

Supplemental Appendix for
“Direct and Indirect Effects of Investment Tax
Incentives”

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A The Investment Tax Credit Policy and the User Cost of Capital

A.1 Share of Modernization Investment

The pervasiveness of modernization investment as defined by the *Investitionszulagen* policy determines the impact of the policy change on the effective investment tax credit rate and hence the cost of capital. While direct evidence from administrative reports would be preferable, I am not aware of any data that disclose the share of modernization investment as defined by the policy. I therefore implement two complementary approaches that allow me to indirectly infer the share of modernization investment. Both approaches rely on confidential micro-level corporate tax data from the German Federal Statistical Office.⁴⁴ The dataset covers the universe of firms liable to corporate income tax in Germany every three years. I obtained access to 1998, 2001, and 2004. While non-corporate firms are covered by personal income tax, the IAB data suggest that 94 percent of firms in the main analysis sample are corporate firms.

In the first approach, I compare the total investment tax credit claims for equipment investment over time. As the investment tax credit rate increased for modernization investment after the policy change, but stayed constant and even declined for non-modernization investment, the magnitude of the relative change in investment tax credit claims can be related to the share of modernization investment.

I aggregate from the corporate tax data the investment tax credit claims for all manufacturing firms. I do so independent of their headquarter location, because any manufacturing firm could claim investment tax credits only for establishments located in East Germany. For 2001 and 2004, I adjust the total claims by the share of claims made for structure investment according to the information provided in the German subsidy reports (2001: 12.0 percent, 2004: 15.0 percent). Column 1 of Table A.1 summarizes the total claimed equipment investment tax credits for 1998 and the average for 2001 and 2004. Claims rose from 276.9 million euros before to 653.9 million euros after the policy change, a 2.4-fold increase.

⁴⁴Source: RDC of the Federal Statistical Office and Statistical Offices of the Länder, Körperschaftsteuerstatistik, 1998, 2001, 2004, own calculations.

Table A.1: Aggregate Equipment Investment and Investment Tax Credits

	Actual		Counterfactual: Constant Investment
	ITC Claims (1)	Investment (2)	ITC Claims (3)
1998 (million)	276.9	7,691.7	276.9
Avg. 2001/2004 (million)	654.1	8,604.7	584.7
Change (ratio)	2.36	1.12	2.11
Implied share of modernization investment (%)			84.5

Note. The table presents the total claimed equipment investment tax credits (column 1) and aggregate equipment investment of the manufacturing sector in East Germany including Berlin (column 2), for 1998 and averaged for 2001 and 2004. Claimed investment tax credits are aggregated from corporate tax records for all manufacturing firms. Values for 2001 and 2004 are reduced by the share of investment tax credit expenditures for structures. Aggregate equipment investment values are from the German national accounts of the German Federal Statistical Office. Column 3 adjusts the claimed investment tax credits for 2001 and 2004 by the relative change in aggregate investment. The implied share of modernization results from a linear interpolation between 0 and 2.5 as the smallest and largest assumed relative change in investment tax credit rates, respectively.

This increase may occur due to fluctuations in aggregate investment. For comparison, column 2 shows the total equipment investment in the manufacturing sector in East Germany (including Berlin) from statistics of the German Federal Statistical Office. Investment increased by 12 percent from 7.7 billion euros to 8.6 billion euros (when I exclude Berlin, the increase is 14.5 percent). Thus, a change in aggregate investment can explain only parts of the increase in claimed investment tax credits. In a simple counterfactual, in which I assume constant aggregate investment, I obtain a 2.1-fold increase in investment tax credit claims (column 3).

I compare the counterfactual increase in investment tax credit claims to expected changes for the two types of investment. For modernization investment, rates increased for small firms from 5 to 12.5 percent and for large firms from 10 to 25 percent, implying a 2.5-fold increase in claims independent of firm size. For non-modernization investment, the rates remained constant between 1998 and 2001 and were lowered in 2002. To facilitate the calculation, I disregard the decrease in the tax credit rates for this type of investment. This simplification means that the comparison of the change in the investment tax credit claims with expected changes of the two types of investment provides a lower bound on the share of modernization investment. A 2.1-fold increase in investment tax credit claims implies a share of modernization investment of 84.4 percent.

In the second approach, I exploit a linkage of the corporate tax data with the firm-level data of the main analysis. The linkage allows me to determine the effective investment tax

credit rate for each firm by relating the investment tax credit claims to capital investment. As a limitation, the linkage is available only for 2001 and for 40 percent of firms.

In 2001, small firms received 12.5 cents more per dollar of modernization investment and 5 cents more per dollar of non-modernization investment than large firms. If small and large firms invest in the same type of machinery, the difference in the effective investment tax credit rate between small and large firms is informative about the share of modernization investment.

I estimate the difference in the effective investment tax credit rate with the specification:

$$ITCR_i^e = \beta_1 Small_i + \beta_2 Small_i \times ShInvS_i + \beta_3 ShInvS_i + \epsilon_i, \quad (1)$$

where $ITCR_i^e$ is the effective investment tax credit rate of firm i in year 2001 and $Small_i$ classifies firms with up to 250 employees as small. I further interact the firm size indicator with the share of structure investment, $ShInvS_i$. With this included interaction term, the coefficient of interest β_1 captures the difference in the investment tax credit rate when all investment is in equipment.

As some firms may not take up the incentive, I focus on observations with an effective investment tax credit rate of at least 2.5 percent. Furthermore, to avoid the influence of outliers, I winsorize rates above 50 percent. The effective tax credit rate can fall outside the lowest and highest policy rates for various reasons. If firms do not claim investment tax credits for all investments, the effective investment tax credit rate can be smaller than the minimum. If firms claim tax credits for several years at once, the rate can be higher than the maximum.

Table A.2 reports estimates for a sample of firms with 40 to 1500 employees and a sample of firms with 80 to 750 employees. I also show the robustness of results to including federal state and broad industry group fixed effects. As measurement error may lead to a misclassification of firms close to the cutoff, I exclude firms with 225 to 275 employees. With the focus on the equipment investment tax credit rate, I further exclude firms with a share of equipment investment below 50 percent. The coefficient estimates imply differences in the average investment tax credit rate between small and large firms of 11.1–12.1 cent per dollar of equipment investment, close to the difference of 12.5 cents for modernization investment. The estimates translate to shares in a range of 81.1 to 94.2 percent. Moreover, I can reject the boundary case of the share being zero

Table A.2: Cross-Sectional Difference in the Effective Investment Tax Credit Rate

	Dependent variable: Effective investment tax credit rate			
	Wide interval		Narrow interval	
	(1)	(2)	(3)	(4)
Small firm	0.117*** (0.018)	0.121*** (0.019)	0.111*** (0.020)	0.115*** (0.022)
Implied share of modernization investment (%)	89.2	94.2	81.1	86.4
95% CI	[40.9, 137.5]	[44.9, 143.5]	[28.9, 133.3]	[29.0, 143.8]
Observations	878	878	350	350
Federal state FE	No	Yes	No	Yes
Industry group FE	No	Yes	No	Yes

Note. The table reports estimates from regressions of specification (1). The dependent variable is the effective investment tax credit rate, calculated as investment tax credit claims over total firm investment, winsorized for rates above 50 percent. Columns 2 and 4 include as additional controls federal state and industry group (six manufacturing groups) fixed effects. The sample consists of manufacturing firms in East Germany with an investment tax credit rate of at least 2.5 percent and an equipment investment share above 50 percent. Columns 1 and 2 include firms with 40 to 1,500 employees. Columns 3 and 4 include firms with 80 to 750 employees. Firms with 225 to 275 employees are excluded. The share of modernization investment is determined by linearly interpolating between the difference in the investment tax credit rates for non-modernization investment between small and large firms of 5 percentage points and the difference in the investment tax credit rates for modernization investment between small and large firms of 12.5 percentage points. Results are based on linked AFiD data with corporate income tax data for 2001. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

at the 5 percent significance level.

In summary, both approaches determine a share of modernization investment above 80 percent. Given the distinct variation that I exploit in both approaches, obtaining comparable estimates strengthens the validity of the results.

A.2 Further Tax Policies

As the German investment tax credits left the depreciation base unaffected, additional tax policies influence the user cost of capital. During the sample period, changes occurred in the corporate income tax (*Körperschaftsteuer*), municipal business tax (*Gewerbesteuer*), and for accelerated depreciation allowances (*Sonderabschreibungen*).

Corporate firms in Germany pay both a corporate income and municipal business tax on their profits. Until 2000, Germany used a split rate imputation system for the nationwide corporate tax, with retained profits subject to a tax rate of 45 percent until 1998 and 40 percent in 1999–2000. Distributed profits were subject to a tax rate of 30 percent throughout this period. From corporate tax records, I find that firms retained on average two thirds of their profits. From 2001, the tax rate was set at 25 percent, with no

distinction of the type of profit. A one-time solidarity surcharge for financing damages of flooding increased the rate to 26.5 percent in 2003. Throughout the period, an additional solidarity surcharge for financing the costs of reunification was applied. The surcharge was 7.5 percent until 1997 and decreased to 5.5 percent for all later years.

The municipal business tax is an important income source for municipalities in Germany. The tax rate is determined by a federal-wide base tax rate (*Steuermesszahl*) and a multiplicative local scaling factor (*Hebesatz*), which is set at the discretion of each municipality. This discretion leads to substantial variation in the municipal business tax rate. For the entire period, the base rate was 5 percent. Scaling factors ranged from 0 to 9, with the average being around 3.5. In 2004, a minimum scaling factor of 2 was introduced.

The overall statutory tax rate for corporate firms is

$$\tau_{corp} = \frac{\tau_{CIT}(1 + soli) + \tau_{fed}^M s_{mun}^M}{1 + \tau_{fed}^M s_{mun}^M}, \quad (2)$$

where τ_{CIT} is the corporate income tax rate, *sol*i the solidarity surcharge, τ_{fed}^M the basic municipal tax rate, and s_{mun}^M the local scaling factor (compare Fuest et al., 2018). The distinct features and changes of the tax policies led to fluctuations of the overall tax rate across regions and over time. On average, for manufacturing firms in East Germany, the overall tax rate was about 50 percent until 2000 and close to 40 percent thereafter.

Firms in East Germany could also claim accelerated depreciation deductions for investment purchases until 1998. A rate of 50 percent allowed firms to depreciate half of the total purchase price in the first year, with the remaining value following the regular depreciation schedule. For 1997 and 1998, the rate decreased to 40 percent, before the allowances were discontinued. Firms benefit from accelerated depreciation because tax deductions are moved to the present when their discounted value is highest. House and Shapiro (2008) show that the benefit depends on the economic life of capital. For long-lived capital, the value of accelerated depreciation is higher due to a more substantial shift of tax deductions to the present. Thus, industries relying on long-lived capital benefit the most.

Importantly, none of the provisions of these additional tax policies varied by firm size. In a standard investment model with investment tax credits leaving the depreciation base

unaffected, the user cost of capital is

$$c = q(r + \delta) \frac{(1 - k - \tau_{corp}z)}{1 - \tau_{corp}}, \quad (3)$$

where c is the cost of capital, q is the price of one unit of capital goods, r is the discount rate, δ is the depreciation rate, k is the investment tax credit rate, τ_{corp} is the corporate tax rate, and z is the per dollar present value of depreciation deductions on investment expenditures. With a fixed discount and depreciation rate, the tax term is the relevant part that influences the cost per dollar of investment.

I determine the tax term separately for each firm and year of the sample period. For the investment tax credit rate, I take the specific provisions from the policy for each firm into account. I assume a share of equipment investment of 85 percent, in line with aggregate investment statistics from the German Federal Statistical Office, and assume a share of modernization investment of 80 percent, as the lower bound of the range of values determined in Section A.1. For the corporate tax rate, I use data on the municipal scaling factors aggregated at the county level from the German Federal Statistical Office. Although the factor is set at the municipality level, this information is not publicly available for the entire period. A check with later years shows that roughly 80 percent of the variation in the scaling factor in East Germany is between counties and only 20 percent across municipalities within counties. For information on the present value of depreciation deductions, I rely on calculations at the industry level by Zwick and Mahon (2017).

B Theoretical Framework

B.1 Overview

As guidance for the empirical analysis, I set up a static firm production model that includes general equilibrium spillovers at the region level. The basic intuition can be translated to spillovers at other levels of aggregation, particularly the industry level. Given the static setup, I refrain from using time indices.⁴⁵

In the model, firms produce according to the constant elasticity of substitution (CES) production function

$$F(K_i, L_i) = Y_i = A_r A_i (a_K K_i^\rho + a_L L_i^\rho)^{\frac{1}{\rho}}, \quad (4)$$

where the output Y_i of firm i is produced from capital K_i and labor L_i , with the production parameters a_K and a_L and the elasticity of substitution between capital and labor $\sigma = \frac{1}{1-\rho} \in [0, \infty)$. Production also depends on a firm-specific productivity parameter A_i .

I assume monopolistic competition, leading firms to face a downward sloping inverse demand curve

$$p_i = B Y_i^{-\frac{1}{\eta^D}}, \quad (5)$$

where the price depends on the elasticity of demand $\eta^D > 1$ and a demand shifter B . Firms take the rental rate of capital r and local wages w_r as given. Tax credits allow firms to reduce their cost of capital by rate τ_i . Each firm maximizes current profits by optimally choosing capital and labor.

Following the previous literature, I capture agglomeration economies as a reduced-form region-specific productivity shifter A_r in firms' production functions (for example, Moretti, 2011; Gathmann et al., 2020). The shifter is defined as

$$A_r = L_r^\lambda, \quad (6)$$

where L_r is the total employment within region r and λ is the elasticity of agglomeration. Changes in the employment in one firm, therefore, impact the productivity of all firms

⁴⁵The static model abstracts from capital adjustment costs that are important for explaining dynamic investment behavior and investment inactivity (Cooper and Haltiwanger, 2006). Bond and Van Reenen (2007) summarize the literature on dynamic investment models.

within the same region.⁴⁶

Firms may also benefit from changes in local demand, for example, through household consumption. A regional product demand shifter in the product demand curve would allow for an explicit distinction between a productivity and a demand effect. Nevertheless, the predictions for capital and labor are qualitatively the same. To simplify notation, I only include the productivity shifter.

Finally, I model local labor supply as a function of wages both in region r and outside of it, with the local labor supply elasticity $\varphi = (dL_r/L_r)/(dw_r/w_r)$ determining how responsive labor is to changes in local wages. In equilibrium, wages will adjust such that local labor demand and supply equalize. I assume many regions that are each small relative to the overall economy. Adjustments in one region therefore imply negligible effects on outcomes in other regions.

