# TAX INCENTIVES TO ENCOURAGE CORPORATE INVESTMENT IN LATVIA

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**Abstract.** During 2006-2017, Latvia has applied a rather generous accelerated depreciation (AD) policy to stimulate firm investment. The AD policy included: (1) the general AD scheme, (2) incentives to acquire new technological equipment, and (3) Investment incentives in the specially assisted areas. This paper analyses the effect of accelerated depreciation policy on firm investment using administrative firm-level data for 2007–14. Lacking data for a natural experiment (AD began before our sample period), we use difference-in-differences methodology with identification based on variation either across time (the crisis period serving as quasi-counterfactual) or by firm size (with large firms unlikely to be genuinely affected by the policy). We find that past use of AD had a positive effect on firm investment rates. The effect is stronger in industries with most of their assets in long-duration categories and among enterprises with fewer than six employees. AD of new equipment has a significant effect both on next year investment rate and on probability to invest next year, but only for firms with six to ten workers.

**Keywords:** *tax incentives, corporate investment, accelerated depreciation.*

**JEL code:** D22, D25, H25, G41

## Introduction

During 2006-2017, Latvia has applied a rather generous accelerated depreciation (hereafter AD) policy to stimulate firm investment. Neighbouring Estonia has applied, since 2000, a zero corporate income tax on reinvested profit (Masso and Meriküll, 2011; Masso et al., 2011). During 2008-2015, business investment rate (defined as gross investment divided by gross value added of non-financial corporations) in Latvia was in line with other Baltic countries and Poland. However, since 2010, Latvia lags behind Estonia in terms of investment per person employed, and the gap is increasing (see Annex 1 for details). Moreover, in Latvia economic activities with high investment per person employed and high business investment rate are not among those with the highest apparent labour productivity. This might indicate that the AD scheme in Latvia was too general and/or too generous, resulting in over-investment in less productive firms or industries.

The purpose of this paper is to shed light on responses to the following questions:

- Did the AD policy encourage firms to invest in Latvia? Was the policy well targeted?
- How did experience in using AD (in terms of relative and absolute size of accelerated depreciation value and the magnitude of the reduction of taxable income) affect the size of investment?
- Was the effect of AD of new equipment stronger than that of other types of AD?

Previous studies have identified several channels through which accelerated depreciation (AD) might affect investments. First, it lowers the user cost of capital (Jorgenson, 1963; Zwick and Mahon, 2017). Second, for firms on a tight margin it relaxes the cash flow constraint (Kaplan and Zingales, 1997; Stein, 2003, Devereux and Liu, 2017; Zwick and Mahon, 2017, among others). Third, managers keen on tax saving might use AD for this reason but only when the tax benefits are immediate (Zwick and Mahon, 2017), as is often the case under the Latvian AD policy.

## Literature Review

So far, only a few studies have investigated the effect of tax incentives and different types of depreciation, especially on business investment across sub-groups of firms.

Bronzini et al. (2008) evaluated the impact of the investment tax credit on business investment in Italy. They focus on the tax credit, which is not restricted to profitable enterprises with tax liability but can also be deducted from any outstanding payment due to central government. The amount of tax credit differs by area of eligibility, and the amount of the deduction decreases as local development grows. The results suggest that the program has been effective in boosting investment.

Devereux, Maffini, and Xing (2016) provide evidence of a substantial positive effect of higher depreciation allowances on firm investments. In the UK, firms that qualify as an SME can claim a higher first-year capital allowance than the larger firms if they were below two of three thresholds for turnover, total assets, and number of employees. In 2004, the UK more than doubled the turnover and total assets thresholds. The authors found that access to more generous capital allowances increases firm investment by 2.1–2.6 percentage points (pp) relative to firms that never qualified for the more generous treatment; at the mean, this is equivalent to an 11 percent increase in investment.

Yagan (2015) studied the effect of the 2003 US dividend tax cut on corporate investment and labour earnings. In his estimation, the tax cut caused zero change in corporate investment and employee compensation. Similarly, Desai and Goolsbee (2014) showed that the dividend tax cut, despite its high revenue cost, had minimal, if any, influence on investment incentives.

Bonus depreciation, passed in the US in 2002 (it expired at the end of 2004) and again in 2008 allowed firms to deduct from their taxable income a “bonus” percentage of the cost of investment purchases. House and Shapiro (2008) explored the effect of the bonus depreciation allowance in 2002–03. Only investment goods with a tax recovery period up to 20 years qualified. The results suggest that bonus depreciation had a powerful effect on the composition of investment, in that there were steep increases in capital investment in assets that benefited substantially from the policy.

Recently Zwick and Mahon (2017) found that bonus depreciation had a substantial effect on investment in 2001–04 and 2008–10. Theirs was the most complete dataset yet applied to study US business investment incentives, and their results suggest that the investment response is larger for small, cash-poor firms—but only when the policy generates immediate rather than future cash flows. Ohrn (forthcoming) estimated the response of manufacturing to bonus depreciation and depreciation allowances in the US that adopted such policies and found that both policies have been effective in boosting investment. The policies also affected employment and total production, but only several years after adoption. In a companion study, Ohrn (2018) examined how firms responded to the domestic production activities deduction, which allows firms to deduct a percentage of domestic manufacturing income from their taxable income and found that corporate tax rate reductions motivated larger firms with more cash flow to invest more, but smaller, more financially constrained firms were more responsive to depreciation policies. Edgerton (2010) found that tax incentives like bonus depreciation have the least impact on investment exactly when they are most likely to be used—during economic downturns when cash flows are low.

To our best knowledge, this paper is the first to ask whether the investment tax incentives that Latvia put in place in 2007–12 were effective. (Forthcoming papers by Guceri and Albinowski (2018) and Mosberger and Varga (2018) look at the effects of tax incentives in two other CEE countries, Poland and Hungary).

## 1. Policy Context

Since 2006, Latvia has used AD policy to stimulate firm investment. It allowed firms to use for tax purposes a larger asset depreciation value (ADV, or AD deduction, hereafter) than for balance sheet depreciation, so that firms were able to reduce taxable income by the difference between ADV and the balance sheet depreciation value (BDV).

The AD policy has three main components: (1) the general AD scheme, (2) incentives to acquire new technological equipment, and (3) investment incentives in Specially Assisted Areas (SAAs). Closely related to AD (but not limited to it) are R&D incentives (effectively, the fourth component of the AD policy).

