***	-0.0145***	-0.0128***	-0.0118***
					(0.00114)	(0.00127)	(0.00130)	(0.00138)
GDP per capita					0.150***	0.142***	0.119***	0.0890***
					(0.0199)	(0.0227)	(0.0244)	(0.0264)
Population					0.0142	0.0176	0.0222**	0.0249**
					(0.0101)	(0.0108)	(0.0110)	(0.0108)
Constant	15.63***	15.78***	15.85***	15.90***	12.91***	13.38***	13.83***	14.35***
	(0.00507)	(0.00458)	(0.00489)	(0.00491)	(0.235)	(0.265)	(0.282)	(0.301)
Establishment FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry–year FE	NO	NO	NO	NO	YES	YES	YES	YES
Observations	493,355	407,937	348,870	295,545	493,355	406,735	347,852	294,578
R^2	0.938	0.944	0.948	0.952	0.939	0.944	0.949	0.952
Adjusted R^2	0.928	0.934	0.939	0.942	0.930	0.935	0.939	0.943

Notes: This table presents the results of OLS regressions with establishment fixed effects and clustered standard errors at the establishment level (in parentheses). The dependent variable is the logarithm of sales revenue of establishment *i* in $t + x$; *Invest* is the logarithm of investment in *t; East* and *Bonus* are dummy variables for the treatment group and the DAL period, respectively; *Capital* is the logarithm of capital stock; *Sales per capital* is the ratio of sales to capital stock in *t*; *GDP per capita* is the logarithm of the GDP per capita; *Unemployment* is the unemployment rate; and *Population* is the logarithm of the number of inhabitants in the district of establishment *i* in $t + x$. Table 10 provides detailed variable definitions. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 4: Mechanism tests: Local tax rates

Dependent variable	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Invest	0.0212***	0.0127***	0.00952***	0.00721***	0.0228***	0.0132***	0.00974***	0.00712***
	(0.000537)	(0.000483)	(0.000493)	(0.000535)	(0.000439)	(0.000391)	(0.000416)	(0.000428)
Invest×Bonus	-0.0155***	-0.0128***	-0.0109***	-0.00919***	-0.0130***	-0.0109***	-0.00930***	-0.00777***
	(0.000624)	(0.000620)	(0.000642)	(0.000659)	(0.000592)	(0.000587)	(0.000600)	(0.000627)
Invest×East	0.00751***	0.00268**	0.00174	0.000886	0.0105***	0.00502***	0.00337***	0.00308***
	(0.00125)	(0.00107)	(0.00116)	(0.00124)	(0.00103)	(0.000889)	(0.000961)	(0.00104)
Invest×East×Bonus	**-0.00425*** **	**-0.00277*** **	**-0.00214** **	**-0.00150**	**-0.00691*** **	**-0.00506*** **	**-0.00416*** **	**-0.00376*** **
	(0.000905)	**(0.000936)**	**(0.000936)**	**(0.000940)**	**(0.000663)**	**(0.000679)**	**(0.000669)**	**(0.000656)**
Invest×Hightax	0.00403***	0.00101	0.000527	-0.000305				
	(0.000808)	(0.000716)	(0.000766)	(0.000770)				
Invest×Bonus×Hightax	0.00439***	0.00361***	0.00312***	0.00285***				
	(0.000418)	(0.000442)	(0.000443)	(0.000452)				
Invest×East×Hightax	0.00700***	0.00559***	0.00446**	0.00587***				
	(0.00211)	(0.00182)	(0.00198)	(0.00215)				
Invest×East×Bonus×Hightax	**-0.00676*** **	**-0.00548*** **	**-0.00445*** **	**-0.00465*** **				
	(0.00122)	**(0.00128)**	**(0.00128)**	**(0.00127)**				
Taxrate					-0.941***	-0.403	0.0127	0.330
					(0.347)	(0.345)	(0.369)	(0.371)
Invest×Taxrate					0.0253	-0.00731	-0.0109	-0.0317
					(0.0206)	(0.0194)	(0.0208)	(0.0213)
Invest×Bonus×Taxrate					0.173***	0.147***	0.117***	0.106***
					(0.0120)	(0.0129)	(0.0131)	(0.0135)
Invest×East×Taxrate					0.0711**	0.0553	-0.00705	-0.0262
					(0.0362)	(0.0366)	(0.0393)	(0.0421)
Invest×East×Bonus×Taxrate					**-0.132*** **	**-0.112*** **	**-0.0908** **	**-0.0837** **
					(0.0370)	**(0.0390)**	**(0.0387)**	**(0.0372)**
Establishment controls	YES	YES	YES	YES	YES	YES	YES	YES
District controls	YES	YES	YES	YES	YES	YES	YES	YES
Establishment FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry–year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	493,355	406,735	347,852	294,578	492,949	406,397	347,573	294,347
R^2	0.939	0.944	0.949	0.952	0.939	0.944	0.949	0.952
Adjusted R^2	0.930	0.935	0.939	0.943	0.930	0.935	0.939	0.943