B.2 Maximization Problem of Firms

The model can be summarized with the maximization problem of firms

$$\max_{K_i, L_i} p_i Y_i - (1 - \tau_i) r K_i - w_r L_i, \quad (7)$$

subject to

$$p_i = B Y_i^{-\frac{1}{\eta^D}} \quad (8)$$

$$F(K_i, L_i) = Y_i = A_r A_i (a_K K_i^\rho + a_L L_i^\rho)^{\frac{1}{\rho}}. \quad (9)$$

Optimal factor inputs at baseline can be written as

$$K_i = a_K^{\frac{1}{1-\rho}} Y_i \left(\frac{(1 - \tau_i) r}{p_i (1 - \frac{1}{\eta^D})} \right)^{\frac{1}{\rho-1}} (A_i A_r)^{\frac{\rho}{1-\rho}} \quad (10)$$

$$L_i = a_L^{\frac{1}{1-\rho}} Y_i \left(\frac{w_r}{p_i (1 - \frac{1}{\eta^D})} \right)^{\frac{1}{\rho-1}} (A_i A_r)^{\frac{\rho}{1-\rho}}. \quad (11)$$

⁴⁶With agglomeration spillovers, a change in the employment in one firm leads to productivity gains for all others in the same region. Firm adjustments from this initial push create additional agglomeration spillovers that also benefit the original firm. With many firms receiving investment tax incentives, this chain of reaction occurs multiple times, making agglomeration effects roughly equal for all firms in a region.

The total derivative of the production function and factor input equations (10) and (11) are

$$\frac{dY_i}{Y_i} = \frac{dA_r}{A_r} + \frac{a_K K_i^\rho}{a_K K_i^\rho + a_L L_i^\rho} \frac{dK_i}{K_i} + \frac{a_L L_i^\rho}{a_K K_i^\rho + a_L L_i^\rho} \frac{dL_i}{L_i} \quad (12)$$

$$\frac{dK_i}{K_i} = \left(1 - \frac{1}{\eta^D} \frac{1}{1-\rho}\right) \frac{dY_i}{Y_i} + \frac{\rho}{1-\rho} \frac{dA_r}{A_r} + \frac{1}{1-\rho} \frac{d\tau_i}{1-\tau_i} \quad (13)$$

$$\frac{dL_i}{L_i} = \left(1 - \frac{1}{\eta^D} \frac{1}{1-\rho}\right) \frac{dY_i}{Y_i} + \frac{\rho}{1-\rho} \frac{dA_r}{A_r} - \frac{1}{1-\rho} \frac{dw_r}{w_r}. \quad (14)$$

For simplicity, I consider the case in which firms do not initially receive tax credits ($\tau_i = 0, \forall i$), leading to

$$\frac{dK_i}{K_i} = \left(\eta^D s_r^K + \frac{1}{1-\rho} s_r^L \right) M d\tau_i + (\eta^D - 1) \frac{dA_r}{A_r} - \left(\eta^D - \frac{1}{1-\rho} \right) s_r^L M \frac{dw_r}{w_r} \quad (15)$$

$$\frac{dL_i}{L_i} = \underbrace{\left(\eta^D - \frac{1}{1-\rho} \right) s_r^K M d\tau_i}_{\text{direct effect}} + \underbrace{(\eta^D - 1) \frac{dA_r}{A_r} - \left(\eta^D s_r^L + \frac{1}{1-\rho} s_r^K \right) M \frac{dw_r}{w_r}}_{\text{indirect effect}}, \quad (16)$$

where s_r^K is the capital share and s_r^L the labor share. $M = \eta^D / (\eta^D - 1)$ is the markup as an additional term arising from the monopolistic competition assumption.

Both the capital and labor response depend on a direct effect, which influences only the firms receiving investment tax credits, and an indirect effect, which is the same for all firms of a region. A comparison of firms within regions according to their tax credit rate change can therefore determine the direct effect of investment tax credits. The direct effect combines two forces, a scaling effect of production and a substitution effect between capital and labor, closely mimicking the standard labor demand model (Hamermesh, 1993). For capital, these effects work in the same direction, with an increase in the tax credit rate thus implying an unambiguous expansion of the capital stock. This relationship is driven both by a general stimulation of production through cheaper production costs and a shift from labor towards capital due to the relative cost reduction. For labor demand, these factors oppose one another. While the expansion of production increases the demand for labor, at the same time relatively more capital is employed. The combined impact depends on the relative magnitude of both forces and is positive if the elasticity of product demand is larger than the elasticity of substitution.

B.3 Indirect Effects

The indirect effect depends on the channels introduced at the regional level: agglomeration economies (and implicitly local demand effects) and local labor supply. While agglomeration benefits have a factor-neutral positive impact in the model, the influence of local labor supply through adjustments of local wages is more complex. An increase in wages leads to higher costs of production and therefore reduces output. Firms can mitigate some of the impact by shifting to the relatively cheaper capital inputs. Consequently, higher wages lead to an unambiguous decrease in labor but an ambiguous effect on capital, depending on the magnitude of the scale and substitution effect.

Using the definition of the regional productivity shifter and the local labor supply elasticity, I solve for the equilibrium adjustment of capital and labor. The direct relations of the change in regional employment with the change in the productivity shifter and local wages are

$$\frac{dA_r}{A_r} = \frac{d(\sum_{j \in j_r} L_j)^\lambda}{A_r} = \lambda \sum_{j \in j_r} \frac{L_j}{L_r} \frac{dL_j}{L_j}, \quad \frac{dw_r}{w_r} = \frac{1}{\varphi} \frac{dL_r}{L_r} = \frac{1}{\varphi} \sum_{j \in j_r} \frac{L_j}{L_r} \frac{dL_j}{L_j}, \quad (17)$$

where j_r represents the set of firms in region r .

Using these terms in the equations for the firm response, I obtain the relation for the indirect employment response

$$\left(\frac{dL_i}{L_i} \right)_{ind} = \left[(\eta^D - 1)\lambda - (\eta^D s_r^L + \frac{1}{1-\rho} s_r^K) M \frac{1}{\varphi} \right] \sum_{j \in j_r} \frac{L_j}{L_r} \left[\left(\frac{dL_j}{L_j} \right)_{dir} + \left(\frac{dL_j}{L_j} \right)_{ind} \right]. \quad (18)$$

Since indirect effects are equal for firms within regions, I rearrange for the final result

$$\left(\frac{dL_i}{L_i} \right)_{indirect} = \frac{(\eta^D - 1)\lambda - (\eta^D s_r^L + \frac{1}{1-\rho} s_r^K) M \frac{1}{\varphi}}{1 - (\eta^D - 1)\lambda + (\eta^D s_r^L + \frac{1}{1-\rho} s_r^K) M \frac{1}{\varphi}} \sum_{j \in j_r} \frac{L_j}{L_r} \left(\frac{dL_j}{L_j} \right)_{direct}, \quad (19)$$

where the parameters need to be bounded by $(\eta^D - 1)\lambda - (\eta^D s_r^L + 1/(1-\rho)s_r^K)M\varphi < 1$ for a stable equilibrium. The indirect firm response is governed by a first term of model parameters, including the agglomeration elasticity and labor supply elasticity as central parameters in shaping the indirect effect. With a positive direct labor demand effect, an agglomeration elasticity above zero ($\lambda > 0$) implies that agglomeration creates additional

firm growth in both capital and labor.⁴⁷ A perfectly elastic local labor supply ($\varphi = \infty$) implies no change to wages and therefore no impact on indirect adjustments. In all other cases, the labor effect is dampened. With a perfectly inelastic local labor supply ($\varphi = 0$), regional employment stays constant and the indirect employment effect—which is equal for all firms within a region—completely offsets the direct effect of those firms receiving tax credits.

The corresponding capital response is

$$\left(\frac{dK_i}{K_i}\right)_{ind} = \left[(\eta^D - 1)\lambda - (\eta^D - \frac{1}{1-\rho})s_r^L M \frac{1}{\varphi} \right] \sum_{j \in j_r} \frac{L_j}{L_r} \left[\left(\frac{dL_j}{L_j}\right)_{dir} + \left(\frac{dL_j}{L_j}\right)_{ind} \right], \quad (20)$$

which simplifies with the result for the indirect labor response to

$$\left(\frac{dK_i}{K_i}\right)_{indirect} = \frac{(\eta^D - 1)\lambda - (\eta^D - \frac{1}{1-\rho})s_r^L M \frac{1}{\varphi}}{1 - (\eta^D - 1)\lambda + (\eta^D s_r^L + \frac{1}{1-\rho}s_r^K) M \frac{1}{\varphi}} \sum_{j \in j_r} \frac{L_j}{L_r} \left(\frac{dL_j}{L_j}\right)_{direct}. \quad (21)$$

The second multiplicative term on the right-hand side comprises the sum of the direct effects within a region, weighted by firm employment. In the German investment tax credit program, firms either received a large tax credit rate change ($d\tau_i = d\tau > 0$) or a small one, which for simplicity I assume to be zero ($d\tau_i = 0$). Under these assumptions, the direct effect of investment tax credits are the same across affected firms in a region. The indirect effects can thus be written as

$$\left(\frac{dK_i}{K_i}\right)_{indirect} = \frac{(\eta^D - 1)\lambda - (\eta^D - \frac{1}{1-\rho})s_r^L M \frac{1}{\varphi}}{1 - (\eta^D - 1)\lambda + (\eta^D s_r^L + \frac{1}{1-\rho}s_r^K) M \frac{1}{\varphi}} \left(\eta^D - \frac{1}{1-\rho}\right) s_r^K M \frac{L_{\tau,r}}{L_r} d\tau \quad (22)$$

$$\left(\frac{dL_i}{L_i}\right)_{indirect} = \frac{(\eta^D - 1)\lambda - (\eta^D s_r^L + \frac{1}{1-\rho}s_r^K) M \frac{1}{\varphi}}{1 - (\eta^D - 1)\lambda + (\eta^D s_r^L + \frac{1}{1-\rho}s_r^K) M \frac{1}{\varphi}} \left(\eta^D - \frac{1}{1-\rho}\right) s_r^K M \frac{L_{\tau,r}}{L_r} d\tau. \quad (23)$$

where $L_{d\tau,r}/L_r$ is the regional employment share of firms receiving a tax credit rate change. The investment tax credit policy thus creates differences in the indirect effects across regions according to the employment share of firms receiving tax credits. Thus, comparing the response of firms across regions by this employment share determines the indirect effect. The effect size will depend on the model parameters of the two indirect mechanisms, agglomeration economies and local labor supply. Additionally, the regional labor share interacts with these mechanisms and may increase or decrease the observed

⁴⁷In principle, the model allows for an agglomeration elasticity $\lambda < 0$, which could be interpreted as the negative impacts of agglomeration, for example, congestion, prevailing.

effect across regions.

B.4 Notes on the Labor and Capital Share

With the production function equation and the FOCs, it is possible to rewrite

$$\frac{a_L L_i^\rho}{a_K K_i^\rho + a_L L_i^\rho} = a_L L_i^\rho \left(\frac{A_i A_r}{Y_i} \right)^\rho = \frac{w_r L_i}{p_i Y_i} \left(\frac{\eta^D}{\eta^D - 1} \right). \quad (24)$$

With the assumption of zero tax credits at baseline, the capital-labor ratio depends on the production function parameters, wages, and the rental rate of capital, all of which are constant at the regional level. The previous term therefore is equal for all firms in a region and can be simplified to

$$\frac{a_L L_i^\rho}{a_K K_i^\rho + a_L L_i^\rho} = s_r^L M. \quad (25)$$

The derivations are analogous for the capital share and lead to

$$\frac{a_K K_i^\rho}{a_K K_i^\rho + a_L L_i^\rho} = s_r^K M. \quad (26)$$

B.5 Employment Ratio with Two Types of Labor

For making predictions about the impact of investment tax credits on different labor types, I consider a nested CES production function with two types of labor and differences in the elasticity of substitution between capital and the two labor types. I further allow for different wages and labor supply elasticities for each labor type.

With these adjustments, the maximization problem is

$$\max_{K_i, S_i, U_i} p_i Y_i - (1 - \tau_i) r K_i - w_r^S S_i - w_r^U U_i, \quad (27)$$

subject to

$$p_i = B Y_i^{-\frac{1}{\eta^D}} \quad (28)$$

$$F(K_i, U_i, S_i) = Y_i = A_i A_r \left[(a_K K_i^\rho + a_S S_i^\rho)^{\frac{\mu}{\rho}} + a_U U_i^\mu \right]^{\frac{1}{\mu}} \quad (29)$$

The first order conditions from the maximization problem are

$$(1 - \tau_i)r = \left(1 - \frac{1}{\eta^D}\right) Ba_K Y_i^{1-\mu-\frac{1}{\eta^D}} (a_K K_i^\rho + a_S S_i^\rho)^{\frac{\mu-\rho}{\rho}} K_i^{\rho-1} (A_i A_{ir})^\mu \quad (30)$$

$$w_r^S = \left(1 - \frac{1}{\eta^D}\right) Ba_S Y_i^{1-\mu-\frac{1}{\eta^D}} (a_K K_i^\rho + a_S S_i^\rho)^{\frac{\mu-\rho}{\rho}} S_i^{\rho-1} (A_i A_{ir})^\mu \quad (31)$$

$$w_r^U = \left(1 - \frac{1}{\eta^D}\right) Ba_U Y_i^{1-\mu-\frac{1}{\eta^D}} U_i^{\mu-1} (A_i A_{ir})^\mu. \quad (32)$$

Totally differentiating the FOCs leads to

$$-\frac{d\tau_i}{1 - \tau_i} = \left(1 - \mu - \frac{1}{\eta^D}\right) \frac{dY_i}{Y_i} + (\mu - \rho)(X_i^K \frac{dK_i}{K_i} + X_i^S \frac{dS_i}{S_i}) + (\rho - 1) \frac{dK_i}{K_i} + \mu \frac{dA_r}{A_r} \quad (33)$$

$$\frac{dw_r^S}{w_r^S} = \left(1 - \mu - \frac{1}{\eta^D}\right) \frac{dY_i}{Y_i} + (\mu - \rho)(X_i^K \frac{dK_i}{K_i} + X_i^S \frac{dS_i}{S_i}) + (\rho - 1) \frac{dS_i}{S_i} + \mu \frac{dA_r}{A_r} \quad (34)$$

$$\frac{dw_r^U}{w_r^U} = \left(1 - \mu - \frac{1}{\eta^D}\right) \frac{dY_i}{Y_i} + (\mu - 1) \frac{dU_i}{U_i} + \mu \frac{dA_r}{A_r}, \quad (35)$$

where $X_i^K = 1 - X_i^S = \frac{a_K K_i^\rho}{a_K K_i^\rho + a_S S_i^\rho}$.