*The general AD scheme* sets out five asset categories, and the baseline depreciation rates range from 5 to 20 percent. The effective rates are twice the baseline rates for most types of assets. For passenger cars, motorcycles, water and air means of transport, the multiplier is 1.5 rather than 2, and representation passenger cars are not eligible for AD at all.

Depreciation (and hence the AD policy) does not apply to land, works of art and antiques, jewellery and other fixed assets that are not subject to physical or economic depreciation, as well as to investment properties, organic assets, and long-term investments held for sale, which the taxpayer has chosen to value at their true value.

*The incentives for new technological equipment* applied to new production equipment acquired or established by the taxpayer in a taxation period commencing in 2006 or later and used in economic activities. For such assets, the acquisition or creation value was multiplied by 1.5 before calculating the depreciation deduction (in 2007 the multiplier was 1.4 and in 2008 it was 1.3). On top of this, the general AD scheme with double depreciation rates applied.

*Investment incentives in SAAs* applied to taxpayers established and operating in such areas (the least developed municipalities, listed in the Cabinet regulations amending the Regional Development Law). Before calculating the depreciation value of fixed assets used for economic activities in SAAs, eligible firms could multiply asset acquisition or creation value by a coefficient varying from 1.3 to 2.0 for different categories of assets. Taxpayers eligible for both the SAA incentives and the incentives to acquire new technological equipment could apply just one (at their own choice) to the same fixed asset.

*R&D incentives* allowed taxpayers to write off 100% (after January 1, 2014 – 300%) of the costs of research and development related to their economic activity (other than costs for geological exploration) in the year when the costs are incurred.

Between 2006 and 2017, the Latvian AD policy was a *permanent feature of the tax code*, unlike the US bonus depreciation (see, e.g., House and Shapiro, 2008; Zwick and Mahon, 2017) but similar to the UK first-year allowance (see, e.g., Maffini et al., 2016). Due to multipliers, the Latvian AD policy was much more generous than the US bonus depreciation.

Due to space restriction, the analysis in this paper is largely limited to the general AD scheme and the incentives for new technological equipment.

Apparently, firms found the AD policy attractive. As shown in Table 1, AD deductions accounted for 11–12% of Latvia's GDP in most years reviewed, though during the crisis it was about 13%. The AD policy apparently reduced firm taxable income by 2.8% of GDP in 2008, 1.5–1.8% in 2009–11, and 2.4% in 2012–14. In 2009–14, more than 90% of all firms with depreciating assets applied AD schemes for tax purposes (Table 1). Indeed, in most cases AD makes it possible to write off an asset faster for tax purposes than for balance sheet needs, thus reducing taxable income.

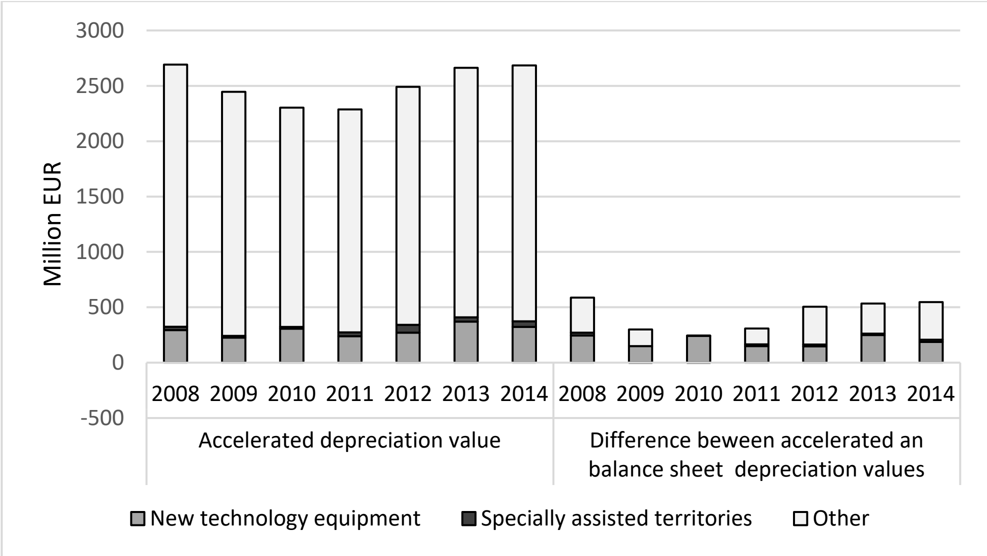
Table 1

**Accelerated and Balance Sheet Depreciation Values, Latvian Firms, 2008–14**

| Year | Accelerated Depreciation Value (ADV) | | | Balance Sheet Depreciation Value (BDV) | | | ADV-BDV | ADV Coverage (ADV>0) | |
|---|---|---|---|---|---|---|---|---|---|
| | € Mill. | % of GDP | # Firms with ADV>0 | € Mill. | % of GDP | # Firms with BDV>0 | % of GDP | % of Firms with BDV > 0 | % of all Firms in CIT data |
| 2008 | 2691 | 11.1 | 50591 | 1999 | 8.2 | 57075 | 2.8 | 88.6 | 66.1 |
| 2009 | 2446 | 13.0 | 52158 | 2109 | 11.2 | 55511 | 1.8 | 94.0 | 67.6 |
| 2010 | 2303 | 12.8 | 51121 | 2030 | 11.3 | 54954 | 1.5 | 93.0 | 63.7 |
| 2011 | 2286 | 11.3 | 49504 | 1953 | 9.6 | 53317 | 1.6 | 92.8 | 60.4 |
| 2012 | 2491 | 11.4 | 48312 | 1960 | 9.0 | 51502 | 2.4 | 93.8 | 57.2 |
| 2013 | 2662 | 11.7 | 49473 | 2108 | 9.3 | 52400 | 2.4 | 94.4 | 56.9 |
| 2014 | 2684 | 11.4 | 49216 | 2120 | 9.0 | 51908 | 2.4 | 94.8 | 56.0 |

*Source: MOF CIT data*

AD for new technological equipment accounted for only a small share (from 9% in 2009 to 14% in 2013) of the total AD value but for a very substantial share of the total reduction in corporate taxable income (Figure 1).




*Source: MOF CIT data*

**Fig. 1. AD Value and Implied Reduction in Corporate Taxable Income by Category, Latvia, 2008–14**

The share of new equipment in the reduction in corporate taxable income was 40–50% in 2008, 2009, 2011, and 2013; about 33% 2012 and 2014; and almost 100% in 2010 (Figure 1).

