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The effect of foreign-owned large plant closures on nearby firms

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Abstract

I estimate the impact of foreign-owned large plant closures on local firms. I identify 41 such events in Hungary and assign comparable control cities with foreign-owned large plants operating in the same industry and not closing. I use a firm-level panel database of Hungarian firms between 1992 and 2012. I do a difference-in-differences estimation comparing outcomes of firms in the treated and control areas, before and after the plant closure. I find that after the foreign-owned large plant closures sales of nearby firms decreased by 6 percentage points and employment decreased by 3 percentage points on average. Firms operating in local services were hurt even more, suggesting that reduced local purchasing power due to the layoffs is a significant channel of the local plant closure effect. Firms operating in the supplier industry of the closing plant also decreased employment more than average, suggesting that input-output linkages play an important role in the propagation of negative shocks. In contrast, firms in the industry of the closing plant increased their employment, suggesting that they could benefit from the increased local labor supply. I also find that low-productivity firms were hurt more by the plant closures than high-productivity firms.

JEL: F23, R12, R23, R58

Keywords: plant closure, agglomeration, local labor market, demand effect, input-output links, propagation of shocks, FDI.

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Hogyan hat a külföldi tulajdonban lévő gyárak bezárása a helyi vállalatokra?

Bisztray Márta

Összefoglaló

Tanulmányomban a külföldi tulajdonban lévő nagy gyárak bezárásának helyi cégekre gyakorolt hatását elemzem 41 magyarországi gyárbezárást vizsgálva. Minden eseményhez hozzárendelek egy hasonló kontroll települést, ahol a vizsgált bezárás idején egy olyan külföldi tulajdonban lévő, azonos iparágban működő nagy gyár volt, amely nem zárt be. Az elemzésekhez cég szintű panel adatbázist használok, mely 1992 és 2012 között tartalmaz adatokat magyar cégekről. A különbségek közti különbségek módszerét alkalmazva a gyárbezárás által érintett és a kontroll településeken lévő cégek teljesítményét hasonlítom össze a bezárás időpontja előtt és után. A gyárbezárás után a környező cégek értékesítése átlagosan 6 százalékponttal csökkent, a foglalkoztatásuk pedig átlagosan 3 százalékponttal lett alacsonyabb. A helyi szolgáltató ágazatban működő cégek esetén az átlagosnál nagyobb volt a visszaesés. Ez arra utal, hogy az elbocsátottak csökkenő vásárlóereje jelentősen hozzájárul a gyárbezárás helyi gazdaságra gyakorolt negatív hatásához. A bezáró gyár beszállító iparágában működő cégek esetén szintén az átlagosnál nagyobb a becsült hatás, ami azt sugallja, hogy a cégek közti input-output kapcsolatok fontos szerepet töltenek be a külső gazdasági hatások helyi tovagyűrűzésében. Ugyanakkor a bezáró gyár iparágában működő cégek növelni tudták a foglalkoztatásukat. A megnövekedett helyi munkaerő kínálat miatt számukra előnyös volt a gyárbezárás. A közgazdasági intuíciónak megfelelően az alacsony termelékenységű cégek esetén erősebb negatív hatást becsülök, mint a magasabb termelékenységű cégeknél.

JEL: F23, R12, R23, R58

Tárgyszavak: gyárbezárás, agglomeráció, helyi munkaerőpiac, keresleti hatás, input-output kapcsolatok, külső hatások tovagyűrűzése, külföldi működőtőke-beruházás.

The effect of foreign-owned large plant closures on nearby firms

Márta Bisztray*

June 30, 2016

Abstract

I estimate the impact of foreign-owned large plant closures on local firms. I identify 41 such events in Hungary and assign comparable control cities with foreign-owned large plants operating in the same industry and not closing. I use a firm-level panel database of Hungarian firms between 1992-2012. I do a difference-in-differences estimation comparing outcomes of firms in the treated and control areas, before and after the plant closure. I find that after the foreign-owned large plant closures sales of nearby firms decreased by 6 percentage points and employment decreased by 3 percentage points on average. Firms operating in local services were hurt even more, suggesting that reduced local purchasing power due to the layoffs is a significant channel of the local plant closure effect. Firms operating in the supplier industry of the closing plant also decreased employment more than average, suggesting that input-output linkages play an important role in the propagation of negative shocks. In contrast, firms in the industry of the closing plant increased their employment, suggesting that they could benefit from the increased local labor supply. I also find that low-productivity firms were hurt more by the plant closures than high-productivity firms.

I Introduction

Local spillover effects of foreign direct investment (FDI) is a widely researched topic.[1] Attracting FDI is an important goal of economic policy in many countries all over the world.[2] Some of these investments is, however, reverted within a few years, resulting in the relocation of production and plant closures. We know that mass layoffs and plant closures happen rather frequently.[3] Moreover, foreign-owned firms and especially multinationals tend to be more footloose than domestic firms.[4] In this paper I look at a much less

*I am very grateful to Ádám Szeidl and Miklós Koren for their guidance throughout the whole project and to Christian Fons-Rosen and Sergey Lychagin for their useful insights. I also thank the audiences at the CEU PhD workshop, at the annual conference of the Hungarian Society of Economics, at the IE-CERS research seminar and at the SMYE 2015 conference for helpful comments. I gratefully acknowledge the support of the Lendület Grant 'Firms, Strategy and Performance' of the Hungarian Academy of Sciences.

[1] See for example Javorcik (2004), Kneller and Pisu (2007), Crespo and Fontoura (2007), Smeets (2008), Meyer and Sinani (2009).

[2] e.g. `http://www.cbi.org.uk/media-centre/news-articles/2012/09/how-the-us-china-and-india-try-to-attract-\` `\external-investment/`.

[3] According to the US Bureau of Labor Statistics, in the first quarter of 2013 there were 914 mass layoff events in the US with about 154 thousand people being laid off (`http://www.bls.gov/mls/`). Before the crisis, in the period of 2000-2007 there were around 123,000 mass layoff events with altogether more than 13.7 million people being laid off (`http://www.bls.gov/mls/mlspnfmle.htm`).

[4] See for example Alvarez and Görg (2009), Bernard and Sjöholm (2003), Bernard and Jensen (2007), Kneller et al. (2012) and van Beveren (2007).

investigated aspect of the FDI effect: the impact on the local economy when FDI leaves. As attracting or keeping existing FDI needs different policy measures, findings about the effect of FDI exits are also relevant from a policy perspective.

My contribution is threefold: first, existing papers related to this topic either investigate the consequences of mass layoffs on individuals losing their jobs (e.g. Browning and Heinesen, 2012 and Eliason-Storrie, 2006), or look at the effects of large plant closures and mass layoffs on the local labor market (e.g. Gathmann et al., 2015, Jofre-Monseny et al., 2015 and Foote et al., 2015) or on subsequent exits (e.g. Ferragina et al., 2012 and Resende et al., 2013). In this paper I look at the effect of foreign-owned large plant closures on various aspects of local firms' performance, including sales, employment, productivity and survival. Second, by looking at the heterogeneity of the effect across firms, I provide some evidence about the various channels through which foreign-owned large plant closures affect local firms: increased labor supply, decreased demand due to lower purchasing power of unemployed local consumers and lost input-output linkages. Third, the main focus of the existing literature is either the USA and Western Europe (e.g. Gathmann et al., 2015) or the developing world (e.g. Bernard and Sjöholm, 2003). Using Hungarian data, this paper looks at a different setting in a middle-income country.