Based on the total derivatives of the FOCs, the relative changes of inputs can be written as

$$\begin{aligned} \frac{dK_i}{K_i} = & \left(1 - \frac{1}{(1 - \mu)\eta^D}\right) \frac{dY_i}{Y_i} + \left(\frac{1}{1 - \mu} - \frac{\mu - \rho}{(1 - \mu)(1 - \rho)} X_i^S\right) \frac{d\tau_i}{1 - \tau_i} \\ & + \frac{\mu}{1 - \mu} \frac{dA_r}{A_r} - \frac{\mu - \rho}{(1 - \mu)(1 - \rho)} X_i^S \frac{dw_r^S}{w_r^S} \end{aligned} \quad (36)$$

$$\begin{aligned} \frac{dS_i}{S_i} = & \left(1 - \frac{1}{(1 - \mu)\eta^D}\right) \frac{dY_i}{Y_i} + \frac{\mu - \rho}{(1 - \mu)(1 - \rho)} X_i^K \frac{d\tau_i}{1 - \tau_i} \\ & + \frac{\mu}{1 - \mu} \frac{dA_r}{A_r} - \left(\frac{1}{1 - \rho} + \frac{\mu - \rho}{(1 - \mu)(1 - \rho)} X_i^S\right) \frac{dw_r^S}{w_r^S} \end{aligned} \quad (37)$$

$$\frac{dU_i}{U_i} = \left(1 - \frac{1}{(1 - \mu)\eta^D}\right) \frac{dY_i}{Y_i} - \frac{1}{1 - \mu} \frac{dw_r^U}{w_r^U} + \frac{\mu}{1 - \mu} \frac{dA_r}{A_r} \quad (38)$$

To consider changes in the composition of the labor force, I determine from the FOCs the implicitly defined ratio

$$\frac{S_i}{U_i} = \left(\frac{w_r^S a_u}{w_r^U a_s}\right)^{\frac{1}{\rho-1}} (a_K K_i^\rho + a_S S_i^\rho)^{\frac{\rho-\mu}{\rho(\rho-1)}} U_i^{\frac{\rho-\mu}{1-\rho}}. \quad (39)$$

The total derivative is

$$\frac{d\frac{S_i}{U_i}}{\frac{S_i}{U_i}} = \frac{\mu - \rho}{1 - \rho} \left(X_i^K \frac{dK_i}{K_i} + X_i^S \frac{dS_i}{S_i} \right) - \frac{\mu - \rho}{1 - \rho} \frac{dU_i}{U_i} - \frac{1}{1 - \rho} \frac{dw_r^S}{w_r^S} + \frac{1}{1 - \rho} \frac{dw_r^U}{w_r^U}. \quad (40)$$

With the equations for the relative change in inputs, I obtain the final result

$$\frac{d\frac{S_i}{U_i}}{\frac{S_i}{U_i}} = \left(\frac{1}{1 - \mu} - \frac{1}{1 - \rho} \right) X_i^K d\tau_i - \left(\frac{1}{1 - \mu} X_i^S + \frac{1}{1 - \rho} X_i^K \right) \frac{dw_r^S}{w_r^S} + \frac{1}{1 - \mu} \frac{dw_r^U}{w_r^U}. \quad (41)$$

The equation shows that changes in the employment composition depend on a direct and an indirect component similar to the previous result. The direct component depends on the absolute difference in the elasticities of substitution between both labor types and capital. For the case of two skill types, if the elasticity between unskilled labor and capital is higher than the one between skilled labor and capital, a lower cost of capital leads to a shift towards skilled labor through capital-skill complementarity.

The indirect component does depend only on the wage changes in a labor market. Increasing wages for skilled (unskilled) labor shift employment towards unskilled (skilled). Since agglomeration economies are modeled as factor-neutral production changes, they do not influence the skill ratio.

B.6 Firm Size Distribution Around the Cutoff

I integrate the firm production model (with a single type of labor) into a Lucas (1978) span-of-control model by assuming that the allocation of productive factors is over managers with varying ability levels. With a managerial ability distribution, I can derive a firm size distribution of aggregate production for the investment tax credit policy.

For this extension, I explicitly take into account that firms maximize profits given the firm size cutoff of investment tax credits. With this modification, each firm maximizes profit according to

$$\pi(A_i) = \max_{K_i, L_i} \begin{cases} p_i Y_i - (1 - \tau) r K_i - w_r L_i & \text{if } L_i \leq N \\ p_i Y_i - r K_i - w_r L_i & \text{if } L_i > N, \end{cases} \quad (42)$$

where N is the employment cutoff and all other variables are defined as above. Without loss of generality, I assume that only firms below the firm size cutoff can take advantage

of tax credits. This modeling choice implies that τ identifies the difference in the tax credit rate of firms below compared to firms above the cutoff, with the rate for large firms subsumed in the capital rental rate r . For simplicity, the model does not include fixed costs that might arise due to bunching at the cutoff. Fixed costs influence the interpretation of the parameters of the firm size distribution but not the shape of the distribution itself. I further abstract from the region-specific variables in the cross-section by setting $A_r = 1$ and $w_r = w$.

The profit function is differentiable for all $L_i \neq N$, with the optimal input choice away from the cutoff described by equations (10) and (11). Solving these equations, optimal labor input is

$$L^* = A_i^{\eta^D-1} \omega_L^{\eta^D} T(\bar{\tau})^{\frac{\eta^D - \rho \eta^D - 1}{\rho}}, \quad (43)$$

where $\omega_L = B \frac{a_L(1-\frac{1}{\eta^D})}{w_r}$, $T(\bar{\tau}) = a_L + a_K \left(\frac{a_K w_r}{a_L(1-\bar{\tau})r} \right)^{\frac{\rho}{1-\rho}}$, and $\bar{\tau}$ is defined as $\bar{\tau} = \tau$ if $L_i \leq N$, and $\bar{\tau} = 1$ if $L_i > N$.

To highlight the influence of the cutoff on firm behavior, I first consider a firm that chooses optimal labor right at the cutoff $L^* = N$ and define the corresponding productivity as A_N . This firm still receives a reduction in the cost of capital due to tax credits. A firm with just slightly higher productivity would be located above the cutoff and therefore be ineligible for tax credits. The firm is better off reducing the firm size to the cutoff value. Such a decision is optimal since the firm chooses a negligible smaller firm size, which translates to insignificant changes in sales but leads to cost savings through tax credits. A similar argument can be made for firms with productivity levels further above A_N . They still can gain from bunching at the cutoff due to the benefits of a lower cost of capital. However, the larger is the decrease in firm size the larger is the impact on output. There exists a firm productivity A_B for which benefits and costs of bunching cancel out. This firm is called the marginal buncher with a firm size L_B .

In the model, decreasing returns to scale lead to non-zero profits that induce firm entry. To close the model, I assume that each individual i chooses between earning wage w_r as a worker or earning the profit $\pi(A_i)$ as a firm owner. The productivity A_i is directly linked to the individual and can be thought of as the managerial ability. Each individual has a fixed managerial ability that is determined by a random draw from the power law distribution

$$\phi(A) = c_A A^{-\beta_A}, \quad (44)$$

where $c_A > 0$, and $\beta_A > 0$.

In equilibrium, there is a minimum ability A_{min} defined as

$$\pi(A_{min}) = w, \quad (45)$$

for which the individual is marginal between being a worker and a firm owner. All individuals with a lower managerial ability choose to be workers, and all those with higher ability choose to be firm owners. Equilibrium wage works as an opportunity cost that equalizes the number of workers with the aggregate labor demand of the firm owners.

This then allows to describe the firm size distribution as follows. Firms in the productivity interval of $[A_{min}, A_N)$ have a firm size below the cutoff and therefore receive tax credits. All firms with productivity of $[A_N, A_B)$ bunch at the firm size cutoff, creating excess mass at the cutoff and missing mass to the right of the cutoff. Firms with productivity of $[A_B, \infty)$ have a firm size above the cutoff and therefore produce without getting tax credits.

To derive the firm size distribution, I apply the change of variable formula

$$g(L) = \phi[r^{-1}(L)] \frac{d}{dL} r^{-1}(L), \quad L = r(A) \text{ with } r \text{ strictly increasing}, \quad (46)$$

where $r(A)$ defines the relation between firm size and productivity in equation (43).

The (preliminary) firm size distribution is

$$\chi(L) = \begin{cases} \frac{c_A}{p} \frac{1}{\eta^{D-1}} \omega_L^{(\beta-1)\eta^D} T(\tau)^{(\beta-1)\frac{\eta^D - \rho\eta^D - 1}{\rho}} L^{-\beta} & \text{if } L_{min} \leq L < N \\ \frac{1}{p} \int_{A_N}^{A_B} \phi(A) dA = \delta & \text{if } L = N \\ 0 & \text{if } N < L < L_r \\ \frac{c_A}{p} \frac{1}{\eta^{D-1}} \omega_L^{(\beta-1)\eta^D} T(1)^{(\beta-1)\frac{\eta^D - \rho\eta^D - 1}{\rho}} L^{-\beta} & \text{if } L_r \leq L \end{cases} \quad (47)$$

where the parameter p rescales the distribution to conform to the conditions of a probability density function, δ defines the mass of firms bunching at the cutoff, and $\beta = 1 + \frac{1-\beta_A}{1-\eta^D}$.

The bunching mass δ is defined both by the mass of firms with productivity between A_N and A_B and as the residual of the other density terms. Solving the integral, the

bunching mass is

$$\begin{aligned}
\delta &= \int_{A_N}^{A_B} \phi(A) dA \\
&= \int_{A_N^{\eta^D-1} \omega_L^{\eta^D} T(\tau)^{\frac{\eta^D-\rho\eta^{D-1}}{\rho}}}^{A_B^{\eta^D-1} \omega_L^{\eta^D} T(\tau)^{\frac{\eta^D-\rho\eta^{D-1}}{\rho}}} \frac{c_A}{p} \frac{1}{\eta^D-1} \omega_L^{\eta^D(\beta-1)} T(\tau)^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} L^{-\beta} dL \\
&= \int_N^{L_B \left[\frac{T(\tau)}{T(1)} \right]^{\frac{\eta^D-\rho\eta^{D-1}}{\rho}}} \frac{c_A}{p} \frac{1}{\eta^D-1} \omega_L^{\eta^D(\beta-1)} T(\tau)^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} L^{-\beta} dL \\
&= \frac{c_A}{p} \frac{1}{\eta^D-1} \omega_L^{\eta^D(\beta-1)} \frac{1}{\beta-1} T(\tau)^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} \left[N^{1-\beta} - L_B^{1-\beta} \left[\frac{T(1)}{T(\tau)} \right]^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} \right], \quad (48)
\end{aligned}$$

and solving for the residual term, the bunching mass is

$$\begin{aligned}
\delta &= 1 - \int_{L_{min}}^N \frac{c_A}{p} \frac{1}{\eta^D-1} \omega_L^{(\beta-1)\eta^D} T(\tau)^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} L^{-\beta} dL \\
&\quad - \int_{L_B}^{\infty} \frac{c_A}{p} \frac{1}{\eta^D-1} \omega_L^{(\beta-1)\eta^D} T(1)^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} L^{-\beta} dL \\
&= 1 - \frac{c_A}{p} \frac{1}{\eta^D-1} \omega_L^{(\beta-1)\eta^D} \frac{1}{\beta-1} \\
&\quad \cdot \left[T(\tau)^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} L_{min}^{1-\beta} - T(\tau)^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} N^{1-\beta} + T(1)^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} L_B^{1-\beta} \right] \quad (49)
\end{aligned}$$

These terms allow me to define the firm size distribution explicitly. Setting the terms equal for δ , the equality simplifies to

$$\frac{c_A}{p} \frac{1}{\eta^D-1} \omega_L^{(\beta-1)\eta^D} = (\beta-1) T(\tau)^{(1-\beta)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} L_{min}^{\beta-1}. \quad (50)$$

The final firm size distribution is

$$\chi(L^*) = \begin{cases} (\beta-1) L_{min}^{\beta-1} L^{*-\beta} & \text{if } L_{min} \leq L^* < N \\ L_{min}^{\beta-1} \left[N^{1-\beta} - L_B^{1-\beta} \left[\frac{T(1)}{T(\tau)} \right]^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} \right] & \text{if } L^* = N \\ 0 & \text{if } N < L^* < L_B \\ (\beta-1) L_{min}^{\beta-1} \left(\frac{T(1)}{T(\tau)} \right)^{(\beta-1)\frac{\eta^D-\rho\eta^{D-1}}{\rho}} L^{*- \beta} & \text{if } L_B \leq L^* \end{cases} \quad (51)$$

While the model leads to sharp predictions around the firm size cutoff, empirically, I do not observe the exact policy-relevant firm size. Measurement error implies that bunching does not appear just at the cutoff, but leads to excess mass for a range of firm

sizes around it.

For estimating the firm size distribution, I assume that the observed firm size relates to actual firm size by

$$L(A, \epsilon) = L^*(A)e^\epsilon, \quad (52)$$

where L^* is the equilibrium firm size as defined in equation (43), $L(A, \epsilon)$ is the observed firm size in the data, and ϵ is unobserved measurement error. I assume that the measurement error is Gaussian noise with mean zero and variance σ^2 .