As of 2018, Latvia has abandoned its AD policy because its tax reform introduced, among other changes, the Estonian model of a zero CIT rate on reinvested profit. Jacobs et al. (2017) provide a discussion of possible advantages and disadvantages of applying the Estonian model in Latvia.

## 2. Data

The main data source for this paper (hereafter: CIT data) is the (anonymized) annual panel of CIT declarations of all 128,459 Latvian firms that paid CIT in 2008–14. In addition to pre-tax profit and loss statements, the data include detailed information necessary for calculating taxable income, such as total depreciation values for accounting purposes and AD values for tax purposes. For total depreciation value, the data report separately the depreciation of new equipment, assets employed in SAAs, and patents. The data include 4-digit NACE codes, 6-digit municipality codes, and type of settlement. The panel is not balanced, but for 47,280 firms data are available for each of the 7 years studies, and at least 5 years of data are available for more than 50% of all firms. However, the CIT data do not contain our key variables of interest, investments and fixed capital.

As an additional data source we use anonymized extracts from annual reports of all Latvian enterprises for 2007–14, provided by Lursoft IT. For each firm and year, this dataset covers tangible fixed assets and intangibles at the end of the year, profit or loss before taxes, the 4-digit NACE code, registration year, legal form of the enterprise, turnover, number of persons employed, CIT paid for the given year, and a 4-digit municipality code. In merging the two datasets we used variables available in both (year, profit or loss, NACE, municipality, CIT paid). Doing so is complicated for several reasons, among them (1) the CIT declarations (extracted from the SRS data warehouse in 2016) include the most recent versions of profit data, which might differ from those in the annual reports. (2) Similarly, the NACE and the municipality codes for the same firm might differ.

Our matching procedure works as follows:

Step 1a. Match by year profit or loss before taxation, 4-digit NACE code, and 4-digit municipality code. Step 1b. For every pair of firms matched in Step 1a for a given year, compare profit or loss before tax for other years. If the absolute difference does not exceed €10 in at least one other year, the two firms are fully matched. However, if a firm from CIT data can be matched in annual report data with more than one other firm (i.e., has multiple twins) it is not considered fully matched.

Step 2a (for firms not fully matched): Match by year, profit or loss before taxation, 2-digit NACE code, and 4-digit municipality code. Step 2b: Similar to Step 1b, but follows the Step 2a result.

Step 3a (for firms not yet fully matched): Match by year, profit or loss before taxation and 4-digit NACE code. Step 3b: Similar to Step 1b, but follows the Step 3a result.

Step 4a (for firms still not yet fully matched): Match by year, profit or loss before taxation and 2-digit NACE code. Step 4b: Similar to Step 1b, but responds to the Step 4a result.

Step 5a (for any firms remaining unmatched): Match by year and profit or loss before taxation. Step 5b: Similar to Step 1b but responds to the Step 5a result.

Steps 1–5 result in matching 67.5% of all enterprises in the CIT data. For the firms still unmatched, we implement a second and third round of the same five steps but this time allowing for a profit difference of up to €100 rather than €10. This allows matching of 1.5% of all firms, thus raising total matching rate to 69%. In the fourth round, we repeat the matching procedure using, in each step, the value of CIT paid in addition to the firm characteristics used in rounds 1-3; adding this new matching variable results in finding single twins in many new cases. As the result, 88.5% of all CIT payers (and 93% of observations in the CIT database) for 2008–14 are matched.

Descriptive statistics (omitted here) suggest that matched firms are representative of all firms. Indeed, distributions of the two sets by 2-digit NACE sectors, by region, and by type of settlement are very similar, as are also distributions by profit before taxes. However, matching CIT and annual report data is not our main purpose: what we need are data on tangible assets and derived investment data. Depending on the year, data on tangible assets are missing for 20% to 33% of matched firms. Hence, the working sample (matched firms with non-missing data on tangible assets) covers about 55,000 firms in each of the study years, accounting for more than 90% of firms in the CIT dataset whose balance sheets declare some asset depreciation. This suggests that for the purposes of this paper, the working sample is representative.

## 3. Econometric Methodology

1. Panel data models

To evaluate the effect of a firm's past AD experience on its investment we estimate fixed-effects panel data models of the following type:

$$Y_{it} = \alpha_t + \beta_t Z\_AD_{it-1} + \gamma X_{it-1} + u_i + \varepsilon_{it} \quad (1)$$

Here, $Y_{it}$ is a measure of investment by firm $i$ in year $t$; $\alpha_t$ are time fixed effects; $Z\_AD_{it-1}$ is a measure of AD used by firm $i$ in the previous year; $\beta_t$ are time-varying effects of AD on investment; $X_{it-1}$ is a lagged vector of firm characteristics (including fixed assets, employment, turnover, profit, and firm age); $u_i$ are unobserved firm fixed effects; and $\varepsilon_{it}$ are error terms. To simplify notation, we allow $t$ in (1) to take all values including the one for the reference year, say, 1.

In model (1), the AD variable can suffer from endogeneity caused by reverse causality (a firm planning to invest in t may want to make use of AD in t-1) or by time-varying unobserved factors affecting both investment and AD decisions. Our baseline models use investment and AD rates rather than just indicators of positive investment and positive AD value, which arguably makes the endogeneity risk less significant. However, to address the endogeneity problem we proceed as follows:

1. Construct the treatment group *T,* firms whose investment behaviour is likely affected by the AD policy, and the control group *C*, firms probably not significantly affected by the policy (see details below).

2. Estimate (1) separately on *T* and *C*.
3. Apply the difference-in-differences methodology by comparing the change in $\beta_t$ (vs. the base year) in the treatment group with the corresponding change in the control group. Technically, this is equivalent to estimating on the pooled (*T* and *C*) sample a fixed-effect model like (1) amended with the treatment group dummy (also denoted *T*) and its interactions with other variables:

$$Y_{it} = \alpha_t + \beta_t Z_{AD_{it-1}} + \lambda_t T + \delta_t T \times Z\_AD_{it-1} + \gamma X_{it-1} + \mu T \times X_{it-1} + \varepsilon_{it} \quad (2)$$

The coefficients of interest in (2) are $\delta_t$; these are equal to differences in $\beta_t$ from (1) estimated on treatment and control groups. As argued next, if the base year corresponds to the crisis period, significant and positive □ in other periods will indicate that AD has a positive effect on firm investment.