I use press announcements from the period 1998-2009 to identify 41 cases in Hungary where a foreign-owned large plant closed and did not reopen. These are typically subsidiaries of a multinational enterprise, and can either be greenfield investments or previous foreign acquisitions. I identify nearby firms using a panel database[5] of firms operating in Hungary between 1992-2012. With a difference-in-differences strategy I compare the performance of local firms within 10 km agglomeration of the closing plant and in a comparable control area, before and after the plant closure. I assign control locations using propensity score matching. I choose the controls from those cities which had a large foreign-owned plant operating in the same 2-digit industry as the closing plant and the plant in the potential control city was still active three years after the closure event.

The identification assumption I use is the exogeneity of the observed plant closures, such that plants did not close because of worsening local conditions. The assumption is supported by three types of evidence: first, the literature finds that foreign multinationals are more likely to relocate independently of local conditions or plant performance than domestic firms (e.g. Bernard and Sjöholm, 2003, Bernard and Jensen, 2007, Alvarez and Görg, 2009, Ferragina et al., 2012 and Engel et al., 2013). Second, the press announcements about the reason for the plant closure either mentioned global reasons (e.g. decreasing demand) or country-specific reasons (e.g. high labor costs). Using control locations in the identification accounts for any country-wide or global changes. Third, I find that on average outcomes of firms in treated and control locations are not significantly different before the plant closure. Additionally, my main findings are robust to controlling for potential differences in pre-closure trends of the two firm groups.

Considering closures of foreign-owned plants has the advantage that local conditions are less likely to affect the decision to close than for domestic plants. Still, my results might not be specific to foreign-owned

[5]The data set I use: "APEH Balance Sheet" is created by the Institute of Economics, Centre for Economic and Regional Studies, Hungarian Academy of Sciences (MTA KRTK) from the original data. The data set is work in progress. Although the MTA KRTK made effort to clean the data, it cannot be held liable for any remaining error.

large closures. In the current paper I do not deal with the question of external validity to domestic plant closures. As the decision about exit might be less correlated with location-specific conditions than the location decision at entry, my results can also be used to give a lower-bound estimate for the effect of an FDI entry. Nevertheless, I expect the true effect of entry to be higher, as transferred knowledge or new infrastructure remains still after the FDI exit.

Looking at a three-year period after a plant closure, I find that the sales of firms within the 10 km agglomeration of a closing plant decreased by 6 percentage points, and their employment decreased by 3 percentage points on average. I still find significantly lower sales and employment 4-5 years after the closures. At the same time, there is no significant effect on productivity, average wage or exit probability. Results are robust to specification changes in which I account for potential differences in the pre-closure trend of firms in treated and control locations. The estimated effects are heterogeneous across firms. Foreign-owned and large firms seem to benefit, and small and low-productivity firms lose more than average in terms of sales or employment. Effects are also heterogeneous by the characteristics of the local economy. Local firms are more affected in smaller cities and in regions with a high unemployment rate.

I also show some evidence suggesting the importance of three different channels in the plant closure effect. First, local labor supply increases for the remaining local firms after a plant closure, exerting a downward pressure on wages. Former employees of the foreign firm might also transfer valuable knowledge to their new firm.[6] Especially those firms can benefit, which employ people with similar education and skills as the closing plant. Indeed, I find that firms operating in the same industry as the closing plant increased their employment and had a lower exit probability after the closure. Second, when the laid-off people stay unemployed or can only find a job paying less, their consumption will decrease due to the lost income, hurting firms which sell to local consumers. In line with Mian and Sufi (2012), I find that firms providing non-tradable local services decreased their employment more than average after the closure. Third, lost input-output linkages can hurt local buyers or suppliers, as it can be costly to find new business partners and transport cost might also increase. I find that firms operating in the local supplier industry of the closing plant decreased their employment more than average after the closure. Buyers were not affected significantly, which can be the result of closing plants having not many local buyers. This explanation is also supported by the large export share of the closing plants.

I.A Related literature

This topic is closely related to the literature on how plant closures affect other firms in the agglomeration or in the same industry. Resende et al. (2013) claim that exits induce more exits but also entries. Bernard and Jensen (2007) point out the importance of plant closures in forming industry productivity and employment. Here I focus on foreign-owned large plants, which makes the identification strategy more reliable due to the exogenous exit assumption. Additionally, magnitude of the effects might be different compared to a domestic plant closure, due to potentially higher knowledge spillovers.

[6]Stoyanov and Zubanov (2011) find that a new employee coming from a more productive firm increases the employer firm's productivity, also when looking at medium-skilled workers.

There are two recent papers highly related to this paper, but focusing on local labor market effects. Both papers use a similar approach to mine, doing a difference-in-difference analysis around the large layoffs with matched control settlements. Gathmann et al. (2015) investigate the spillover effect of domestic and foreign plant closures and mass layoffs in the local labor market. Using German data, they find that the overall negative employment effect within the region is larger than the size of the initial layoff, but as opposed to my results, especially same-sector firms are hurt. They also find that people moving across locations decrease the effect of a plant closure on individual employment. On the contrary, I see no increases in the aggregate move-out rates after a plant closure. This might be the result of the lower mobility in Hungary compared to Germany. Jofre-Monseny et al. (2015) use the same identifying assumption as this paper. They investigate the effect of large plant closures by looking at plants relocating abroad. Using Spanish data they find that a considerable share of the laid-off gets employed by incumbents operating in the same industry as the relocating plant, decreasing the actual labor losses of plant closures. This is in line with my finding on same-industry firms increasing their employment after the closure. As opposed to my results on local service or supplier-industry firms, they find no employment effect in other industries. In contrast with both papers, I look at firm-level outcomes instead of aggregate industry measures. I also look at performance measures other than employment, like sales, productivity and exit probability. Finally, as an additional contribution, I use variation by industry to provide some suggestive evidence for the existence of different channels through which a foreign-owned large plant closure has an effect on the local economy.