To derive the observed empirical firm size distribution, as a first step I consider the conditional cdf

$$\begin{aligned}
P(L < n | \epsilon) &= \begin{cases} 0 & \text{if } ne^{-\epsilon} \leq L_{min} \\ \frac{\beta-1}{L_{min}^{1-\beta}} \int_{L_{min}}^{ne^{-\epsilon}} L^{*-\beta} dL^* & \text{if } L_{min} \leq ne^{-\epsilon} < N \\ \frac{\beta-1}{L_{min}^{1-\beta}} \int_{L_{min}}^N L^{*-\beta} dL^* + \frac{1}{L_{min}^{1-\beta}} \left[N^{1-\beta} - L_B^{1-\beta} \left[\frac{T(1)}{T(\tau)} \right]^{(\beta-1) \frac{\eta^D - \rho\eta^{D-1}}{\rho}} \right] & \text{if } N \leq ne^{-\epsilon} < L_B \\ \dots + \frac{\beta-1}{L_{min}^{1-\beta}} \left(\frac{T(1)}{T(\tau)} \right)^{(\beta-1) \frac{\eta^D - \rho\eta^{D-1}}{\rho}} \int_{L_B}^{ne^{-\epsilon}} L^{*- \beta} dL^* & \text{if } L_B \leq ne^{-\epsilon} \end{cases} \quad (53) \\
&= \begin{cases} 0 & \text{if } \ln(n) - \ln(L_{min}) \leq \epsilon \\ 1 - \left(\frac{ne^{-\epsilon}}{L_{min}} \right)^{1-\beta} & \text{if } \ln(n) - \ln(N) < \epsilon \leq \ln(n) - \ln(L_{min}) \\ 1 - \left(\frac{L_B}{L_{min}} \right)^{1-\beta} \left(\frac{T(1)}{T(\tau)} \right)^{(\beta-1) \frac{\eta^D - \rho\eta^{D-1}}{\rho}} & \text{if } \ln(n) - \ln(L_B) < \epsilon \leq \ln(n) - \ln(N) \\ 1 - \left(\frac{ne^{-\epsilon}}{L_{min}} \right)^{1-\beta} \left(\frac{T(1)}{T(\tau)} \right)^{(\beta-1) \frac{\eta^D - \rho\eta^{D-1}}{\rho}} & \text{if } \epsilon \leq \ln(n) - \ln(L_B) \end{cases} \quad (54)
\end{aligned}$$

I can then compute the unconditional cdf by integrating over the distribution of ϵ to obtain

$$\begin{aligned}
P(L < n) &= \int_{\mathbb{R}} P(L < n | \epsilon) \frac{1}{\sigma} \varphi\left(\frac{\epsilon}{\sigma}\right) d\epsilon \\
&= \int_{\ln(n) - \ln(N)}^{\ln(n) - \ln(L_{min})} \left[1 - \left(\frac{ne^{-\epsilon}}{L_{min}} \right)^{1-\beta} \right] \frac{1}{\sigma} \varphi\left(\frac{\epsilon}{\sigma}\right) d\epsilon \\
&\quad + \int_{\ln(n) - \ln(L_B)}^{\ln(n) - \ln(N)} \left[1 - \left(\frac{L_B}{L_{min}} \right)^{1-\beta} \left(\frac{T(1)}{T(\tau)} \right)^{(\beta-1) \frac{\eta^D - \rho\eta^{D-1}}{\rho}} \right] \frac{1}{\sigma} \varphi\left(\frac{\epsilon}{\sigma}\right) d\epsilon \\
&\quad + \int_{-\infty}^{\ln(n) - \ln(L_B)} \left[1 - \left(\frac{ne^{-\epsilon}}{L_{min}} \right)^{1-\beta} \left(\frac{T(1)}{T(\tau)} \right)^{(\beta-1) \frac{\eta^D - \rho\eta^{D-1}}{\rho}} e^{-\epsilon(1-\beta)} \right] \frac{1}{\sigma} \varphi\left(\frac{\epsilon}{\sigma}\right) d\epsilon
\end{aligned}$$

$$\begin{aligned}
&= \Phi\left(\frac{\ln(n) - \ln(L_{min})}{\sigma}\right) - \left(\frac{L_B}{L_{min}}\right)^{1-\beta} \left(\frac{T(1)}{T(\tau)}\right)^{(\beta-1)\frac{\eta^D - \rho\eta^{D-1}}{\rho}} \\
&\quad \cdot \left[\Phi\left(\frac{\ln(n) - \ln(N)}{\sigma}\right) - \Phi\left(\frac{\ln(n) - \ln(L_B)}{\sigma}\right) \right] \\
&\quad - \left(\frac{n}{L_{min}}\right)^{1-\beta} e^{\frac{\sigma^2}{2}(\beta-1)^2} \left[\Phi\left(\frac{\ln(n) - \ln(L_{min})}{\sigma} - \sigma(\beta-1)\right) - \Phi\left(\frac{\ln(n) - \ln(N)}{\sigma} - \sigma(\beta-1)\right) \right] \\
&\quad - \left(\frac{n}{L_{min}}\right)^{1-\beta} e^{\frac{\sigma^2}{2}(\beta-1)^2} \left(\frac{T(1)}{T(\tau)}\right)^{(\beta-1)\frac{\eta^D - \rho\eta^{D-1}}{\rho}} \Phi\left(\frac{\ln(n) - \ln(L_B)}{\sigma} - \sigma(\beta-1)\right), \quad (55)
\end{aligned}$$

where φ is the Gaussian pdf, Φ is the Gaussian cdf, and I use that $\frac{\partial}{\partial \epsilon} e^{\frac{\sigma^2}{2}(\beta-1)^2} \Phi\left(\frac{\epsilon}{\sigma} - \sigma(\beta-1)\right) = \frac{1}{\sigma} \varphi\left(\frac{\epsilon}{\sigma}\right) e^{\epsilon(\beta-1)}$.

As a final step I take the derivate with respect to n to compute the corresponding pdf as

$$\begin{aligned}
\chi(n) &= \frac{1}{\sigma n} \frac{1}{L_{min}^{1-\beta}} (N^{1-\beta} - \left(\frac{T(1)}{T(\tau)}\right)^{(\beta-1)\frac{\eta^D - \rho\eta^{D-1}}{\rho}} L_B^{1-\beta}) \varphi\left(\frac{\ln(n) - \ln(N)}{\sigma}\right) \\
&\quad - (1-\beta) \left(\frac{1}{L_{min}}\right)^{1-\beta} n^{-\beta} e^{\frac{\sigma^2}{2}(\beta-1)^2} \\
&\quad \cdot \left[\Phi\left(\frac{\ln(n) - \ln(L_{min})}{\sigma} - \sigma(\beta-1)\right) - \Phi\left(\frac{\ln(n) - \ln(N)}{\sigma} - \sigma(\beta-1)\right) \right] \\
&\quad - (1-\beta) \left(\frac{1}{L_{min}}\right)^{1-\beta} n^{-\beta} e^{\frac{\sigma^2}{2}(\beta-1)^2} \left(\frac{T(1)}{T(\tau)}\right)^{(\beta-1)\frac{\eta^D - \rho\eta^{D-1}}{\rho}} \Phi\left(\frac{\ln(n) - \ln(L_B)}{\sigma} - \sigma(\beta-1)\right), \quad (56)
\end{aligned}$$

where I simplify with $e^{\frac{\sigma^2}{2}(\beta-1)^2} n^{1-\beta} \varphi\left(\frac{\ln(n) - \ln(X)}{\sigma} - \sigma(\beta-1)\right) = \varphi\left(\frac{\ln(n) - \ln(X)}{\sigma}\right) X^{1-\beta}$

B.7 Heterogeneous Indirect Effects

So far, the indirect effects are assumed to be the same for all firms in a region. However, the different channels of agglomeration economies suggest that the strength of spillovers depends on the economic closeness between firms. To inform the empirical estimation strategy, I consider a version of the model that allows for differences in the spillovers. I do so by adjusting the relationship of the productivity shifter, which generates the indirect effects, to

$$A_{ir} = \left(\sum_{j \in j_r} w_{ij} L_j \right)^\lambda, \quad (57)$$

where w_{ij} is the weight of firm j for the productivity shifter of firm i .

A change in the productivity shifter can be written as

$$\frac{dA_{ir}}{A_{ir}} = \frac{\lambda}{w_i} \sum_{j \in j_r} w_{ij} \frac{L_j}{L_r} \frac{dL_j}{L_j}, \quad (58)$$

$\bar{w}_i$ captures the average of the weights w_{ij} , such that $\bar{w}_i L_r = \sum_{j \in j_r} w_{ij} L_j$. Through these weights, I allow for the productivity shifter to vary across firms in the same region. The relationship shows that a relative change of the productivity shifter is linearly related to the change in the employment rate of a firm and nests the homogeneous case with $w_{ij} = 1$ for all i and j . In the subsequent discussion, I assume perfectly elastic labor supply and consider as before the case of firms either receiving a large tax credit rate change ($d\tau_i = d\tau > 0$) or a small one, which for simplicity I assume to be zero ($d\tau_i = 0$). Under this assumption, the direct effect of investment tax credits, denoted as $\left(\frac{dL}{L}\right)_{dir, treated, r}$, is the same for all affected firms in a region. I also assume that the weights for each firm pair are drawn from the same distribution and are uncorrelated with the size of the firms, thus $\bar{w}_i \approx \bar{w}$.

With these assumptions, the indirect effect on employment of firm i is

$$\left(\frac{dL_i}{L_i}\right)_{ind} = (\eta^D - 1) \frac{\lambda}{\bar{w}} \left(\frac{dL}{L}\right)_{dir, treated, r} \sum_{j \in j_r} w_{ij} \frac{L_{r,j}}{L_r} + (\eta^D - 1) \frac{\lambda}{\bar{w}} \sum_{j \in j_r} w_{ij} \left(\frac{dL_j}{L_j}\right)_{ind}. \quad (59)$$

The relationship shows that the indirect effect consists of direct spillovers (the first term on the right-hand side) and spillovers of spillovers (the second term on the right-hand side). The recursiveness of the second term gives rise to highly complex derivations for all but the simplest scenarios. Nevertheless, because of the recursiveness, spillovers of spillovers will generally matter less than the direct ones. It is therefore instructive to focus on the direct spillovers.

The direct spillovers show that the relative employment effect is linked to the sum of the weighted employment rates of small firms in the manufacturing sector (weighted employment share of small firms). In the empirical analysis, I put additional structure on the weights. Main text equation (4) defines weights at the level of industry pairs. As the weights are unobservable, I use different industry closeness measures as weights to compare the strength of the relationship between these employment shares and the indirect firm production effects.

The empirical analysis of spillovers for firms in the same and other industry groups based on main text equation (3) relies on a further restriction of the weights across industries. For this analysis, the assumption is that $w_{ij} = w_{sameindu}$ if i and j are firms in the same broad industry group n , and $w_{ij} = w_{otherindu}$, if i and j belong to different

industry groups (n and n'). In this case,

$$\left(\frac{dL_i}{L_i}\right)_{ind} = (\eta^D - 1) \frac{\lambda}{\bar{w}} \left(\frac{dL}{L}\right)_{dir, treated, r} \left(w_{sameindu} \frac{L_{\tau, n, r}}{L_r} + w_{otherindu} \frac{L_{\tau, n', r}}{L_r} \right). \quad (60)$$

C Data

This section complements the data section in the main text. I provide additional information on creating the final datasets and summary statistics for all key variables used in the empirical analysis. The following information primarily covers the *AFiD-Panel Industriebetriebe* (AFiD),⁴⁸ *Kostenstrukturerhebung* (KSE),⁴⁹ and the *Beschäftigten-Historik* (BeH).

C.1 Calculation of the Capital Stock in the AFiD

I calculate firms' capital stock from capital depreciation information in the KSE. Depreciation is related to capital stock by

$$D_{it} = \delta K_{it-1}, \quad (61)$$

where D_{it} is the value of depreciation of firm i in year t , δ is the depreciation rate, and K_{it-1} is the firm capital stock at the end of year $t - 1$. I determine capital stock by combining the depreciation information with industry-level depreciation rates obtained from the average economic life calculations by Müller (2017). As the KSE uses a stratified random sample, depreciation information is not available for all firm-year observations. Of the firms in the analysis sample, 6.1 percent never participated in the survey between 1995 to 2005. Another 1.4 percent of observations are affected by firms providing depreciation information with implausibly high changes across years (increase or decrease in values by a factor of 100), or implausibly low values below 100 euros. To avoid bias from outliers, I exclude these observations. For the remaining firms, I obtain capital stock values from equation 61 for 52 percent of the observations.

To impute further values, I build on the motion of capital

$$K_{it} = (1 - \delta)K_{it-1} + I_{it}, \quad (62)$$

where the current capital stock depends on the previous one adjusted by depreciation and

⁴⁸Source: RDC of the Federal Statistical Office and Statistical Offices of the Länder, AFiD-Panel Industriebetriebe, 1995–2005, own calculations.

⁴⁹Source: RDC of the Federal Statistical Office and Statistical Offices of the Länder, Kostenstrukturerhebung, 1995–2005, own calculations.

Table C.1: Depreciation Rate and Direct Effects On the Capital Stock

	Dependent variable: Log capital			
	Baseline depreciation rate	3-times higher rate all firms	3-times higher rate small firms	1% yearly increase small firms after policy change
	(1)	(2)	(3)	(4)
Small firm $\times$ post	0.163*** (0.056)	0.188*** (0.058)	0.174*** (0.057)	0.139** (0.056)
Observations	15,146	15,037	15,038	15,145

Note. The table reports estimates from regressions of main text specification (1). The dependent variable is the log value of capital stock calculated for different assumptions about the depreciation rate. Compared to the capital stock of the main analysis in column 1, the underlying depreciation rate for the capital stock variable is three times higher in column 2, is three times higher for firms with a policy-relevant firm size of up to 250 employees in 1998 (small firms) in column 3, and increases annually by one percent for small firms from 1999 in column 4. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

capital investment I_{it} . Given an initial capital stock value, I am able to impute missing values with the investment information in the AFiD.

For missing information at the beginning or end of the sample period, I apply the motion of capital from the closest available capital stock value. For missing information in between two capital stock measures, I average across both according to

$$K_{it}^{imp} = \frac{j}{k+j} K_{it}^{imp,t-k} + \frac{k}{k+j} K_{it}^{imp,t+j}, \quad (63)$$

where K_{it}^{imp} is the imputed capital stock, $K_{it}^{imp,t-k}$ is determined by the motion of capital from the capital stock in period $t-k$, and $K_{it}^{imp,t+j}$ is determined by the motion of capital from the capital stock in period $t+j$.

The depreciation rate is crucial for determining the level of a firm's total capital stock. With the depreciation rate potentially varying freely across firms and over time, inaccurate assumptions about the depreciation rate might invalidate the estimation results for this outcome. Nevertheless, in Table C.1, I present evidence that the estimated effects on capital are robust to rather extreme assumptions about the depreciation rate. Compared to the main result for the capital stock measure based on industry-level average economic lives in column 1, the estimate is similar for capital based on three times higher depreciation rates (column 2). The same holds true, when I assume three times higher depreciation rates just for small firms (column 3) or a one percent yearly increase in the depreciation rate of small firms after the policy change (column 4). The assumption

underlying the results in column 4 reflects a counterfactual scenario of small firms completely shifting new investment to equipment (with shorter average economic lives than structures) and is based on an analysis of German industry-level data.