We then modify this version of regression discontinuity design (RDD) by replacing the variation across time with the variation (within treatment and control groups) across firm size (in terms of employment). After replacing time effects with size-specific effects, the model takes the form

$$Y_{ist} = \alpha_{st} + \beta_s Z_{AD_{t-1}} + \lambda_s T + \delta_s T \times Z_{AD_{it-1}} + \gamma_s X\_{it-1} + \mu_s T \times X\_{it-1} + + u_i + \varepsilon_{it} \quad (3)$$

Here, *s* varies across size categories and X_ includes firm characteristics other than employment. If one can argue that in the base category the treatment effect is absent, significant and positive $\delta_s$will indicate that AD has a positive effect for firms in other categories.

2. Treatment and control groups

Our identification strategy follows the idea of Zwick and Mahon (2017) to use as the control group firms in industries where investment is mostly short-term, as AD only modestly alters their depreciation schedule. Technically, our analysis differs from that of Zwick and Mahon (2017), who assign industries to the treatment group (respectively, control) group if the industry average discounted value of one dollar of investment deductions without bonus depreciation is low (respectively, high). We use for the same purpose the industry average ratio *DR* of accelerated depreciation value to balance sheet depreciation value, and the industry average difference *DD* of the same quantities. Our treatment group features high values of *DR* and *DD*, and our control group has low values. Like Zwick and Mahon (2017), we use four-digit industries.

When all types of AD are considered together, *the treatment group* includes firms belonging to the top 20% in terms of *DR* (i.e., having *DR* ≥ 1.275) and to the top 33% in terms of *DD* (i.e., having *DD* ≥ €3,000), which ensures that AD provides a non-negligible increase in tax deductions. On the other hand, *the control group* includes firms from industries with either *DR < 1.05* or *DD < €500* and hence the increase in tax deductions due to AD is small. See Table A2.1 for details.

Our estimates of the AD effect on investment include firm fixed effects and control for a number of time-varying firm characteristics. Nevertheless, in the spirit of the D-i-D methodology, it is preferably that the control and the treatment groups be as similar as possible. Descriptive statistics (omitted to save space) show that distributions of treatment and control groups by firm size, turnover, investment rate, region and type of settlement are quite similar. Moreover, across the years, the average proportion of firms making an investment of at least €100 is about 50% in both groups, and average investment rate (with respect to beginning-of-the-year capital) is 24.3% in the treatment group and 27.9% in the control group. Note, however, that there are inevitable differences between treatment and control groups in terms of industry composition, because definitions of the groups refer to industry level indicators. Real estate activities account for more than half of the treatment group observations, while retail trade (incl. trade and repair of motor vehicles) account for one-third of the control group. Most other services are almost completely in the control group, although manufacturing, utilities, and construction firms are present in both groups.

As AD began before our sample period, we are not able to use its introduction as a natural experiment, in which case $t = 1$ in (1) would correspond to the pre-reform period. Instead, we argue that during the crisis in 2009–10 investment rates were very low (see Figure A1) due to cash constraints and the uncertain prospects of the economy, and hence the effect of past AD experience on investment was absent or very small in both groups (see Figure 2 below for empirical evidence). Hence, we *use the crisis period as a quasi-counterfactual*. Post-crisis, investment activity in Latvia revived, but not to the pre-crisis level (Figure A1); firms are more often cash constrained and are more careful in making decisions to invest. We expect that in comparison with 2009, the increase of the effect of past AD experience on investment is much larger in the treatment than in the control group, so the post-crisis $\delta_t$ in model (2) are positive. Figure 2 below supports this hypothesis. A weakness in this approach is that we cannot convincingly test the parallel lines assumption because we only have two crisis years.

Our second version of RDD refers to *variation across firm size instead of across time*. Small firms are more likely to be cash-constrained and to have uncertain prospects; hence, we expect that in the treatment group, the effect of past AD experience on investment increases as firm size (measured by employment) falls. By contrast, in the control group, because small firms do not see an immediate cash benefit from AD, they are likely to invest only sporadically if at all. For large firms in the control group investment is likely to be a part of their business model; plausibly, these investments are regular due to short asset lives, leading to reversed causality of the estimated AD effect, which is likely to increase with firm size (larger firms invest more regularly).

## 4. Research results and discussion

1. Key variables

We define a firm's investment rate in year *t* as

$$Inv\_rate(t) = \log\big(1 + (Gross\ investment\ in\ fixed\ assets)(t)\big)/(K(t-1)) \quad (4)$$

where *K(t)* is the end-of-year value of fixed assets, and

$$(Gross\ investment\ in\ fixed\ assets)(t) = K(t) - K(t-1) + Balance\ sheet\ depreciation\ value\ (t) \quad (5)$$

Note that (4) is just the continuously compounded version of the usual investment rate. We have used two firm-level measures of AD experience: the accelerated depreciation rate:

$$AD\_rate(t) = \log(1 + ADV(t)/K(t-1)) \quad (6)$$

and the reduction in taxable income caused by AD (also scaled by K(*t*–1)):

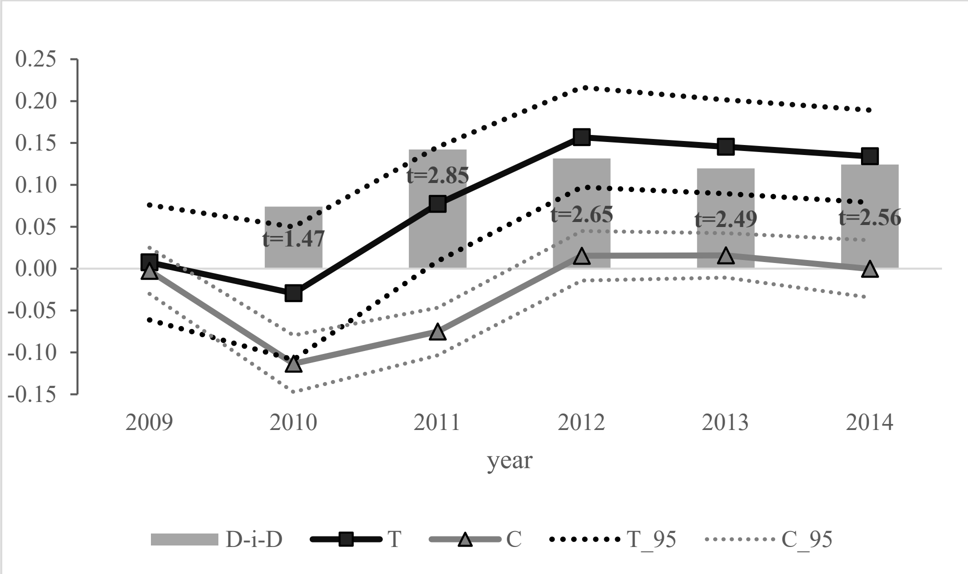
$$AD\_gain(t) = \log(1 + (ADV(t) - BDV(t))/K(t-1)) \quad (7)$$

The rationale for using *AD_gain* is straightforward; use of the *AD_rate* is motivated by behavioural considerations: the tax declaration template refers to ADV as one of the items reducing taxable income, so managers or owners of small firms might see this (rather than *AD_gain*) as a measure of the tax benefit. In models with *Inv_rate* as the dependent variable, estimated coefficients on lagged *AD_rate* or *AD_gain* can be interpreted as investment elasticities with respect to the previous year AD value or the corresponding reduction in taxable income.