My analysis on the differential effect of plant closures in related industries can be linked to the literature investigating the propagation of idiosyncratic shocks in production networks. Allcott et al. (2015) investigate how shortages in electricity supply affect Indian manufacturing firms using electricity. They find significant reductions in revenues but not in productivity. Instead of looking at a single supplier-buyer relation, Acemoglu et al. (2015) consider the full input-output network. They find that both the input-output network and the geographic network play an important role in the propagation of industry-level shocks. There are two papers using data on exact buyer-supplier relations between firms. Carvalho et al. (2014) take the Great East Japan Earthquake as an exogenous shock and investigate how its effect propagates through inter-firm transactions to areas unaffected by the tsunami. Looking at the exiting firms in the tsunami-hit areas, they find a significantly negative effect on sales growth for both the suppliers and buyers of these firms. Similarly, Barrot and Sauvagnat (2015) investigate firm-level idiosyncratic shocks by looking at natural disasters. They find a negative effect on the customers of the affected firms, which spills over to their other suppliers, originally not affected by the shock. In line with these findings, in this paper I show that firms in the supplier industry of the closing plant are hurt more than average after the plant closure. If foreign-owned large plant closures can be regarded as exogenous shocks in the local economy, my findings can serve as a further evidence for the role of input-output linkages in the propagation of local shocks.

The study is structured as follows: section II gives a brief outline of the history of FDI entry and exit in Hungary, and section III presents the data. Section IV describes the cases of exit and the process of matching controls and section V presents the empirical strategy. Section VI shows the results and finally, section VII concludes.

II FDI in Hungary

Antalóczy et al. (2011) and Antalóczy-Sass (2005) give a nice overview of the evolution of foreign direct investment in Hungary. This country was the first in the region opening up for FDI. After the transition foreign investments played a crucial role in the economic development, and they remained important ever since. Beyond greenfield investments almost all of the large Hungarian firms were privatized. At the same time, FDI is still not embedded enough into the domestic economy. Foreign firms have relatively few local buyers or suppliers. Foreign investment is spatially concentrated. The most popular location are the central part of the country, especially Budapest and its agglomeration, and Central and Northern Transdanubia. Pintér (2008) notes that Budapest was mostly chosen by the tertiary sector, and manufacturing firms located their plants in other parts of the country. FDI is also concentrated in specific industries: electronics, vehicle manufacturing and oil extraction and processing were the most popular ones in the 90s. At the same time, there were also many cases when foreign investments exited Hungary (e.g. Kukely, 2008). Especially the county of Vas was affected, but foreign-owned large plant closures occurred all over the country. Many of these happened around the EU accession, since the easily accessible borders reduced cross-country transport costs. As a result, companies could optimize production costs by concentrating their activity in fewer sites within the region. Food, textile and the electronic industry were affected the most. Demand fluctuations, the attractiveness of cheaper labor in Asia and global reorganizations within the company were the main driving forces behind plant closures in the electronics industry. All in all, the high number of FDI entries and exits in the 90's and in the 2000's ensure that Hungary is a good setting for investigating the effects of foreign-owned large plant closures.

III Data

In this paper I use four types of data sources: press announcements to find closing plants, city-level data to match control locations, industry-level data to determine industry linkages, and firm-level data to investigate the effect of foreign-owned large plant closures on local firms. I find the press announcements on closures by searching the web. The city-level data I use are from the freely accessible T-Star database of the Hungarian Central Statistical Office.[7] I use data on working-age population, unemployment and people moving out of the city. I measure working-age population as the number of inhabitants aged 18-59. In order to make the other measures comparable across locations, I always normalize with the number of working-age population. City-level data are available for the period 2000-2013. For the propensity score matching I need to proxy missing data before 2000. For population, I use the earliest available data from 2000. For unemployment rate, I use NUTS-2 unemployment rate data, which are also available for the 90's. I also have the GPS coordinates of all the Hungarian settlements and use this information to determine the distance of settlement pairs.

For the main analysis I use a firm-level panel dataset from the Hungarian Tax Authority (NAV), covering

[7] The data are accessible at the webpage `http://statinfo.ksh.hu/Statinfo/themeSelector.jsp?page=2&szst=T`.

the period 1992-2013. The dataset contains all double book-keeping firms in Hungary with yearly information on balance sheet data, industry, foreign ownership share and location of the headquarter. I adjust all the balance sheet data expressed in monetary values for inflation.[8] Industry categories are provided following the 2-digit NACE Rev 1.1 categorization. I determine industry links using the Hungarian input-output table from 2005, which uses a 2-digit NACE Rev 1.1 classification. I define supplier and buyer industries in the following way: industry j is a supplier industry of industry i if j is different from i, and j provides at least 5% of all the industrial inputs used by i. Industry k is a buyer industry of i if k is different from i, and i provides at least 5% of all the industrial inputs used by k. For the calculations I use all industries and not just manufacturing. The list of buyer and supplier industries, separately for each 2-digit industry in which I have a closing plant can be found in Table A6-A9 of the Appendix.

I calculate two productivity measures from the balance sheet data. The first measure is labor productivity, defined as value added over the number of employees. I calculate value added by deducting material cost from the sum of sales and the capitalized value of self-manufactured assets. The second measure is total factor productivity (TFP), which I estimate assuming a Cobb-Douglas production function with coefficients varying by two-digit industries. For firm i in industry j in year t the production function is

$$Y_{ijt} = A_{ijt} + \alpha_j L_{ijt} + \beta_j K_{ijt} + \gamma_j M_{ijt}, \tag{1}$$

where Y denotes sales, A is total factor productivity, L is labor measured by the number of employees, K is capital and M is material. I use the method of Levinsohn and Petrin (2003) for estimating TFP.

Finally, I use an additional firm-level database from Complex to calculate the age of a firm in a given year. I provide descriptive statistics of the variables I use in Table A11 of the Appendix.

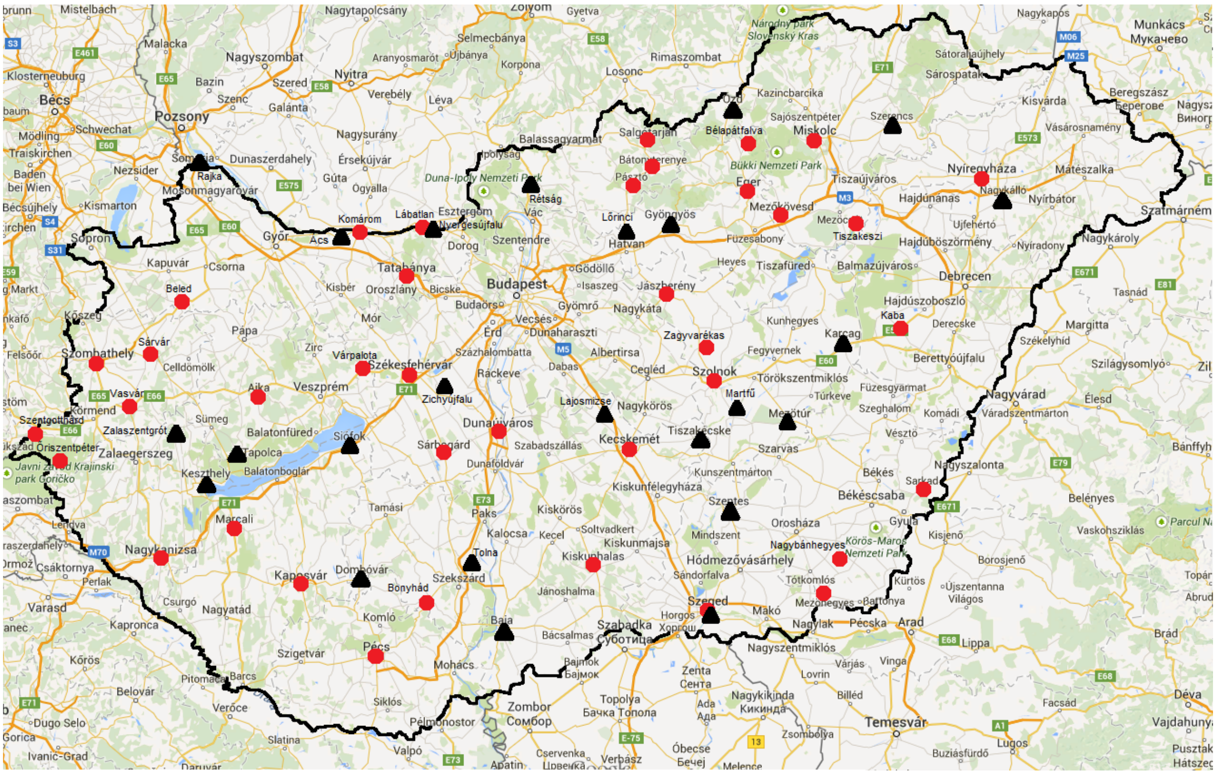
IV The closure events and the matched controls