One explanation for the robustness of the estimates is that the depreciation rate becomes an additively separable term with the log capital stock as outcome variable in the regression analysis (see equation (61)). Thus, fixed effects can absorb this term. The included firm, industry-year, and region-year fixed effects seem to be sufficient to control for a wide variety of assumptions about the functional form of the depreciation rate.

C.2 Creating Firm Identifiers in the BeH

The investment tax credit policy creates variation at the firm level. As the BeH data include only establishment identifiers, I rely on additional steps to link establishments at the firm level. Specifically, I rely on Schäffler (2014), who constructs firm identifiers based on the uniqueness of firm names recorded in the German Federal Employment Agency registries. The generated dataset provides firm identifiers for 94 percent of establishment observations between 1998 and 2004. Because of missing firm name information, the rate drops to 57 percent for 1997 and 4 percent for earlier years.

I impute missing firm identifiers by assigning the value from the closest available year within an establishment. This approach is supported by the fact that the allocation of establishment identifiers follows official guidelines stipulating that a new establishment identifier should be assigned after every change of the firm. Vice versa, a constant establishment identifier over time suggests that the firm remained the same. After the imputation, 90 percent of establishment observations for 1995–1997 have an assigned firm identifier. However, an implausibly high number of firm identifier changes within establishments indicates artificial breaks introduced during the data generation, for example, because of spelling errors in the firm names. In a final step, I therefore harmonize the firm identifiers over time.

I again rely the official guidelines that, in principle, a firm identifier should stay constant within an establishment identifier. A change in a firm identifier without a change in an establishment identifier therefore may not indicate a true change of the firm. As an additional requirement, I take into account whether the change in a firm identifier coincides with a change in the firm structure. For example, if two establishments have

the same firm identifier in one year and switch to a new but congruent firm identifier in the next year, I assume that no firm change has occurred. In contrast, if the firm structure changes, I assume that the change in the firm identifier is a true change of the firm. Without this condition, multi-establishment firms would consist of an unreasonably large number of establishments and frequently change their establishment structure in ways inconsistent with the evidence from the AFiD data.

C.3 Imputation of Vocational Trainees

The investment tax credit rate granted to a firm depends on the policy-relevant firm size measured as the headcount of all employees (independent of their employment contract or working hours). This measure does not include vocational trainees, who are not legally considered employees in Germany. The AFiD data do not separately account for the number of trainees, preventing me from a direct calculation of the policy-relevant firm size.

To obtain a more accurate measure, I link to the AFiD data vocational trainee information from the KSE, available for 1999–2001. I calculate the share of trainees for observations with available information and impute missing trainee information within firms by assuming a constant trainee share over time. For firms without any information on trainees, I take the average share within 3-digit industry codes. This approach leads to information on vocational trainees for all observations, 42 percent of which are imputed within firms and 40 percent of which are imputed within industries. I determine the policy-relevant firm size by excluding vocational trainees according to these shares. While the imputation may lead to a misclassification of firms into small and large for the empirical analysis, the exclusion of firms close to the firm size cutoff in the main sample considerably reduces this risk.

C.4 Geolocation Data

As the geolocation information from IEB GEO is available only from 1999, simply assigning the same location to earlier years would not account for relocation. To obtain accurate location information for 1998—the year preceding the policy change—I combine the geolocation data with a mix of additional data sources. I use municipality information from the BeH dataset and postal code information recorded in the German Federal

Employment Agency registries, both of which are available for establishments in 1998. I link this information with geographic coordinates for municipalities from the list of municipalities from the German Federal Statistical Office and for postal code areas from data collected by the OpenStreetMap project and Opendatasoft. In both cases, the coordinates represent the center of these areas. I assign the geographic coordinates to each establishment according to the most precise source. In particular, in rural places, several municipalities typically share the same postal code, while large cities are commonly divided into several postal code areas.

As municipalities or postal codes distinguish relatively confined areas, I obtain an accurate measure for establishment location in 1998 even without the IEB GEO. Nevertheless, to improve the location information, I use the geographic coordinates from the addresses of establishments. I assign establishments the exact coordinates as long as the probability of an establishment having relocated after 1998 is low. I determine relocations according to the following procedure. If establishments are located in the same municipality in 1998 and in the year of the earliest availability of the geolocation data (which is 1999 for most establishments), and if the distance between the geographic coordinates from the address data and the municipality/postal code data is below 25 kilometers, I assume that no relocation occurred. For all other cases, I assume that the establishment relocated and use the geographic coordinates from the municipality/postal code data. For manufacturing firms in East Germany, the procedure assigns geographic coordinates from the address data to 88 percent of establishments and from the municipality/postal code data to 12 percent of establishments. Almost no establishments have missing location information.

C.5 Summary Statistics

Table C.2: Overview of Variables in the AfID Data for the Empirical Analysis

	Mean	P10	Median	P90	Count
<i>Time-varying</i>					
Log capital stock (million)	2.085	0.514	2.068	3.690	15,146
Log investment (thousand)	5.770	3.515	5.866	7.872	15,590
Investment rate	0.063	0.005	0.041	0.174	15,094
Log employment	4.537	3.784	4.419	5.447	16,514
Log total sales (million)	2.151	0.936	2.024	3.624	16,486
Log domestic sales (million)	1.981	0.785	1.855	3.436	16,482
Log firm wage	7.433	7.060	7.438	7.787	16,490
<i>Time-constant</i>					
Pre-treatment wage growth	0.024	−0.024	0.024	0.069	1,650
Pre-treatment employment growth	0.034	−0.075	0.027	0.152	1,651
Share small county (%)	66.5	44.7	70.0	85.3	1,652
Share small industry (%)	72.0	40.5	75.5	100.0	1,642
Labor share county (%)	68.1	54.6	69.7	78.7	1,652
Rate small same industry county	0.131	0.049	0.115	0.241	1,652
Rate small other industry county	0.534	0.340	0.539	0.715	1,652
Weighted share small downstream	0.437	0.056	0.376	0.901	1,652
Weighted share small upstream	0.414	0.090	0.331	0.815	1,652
Weighted share small labor sharing	0.380	0.072	0.264	0.820	1,652

Note. The statistics are for the main analysis sample, consisting of East German manufacturing firms active throughout 1995–2004 with policy-relevant firm size in 1998 between 40 and 1500 employees, excluding those in Berlin and with policy-relevant firm size in 1998 of more than 225 and fewer than 275.

Table C.3: Overview of Variables in the BHP Data for the Empirical Analysis

	Mean	P10	Median	P90	N
<i>Time-varying</i>					
Log employment	4.498	3.761	4.382	5.416	20,590
Log college educated	2.041	0.693	2.079	3.497	19,145
Log non-college educated	4.361	3.584	4.248	5.293	20,589
Log ratio education	-2.347	-3.714	-2.303	-1.168	19,144
Log abstract/manual jobs	3.011	1.609	2.996	4.357	20,427
Log routine jobs	3.920	2.890	3.932	5.004	20,479
Log ratio tasks	-0.916	-2.303	-1.118	0.805	20,316
Log net flows total	0.133	-0.283	0.059	0.643	20,590
Log net flows non-employment	0.040	-0.221	0.000	0.344	20,590
Log net flows movers	0.112	-0.091	0.056	0.409	20,590
Log net flows service sector	0.045	-0.047	0.019	0.179	20,590
Log net flows business services	0.010	-0.024	0.000	0.055	20,590
Log net flows West Germany	-0.001	-0.045	0.000	0.038	20,590
Log net flows large manuf. firms	0.003	-0.017	0.000	0.019	20,590
Log net flows other county East manuf. firms	0.011	-0.022	0.000	0.054	20,590
Log firm wage	7.472	7.121	7.470	7.817	20,590
Avg. log residual (tenure)	-0.143	-0.474	-0.135	0.167	20,590
Avg. log residual (all observables)	-0.094	-0.319	-0.096	0.138	20,590
Avg. log residual (all interacted with industry)	-0.090	-0.308	-0.085	0.120	20,590
<i>Time-constant</i>					
Pre-treatment wage growth	0.028	-0.009	0.028	0.064	2,059
Pre-treatment employment growth	0.048	-0.073	0.034	0.192	2,059
Share small county (%)	74.5	49.8	77.5	92.3	2,059
Share small (0km, 2km) (%)	83.6	39.7	100.0	100.0	1,876
Share small [2km, 5km) (%)	81.6	41.4	100.0	100.0	1,912
Share small [5km, 5km) (%)	78.6	44.5	84.7	100.0	2,035
Share small [10km, 25km) (%)	73.5	55.0	74.7	91.2	2,059
Share small [25km, 50km) (%)	70.2	60.5	70.7	81.4	2,059

Note. The statistics are for the main analysis sample, consisting of East German manufacturing firms active throughout 1995–2004 with policy-relevant firm size in 1998 between 40 and 1500 employees, excluding those in Berlin and with policy-relevant firm size in 1998 of more than 225 and fewer than 275.

C.6 Overview of Additional Data Sources

Table C.4: Additional Variables, Description, and Data Sources

Name	Description	Data Source
Area	Surface area of counties, aggregated from municipalities, used as control variable	List of municipalities, German Federal Statistical Office
Population density	Calculated from county population and surface area information, used as control variable	List of municipalities, German Federal Statistical Office
Total employment	Employment all industries in each county, used as control variable	BeH data
Value added per worker	Calculated from value added and number of worker information, used as control variable	Regional accounts of federal states, Statistical Library of German Federal Statistical Office
Unemployment rate	Average unemployment rate of counties, used as control variable	Statistics ‘Unemployment over time’, German Federal Employment Agency
Trade exposure to Eastern Europe and China	For county, calculated as in Dauth et al. (2014), for industry, calculated as total trade over industry employment, used as control variable	Employment information from the BeH data, trade information from Dauth et al. (2017)
Employment shares of manufacturing, private services, and public services	Employment in a sector divided by total employment for each county, used as control variable	BeH data
High skill share	College-educated workers over total employment for each 3-digit industry, used as control variable	BeH data
Regional industry concentration	Herfindahl index of regional employment in 3-digit industries, used as control variable	BeH data
High innovation activity	Indicator for 3-digit industries with R&D expenses exceeding 2.5 percent of sales, used as control variable	Legler and Frietsch (2007).
Local input-output linkages, similarity of intermediate goods	Share of output of industry n to industry n' and share of inputs of industry n from industry n' , covariance intermediate input shares for industry n and n' , closeness measure for weighted share of small firms	Input-output tables, Statistical Library of German Federal Statistical Office
Job-to-job movers	Share of workers from industry n moving to industry n' , closeness measure for weighted share of small firms	BeH data

Continued on next page

Table C.4 – *Continued from previous page*

Name	Description	Data Source
Similarity capital inputs	Covariance equipment capital shares for industry n and n' , closeness measure for weighted share of small firms	Capital flow table 1997, U.S. Bureau of Economic Analysis
Similarity labor inputs	Covariance occupation shares for industry n and n' , closeness measure for weighted share of small firms	BeH data
Local scaling factor	County level, calculation of the user cost of capital	Tax revenue comparison, regional database of the German Federal Statistical Office
Present value of depreciation deductions	US industry classification translated to German industry codes, calculation of the user cost of capital	Present values from Zwick and Mahon (2017), industry concordance table from U.S. Census Bureau, industry employment from U.S. Bureau of Labor Statistics
Classification municipalities over time	Translating BeH location information to 2001 county boundaries	List of municipalities and changes of municipalities, German Federal Statistical Office
Classification labor markets	Matching variable in placebo analysis	Dustmann and Glitz (2015)
Geocodes	At municipality and postal code level, used for determining location for establishments with missing or implausible address information	List of municipalities, German Federal Statistical Office; https://github.com/ratopi/opengeodb , last accessed: March 19, 2025 via GitHub copy

C.7 Counties in Placebo Analysis

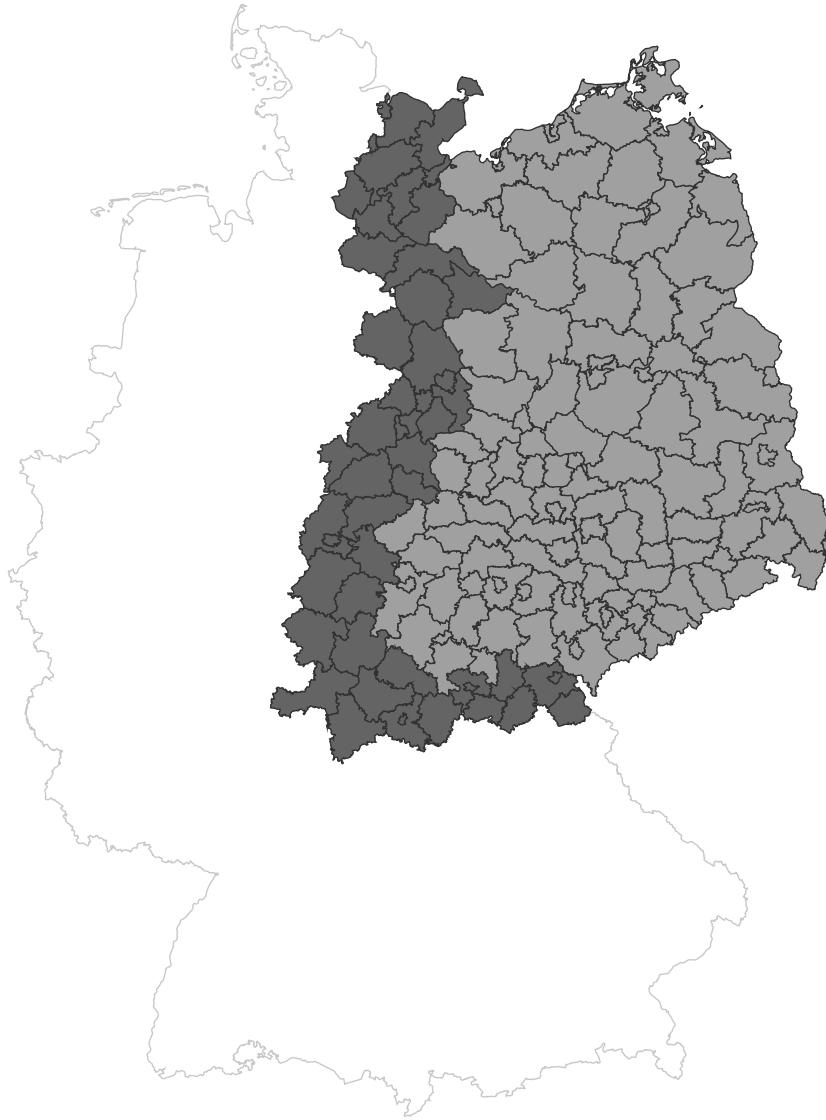


Figure C.1: West German Counties Close to the Former Inner German Border

Note. The figure highlights in dark gray the counties selected for the placebo analysis of firms close to the former inner German border. East German counties are colored gray. The county borders are for 2001.