Notes: This table presents the results of OLS regressions with establishment fixed effects and clustered standard errors at the establishment level (in parentheses). The dependent variable is the logarithm of sales revenue of establishment i in $t + x$; *Invest* is the logarithm of net investment in t; *East* and *Bonus* are dummy variables for the treatment group and the DAL period, respectively; *Hightax* is a dummy variable for establishments with an average local tax rate during the DAL period that exceeds the median average tax rate of that period; and *Taxrate* is the demeaned local business tax rate of establishment i in t. Establishment controls include *Capital stock* and *Sales per capital stock*. District controls include *Unemployment*, *GDP per capita*, and *Population*. *Capital* is the logarithm of capital stock; *Sales per capital* is the ratio of sales to capital stock in t; *GDP per capita* is the logarithm of the GDP per capita; *Unemployment* is the unemployment rate; and *Population* is the logarithm of the number of inhabitants in the district of establishment i in $t + x$. Table 10 provides detailed variable definitions. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5: Mechanism tests: Firms located in West Germany with establishments in both parts of Germany

Dependent variable	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Invest	0.0139***	0.00737***	0.00785***	0.00493**	0.00650***	0.00235**	0.00289**	0.00160
	(0.00172)	(0.00168)	(0.00194)	(0.00207)	(0.00101)	(0.000998)	(0.00119)	(0.00130)
$Invest_t$× *Bonus*	-0.00703***	-0.00288	-0.00341	-0.00404	-0.00608***	-0.00183	-0.000366	-0.000236
	(0.00259)	(0.00253)	(0.00248)	(0.00275)	(0.00168)	(0.00170)	(0.00164)	(0.00167)
Invest×*East*	0.000628	0.00266	0.00127	0.00336	9.97e-05	0.00204*	0.000931	0.00179
	(0.00256)	(0.00247)	(0.00294)	(0.00333)	(0.00120)	(0.00117)	(0.00153)	(0.00170)
Invest*×*East*×*Bonus	**-0.00968*** **	**-0.00749*** **	**-0.00771*** **	**-0.00812*** **	**-0.00516** **	**-0.00410* **	**-0.00373** **	**-0.00392** **
	(0.00266)	**(0.00264)**	**(0.00247)**	**(0.00240)**	**(0.00214)**	**(0.00212)**	**(0.00168)**	**(0.00157)**
Establishment controls	YES	YES	YES	YES	YES	YES	YES	YES
District controls	YES	YES	YES	YES	YES	YES	YES	YES
Establishment FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry–year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm-year FE	NO	NO	NO	NO	YES	YES	YES	YES
Observations	34,094	28,296	23,639	19,547	31,498	25,923	21,436	17,640
R^2	0.960	0.962	0.963	0.966	0.881	0.884	0.891	0.898
Adjusted R^2	0.951	0.953	0.954	0.956	0.806	0.807	0.815	0.822

Notes: This table presents the results of OLS regressions with establishment fixed effects and clustered standard errors at the establishment level (in parentheses). The dependent variable is the logarithm of sales revenue of establishment *i* in $t + x$; *Invest* is the logarithm of net investment in *t*; *East* and *Bonus* are dummy variables for the treatment group and the DAL period, respectively. Establishment controls include *Capital stock* and *Sales per capital stock*. District controls include *Unemployment*, *GDP per capita*, and *Population*. *Capital* is the logarithm of capital stock; *Sales per capital* is the ratio of sales to capital stock in *t*; *GDP per capita* is the logarithm of the GDP per capita; *Unemployment* is the unemployment rate; and *Population* is the logarithm of the number of inhabitants in the district of establishment *i* in $t + x$. Table 10 provides detailed variable definitions. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 6: Mechanism tests with district–year fixed effects, matched sample