IV.A The cases of foreign-owned plant closures

In the current analysis I identify foreign-owned large plant closures using press announcements. Focusing on manufacturing plants I collect 49 such events which fulfill the following criteria: 1. the closing plant should have majority foreign ownership. 2. It has to be large enough, i.e. having more than 150 employees at the site in the last year of operation. This ensures that the presence of the plant was important enough for the local economy. 3. The site should not be in Budapest. I expect that the impact of a closure cannot be so strong in the capital city as elsewhere with less employment opportunities. 4. Closure should fall within the period of 1995-2009, as I have data on firms from 1992-2012. In this way I can look at pre- and post-event periods of at least three years. 5. I also check that exits were permanent, and the plant was not reopened in the next three years, either by the same owner or a new one. At the same time, I allow for new

[8] For sales and value added I use the producer price index (PPI) of the 2-digit industry. For export sales I use the export price index of the 2-digit industry. For capital I use a capital deflator created as the average PPI of industries producing capital goods: NACE Rev 1.1 sectors 29, 30, 31, 34 and 35. For materials I use a material price index calculated separately for each 2-digit industry: the weighted average PPI of all input-providing sectors with input shares as weights. For the wage I use a wage index, calculated from the national average of per capita earnings.

Figure 1: The location of treated and control settlements



entries in other industries. I will refer to the locations with a plant closure as "treated". It is important to emphasize, that the information I collect on closures is at the plant-level, but the data sets which I use for the matching and in the main analysis are at the firm-level.

I verify the information collected from the press using firm-level administrative data, containing ownership and balance sheet information. I check ownership, compare decreases in the number of employment to the announced number of people being laid off from the plant and also check exit from the database in case of single-plant firms. The full list of plant closures, including the name of the firm, the city of the plant, plant size, industry, city population and the time of closure can be found in Table A1 and A2 of the Appendix. Most of the closures happened around the EU accession or in the crisis year 2009, but there are closures from all years of the period 1998-2009. The majority of the observed plant closures happened in the food industry, the wearing apparel industry and the footwear manufacturing industry. There are closures in other industries as well, like manufacturing of electrical machinery, manufacturing of communication equipment or manufacturing of paper. The number of employees laid off are typically below 250, but there are closing plants with more than 1000 employees as well. The closing plants are important employers in the local economy. Their average share in total employment within 10 km of the city is about 10%. Figure 1 shows the treated settlements marked by red dots. The figure shows that treated settlements are located all over Hungary with no significant spatial concentration.

IV.B Assignment of controls

I assign control locations to treated locations using propensity score matching. I do cross-location comparisons to account for countrywide or global trends which could drive the results. Matching based on pre-closure location characteristics helps me to choose comparable locations as controls. Additionally, if exits were not entirely independent of location-specific characteristics, propensity score matching also helps choosing controls being similarly at risk of a closure.

Candidates for controls are such cities in Hungary where an established foreign-owned large firm operated in the year of a plant closure. Accordingly, I do propensity score matching on this subsample of city-year observations, also including the previously collected events of closure. As there are two cases in which two plant closures happened in the same city and in the same year, I have 47 treated city-year observations. I will refer to a treated city-year observation as a case. I define a firm as established if it already existed three years before the given year. In this way I exclude those cases where the outcomes in the control location would be driven by a large new entry. I define a firm as foreign-owned if it had a majority foreign ownership in the previous year or ever before, and disregard changes back to domestic ownership. Doing this I assume that the experience of foreign ownership has long-lasting effects. Additionally, the local economy can benefit from the presence of these firms still after the ownership change.[9] I define a firm as large if the median number of employees is at least 100 and there is a year when there are at least 150 employees. I assign these firms to cities based on the headquarters of the firm, as I have a database with information on all firms only at the firm-level. I identify closures on the plant-level using extra information from press announcements, but I can only identify controls using firm-level information. This is a limitation, as with multi-plant firms I lose potential control cities. Still, it doesn't worsen the comparability of controls, provided that headquarters are not separated from production facilities. This is a reasonable assumption except for Budapest, which I exclude from the pool of potential controls. I also exclude treated cities from the set of potential controls in the three-year period before the plant closure, but they are included earlier. In the estimation I use only those city-year observations which had at least one firm operating in the industry of a treated plant closing that year, and at some point there was a closure in the same NUTS2 region. In this way I end up with 168 potential control cities.

For the propensity score matching I estimate the following equation, using a probit model:

$$y_{ct} = \Phi(\beta_0 + \beta_1 lPop_{ct-1} + \beta_2 lPopA_{ct-1} + \beta_3 Unemp_{ct-1} + \beta_4 UnempA_{ct-1} + \beta_5 dUnemp_{ct-1} + \beta_6 dUnempA_{ct-1} + \beta_7 Supp_{ct-1} + \beta_8 Buy_{ct-1} + \beta_9 Sales_{ct-1} + \beta_{10} dSales_{ct-1} + \beta_{11} I_{ct} + \beta_{12} D_t + \beta_{13} R_c + \epsilon_{ct}), \quad (2)$$

where c denotes city and t denotes year. y is an indicator of plant closure, being one for the 49 plant closure events and zero otherwise. $lPop$ is working-age population in he city, which I measure as the number of people being 18-59 years old, and $lPopA$ is working-age population in the 30 km agglomeration, both measured in logs. $Unemp$ and $UnempA$ are the unemployment rate in the city and in the 30 km agglomeration

[9] Only 17% of the firms classified as foreign ever switch back to majority domestic ownership. This share is only 6% when I aggregate up the measure to city-industry-year level.

respectively. I measure the unemployment rate as the number of unemployed divided by the size of working-age population. *dUnemp* refers to changes in the unemployment rate from two years before, measured in percentage points. *Supp* is the share of the large foreign firm's supplier industry in total employment within the 30 km agglomeration of the city. Similarly, *Buy* is the share of the large foreign firm's buyer industry in total employment within the 30 km agglomeration of the city.[10] *Sales* is total sales measured in logs and *dSales* is the average growth rate of per firm sales, both measured in the 30 km agglomeration of the city.[11] I is a set of industry dummies, being one if there was a foreign-owned large plant in the given city and year operating in the given industry.[12] D_t is a set of year dummies, and R is a set of NUTS-2-level region dummies.