D Additional Empirical Results

Table D.1: Direct Effects on Total Sales

	Exclusion of volatile exporters							
	Log total sales		Log total sales			Log domestic sales		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Small firm $\times$ post	0.013 (0.043)	0.022 (0.040)	0.057 (0.044)	0.063 (0.043)	0.095** (0.047)	0.100** (0.044)	0.103** (0.043)	0.128*** (0.048)
Observations	16,486	16,472	15,657	15,643	15,643	15,657	15,643	15,643
Pre-treat. trends	No	Yes	No	Yes	Yes	No	Yes	Yes
$X_n, X_c \times$ year FE	No	Yes	No	Yes	Yes	No	Yes	Yes
Rank sales 1998 $\times$ post	No	No	No	No	Yes	No	No	Yes

Note. The table reports estimates from regressions of main text specification (1). Details about the control variables are provided in main text Table 2. The dependent variables are the log total sales in columns 1–5 and log domestic sales in columns 6–8. Firms with a difference between their minimum and maximum export rate in the pre-treatment period above the 95th percentile are excluded in columns 3–8. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.2: Direct Firm Effects when Controlling for Firm Size

	Percentile rank sales 1998		Percentile rank employment 1998		Log sales 1998	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Log capital						
Small firm $\times$ post	0.141** (0.059)	0.152** (0.060)	0.143** (0.062)	0.144** (0.061)	0.108* (0.064)	0.122* (0.067)
Firm size $\times$ post	-0.084 (0.096)	-0.076 (0.099)	-0.079 (0.131)	-0.112 (0.129)	-0.027 (0.021)	-0.025 (0.022)
Observations	15,146	15,128	15,146	15,128	15,146	15,128
Dependent variable: Log employment						
Small firm $\times$ post	0.135*** (0.037)	0.112*** (0.031)	0.092** (0.039)	0.060* (0.032)	0.143*** (0.041)	0.117*** (0.035)
Firm size $\times$ post	0.080* (0.048)	0.051 (0.038)	-0.082 (0.058)	-0.146*** (0.048)	0.014 (0.011)	0.009 (0.008)
Observations	16,514	16,497	16,514	16,497	16,514	16,497
Dependent variable: Log domestic sales						
Small firm $\times$ post	0.134*** (0.048)	0.124*** (0.046)	0.128** (0.050)	0.111** (0.048)	0.152*** (0.053)	0.133** (0.052)
Firm size $\times$ post	0.134** (0.061)	0.095 (0.062)	0.121 (0.084)	0.050 (0.081)	0.026* (0.014)	0.017 (0.014)
Observations	16,482	16,468	16,482	16,468	16,482	16,468
Pre-treat. trends	No	Yes	No	Yes	No	Yes
$X_n, X_c \times$ year FE	No	Yes	No	Yes	No	Yes

Note. The table reports estimates from regressions of main text specification (1), with the 1998 percentile rank of sales (columns 1 and 2), 1998 percentile rank of employment (columns 3 and 4), or 1998 log sales (columns 5 and 6) interacted with the treatment period dummy as additional controls. Details about the other control variables are provided in main text Table 2. The dependent variables are the log value of capital stock, log employment, and log domestic sales. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.3: Heterogeneous Response By Net Income

	Log capital		Log employment		Log domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. Positive and negative net income</i>						
Small firm $\times$ post						
Negative income group	0.142** (0.064)	0.173*** (0.064)	0.087* (0.049)	0.104*** (0.034)	0.093 (0.067)	0.123** (0.058)
Positive income group	0.197* (0.100)	0.189* (0.098)	0.117** (0.050)	0.081* (0.044)	0.102* (0.053)	0.085* (0.051)
Observations	13,499	13,489	13,774	13,767	13,759	13,752
Pre-treat. trends	No	Yes	No	Yes	No	Yes
$X_n, X_c \times$ year FE	No	Yes	No	Yes	No	Yes
<i>Panel B. Net income over employment</i>						
Small firm $\times$ post	0.162*** (0.057)	0.174*** (0.054)	0.099*** (0.034)	0.092*** (0.028)	0.099** (0.042)	0.103*** (0.038)
Small firm $\times$ post $\times$ demeaned income over employment	0.000 (0.003)	-0.003 (0.004)	0.001 (0.002)	-0.002 (0.002)	0.000 (0.004)	-0.003 (0.004)
Observations	13,499	13,489	13,774	13,767	13,759	13,752
Pre-treat. trends	No	Yes	No	Yes	No	Yes
$X_n, X_c \times$ year FE	No	Yes	No	Yes	No	Yes

Note. The table reports estimates from regressions of main text specification (1), with separate coefficients for firms divided by the average net income in the pre-treatment period into a positive and negative income group in panel A and with the demeaned pre-treatment period net income over employment interacted with both the treatment period dummy and the direct effect regressor as additional controls in panel B. Net income is calculated from the supplementary *Kostenstrukturserhebung* and measured in 1,000 euros. Details about the other control variables are provided in main text Table 2. The dependent variables are log value of capital stock in columns 1 and 2, log employment in columns 3 and 4, and log domestic sales in columns 5 and 6. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.4: Direct Effects By Worker Types and Industry ICT Reliance

	Log all (BeH)	Log college	Log non- college	Log skill ratio	Log abstract	Log routine	Log task ratio
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Panel A: Average employment effects</i>							
Small firm	0.122***	0.124***	0.119***	0.005	0.131***	0.117***	0.014
× post	(0.030)	(0.032)	(0.031)	(0.020)	(0.036)	(0.036)	(0.028)
Observations	20,590	19,145	20,589	19,144	20,427	20,479	20,316
<i>Panel B: Employment effects by ICT reliance of industries</i>							
Low reliance	0.124***	0.093**	0.127***	−0.035	0.132**	0.139**	−0.006
	(0.043)	(0.041)	(0.043)	(0.028)	(0.052)	(0.055)	(0.043)
High reliance	0.119***	0.162***	0.108**	0.054	0.130***	0.090**	0.038
	(0.045)	(0.055)	(0.047)	(0.032)	(0.049)	(0.044)	(0.029)
Observations	20,590	19,145	20,589	19,144	20,427	20,479	20,316

Note. The table reports estimates from regressions of main text specification (1). Panel B shows estimated effects split for firms in industries with a share of ICT capital below (low reliance) and above (high reliance) the median (4 percent). The dependent variables are the log employment in column 1, the log of college-educated employees in column 2, the log of non-college-educated employees in column 3, the log ratio of college-educated to non-college-educated employees in column 4, the log of abstract (including non-routine manual) occupation employees in column 5, the log of routine occupation employees in column 6, and the log ratio of abstract to routine occupation employees in column 7. Results are based on the BeH data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.5: Firm Size Distribution of the Manufacturing Sector

	Measurement error $\hat{\sigma}$ (1)	Power law $\hat{\beta}$ (2)	Distribution shift $\hat{T}$ (3)	Marginal buncher $\hat{L}_B$ (4)	Observations (5)
East Germany	0.045 (0.008)	2.516 (0.059)	0.918 (0.015)	260.3 (4.2)	3,703
West Germany	0.045 (fixed) —	1.897 (0.022)	1.001 (0.002)	250.0 (2.4)	26,165

Note. Each row reports the parameters of the firm size distribution estimated by maximum likelihood, with standard errors in parentheses. The sample includes manufacturing firms with 150 to 400 employees, in the period 1999–2004. Since the measurement error is identified from the shape of bunching around the cutoff, for West Germany, this parameter is set to the estimate for East Germany. Results are based on the AFiD data.

Table D.6: Indirect Effects on Total Sales

	Exclusion of volatile exporters							
	Log total sales			Log total sales			Log domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Small firm $\times$ post	0.010 (0.043)	0.008 (0.039)	0.021 (0.040)	0.054 (0.043)	0.051 (0.043)	0.062 (0.043)	0.098** (0.043)	0.102** (0.043)
Share small county $\times$ post	0.101 (0.074)	0.091 (0.066)	0.121* (0.071)	0.116 (0.071)	0.085 (0.067)	0.120 (0.073)	0.076 (0.067)	0.119 (0.072)
Observations	16,486	16,472	16,472	15,657	15,643	15,643	15,657	15,643
Pre-treat. trends	No	Yes	Yes	No	Yes	Yes	No	Yes
$X_n, X_c \times$ year FE	No	No	Yes	No	No	Yes	No	Yes

Note. Each column reports estimates from regressions of main text specification (2). Details about the control variables are provided in main text Table 2. The dependent variables are the log total sales in columns 1–6 and log domestic sales in columns 7 and 8. Firms with a difference between their minimum and maximum export rate in the pre-treatment period above the 95th percentile are excluded in columns 4–8. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

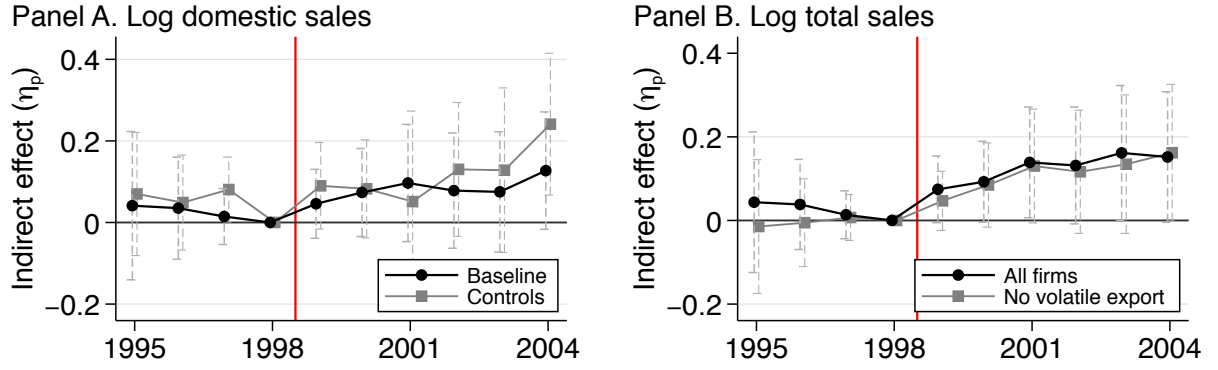


Figure D.1: Dynamic Effects of Local Spillovers on Domestic and Total Sales

Note. The figure plots yearly indirect effect estimates η_p from regressions of specification $Outcome_{it} = \sum_{p=1995}^{2004} \beta_p Small_{i,98} \times \mathbb{1}(t = p) + \sum_{p=1995}^{2004} \eta_p ShSmall_{-ir,98} \times \mathbb{1}(t = p) + \psi_i + \psi_{nt} + \psi_{st} + \epsilon_{it}$. The coefficients for 1998 are set to zero. The 'Control' specification adds pre-treatment trends and industry and county characteristics interacted with year fixed effects. The 'No volatile export' specification excludes firms with a difference between their minimum and maximum export rate in the pre-treatment period above the 95th percentile. The dependent variables are log domestic sales in panel A and log total sales in panel B. Results are based on the AFiD data. The dashed lines show the 95 percent confidence interval for each estimate, with standard errors clustered at the county level.

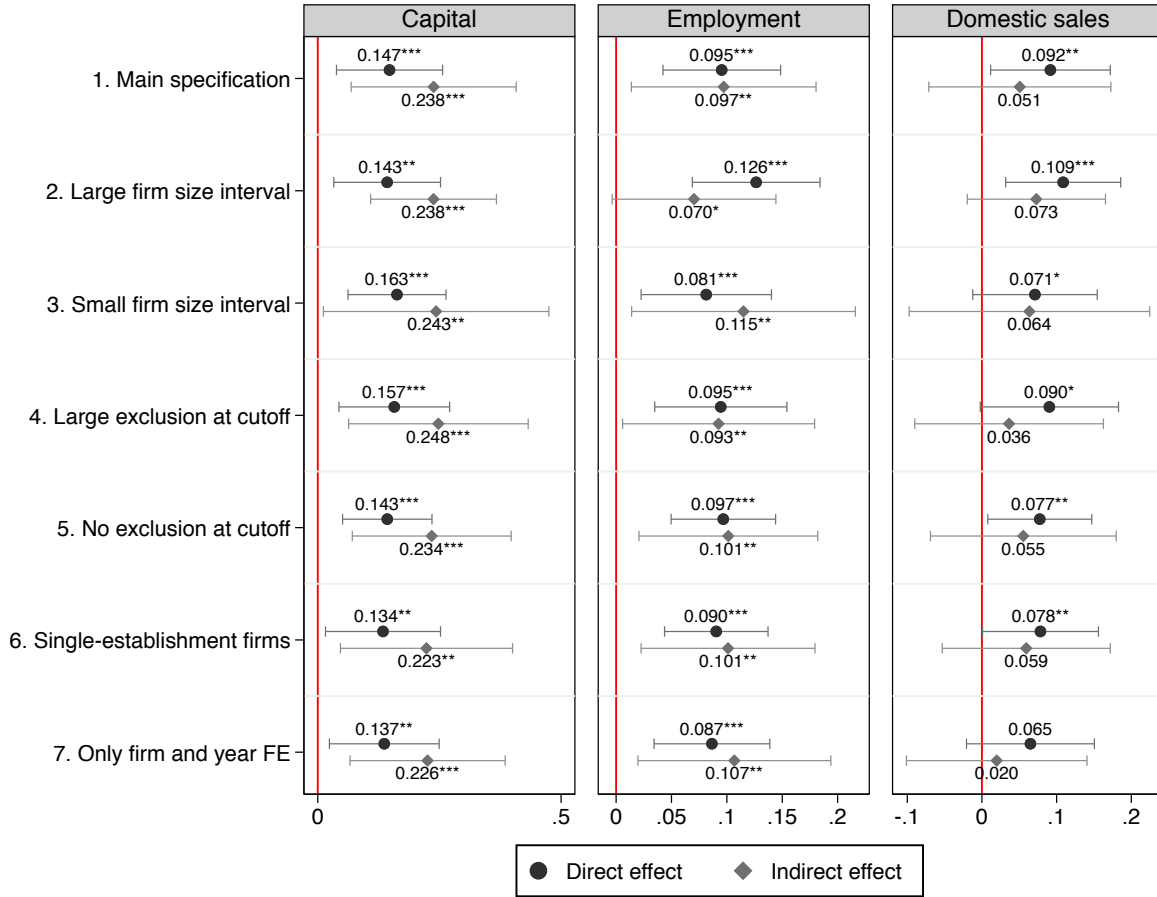


Figure D.2: Impact of Different Sample Selection Criteria and Included Fixed Effects

Note. The figure reports estimates from regressions of main text specification (2), with pre-treatment trends as additional controls. The dependent variables are log value of capital stock in the left panel, log employment in the middle panel, and log domestic sales in the right panel. Compared to the main specification in row 1, the sample includes firms with policy-relevant firm size in 1998 between 20 and 3,000 (excluding firms between 225 and 275) in row 2, includes firms with policy-relevant firm size in 1998 between 60 and 1,000 (excluding firms between 225 and 275) in row 3, excludes firms with policy-relevant firm size in 1998 between 200 and 300 in row 4, excludes none of the firms close to the cutoff in row 5, and includes only single-establishment firms in row 6. Results in row 7 are for the main sample for a specification excluding industry-year and federal state-year fixed effects. Results are based on the AFiD data. The solid lines around the coefficients show the 95 percent confidence interval.