Robustness check	District-year fixed effects				Matched sample			
Dependent variable	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Invest	0.0236***	0.0136***	0.0102***	0.00764***	0.0150***	0.0119***	0.0103***	0.00675***
	(0.000421)	(0.000375)	(0.000398)	(0.000409)	(0.00114)	(0.00106)	(0.00111)	(0.000938)
Invest×Bonus	-0.0143***	-0.0115***	-0.00996***	-0.00825***	-0.0105***	-0.00838***	-0.00838***	-0.00679***
	(0.000586)	(0.000591)	(0.000600)	(0.000623)	(0.00141)	(0.00139)	(0.00134)	(0.00129)
Invest×East	0.0104***	0.00595***	0.00421***	0.00390***	0.00431***	0.00316**	0.000911	0.00141
	(0.00104)	(0.000919)	(0.00101)	(0.00112)	(0.00141)	(0.00129)	(0.00133)	(0.00126)
Invest×East×Bonus	**-0.00431****	**-0.00750*****	**-0.00589*****	**-0.00580*****	**-0.00571*****	**-0.00343*****	**-0.00198****	**-0.00113**
	(0.00182)	**(0.00174)**	**(0.00168)**	**(0.00177)**	**(0.000871)**	**(0.000844)**	**(0.000805)**	**(0.000786)**
Establishment controls	YES	YES	YES	YES	YES	YES	YES	YES
District controls	YES	YES	YES	YES	YES	YES	YES	YES
Establishment FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry–year FE	YES	YES	YES	YES	YES	YES	YES	YES
District–year FE	YES	YES	YES	YES	NO	NO	NO	NO
Observations	493,355	406,735	347,852	294,578	85,322	74,491	66,172	58,250
R^2	0.939	0.945	0.949	0.952	0.945	0.951	0.956	0.960
Adjusted R^2	0.929	0.934	0.939	0.942	0.939	0.945	0.951	0.954

Notes: This table presents the results of OLS regressions with establishment fixed effects and clustered standard errors at the establishment level (in parentheses). The dependent variable is the logarithm of sales revenue of establishment i in $t + x$; *Invest* is the logarithm of net investment in t; *East* and *Bonus* are dummy variables for the treatment group and the DAL period, respectively. Establishment controls include *Capital stock* and *Sales per capital stock*. District controls include *Unemployment*, *GDP per capita*, and *Population*. *Capital* is the logarithm of capital stock; *Sales per capital* is the ratio of sales to capital stock in t; *GDP per capita* is the logarithm of the GDP per capita; *Unemployment* is the unemployment rate; and *Population* is the logarithm of the number of inhabitants in the district of establishment i in $t + x$. Table 10 provides detailed variable definitions. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 7: Heterogeneity tests: Productivity and size