I use the estimated propensity scores for choosing the final set of controls. First, I ensure overlap between treated and controls by dropping treated with a propensity score more than 20% higher than the highest propensity score among the controls. I also drop those controls where the lowest treated propensity score is more than 20% higher than the estimated propensity score of the control. As I cannot find any comparable controls for 6 treated, I end up with 41 cases. I also drop those potential controls which were treated in the previous two years. Then I create industry-year brackets and look for comparable controls within each bracket. I look for control cities with a plant operating in the same industry as the closing plant, because I am especially interested in the performance of firms in the buyer, the supplier and the same industry. In this final step of matching I also drop those potential control cities which are closer than 30 km to the treated. With this I ensure that there are no sizeable spillover effects from the treated to the control locations. In the baseline version I assign a single control city to each treated case. From the remaining potential controls within the given industry-year bracket I take the city which has a propensity score closest to the propensity score of the treated. The same control city can be assigned to multiple cases, and a treated city can be a control more than three years after or more than two years before the plant closure. The black triangles in Figure 1 show the location of control cities. Like treated cities, controls are also located all over the country. The full list of control cities with their size, and the name and size of the foreign-owned large firm can be found in Table A1 and A2 of the Appendix. As a robustness check I use multiple controls, and assign all the remaining potential controls within the given industry-year bracket to the treated. I weight each control in such a way, that weights are proportional to the inverse of their distance from the treated in terms of propensity scores and weights add up to one.

Checking pre-closure differences shows that treated and control cities are indeed comparable. Table 1 presents the results of this comparison when a single control city is assigned to each case. Table A5 of the

[10] I define the buyer industry differently for the matching than for the estimation of the plant closure effect by industry group. Here I classify industry k as a buyer industry of industry i if k is different from i, and k uses at least 5% of all the output produced by i and used by an industry. In about 1/3 of the observations there are foreign-owned large plants operating in multiple industries. In these cases there is no single supplier or buyer share to be used. Since I am interested in the probability of having a closing plant, I use the lowest buyer share, as I estimate a negative relationship between the buyer share and the plant closure probability. As the estimated relationship between supplier share and plant closure is positive, I include the highest supplier share in the regression for matching.

[11] When I calculate *Sales* and *dSales* I include only those firms which have a median level of employment of at least 5. I also exclude the firms of the closing plants and all the large foreign firms operating in the potential control cities. I also get rid of outliers in sales growth, excluding the lowest and highest 5% when calculating agglomeration-level averages.

[12] I use TEAOR'03 subsectors which almost correspond to 2-digit NACE Rev 1.1 codes, but groups together 15 and 16, 17 and 18, 21 and 22, 27 and 28, 30-33, 34 and 35, 36 and 37.

Appendix does the same comparison for the version with multiple controls. Here I use weighted regressions with a constant and a treated dummy on the right-hand side. Weights are the ones determined in the matching procedure. When the treated dummy is insignificant, the two groups are similar in terms of the given characteristic. Table 1 shows that the pre-closure characteristics used for the matching are not significantly different in the treated and control groups. The only exceptions are city size and propensity score. Cities with a closing plant are on average larger than the control cities.

Table 1: Similarity of treated and control cities before the closures

Controls: a single control is matched to each case

Pre-closure characteristics	Average for treated	Average for controls	P-value of H0: treated=control
Propensity score	0.31 (0.04)	0.13 (0.02)	0.00
Log working-age population in city	9.44 (0.22)	8.99 (0.15)	0.04
Log working-age population in 30 km	11.80 (0.06)	11.85 (0.05)	0.50
Unemployment rate in city	0.065 (0.006)	0.067 (0.004)	0.82
Unemployment rate in 30 km	0.068 (0.005)	0.067 (0.004)	0.77
2-year change in city unemployment rate (pp)	0.0026 (0.0018)	0.0010 (0.0023)	0.45
2-year change in 30 km unemployment rate (pp)	0.0013 (0.0017)	0.0015 (0.0016)	0.93
Buyer-industry share in 30 km	0.090 (0.010)	0.089 (0.008)	0.99
Supplier-industry share in 30 km	0.122 (0.013)	0.127 (0.010)	0.67
Log total sales in 30 km	19.27 (0.012)	19.38 (0.010)	0.46
Average sales growth in 30 km	0.130 (0.007)	0.128 (0.007)	0.75

Controls are cities with a foreign-owned large firm operating in the same industry as the closing plant, and having the closest propensity score to the treated. Pre-closure characteristics are measured one year before the plant closure. 2-year change in the unemployment rate refers to changes from t-3 to t-1 where t is the year of the plant closure, and it is expressed in percentage points. Working-age population refers to the number of people aged 18-59 on Dec. 31. of the given year. Unemployment rate is the number of registered unemployed on Dec. 20. of the given year, divided by the working-age population. Buyer-industry share is the employment share of firms operating in the buyer industries of the closing plant in total employment. Supplier-industry share is defined analogously. Buyers are industries which use more than 5% of the closing plant industry's output, suppliers are industries of which more than 5% of the closing plant industry's inputs come. Total sales and average sales growth is calculated omitting the closing plant's firm and the foreign-owned large firms in the control cities. Standard errors are in parentheses.

V Empirical strategy

V.A Estimation

I use a difference-in-differences estimation strategy, combined with an event study approach. In my estimation strategy I build on Greenstone et al. (2010) and partly also on Greenstone and Moretti (2004). In these papers the authors look at the effect of large plant openings on the local economy by using the runner-up locations as controls. Analogously, I use comparable locations with similar but still operating plants as controls. I assume that FDI exits are independent of the local economic conditions. Consequently, control locations being similar before the closure provide a proper counterfactual, showing what would have happened in the treated locations without the plant closure.