Table D.7: Controlling for the Local Labor Share

	Log capital		Log employment		Log domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
Small firm $\times$ post	0.146*** (0.055)	0.168*** (0.054)	0.096*** (0.027)	0.097*** (0.028)	0.092** (0.041)	0.097** (0.041)
Share small county $\times$ post	0.243*** (0.087)	0.194* (0.104)	0.098** (0.042)	0.085* (0.048)	0.055 (0.063)	0.067 (0.077)
Demeaned labor share $\times$ post	0.257 (0.379)	0.084 (0.435)	-0.257 (0.233)	-0.361 (0.276)	-0.130 (0.339)	-0.158 (0.419)
Share small $\times$ demeaned labor share $\times$ post	-0.616 (0.682)	-0.377 (0.722)	0.375 (0.365)	0.508 (0.435)	0.053 (0.610)	0.138 (0.723)
Observations	15,128	15,128	16,497	16,497	16,468	16,468
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes	Yes
$X_n, X_c \times$ year FE	No	Yes	No	Yes	No	Yes

Note. The table reports estimates from regressions of main text specification (2), with the demeaned labor share in a county (proxied by the total wage bill over the sum of the total wage bill and total investment in 1998) interacted with both the treatment period dummy and the indirect effect regressor as additional controls. Details about the other control variables are provided in main text Table 2. The dependent variables are log value of the capital stock in columns 1 and 2, log employment in columns 3 and 4, and log domestic sales in columns 5 and 6. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.8: Detailed Industry-Year Fixed Effects

	Log capital		Log employment		Log domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
Small firm $\times$ post	0.132** (0.055)	0.142** (0.055)	0.087*** (0.028)	0.084*** (0.028)	0.076* (0.042)	0.072* (0.042)
Share small county $\times$ post	0.294*** (0.087)	0.273*** (0.104)	0.106** (0.044)	0.100** (0.049)	0.075 (0.060)	0.081 (0.077)
Observations	15,128	15,128	16,497	16,497	16,468	16,468
Industry groups	53	53	53	53	53	53
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes	Yes
$X_c \times$ year FE	No	Yes	No	Yes	No	Yes

Note. The table reports estimates from regressions of main text specification (2), with industry-year fixed effects for 53 industry groups. Details about the other control variables are provided in main text Table 2. The dependent variables are log value of capital stock in columns 1 and 2, log employment in columns 3 and 4, and log domestic sales in columns 5 and 6. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.9: Impact of Different Trade Exposure Controls

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Panel A. Dependent variable: Log capital</i>						
Small firm $\times$ post	0.152*** (0.056)	0.150*** (0.055)	0.153*** (0.056)	0.159*** (0.057)	0.164*** (0.057)	0.178*** (0.056)
Share small county $\times$ post	0.170* (0.091)	0.162* (0.092)	0.169* (0.091)	0.167* (0.092)	0.164* (0.092)	0.188* (0.105)
Observations	15,128	15,128	15,128	15,128	15,128	15,128
<i>Panel B. Dependent variable: Log employment</i>						
Small firm $\times$ post	0.096*** (0.027)	0.095*** (0.027)	0.096*** (0.027)	0.101*** (0.027)	0.100*** (0.027)	0.100*** (0.028)
Share small county $\times$ post	0.098** (0.043)	0.105** (0.044)	0.098** (0.043)	0.097** (0.044)	0.097** (0.044)	0.084* (0.048)
Observations	16,497	16,497	16,497	16,497	16,497	16,497
<i>Panel C. Dependent variable: Log domestic sales</i>						
Small firm $\times$ post	0.092** (0.041)	0.093** (0.040)	0.092** (0.041)	0.114*** (0.041)	0.095** (0.038)	0.099** (0.039)
Share small county $\times$ post	0.062 (0.064)	0.068 (0.065)	0.059 (0.064)	0.071 (0.066)	0.087 (0.066)	0.072 (0.081)
Observations	16,468	16,468	16,468	16,468	16,468	16,468
Year fixed effects interacted with						
Net trade exposure county	Yes	No	Yes	Yes	Yes	Yes
Net trade exposure industry	Yes	No	Yes	Yes	Yes	Yes
Export and import exposures county	No	Yes	No	No	No	No
Export and import exposures industry	No	Yes	No	No	No	No
Δ Net trade exposure 95–04 county	No	No	Yes	No	No	No
Δ Net trade exposure 95–04 industry	No	No	Yes	No	No	No
Dummy exporter ever firm	No	No	No	Yes	Yes	Yes
Export share firm	No	No	No	Yes	Yes	Yes
Export share quadratic and cubic firm	No	No	No	No	Yes	Yes
Other controls X_n, X_c	No	No	No	No	No	Yes
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes	Yes

Note. The table reports estimates from regressions of main text specification (2), with additional trade exposure measures interacted with year fixed effects as additional controls. Exposure measures at the county and 3-digit industry level are for trade of Germany with China and Eastern European countries. If not specified, these controls are averaged for the pre-treatment period. Details about the other control variables are provided in main text Table 2. The dependent variables are log value of capital stock in panel A, log employment in panel B, and log domestic sales in panel C. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

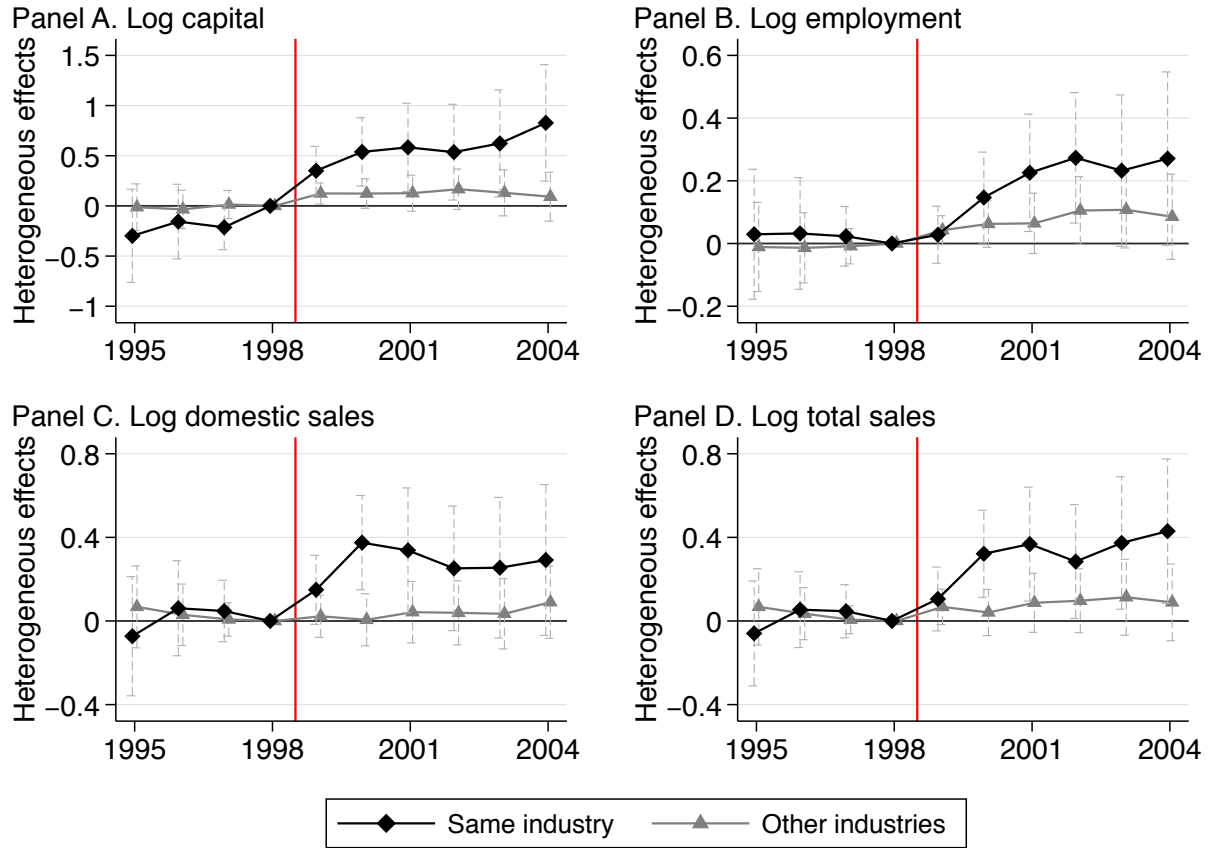


Figure D.3: Dynamic Effects of Local Spillovers Within and Across Industry Groups

Note. The figure plots yearly indirect effect estimates from an event-study approach, with the share of small firms split according to main text equation (3) into a part of small firms in the same industry group (black line) and a part of small firms in other industry groups (gray line). The coefficients for 1998 are set to zero. The broad industry groups are chemical products; metal products; equipment; electronics; food, beverages, and apparel; and other manufacturing. The dependent variables are the log value of capital stock in panel A, log employment in panel B, log domestic sales in panel C, and log total sales in panel D. Results are based on the AFiD data. The dashed lines show the 95 percent confidence interval for each estimate, with standard errors clustered at the county level.

Table D.10: Local Spillover Effects For Same Narrow Industry, Same Broad Industry, and Other Manufacturing Industries

	Log capital		Log employment		Log domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
Small firm $\times$ post	0.146*** (0.054)	0.167*** (0.054)	0.095*** (0.027)	0.096*** (0.028)	0.092** (0.040)	0.097** (0.041)
Share small county $\times$ post						
Part same narrow industry	-0.013 (0.624)	-0.185 (0.642)	-0.250 (0.273)	-0.247 (0.284)	-0.378 (0.458)	-0.352 (0.455)
Part same broad industry	0.834*** (0.273)	0.726** (0.281)	0.222** (0.087)	0.209** (0.091)	0.323** (0.133)	0.318** (0.142)
Part other industries	0.125 (0.102)	0.103 (0.119)	0.082* (0.045)	0.074 (0.051)	0.008 (0.067)	0.032 (0.083)
Observations	15,128	15,128	16,497	16,497	16,468	16,468
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes	Yes
$X_n, X_c \times$ year FE	No	Yes	No	Yes	No	Yes

Note. The table reports estimates from regressions of main text specification (2), with the share of small firms split into a part of small firms in the same 4-digit industry group, a part of small firms in the rest of the same broad industry group, and a part of small firms in other industry groups. The broad industry groups are chemical products; metal products; equipment; electronics; food, beverages, and apparel; and other manufacturing. Details about the control variables are provided in main text Table 2. The dependent variables are log value of capital stock in columns 1 and 2, log employment in columns 3 and 4, and log domestic sales in columns 5 and 6. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.11: Local Spillover Effects for the Share of Small Firms by Industry

	Log capital		Log employment		Log domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
Small firm $\times$ post	0.147*** (0.055)	0.168*** (0.054)	0.094*** (0.026)	0.096*** (0.028)	0.091** (0.040)	0.097** (0.040)
Share small same county same industry $\times$ post	0.197** (0.083)	0.173** (0.087)	0.097*** (0.031)	0.101*** (0.031)	0.130*** (0.049)	0.142*** (0.049)
Share small same county other industries $\times$ post	0.122 (0.098)	0.098 (0.114)	0.051 (0.041)	0.049 (0.046)	-0.004 (0.061)	0.025 (0.075)
Share same county same industry $\times$ post	0.426** (0.195)	0.373* (0.200)	0.099 (0.069)	0.091 (0.070)	0.234** (0.103)	0.215** (0.100)
Observations	15,080	15,080	16,437	16,437	16,408	16,408
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes	Yes
$X_n, X_c \times$ year FE	No	Yes	No	Yes	No	Yes

Note. The table reports estimates from regressions of main text specification (2), with the employment share of small firms in the manufacturing sector in a given county in 1998 substituted with both the employment shares of small firms in the same broad industry group and in other industry groups in a given county in 1998. All regressions further include the share of employment in the same broad industry group in a given county in 1998 interacted with the treatment period dummy. The broad industry groups are chemical products; metal products; equipment; electronics; food, beverages, and apparel; and other manufacturing. Details about the other control variables are provided in main text Table 2. The dependent variables are log value of capital stock in columns 1 and 2, log employment in columns 3 and 4, and log domestic sales in columns 5 and 6. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.12: Robustness Results for Local Spillover Channels