Dependent variable	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Invest	0.0222***	0.0126***	0.00884***	0.00637***	0.0187***	0.0111***	0.00796***	0.00563***
	(0.000523)	(0.000460)	(0.000507)	(0.000515)	(0.000471)	(0.000434)	(0.000490)	(0.000499)
Invest×Bonus	-0.0138***	-0.0120***	-0.00965***	-0.00743***	-0.0156***	-0.0131***	-0.0109***	-0.00904***
	(0.000665)	(0.000656)	(0.000669)	(0.000694)	(0.000701)	(0.000698)	(0.000714)	(0.000741)
Invest×East	0.00909***	0.00271**	0.00194	0.00229*	0.00810***	0.00349***	0.00249**	0.00234*
	(0.00129)	(0.00108)	(0.00119)	(0.00133)	(0.00112)	(0.000994)	(0.00112)	(0.00130)
Invest×East	**-0.00910*** **	**-0.00764*** **	**-0.00646*** **	**-0.00568*** **	**-0.00589*** **	**-0.00405*** **	**-0.00282** **	**-0.00237** **
× *Bonus*	**(0.000999)**	**(0.00102)**	**(0.00100)**	**(0.000999)**	**(0.00108)**	**(0.00111)**	**(0.00110)**	**(0.00109)**
Invest×Highprod	0.00190**	0.00149**	0.00217***	0.00152*				
	(0.000817)	(0.000729)	(0.000761)	(0.000781)				
Invest×Bonus	0.00124***	0.00155***	0.000413	-0.000535				
× *Highprod*	(0.000439)	(0.000462)	(0.000463)	(0.000471)				
Invest×East	0.00274	0.00554***	0.00411**	0.00280				
× *Highprod*	(0.00208)	(0.00182)	(0.00196)	(0.00212)				
Invest×East	**0.00268** **	**0.00368*** **	**0.00374*** **	**0.00348*** **				
× *Bonus×Highprod*	**(0.00125)**	**(0.00130)**	**(0.00129)**	**(0.00129)**				
Invest×Large					0.0120***	0.00630***	0.00516***	0.00407***
					(0.000868)	(0.000767)	(0.000785)	(0.000801)
Invest×Bonus×Large					0.00210***	0.00205***	0.00152***	0.00124***
					(0.000438)	(0.000463)	(0.000465)	(0.000474)
Invest×East×Large					0.00727***	0.00482**	0.00347*	0.00314
					(0.00231)	(0.00199)	(0.00208)	(0.00216)
Invest×East					**-0.00327** **	**-0.00252* **	**-0.00244* **	**-0.00214**
× *Bonus×Large*					**(0.00130)**	**(0.00135)**	**(0.00134)**	**(0.00134)**
Establishment controls	YES	YES	YES	YES	YES	YES	YES	YES
District controls	YES	YES	YES	YES	YES	YES	YES	YES
Establishment FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry–year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	493,355	406,735	347,852	294,578	493,355	406,735	347,852	294,578
R^2	0.939	0.944	0.949	0.952	0.939	0.944	0.949	0.952
Adjusted R^2	0.930	0.935	0.939	0.943	0.930	0.935	0.939	0.943

Notes: This table presents the results of OLS regressions with establishment fixed effects and clustered standard errors at the establishment level (in parentheses). The dependent variable is the logarithm of sales revenue of establishment i in $t + x$; *Invest* is the logarithm of net investment in t; *East* and *Bonus* are dummy variables for the treatment group and the DAL period, respectively; *Large* is a dummy variable for establishments with wage expenses above the median wage expense in the DAL period; and *Highprod* is a dummy variable for establishments whose average ratio of the gross margin (i.e., sales minus wage costs) to wages in the DAL period exceeds the median. Establishment controls include *Capital stock* and *Sales per capital stock*. District controls include *Unemployment*, *GDP per capita*, and *Population*. *Capital* is the logarithm of capital stock; *Sales per capital* is the ratio of sales to capital stock in t; *GDP per capita* is the logarithm of the GDP per capita; *Unemployment* is the unemployment rate; and *Population* is the logarithm of the number of inhabitants in the district of establishment i in $t + x$. Table 10 provides detailed variable definitions. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 8: Robustness checks: Alternative performance measures and reduced observation period

Robustness check	Alternative performance measure				Reduced observation period			
Dependent variable	*Gross profit*$_{t+1}$	*Gross profit*$_{t+2}$	*Gross profit*$_{t+3}$	*Gross profit*$_{t+4}$	*Sales*$_{t+1}$	*Sales*$_{t+2}$	*Sales*$_{t+3}$	*Sales*$_{t+4}$
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Invest	0.0225***	0.0131***	0.00939***	0.00679***	0.0243***	0.0130***	0.00946***	0.00697***
	(0.000449)	(0.000427)	(0.000447)	(0.000483)	(0.000494)	(0.000436)	(0.000485)	(0.000517)
Invest×Bonus	-0.0133***	-0.0114***	-0.00932***	-0.00755***	-0.0138***	-0.0109***	-0.00947***	-0.00797***
	(0.000643)	(0.000656)	(0.000685)	(0.000735)	(0.000597)	(0.000587)	(0.000612)	(0.000643)
Invest×East	0.0104***	0.00523***	0.00377***	0.00395***	0.0118***	0.00594***	0.00470***	0.00406***
	(0.00109)	(0.000999)	(0.00106)	(0.00116)	(0.00116)	(0.00102)	(0.00111)	(0.00126)
Invest×East×Bonus	**-0.00759*** **	**-0.00516*** **	**-0.00396*** **	**-0.00324*** **	**-0.00728*** **	**-0.00524*** **	**-0.00410*** **	**-0.00346*** **
	(0.000681)	**(0.000713)**	**(0.000719)**	**(0.000718)**	**(0.000614)**	**(0.000647)**	**(0.000647)**	**(0.000646)**
Establishment controls	YES	YES	YES	YES	YES	YES	YES	YES
District controls	YES	YES	YES	YES	YES	YES	YES	YES
Establishment FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry–year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	489,715	403,913	345,472	292,562	415,830	335,774	280,850	231,600
R^2	0.935	0.940	0.944	0.947	0.942	0.947	0.952	0.956
Adjusted R^2	0.925	0.930	0.934	0.937	0.932	0.937	0.941	0.944