I measure the effect of plant closures by comparing outcomes of firms located in the treated and in the control area, before and after the closure. I use a somewhat more flexible version of a simple difference-in-differences estimation, as I divide the before and after periods to multiple sub-periods. This approach helps me to separate immediate effects (1-3 years after the closure) from effects in the longer-run (4-5 years after the closure). As there are few cases from the early years with a long post-closure period, my sample size drops considerably six years after the closure, and I cannot reliably estimate long-run effects beyond 5 years. To control for this drop I include separate dummies for early and late periods with few observations. I define an early period as 7 or more years before the plant closure, and a late period as 6 or more years after the plant closure. Figure A1 of the Appendix shows the number of cases by event-year, where event-years are normalized to zero in the year of the plant closure. All the cases have observations up to 3 years after the plant closure. This supports my choice to cut the first period of interest 3 years after the closure. In the baseline specification I estimate the following equation, where the unit of observation is firm-year-case:

$$\begin{aligned} Y_{it} = \beta_0 + \beta_1 Treated_{ic} + \beta_2 Before7_{ct} + \beta_3 After1\_3_{ct} + \beta_4 After4\_5_{ct} + \beta_5 After6_{ct} + \beta_6 Treated_{ic} Before7_{ct} \\ + \beta_7 Treated_{ic} After1\_3_{ct} + \beta_8 Treated_{ic} After4\_5_{ct} + \beta_9 Treated_{ic} After6_{ct} + \alpha_i + \alpha_{ct} + \alpha_t + u_{ict}, \quad (3) \end{aligned}$$

where i stands for firm, c denotes case and t denotes year. Y stands for the various outcome variables: log sales, log employment, labor productivity in logs, log per capita wage or log total factor productivity. $Treated$ is a dummy being one if the firm is located in a treated area. I assign firms to treated and control locations based on the location of their headquarters two years before the plant closure. For firms with a later entry I use the first location, for firms with an earlier exit I use the last location. A treated location consists of the city with the closing plant and the agglomeration around the city. I define control locations in the same way. As the baseline I define the agglomeration as a 10 km radius circle around the city. I determine the settlements which belong to each agglomeration by using distance data of settlement pairs.[13] $Before7$, $After1\_3$, $After4\_5$ and $After6$ are case-specific dummies being one in 7 or more years before, 1-3 years after, 4-5 years after or 6 and more years after the plant closure, respectively. $TreatedBefore7$, $TreatedAfter1\_3$,

[13] Table A10 of the Appendix shows the average number of treated and control firms per case. As treated cities are on average larger than controls, there are also more firms in the treated locations than in the controls.

$TreatedAfter4\_5$ and $TreatedAfter6$ denote the interaction terms of time period dummies and the treated dummy. The variables of interest are $TreatedAfter1\_3$ and $TreatedAfter4\_5$, which show if the outcomes of treated firms 1-3 years and 4-5 years after the plant closure are different on average from the outcomes of control firms, controlling for pre-treatment differences in the 6-year period before the closure. Finally, I also include fixed effects for firm (α_i), case (α_{ct}) and calendar-year (α_t), and u_{ict} is the error term. I cluster the standard errors by city[14], allowing for correlated errors within cities. I estimate bootstrapped standard errors in the regression where the left-hand side variable is log TFP, which is an estimated measure. I include only those firms in the analysis which have at least 5 employees, taking the median value. In this way I expect to have more robust estimates, as very small firms tend to misreport more frequently. I also exclude all the firms with a closing plant and the foreign-owned large firms operating in the same industry in the control locations. Finally, I exclude those outliers which ever had a sales value larger than 0.5% of the total sales of all firms in the database that year. There are only 33 such firms.

When I look at the effect on exit probability I estimate a modified version of equation 3. I estimate a simple linear probability model with a dummy on the left-hand side being one if the given year is the last year of the firm before exit. Following Bernard and Jensen (2007), instead of firm-fixed effects I control for firm characteristics like age, log of employment, capital to labor ratio, per capita wage, TFP and an indicator showing that the firm has never exported before. I include fixed effects for case, industry[15] and calendar year, and I cluster the standard errors by firm.

As a robustness check I also use two alternative specifications. In line with Greenstone et al. (2010), the first specification controls for potential differences in trends before the closure. This ensures that average differences after the plant closure are not driven by different trends in treated and control locations, which can already be observed in the pre-closure period. I estimate the following equation:

$$\begin{aligned} Y_{it} = \beta_0 &+ \beta_1 Treated_{ic} + \beta_2 Trend_t + \beta_3 Treated_{ic} Trend_t + \beta_4 After_{ct} + \beta_5 Trend_t After_{ct} \\ &+ \beta_6 Treated_{ic} After_{ct} + \beta_7 Treated_{ic} Trend_t After_{ct} + \alpha_i + \alpha_{ct} + \alpha_t + u_{ict}. \end{aligned} \tag{4}$$

I include a simple time trend ($Trend$), allowing for different trends in treated and control groups ($TreatedTrend$), and a trend break after the plant closure ($TrendAfter$), which can also be different in treated locations ($TreatedTrendAfter$). In this specification I use observations only from the period 6 years before and 5 years after the closure, omitting the $Before7$ and $After6$ dummies. I also include a single dummy for the period after the plant closure ($After$). The variables of interest are the interactions of $Treated$ with the after period and with the trend difference after the closure. β_6 shows if there is a level shift and β_7 shows if there is a change in the trend after the closure.

The second alternative specification is even more flexible. Instead of the time period dummies I use a full set of event-year dummies, also interacted with the $Treated$ dummy. Event-years are calculated relative to the year of the plant closure. For positive event-years, coefficients on the interaction terms measure if firms in treated and control locations have significantly different outcomes a given year after the plant closure.

[14]For the clustering of standard errors I use the first location of each firm in order to give a nested structure.

[15]I use a time-invariant 2-digit NACE Rev. 1.1 categorisation. I assign a firm to that industry in which it operated for the longest time throughout its life.

In the analysis I also check if there is any heterogeneity in the plant closure effect by the characteristics of local firms or by the characteristics of the closing plant or the location. For doing this I include additional firm group or case group dummies into equation 3, also in interactions with all the other right-hand-side variables (treated dummy, time period dummies and their interactions) of equation 3. The coefficients of interest are the ones on the triple interaction term of the treated and after period dummies with the firm group or case group dummies. Interactions with firm group dummies show if the plant closure had a significantly different effect on the given firm group compared to firms in the baseline category. Interactions with case group dummies show the same for firms located close to specific types of closures.

V.B Identification issues

The two main concerns with the identification are the possible endogeneity of exits and potential other reasons for which controls might not provide a proper counterfactual for the treated locations. Concerning the first, if exits happened systematically in locations with worsening economic conditions, the observed worse performance of local firms after the plant closure would be the result of local tendencies and not the result of the closure. There are three arguments against that. First, the literature shows that foreign firms are more footloose than domestic firms.[16] Foreign-owned firms are more likely to close or relocate due to global strategic considerations which are unrelated to local economic conditions. Second, press announcements and articles on the plant closures in my sample never mention location-specific economic problems among the reasons for the closure.[17] Some of the reasons are country-specific, like high wages compared to Asia or regulation changes after the EU-accession. Using control locations, however, I account for these country-wide factors changing over time. As control cities have large foreign plants operating in the same industry as the closing plant, I also account for potential global industry-specific shocks. Third, I assign control locations in such a way that I ensure pre-closure comparability. Outcomes in the treated and control groups are not significantly different in the period before the closure. Additionally, as a robustness check I test if differences in pre-closure trends can account for differences in post-closure outcomes. Results are robust to the inclusion of treatment group-specific trends. It might also be the case, that the foreign-owned large plants close because they are worse than the comparable plants in the control locations. As a result, the presence of the foreign firm could have different impact on the local economy in treated and control locations. Local firms, however, have similar performance in treated and control locations before the closure. Additionally, my main results are robust to the exclusion of those cases where the plants closed because of indebtedness.