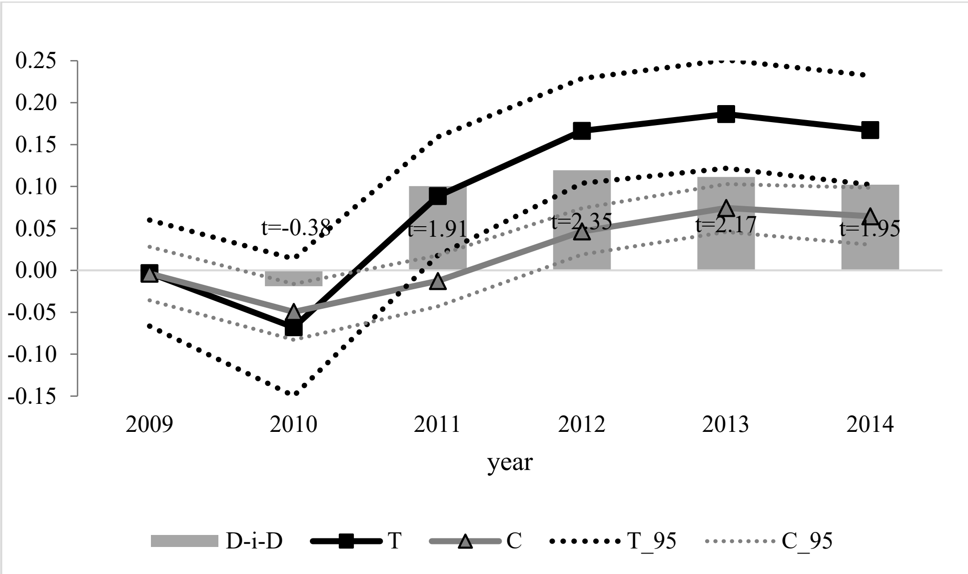
2. Total aggregate effects of accelerated depreciation

Table A3.1 presents estimation results from specifications (1) and (2) which use the crisis period as a quasi-counterfactual. Expectedly, in both treatment and control groups and for both AD value and tax gain, lagged AD variables have no effect on firm investment in 2009–10. In 2011–14, we find a positive and significant effect for the treatment group (Figure 2). In the control group, there is no effect of the past AD value; the past AD gain appears to be significant in 2012–14, but the effect is much weaker than in the treatment group. Both specifications produce a strongly significant positive D-i-D effect of AD in 2011–14 (Figure 2).

*A. Effect of Lagged AD Value*




*B. Effect of Lagged AD-caused Reduction in Taxable Income*




*Source: authors` calculations using MOF CIT data*

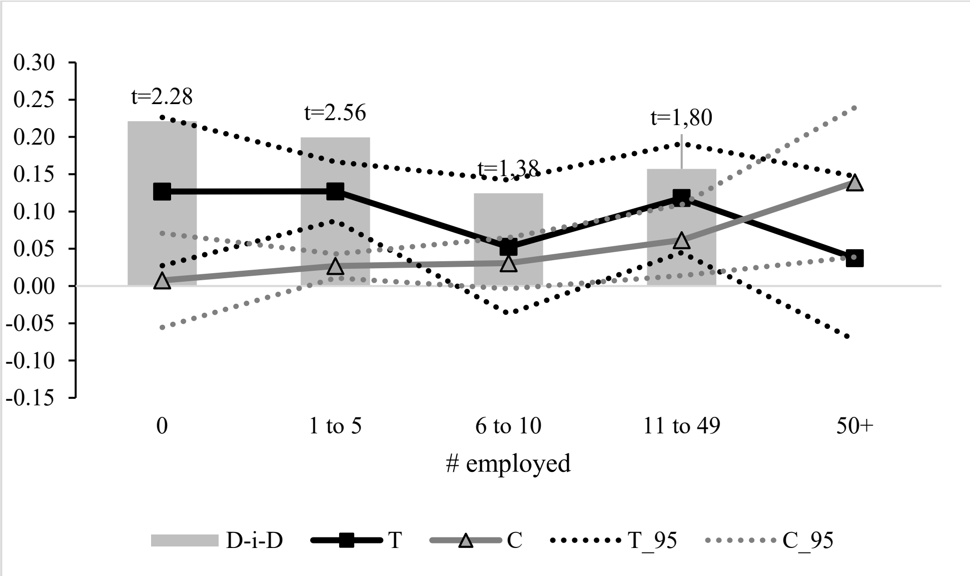
*Notes: Labels in the D-i-D series show t-values from fixed-effect model with interactions*

**Fig. 2. Estimated Effect of Past AD Experience on Firm Investment. Treatment and Control Groups, D-i-D: (T_year – T_2009) – (C_year – C_2009)**

As far as other factors are concerned, the investment rate tends to increase with firm size and turnover, other things equal. Lagged capital stock has a negative effect on investment. Not surprisingly, enterprises in the first two to three years after registration invest the most.

Among profit-making enterprises, as might be expected, investment rises in track with the previous year's profit—but loss-making firms also tend to invest more the larger the previous year's loss (the effect among loss-makers is much weaker than among profit-makers). It might be rational for firms with large losses to invest more than do those with small losses, but this might also relate to losses carried forward and coordination of investment plans with a tax-optimization strategy.

Figure 3 presents AD effect on investment derived from specification (3) with identification based on variation across firm size instead of variation across time.