Notes: This table presents the results of OLS regressions with establishment fixed effects and clustered standard errors at the establishment level (in parentheses). Dependent variables are *Gross profit* (the logarithm of the difference of sales revenue minus wage costs) and *Sales* (the logarithm of sales revenue) of establishment *i* in $t + x$; *Invest* is the logarithm of net investment in *t*; *East* and *Bonus* are dummy variables for the treatment group and the DAL period, respectively. Establishment controls include *Capital stock* and *Sales per capital stock*. District controls include *Unemployment*, *GDP per capita*, and *Population*. *Capital* is the logarithm of capital stock; *Sales per capital* is the ratio of sales to capital stock in *t*; *GDP per capita* is the logarithm of the GDP per capita; *Unemployment* is the unemployment rate; and *Population* is the logarithm of the number of inhabitants in the district of establishment *i* in $t + x$. Table 10 provides detailed variable definitions. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 9: Robustness checks: Alternative measures for productivity and size

Dependent variable	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$	$Sales_{t+1}$	$Sales_{t+2}$	$Sales_{t+3}$	$Sales_{t+4}$
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Invest	0.0224***	0.0127***	0.00893***	0.00666***	0.0221***	0.0128***	0.00956***	0.00696***
	(0.000520)	(0.000457)	(0.000503)	(0.000513)	(0.000447)	(0.000405)	(0.000446)	(0.000454)
Invest×*Bonus*	-0.0138***	-0.0120***	-0.00968***	-0.00756***	-0.0155***	-0.0131***	-0.0111***	-0.00919***
	(0.000664)	(0.000654)	(0.000666)	(0.000691)	(0.000645)	(0.000634)	(0.000650)	(0.000674)
Invest×*East*	0.00895***	0.00267**	0.00239**	0.00167	0.00924***	0.00404***	0.00252**	0.00278**
	(0.00129)	(0.00107)	(0.00119)	(0.00130)	(0.00104)	(0.000903)	(0.000992)	(0.00110)
Invest*×*East	**-0.00889*** **	**-0.00734*** **	**-0.00619*** **	**-0.00523*** **	**-0.00624*** **	**-0.00414*** **	**-0.00302*** **	**-0.00269*** **
× *Bonus*	**(0.00101)**	**(0.00103)**	**(0.00101)**	**(0.00100)**	**(0.000743)**	**(0.000769)**	**(0.000768)**	**(0.000761)**
Invest×*Highprod*	0.00153*	0.00144**	0.00203***	0.000923				
	(0.000822)	(0.000734)	(0.000765)	(0.000785)				
Invest×*Bonus*	0.00134***	0.00170***	0.000509	-0.000296				
× *Highprod*	(0.000439)	(0.000462)	(0.000464)	(0.000470)				
Invest×*East*	0.00310	0.00571***	0.00306	0.00424**				
× *Highprod*	(0.00207)	(0.00183)	(0.00197)	(0.00213)				
Invest*×*East	**0.00231***	**0.00315** **	**0.00332** **	**0.00269** **				
× *Bonus*×*Highprod*	**(0.00126)**	**(0.00131)**	**(0.00129)**	**(0.00129)**				
Invest×*Large*					0.0108***	0.00664***	0.00461***	0.00366***
					(0.00143)	(0.00120)	(0.00115)	(0.00117)
Invest×*Bonus*×*Large*					0.00385***	0.00346***	0.00282***	0.00231***
					(0.000460)	(0.000484)	(0.000490)	(0.000501)
Invest×*East*×*Large*					0.00681*	0.00676**	0.00790**	0.00442
					(0.00386)	(0.00334)	(0.00339)	(0.00329)
Invest*×*East					**-0.00495*** **	**-0.00477*** **	**-0.00447*** **	**-0.00341** **
× *Bonus*×*Large*					**(0.00133)**	**(0.00139)**	**(0.00138)**	**(0.00139)**
Establishment controls	YES	YES	YES	YES	YES	YES	YES	YES
District controls	YES	YES	YES	YES	YES	YES	YES	YES
Establishment FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry–year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	493,355	406,735	347,852	294,578	493,355	406,735	347,852	294,578
R^2	0.939	0.944	0.949	0.952	0.939	0.944	0.949	0.952
Adjusted R^2	0.930	0.935	0.939	0.943	0.930	0.935	0.939	0.943