The second concern is the comparability of controls. The relatively worse performance of the treated firms after the closure might be the result of the exceptionally good performance of control firms. It might be the case if control firms are not hurt by the plant closure but benefit from that. For example, people being laid off from the plant provide cheap labor or supplier firms losing their business partners are ready to

[16]e.g. Alvarez and Görg (2009), Bernard and Sjöholm (2003), Bernard and Jensen (2007), Kneller et al. (2012), van Beveren (2007).

[17]The full list of closures with the publicly available information on why plants closed can be found in Table A3 and A4 of the Appendix.

provide cheaper inputs. As controls are located far[18] and most of the plants are not large enough[19] to have considerable effect on far-away locations, it is unlikely that the difference is due to favourable consequences of plant closures for the control locations. Alternatively, control locations might have other positive shocks at the time of the plant closures improving their economy and leading to a downward bias in a measured negative plant closure effect. As I have several closures from different years, it is unlikely that control cities systematically get positive shocks in the year of the corresponding closure. Additionally, I show that results remain robust to narrowing down the set of cases to different subgroups.

In the estimations I don't control for additional closures (e.g. smaller firms or domestic ones), mass layoffs or entries. I assume that without the plant closures exits and entries occur randomly. After a plant closure I treat changes in the number of exits or entries as outcomes. On one hand, the negative effect of a large plant closure on the local economy might result in further exits. On the other hand, if the plant closure was exogenous, the location could become attractive for new entrants. The local economic policy is also likely to work hard for attracting new investors. I consider these as potential results of a closure. In case of new entries the effect I estimate is definitely lower than the direct effect of a plant closure without a new entry. Yet, I am interested in the net effect which includes the potential counterbalance of new entries. If the foreign-owned large plants close because of negative industry-level shocks, the comparable foreign firms operating in the same industry in the control locations might be also affected. If this resulted in mass layoffs in control locations which I don't control for, it would go against me, biasing the estimated effects towards zero.

V.C Different channels of the plant-closure effect

After the baseline estimations I give some evidence on the different channels of the plant closure effect. I use a simplified and somewhat modified version of the model presented in Acemoglu et al. (2010) to show which are the expected effects of a plant closure on the local economy. Here I only summarize the results, I present the model in Appendix A. If the closing plant had only few local buyers and sold most of its output in other locations, its closure is such a local shock which I expect to propagate upwards. This means, firms in the supplier industries of the closing plant's industry face lower demand. This leads to decreases both in their output and in the amount of inputs they use. I call this the "input/output linkages channel". The average export share of the closing plants was 62%, and the large manufacturing plants also sold in different locations within Hungary. So it is reasonable to assume that there were very few local buyers, and as a result, firms operating in the buyer industry were not affected more than the average firm. If the "input/output linkages channel" is at work, I expect that firms operating in the supplier industry are hurt more than average, but firms operating in the buyer industry might not be affected differently than the average firm.

Decreasing local labor demand puts a downward pressure on wages. The average wage might indeed decrease if the laid-off are ready to work for a lower wage. From the firms' perspective this is equivalent to

[18] According to Google Maps, the average road distance between treated and control cities is 204 km. There are only six cases, where the distance is less than 60 km. The closest city pair is 40 km away from each other.

[19] The average size of a closing plant is 340 employees. 10 plants had more than 500 employees and only 3 firms had more than 1000 employees.

a lower input price, and as a result firms use labor more intensively. I call this the "increasing labor supply" channel. Although it is not a model prediction, I expect that those firms can benefit the most from the increased labor supply which employ people with similar skills and experiences as the closing plant. This is definitely true for firms operating in the same industry as the closing plant. If the "increasing labor supply" channel is at work, I expect that firms operating in the same industry as the closing plant are hurt less than average or can even benefit from the closure.

Finally, decreasing local labor demand lowers the income of local households, both by decreasing wages and increasing unemployment if there is no perfect adjustment of wages. Lower income lowers the consumption of local households, decreasing local demand for consumer goods. I call this the "decreasing purchasing power" channel. Especially those firms are affected which sell a lot locally. If the "decreasing purchasing power" channel is at work, I expect firms providing non-tradable local services to be hurt more than average by the plant closure.

I test the above assumptions by allowing for differences in the plant closure effect by industry groups. I estimate a modified version of equation 3, where I interact all the right-hand side variables with four industry group dummies, standing for supplier industry, buyer industry, the closing plant's industry and local services. I do all the industry categorizations by 2-digit NACE categories. I define the supplier and buyer industries as I described in the Data section. I define local services as the sum of 52. Retail trade and 55. Hotels and restaurants. I present the average number of firms per case operating in the different industry categories in Table A10 of the Appendix.

VI Results

VI.A Suggestive evidence on aggregates

As a starting point I show the evolution of aggregate sales and employment in the average closure event, looking at the 10 km agglomeration. Figure 2 shows coefficient estimates from case-level regressions of log total sales and employment on event-year dummies and their interaction with the treatment indicator, also controlling for city-fixed effects. I present the estimated average for each event year separately in the treated and control group, taking two years before the closure as the reference point. In the first row of Figure 2 I also include sales and employment of the closing plant. The figures suggest that total sales and employment decrease after the closure without recovering even after five years. The figures also suggest that treated and controls are comparable in terms of aggregates 1-3 years before the closures but not earlier. Figures in the second row show the same estimates when I exclude the closing and the control plants from the estimation. The difference after the closure disappears, suggesting that local firms seem to be unaffected on average. This might be the result of no effect, or of a heterogeneous effect, where the positive effect on some firms and the negative effect on others average out. Figures A2 and A3 of the Appendix suggest that the effect is indeed heterogeneous, larger firms seem to gain and smaller firms lose, competitors gain and suppliers lose to some extent. As an additional source of heterogeneity, the third row of Figure 2 shows that local firms in smaller cities also tend to lose.

I can further support the heterogeneity across cases by doing a simple back of the envelope calculation, where I compare the growth rate of total sales and total employment in treated and control firms, case by case. I look at the period 2 years before and 3 years after the closure. In this exercise I exclude the closing and control plants. Taking the average difference in the growth rates weighted by the levels 2 years before the closure, I find that the average growth rate in treated cities is 17 percentage points higher for sales and 3 percentage points higher for employment. There is a large heterogeneity, though, growth of total sales is lower in the treated city for 25 out of the 41 cases, and growth of employment is lower for 23 cases. When I only look at small cities, I find that the weighted average growth rate in treated cities is 7 percentage points lower for sales and 1.9 percentage points lower for employment compared to controls. Looking at simple averages, differences between treated and control cities suggest, that total sales growth would have been 15% higher in the treated cities without the plant closure. As a comparison, the observed average growth rate in the treated cities is 27%. When I decompose the growth rate difference between treated and controls to the contribution of continuing, newly entering and exiting firms, as suggested in Eaton et al. (2007), I find that the share of continuing firms is quite large in most cases. The contribution of the continuing firms in the median case is 81% for sales and 68% for employment. These results support my approach to focus on the incumbents.