*Source: authors` calculations using MOF CIT data*

*Notes: Labels in the D-i-D series show t-values from fixed-effect model with interactions*

**Fig. 3. Estimated Effect of Past AD Experience on Firm Investment, by firm size. Treatment and Control Groups, D-i-D: (T_size – T_50+) – (C_size – C_50+)**

Using large (50+ worker) firms as the base category, we indeed find a positive and significant effect of lagged AD-caused reduction in taxable income on investment for smaller firms in the treatment group, except for firms with six to ten workers. This effect gets larger as firm size falls, suggesting that there is no reversed causality. In the control group, the estimated effect of AD-caused reduction in taxable income is positive and significant among firms with at least one worker. This effect grows with firm size, suggesting that reversed causality is at work (firms use AD because they invest regularly) in the control group. In both specifications, the D-i-D estimate of AD effect on investment rate is highly significant for firms with fewer than six workers. The effects of lagged AD value (not shown to save space) are similar but somewhat less significant.

3. Disaggregated AD effects on firm investment rate and investment decisions, by program type

Each of our main explanatory variables, *AD_rate* and *AD_gain*, can be decomposed into three components corresponding to AD of new equipment, AD in SAAs, and other types of AD. To isolate the effect of the AD of new equipment, we narrow down the Treatment group used until now (*T_tot*) by imposing, in addition, the following conditions (as before, we use four-digit level industry): (i) the industry average accelerated depreciation value of new equipment *ADV_new* ≥ 1000 euro; (ii) the industry average ratio of the accelerated depreciation value to the balance sheet depreciation value of new equipment *DR_new* ≥ 2.00; (iii) there are more than three observations with positive *ADV_new* in the industry.

These conditions reduce the number of firms by nearly a half, from 10.6 thousand in *T_tot* to 6.2 thousand in *T_new* (Table A2.1). For firms in *T_new,* one can expect substantial tax savings from using the AD of new equipment. The restriction on the total Control group (*C_tot*) that the industry average difference *DD* = *ADV* – *BDV* ≤ 500 EUR applies of course also to *DD_new* and is sufficient to make non-negligible tax savings unlikely. To ensure sufficient common support with the Treatment group *T_new*, we require, in addition, the industry average share of firms using AD of new equipment in *C_new* to be at least 0.38% (the minimum in *T_new*). This reduces the number of firms by one-third, from 30.9 thousand in *C_tot* to 20.5 thousand in *C_new* (Table A2.1). Descriptive statistics (omitted to save space) shows that *T_new* and *C_new* do not differ much in terms of distribution by firm size, turnover, investment rate, region and type of settlement.

Disaggregated by type of AD models (2) and (3) estimated on pooled *T_new* and *C_new* samples provide some (inconclusive) evidence of the effect of the past AD of new equipment on firm's investment rate and investment decisions. In this paper (see Table A3.2), we present only results from model (3), with identification across size groups. AD of new equipment is found to have a significant (at 5%) effect both on next year investment rate and on probability to invest next year, but only for firms with six to ten workers; the effect on investment rate is also positive and close to being significant for firms with 11 to 49 workers.

## Conclusions

1. This paper has studied the effect of generous accelerated depreciation (AD) policy on firm investment in Latvia in 2009–14. Lacking data for a natural experiment, we use difference-in-differences methodology with identification based on variation across time, with the crisis period serving as quasi-counterfactual, and by firm size, with large firms unlikely to be genuinely affected by the policy.
2. We find a positive effect of the past use of the general AD scheme on firms' investment rate.
3. The AD effect on investment is stronger in industries with most of their investment in long-lasting assets and in enterprises with fewer than six employees.
4. Regarding AD of new equipment, we find a significant effect both on next year investment rate and on probability to invest next year, but only for firms with six to ten workers.
5. Our results indicate that AD policy has indeed stimulated investment in Latvia. However, the evidence for the effect is stronger for the general scheme than for new equipment, and this raises the question whether the AD scheme in Latvia was too general and/or too generous, resulting in over-investment in less productive firms or industries.

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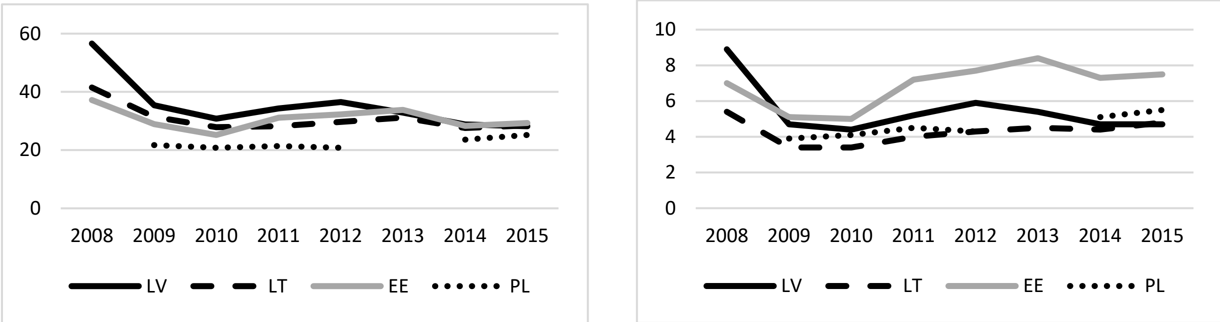
**Annex**

1. The Economic Context: Firm Investment in the Baltic Countries and Poland

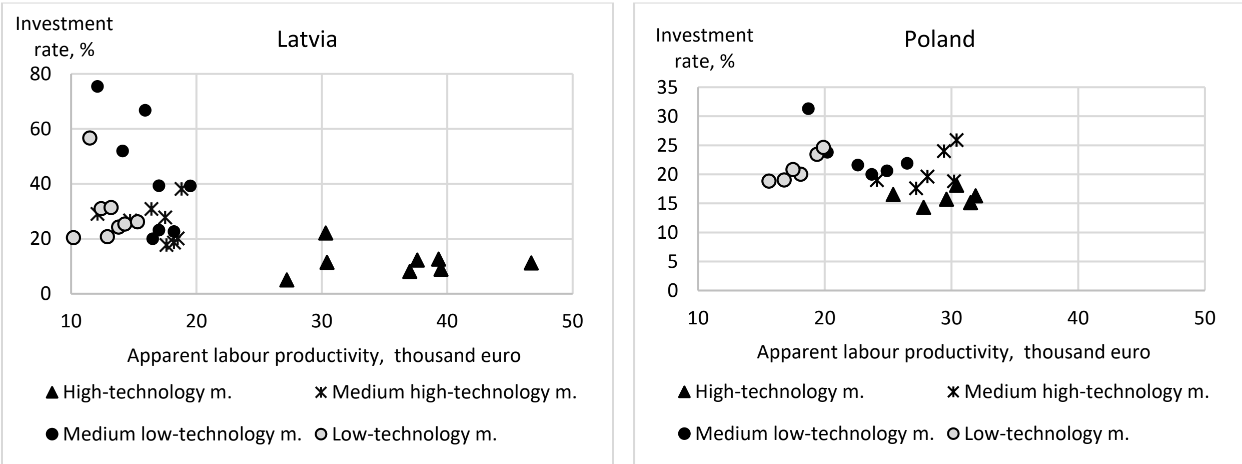



A. Business Investment Rate, Percent. B. Investment per Person Employed, € thousands

*Sources: Calculation with Eurostat data. Legend: LV – Latvia, LT – Lithuania, EE – Estonia, PL – Poland*