	Log capital			Log employment			Log domestic sales		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Panel A. Single spillover channels</i>									
Small firm $\times$ post	0.169*** (0.054)	0.173*** (0.054)	0.177*** (0.055)	0.098*** (0.028)	0.098*** (0.028)	0.097*** (0.029)	0.098** (0.041)	0.099** (0.041)	0.096** (0.041)
Share small (weighted) $\times$ post									
Downstream customer	0.126** (0.057)			0.028 (0.025)			0.075* (0.042)		
Upstream supplier		0.121** (0.059)			0.010 (0.025)			0.033 (0.039)	
Labor sharing			0.058 (0.051)			-0.008 (0.019)			-0.026 (0.031)
Observations	15,128	15,128	15,128	16,497	16,497	16,497	16,468	16,468	16,468
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$X_n, X_c \times$ year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Panel B. Additional spillover channels</i>									
Small firm $\times$ post	0.168*** (0.055)	0.171*** (0.055)	0.173*** (0.055)	0.092*** (0.029)	0.092*** (0.029)	0.093*** (0.029)	0.085** (0.041)	0.083** (0.041)	0.087** (0.041)
Share small (weighted) $\times$ post									
Downstream customer	0.101 (0.125)	0.077 (0.123)	0.084 (0.122)	0.091* (0.047)	0.097* (0.051)	0.084 (0.051)	0.237*** (0.090)	0.256*** (0.094)	0.224** (0.094)
Upstream supplier	0.006 (0.133)	-0.134 (0.164)	-0.140 (0.160)	-0.069 (0.049)	-0.060 (0.070)	-0.068 (0.071)	-0.133 (0.087)	-0.022 (0.127)	-0.054 (0.122)
Labor sharing	-0.001 (0.062)	0.002 (0.062)		-0.026 (0.022)	-0.026 (0.022)		-0.076* (0.039)	-0.077** (0.039)	
Labor sharing (alternative)			0.050 (0.117)			-0.057 (0.044)			-0.091 (0.060)
Capital sharing		0.028 (0.094)	0.013 (0.101)		-0.016 (0.037)	0.000 (0.039)		-0.015 (0.059)	0.009 (0.062)
Intermediate input sharing		0.181 (0.158)	0.161 (0.158)		-0.007 (0.070)	0.020 (0.075)		-0.149 (0.104)	-0.102 (0.104)
Share small (unweighted) $\times$ post	0.125 (0.113)	0.028 (0.154)	-0.001 (0.158)	0.086* (0.051)	0.095 (0.057)	0.122** (0.059)	0.038 (0.081)	0.114 (0.095)	0.151 (0.098)
Observations	15,128	15,128	15,128	16,497	16,497	16,497	16,468	16,468	16,468
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$X_n, X_c \times$ year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. The table reports estimates from regressions of main text specification (2), with small firms in the calculation of the share of small firms weighted by different industry closeness measures according to main text equation (4). Panel A includes the weighted shares of main text Table 6 as single regressors. Panel B includes the unweighted share of small firms and weighted shares for additional closeness measures. The additional closeness measures are the covariance of the equipment type shares of industry n and n' (capital sharing), the covariance of the intermediate input shares of industry n and n' (intermediate input sharing), and the covariance of the occupation shares of industry n and n' (alternative labor sharing). Details about the control variables are provided in main text Table 2. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.13: Local Spillover Effects on Exporting Firms

	Log capital		Log employment		Log domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
Small firm $\times$ post	0.156*** (0.056)	0.178*** (0.055)	0.100*** (0.026)	0.101*** (0.028)	0.102** (0.040)	0.106*** (0.040)
Share small $\times$ post $\times$ Non-exporter	0.492*** (0.134)	0.466*** (0.139)	0.167*** (0.058)	0.148** (0.058)	0.174** (0.076)	0.178** (0.084)
Exporter	0.072 (0.114)	0.004 (0.132)	0.047 (0.057)	0.034 (0.065)	-0.038 (0.092)	-0.034 (0.111)
Observations	15,128	15,128	16,497	16,497	16,468	16,468
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes	Yes
$X_n, X_c \times$ year FE	No	Yes	No	Yes	No	Yes

Note. The table reports estimates from regressions of main text specification (2), with the indirect effects split for firms having positive exports and firms without exports in the pre-treatment period. Details about the control variables are provided in main text Table 2. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.14: Wage Effects of Investment Tax Credits

	Avg. log wage residual (BeH)					
	Log avg. wage (AFiD)		Log avg. wage (BeH)	Only tenure	Additional observables	All interacted with industry
	(1)	(2)	(3)	(4)	(5)	(6)
Small firm $\times$ post	-0.025*** (0.009)	-0.020** (0.009)	-0.018*** (0.005)	-0.009* (0.005)	-0.007 (0.005)	-0.005 (0.005)
Share small county $\times$ post	0.015 (0.013)	0.037** (0.016)	0.028*** (0.010)	0.028*** (0.010)	0.029*** (0.011)	0.025** (0.011)
Observations	16,476	16,476	20,520	20,520	20,520	20,520
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes	Yes
$X_n, X_c \times$ year FE	No	Yes	Yes	Yes	Yes	Yes

Note. The table reports estimates from regressions of main text specification (2). Details about the control variables are provided in main text Table 2. The dependent variables are the log wage bill over employment in columns 1 and 2, log average full-time wage in column 3, and average residuals from individual-level regressions of log wage on full-time worker characteristics in columns 4–6. The residual in column 4 controls for a cubic functional form of tenure. The residual in column 5 additionally controls for gender, secondary and post-secondary education, type of employment contract, a cubic functional form of worker age, and occupation (2-digit) fixed effects. The residual in column 6 controls for the same characteristics interacted with industry (2-digit) fixed effects. Results are based on the AfiD data in columns 1–2 and on the BeH data in columns 3–6. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.15: Placebo Results for the Complete West German Sample

	Log capital		Log employment		Log domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
Small firm $\times$ post	0.020 (0.013)	0.013 (0.016)	0.055*** (0.006)	0.019*** (0.007)	0.035*** (0.010)	0.015 (0.011)
p-value West=East	[0.017]	[0.013]	[0.117]	[0.004]	[0.161]	[0.061]
Observations	119,226	117,506	135,663	133,703	135,453	133,511
Pre-treat. period	Yes	Yes	Yes	Yes	Yes	Yes
Exclusion outliers	No	Yes	No	Yes	No	Yes
Rank employment 1998 $\times$ post	No	Yes	No	Yes	No	Yes

Note. The table reports estimates from regressions of main text specification (1) for West German manufacturing firms. Details about the control variables are provided in main text Table 2. The dependent variables are log value of capital stock in columns 1 and 2, log employment in columns 3 and 4, and log domestic sales in columns 5 and 6. The sample consists of all West German manufacturing firms active throughout the analysis period with a policy-relevant firm size in 1998 between 40 and 1,500 employees, excluding those with more than 225 and fewer than 275 employees. Outliers are defined as firms with the maximum absolute yearly change in log employment above the 99th percentile of the main sample. The p-values are for a test of equality of the coefficients for West and East German firms in a model including the firms of the main sample. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

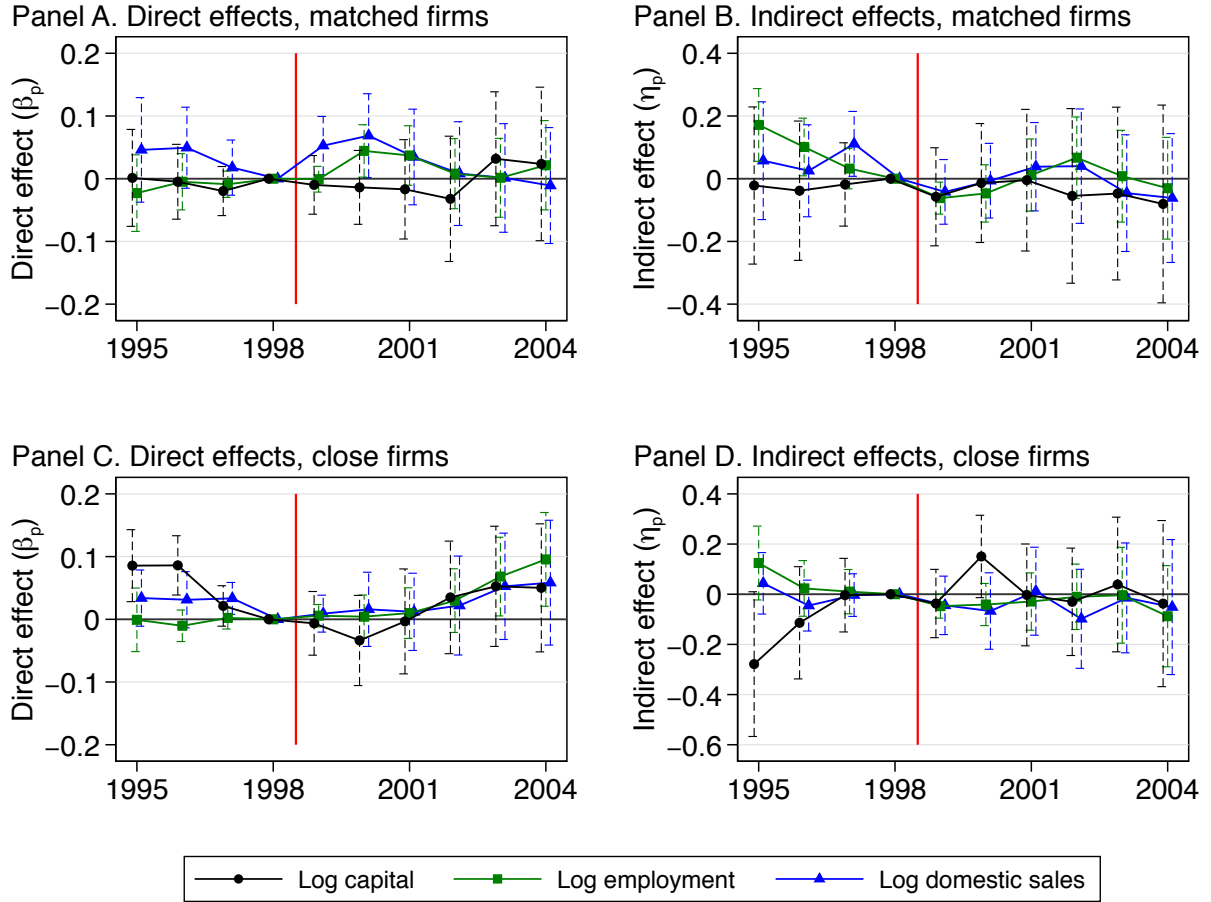


Figure D.4: Dynamic Effects of the Placebo Analysis

Note. The figure plots yearly estimates from regressions of specification $Outcome_{it} = \sum_{p=1995}^{2004} \beta_p Small_{i,98} \times \mathbb{1}(t = p) + \sum_{p=1995}^{2004} \eta_p ShSmall_{-ir,98} \times \mathbb{1}(t = p) + \psi_i + \psi_{nt} + \psi_{st} + \epsilon_{it}$. The coefficients for 1998 are set to zero. Panels A and C plot the direct effect estimates (β_p), and panels B and D plot the indirect effect estimates (η_p). The dependent variables are the log value of the capital stock (black line), log employment (green line), and log domestic sales (blue line). The sample consists of West German manufacturing firms matched to the East German firms in the main sample in panels A and B and of West German manufacturing firms in counties close to the former inner German border. Both samples are restricted to firms active throughout the sample period with a policy-relevant firm size in 1998 between 40 and 1,500, excluding those with more than 225 employees and fewer than 275. Results are based on the AFiD data. The dashed lines show the 95% confidence interval for each estimate, with standard errors clustered at the county level.

Table D.16: Robustness Results for Changes in GRW Subsidies

	Log capital		Log employment		Log domestic sales	
	(1)	(2)	(3)	(4)	(5)	(6)
Small firm $\times$ post	0.140*** (0.052)	0.162*** (0.053)	0.091*** (0.029)	0.096*** (0.029)	0.109** (0.043)	0.118*** (0.043)
Share small county $\times$ post	0.240*** (0.087)	0.198* (0.103)	0.096** (0.041)	0.089* (0.048)	0.044 (0.060)	0.072 (0.078)
GRW subsidy decrease	-0.019 (0.087)	-0.001 (0.087)	-0.021 (0.042)	-0.008 (0.042)	0.043 (0.066)	0.040 (0.064)
Small firm $\times$ GRW subsidy decrease	0.028 (0.099)	0.028 (0.097)	0.019 (0.044)	0.005 (0.045)	-0.066 (0.062)	-0.077 (0.062)
Observations	15,128	15,128	16,497	16,497	16,468	16,468
Pre-treat. period	Yes	Yes	Yes	Yes	Yes	Yes
$X_n, X_c \times$ year FE	No	Yes	No	Yes	No	Yes

Note. The table reports estimates from regressions of main text specification (2), with added controls for firms in regions with a GRW maximum subsidy rate reduction. 'GRW subsidy decrease' is a dummy for all firm-year observations that are affected by a decrease in the maximum GRW subsidy rate. Details about the other control variables are provided in main text Table 2. The dependent variables are log value of capital stock in columns 1 and 2, log employment in columns 3 and 4, and log domestic sales in columns 5 and 6. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.17: Effects on Worker Flows

	Log of cumulative employment growth by worker flow type							
	Job-to-job movers							
	All	Non- employed	All	All services	Business services	West	Large firms	Other East
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Small firm $\times$ post	0.120*** (0.023)	0.049*** (0.011)	0.071*** (0.018)	0.025*** (0.008)	0.010** (0.005)	0.003 (0.003)	−0.006 (0.013)	0.005 (0.003)
Share small county $\times$ post	0.095** (0.040)	0.081*** (0.025)	0.012 (0.024)	−0.015 (0.016)	−0.009 (0.007)	0.010 (0.007)	−0.001 (0.008)	−0.015 (0.010)
Observations	20,590	20,590	20,590	20,590	20,590	20,590	20,590	20,590
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. The table reports estimates from regressions of main text specification (2). Details about the control variables are provided in main text Table 2. The dependent variables are log cumulative employment growth calculated according to main text equation (5), using all types of worker flows in column 1 and flows to and from non-employment in column 2, all other establishments in column 3, establishments in the service sector in column 4, establishments in the business service industries in column 5, establishments located in West Germany in column 6, establishments in the manufacturing sector located in East Germany with more than 250 employees in column 7, and establishments in the manufacturing sector located in a different East Germany county in column 8. Flows in column 6–8 exclude those to and from establishments in Berlin. Results are based on the BeH data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.18: Treatment-on-the-Treated Effects

	Log Investment	Investment rate	Log capital	Log employment	Log domestic sales
	(1)	(2)	(3)	(4)	(5)
Small firm $\times$ post	0.265** (0.107)	0.013*** (0.005)	0.181*** (0.064)	0.116*** (0.033)	0.109** (0.049)
Observations	15,571	15,075	15,126	16,497	16,468
Pre-treat. trends	Yes	Yes	Yes	Yes	Yes

Note. The table shows treatment-on-the-treated (TOT) effects of the investment tax credit rate policy. The TOT results are based on an event-study specification with firm size dummies for each year instrumented with the firm size dummy of the base year 1998. Additional control variables are firm, industry-year, and federal state-year fixed effects and pre-treatment trend controls, detailed in main text Table 2. Coefficients are calculated as the difference of the average effect between the treatment period (1999–2004) and the pre-treatment period (1995–98). The dependent variables are log investment in column 1, investment over lagged capital winsorized at the 95th percentile in column 2, log value of capital stock in column 3, log employment in column 4, and log domestic sales in column 5. Results are based on the AFiD data. Standard errors in parentheses are clustered at the county level: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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