Notes: This table presents the results of OLS regressions with establishment fixed effects and clustered standard errors at the establishment level (in parentheses). The dependent variable is the logarithm of sales revenue of establishment *i* in $t + x$; *Invest* is the logarithm of net investment in *t*; *East* and *Bonus* are dummy variables for the treatment group and the DAL period, respectively; *Large* is a dummy variable for establishments with wage expenses in the top quintile of the wage expense in the DAL period; and *Highprod* is a dummy variable for establishments whose average ratio of the gross margin (i.e., sales minus wage costs) to sales revenue in the DAL period exceeds the median. Establishment controls include *Capital stock* and *Sales per capital stock*. District controls include *Unemployment*, *GDP per capita*, and *Population*. *Capital* is the logarithm of capital stock; *Sales per capital* is the ratio of sales to capital stock in *t*; *GDP per capita* is the logarithm of the GDP per capita; *Unemployment* is the unemployment rate; and *Population* is the logarithm of the number of inhabitants in the district of establishment *i* in $t + x$. Table 10 provides detailed variable definitions. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 10: Variable definitions

Variable	Definition
Dependent variables	
$Sales_{t+x}$	Logarithm of the price-adjusted sales revenue of establishment *i* in year $t + x$, where *t* is the current year and *x* takes values from 1 to 4.
$Gross\ profit_{t+x}$	Logarithm of the price-adjusted gross profit (i.e., sales revenue minus wage costs) of establishment *i* in the year $t + x$, where *t* is the current year and *x* takes values from 1 to 4.
Explanatory variables for DiD interaction terms	
Invest	Logarithm of the price-adjusted net investments (i.e., gross investments minus disinvestments) of establishment *i* in the current year *t*.
Bonus	Dummy variable for the bonus depreciation period (sample years 1995–1998).
East	Dummy variable for the treatment group (establishments in East Germany).
Hightax	Dummy variable equal to one if the establishments' average local business tax rate in the DAL period (1995–1998) is above the median of the average local business tax rate of the respective reference group (Eastern establishments for the treatment group and Western establishments for the control group) in the DAL period.
Taxrate	Standardized (= demeaned) local business tax rate of establishment *i* in year *t*.
Highprod	Dummy variable equal to one if the establishments' average ratio of gross profit over total wages in the DAL period (1995–1998) is above the median of the corresponding average ratio of the respective reference group (Eastern establishments for the treatment group and Western establishments for the control group) in the DAL period. In a robustness check (Table 9), we use an alternative ratio of gross profit to sales revenue instead of gross profit to wages.
Large	Dummy variable equal to one if the establishments' size measured by total wages is above the median size of the respective reference group (Eastern establishments for the treatment group and Western establishments for the control group). In a robustness check (Table 9) Large takes a value of one if the establishments' size is above the top quintile of size in the respective reference group.
Establishment-level control variables	
Capital stock	Logarithm of the price-adjusted capital stock of establishment *i* in the current year *t* (for calculation details, see Eichfelder and Schneider, 2018).
Sales per capital stock	Ratio of sales revenue to the capital stock of establishment *i* in the current year *t*.
Wage	Logarithm of the price-adjusted wage costs of establishment *i* in the current year *t*.
District-level control variables	
Unemployment	GDP of an entity's host district, in billions of U.S. dollars.
GDP per capita	GDP of an entity's host district per capita, in thousands of U.S. dollars.
Population	Unemployment rate of an entity's host district.