*Notes: Total business economy includes all NACE activities except sections A, K, O, P, Q, R, S94, S96, T, U.*

Fig. A1. **Investment intensity in Total Business Economy. The Baltic countries and Poland, 2008-15**




*Source: Eurostat data*

*Notes: Every point corresponds to one annual observation for one of the four industry groups*

Fig. A2. **Business Investment and Apparent Labour Productivity by Level of Technology in Manufacturing, Latvia and Poland, 2008–15**

2. Treatment and control groups

**Table A2.1**

**Definitions of treatment and control groups in terms of 4-digit industry average accelerated depreciation value (ADV) and balance sheet depreciation value (BDV)**

| | Accelerated depreciation category | | | |
|---|---|---|---|---|
| | Total | | New Equipment | |
| | Treatment | Control | Treatment | Control |
| ADV/BDV | ≥ 1.275 | < 1.05 | ≥ 1.275 | < 1.05 |
| ADV - BDV | ≥ € 3000 | < € 500 | ≥ € 3000 | < € 500 |
| ADV_new/BDV_new | | | ≥ 2.00 | |
| ADV_new | | | ≥ € 1000 | |
| N obs with ADV_new > 0 | | | > 3 | |
| % obs with ADV_new > 0 | | | | > 0.38% |
| N firms / N obs | 10649 / 59297 | 30872 / 158259 | 6245 / 36907 | 20544 / 106119 |

*Source: Firm CIT and annual report data*

*Notes: Firm size refers to the previous year. N firms and N obs refer to the working sample*

3. Estimation Results – Fixed Effects Panel Data Models

**Table A3.1**

**Determinants of Firm Investment Rate with Total AD Effects, 2009–14**

| Dep. Var.: Inv_rate, | AD = AD_rate, see (6) | | | AD = AD_gain, see (7) | | |
|---|---|---|---|---|---|---|
| see (4)-(5) | Treatment | Control | D-i-D | Treatment | Control | D-i-D |
| L.Log(Fixed assets) | -0.5017*** | -0.3738*** | | -0.5053*** | -0.3843*** | |
| | *0.0122* | *0.0054* | | *0.0124* | *0.0057* | |
| L.Log(Turnover) | 0.0790*** | 0.0767*** | | 0.0778*** | 0.0754*** | |
| | *0.0083* | *0.0043* | | *0.0082* | *0.0043* | |
| L.log(Profit) | 0.0149*** | 0.0108*** | | 0.0151*** | 0.0105*** | |
| (if Profit ≥ 1 EUR) | *0.0037* | *0.0019* | | *0.0036* | *0.0019* | |
| L.log(\|Loss\|) | 0.0125*** | 0.0033* | | 0.0124*** | 0.0034* | |
| (if \|Loss\| ≥ 1 EUR) | *0.0036* | *0.0019* | | *0.0036* | *0.0019* | |
| Firm age (vs. 2-3 yrs) | | | | | | |
| 4-7 | -0.0282 | -0.0498*** | | -0.016 | -0.0419*** | |
| | *0.0207* | *0.0102* | | *0.0205* | *0.0101* | |
| 8-10 | -0.0677** | -0.037** | | -0.0505* | -0.0306* | |
| | *0.0293* | *0.016* | | *0.0287* | *0.0159* | |
| 11-19 | -0.0759** | -0.0547*** | | -0.0482 | -0.0485** | |
| | *0.0383* | *0.021* | | *0.0375* | *0.0210* | |
| 20+ | -0.0586 | -0.0513* | | -0.033 | -0.0488* | |
| | *0.0471* | *0.0264* | | *0.0461* | *0.0263* | |
| L.#employed (vs. 1-5) | | | | | | |
| 0 | 0.0896*** | 0.0398*** | | 0.0835*** | 0.0411*** | |
| | *0.0234* | *0.014* | | *0.0232* | *0.0139* | |
| 6-10 | 0.063*** | 0.0679*** | | 0.0590*** | 0.0690*** | |
| | *0.0196* | *0.0104* | | *0.0195* | *0.0103* | |
| 11-49 | 0.0916*** | 0.0905*** | | 0.0949*** | 0.0953*** | |
| | *0.0282* | *0.0151* | | *0.0281* | *0.0149* | |
| 50+ | 0.1230*** | 0.1106*** | | 0.1230*** | 0.1179*** | |
| | *0.0456* | *0.0277* | | *0.0456* | *0.0276* | |
| L.AD | 0.0074 | -0.0026 | | -0.0033 | -0.0039 | |
| | *0.0350* | *0.0140* | | *0.0323* | *0.0163* | |
| year#L.AD: 2010 | -0.0369 | -0.1109*** | 0.0740 | -0.0647 | -0.0457** | -0.019 |
| | *0.0457* | *0.0213* | *0.0504* | *0.0457* | *0.0214* | *0.0505* |
| 2011 | 0.0697 | -0.0725*** | 0.1422*** | 0.0917* | -0.0088 | 0.1005* |
| | *0.0457* | *0.0202* | *0.0499* | *0.0474* | *0.0227* | *0.0525* |
| 2012 | 0.1494*** | 0.0179 | 0.1315*** | 0.1696*** | 0.0503** | 0.1192** |
| | *0.0453* | *0.0201* | *0.0496* | *0.0459* | *0.0218* | *0.0508* |
| 2013 | 0.1381*** | 0.0184 | 0.1197** | 0.1896*** | 0.0782*** | 0.1113** |
| | *0.044* | *0.0194* | *0.0481* | *0.0462* | *0.0225* | *0.0513* |
| 2014 | 0.1267*** | 0.0024 | 0.1243** | 0.1705*** | 0.0684*** | 0.1021* |
| | *0.0433* | *0.0222* | *0.0486* | *0.0462* | *0.0244* | *0.0522* |
| Year fixed effects | yes | yes | yes | yes | yes | yes |
| Firm fixed effects | yes | yes | yes | yes | yes | yes |
| R-sq: within | 0.3252 | 0.2387 | 0.2678 | 0.3167 | 0.2402 | 0.2655 |
| overall | 0.0753 | 0.0479 | 0.0329 | 0.0679 | 0.0476 | 0.034 |
| N obs/N firms, 1000 | 37.3 / 8.98 | 103.9 / 26.6 | 141.2 / 35.6 | 37.0 / 8.97 | 103.4 / 26.6 | 141.4 / 35.5 |

*Source: Calculation with firm CIT and annual report data. Notes: AD refers to total accelerated depreciation variables*

*Notes: Columns "Treatment" and "Control" present estimates of model (1) on groups defined in Table A2.1 (panel "Total"). Columns D-i-D present only time-varying coefficients □ of interactions of the treatment dummy (T) with lagged AD_rate or AD_gain from model (2) estimated on the Treatment + Control sample. Robust standard errors (shown in italics) are clustered on firms. Legend: * p<.1; ** p<.05; *** p<.01*

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Table A3.2

**AD of New Equipment: Effects on Firm Investment Rate and Probability of Investment**

| | Dep. Var.: Inv_rate, see (4)-(5) | | | Dep. Var.: 1 if investment ≥ 100 EUR | | |
|---|---|---|---|---|---|---|
| | AD = AD_rate, see (6) | | | AD = AD_gain, see (7) | | |
| | T_new | C_new | D-i-D | T_new | C_new | D-i-D |
| L.AD_new | -0.0686 | 0.0256 | | 0.0307 | 0.004 | |
| | *0.0894* | *0.1219* | | *0.0495* | *0.071* | |
| N workers (vs. 50+)#L.AD_new | | | | | | |
| 0 | 0.3184** | 0.4146*** | -0.0962 | -0.0945 | 0.1772 | -0.2717* |
| | *0.1452* | *0.155* | *0.2123* | *0.1069* | *0.1184* | *0.1594* |
| 1 to 5 | 0.0595 | -0.0373 | 0.0968 | -0.038 | 0.1036 | -0.1416 |
| | *0.1249* | *0.1362* | *0.1848* | *0.1075* | *0.0785* | *0.1331* |
| 6 to 10 | 0.7773*** | 0.1444 | 0.6329** | 0.4237*** | 0.1017 | 0.3220** |
| | *0.2318* | *0.142* | *0.2717* | *0.1051* | *0.0976* | *0.1434* |
| 11 to 49 | 0.2347** | -0.0454 | 0.2801 | 0.0293 | 0.0641 | -0.0348 |
| | *0.1019* | *0.1498* | *0.1811* | *0.0602* | *0.0895* | *0.1079* |
| L.AD_terr | 0.1454*** | 0.1247 | | 0.0537*** | 0.1512 | |
| | *0.0412* | *0.1915* | | *0.0188* | *0.1702* | |
| N workers (vs. 50+)#L.AD_terr | | | | | | |
| 0 | -1.6803 | -0.3311 | -1.3492 | -1.250*** | 0.1571 | -1.407*** |
| | *1.6234* | *0.262* | *1.6430* | *0.3144* | *0.3312* | *0.4565* |
| 1 to 5 | -0.1306 | 0.0058 | -0.1364 | -0.0821** | -0.1049 | 0.0228 |
| | *0.0832* | *0.2045* | *0.2208* | *0.0403* | *0.1732* | *0.1778* |
| 6 to 10 | 0.051 | 0.0511 | -0.0002 | 0.1013 | -0.1721 | 0.2735 |
| | *0.457* | *0.2005* | *0.4987* | *0.2117* | *0.1749* | *0.2745* |
| 11 to 49 | -0.118 | 0.0221 | -0.1401 | 0.0537 | -0.1102 | 0.1639 |
| | *0.283* | *0.2415* | *0.3719* | *0.0684* | *0.1784* | *0.1911* |
| L.AD_oth | 0.0377 | 0.1568*** | | 0.0704 | 0.0747** | |
| | *0.1054* | *0.0602* | | *0.045* | *0.0346* | |
| N workers (vs. 50+)#L.AD_oth | | | | | | |
| 0 | 0.1028 | -0.2376*** | 0.3404** | -0.0473 | -0.0564 | 0.0090 |
| | *0.1198* | *0.0711* | *0.1392* | *0.0523* | *0.0397* | *0.0656* |
| 1 to 5 | 0.0826 | -0.1835*** | 0.2661** | -0.0332 | -0.0442 | 0.0110 |
| | *0.1065* | *0.0609* | *0.1226* | *0.0456* | *0.0349* | *0.0574* |
| 6 to 10 | 0.045 | -0.1267** | 0.1717 | -0.0245 | -0.032 | 0.0074 |
| | *0.1235* | *0.0642* | *0.1391* | *0.0504* | *0.0363* | *0.0621* |
| 11 to 49 | 0.0056 | -0.1424** | 0.148 | -0.0145 | -0.0148 | 0.0003 |
| | *0.1126* | *0.0642* | *0.1296* | *0.0502* | *0.0369* | *0.0623* |
| Other controls | As in Table A3.1 | | | | | |
| N obs/N firms, 1000 | 24.4 / 5.6 | 70.3 / 17.7 | 94.7 / 23.3 | 24.3 / 5.6 | 70.5 / 17.8 | 94.8 / 23.5 |
| R-sq: within | 0.3592 | 0.2416 | 0.2802 | 0.0396 | 0.0308 | 0.0329 |
| overall | 0.0915 | 0.0510 | 0.0582 | 0.0009 | 0.0062 | 0.0000 |

*Source: Calculation with firm CIT and annual report data*

*Notes: AD_new, AD_terr and AD_oth refer to AD of new equipment, AD in specially assisted areas and other types of AD, respectively.*

*Columns "T_new" and "C_new" present estimates of fixed effect models* $Y_{is} = \square_t + \beta_s Z\_AD_{it-1} + \gamma_s X_{it-1} + u_i + \varepsilon_{it}$ *on groups defined in Table A.2.1 (panel "New equipment"). Columns D-i-D present only size-varying coefficients* $\square\square$ *of interactions of the treatment dummy (T) with lagged AD_rate or AD_gain from model (3) estimated on the pooled (T_new and C_new) sample. Robust standard errors (shown in italics) are clustered on firms.*