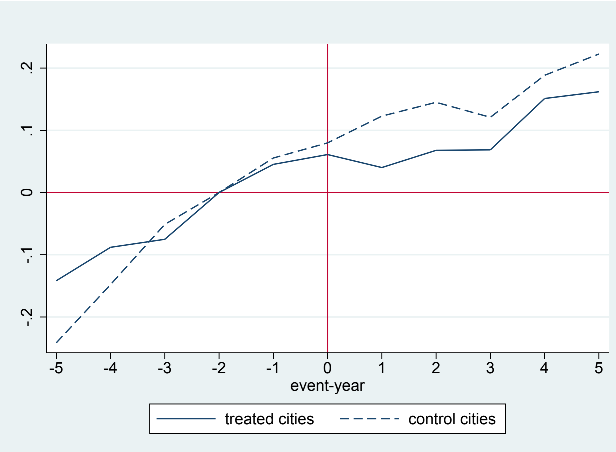
In the followings, I look at firm-level estimates where I can control for potential composition differences between the treated and the control group. First, I present the estimated average effect of a foreign-owned large plant closure on the local firms. Then I show some evidence on the different channels of the plant closure effect. Next, I show heterogeneity in these estimates by ownership, firm size and productivity. After that, I show how the estimated effect differs by various characteristics of the closing plant and the location. Finally, I evaluate the aggregate employment effect, and show some robustness checks for the main results.

VI.B Effect on local firms

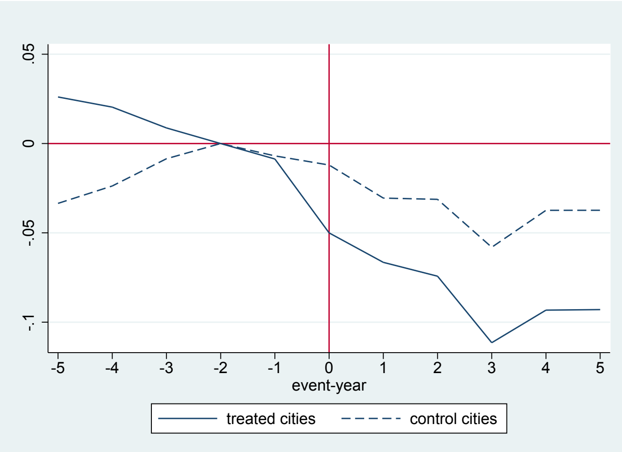
In the estimations I focus on the short-run effect of foreign-owned large plant closures on local firms, looking at changes in different firm-level outcomes 1-3 years after the closure. My secondary interest is on the period 4-5 years after the closure. Table 2 shows the baseline results for all firms in treated or control cities, having at least 5 employees at the median. On average, sales decreased by 6 percentage points and employment decreased by 3 percentage points 1-3 years after the plant closure. Effects seem to be persistent, as 4-5 years after the plant closure the sales and employment difference between treated and closure location firms is even larger. At the same time, I find no significant effect on productivity, average wage or exit probability. The treated dummy is small and insignificant in all cases, which supports my identification strategy. It shows, that firms in treated and control locations are on average not significantly different from each other in the baseline period before the closure.

Next, I show how the difference in sales and employment between treated and control firms evolves over time. I use a flexible specification with event-year dummies instead of time period dummies in the period

Figure 2: Case-level averages of the log of total employment and sales within 10 km agglomeration, including or excluding the closing plant

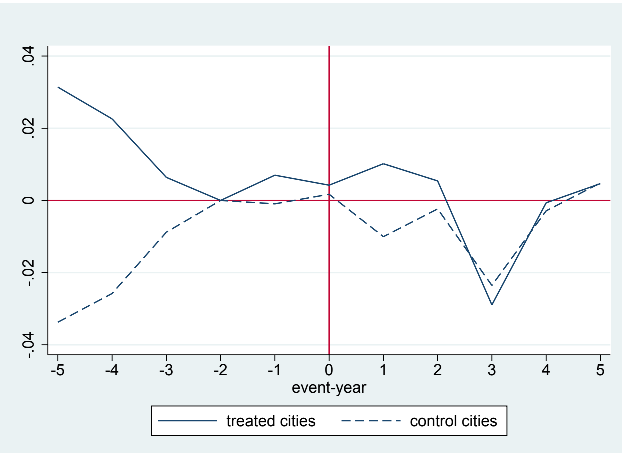


(a) Log sales, including the closing plant

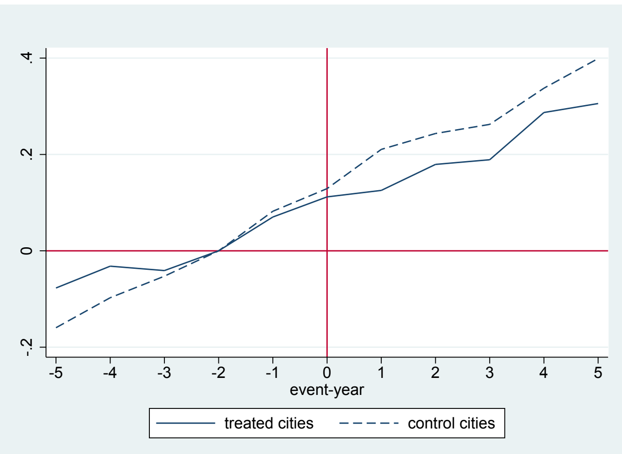


(b) Log employment, including the closing plant

(c) Log sales, excluding the closing plant



(d) Log employment, excluding the closing plant



(e) Log sales in small cities, excluding the closing plant

(f) Log employment in small cities, excluding the closing plant

Table 2: Baseline regression results for firm-level outcomes

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated	0.008	0.000	0.005	-0.004	-0.003	-0.002
	(0.009)	(0.007)	(0.005)	(0.003)	(0.004)	(0.002)
Treated x After(1-3)	-0.061***	-0.030**	-0.010	-0.007	-0.005	0.003
	(0.020)	(0.012)	(0.010)	(0.006)	(0.008)	(0.002)
Treated x After(4-5)	-0.077**	-0.049**	-0.013	-0.010	0.001	0.002
	(0.030)	(0.019)	(0.014)	(0.011)	(0.010)	(0.003)
Time period dummies	YES	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	359,826	353,768	326,784	330,158	353,607	332,702
Number of unique firms	26,434	26,512	25,914	26,142	26,527	

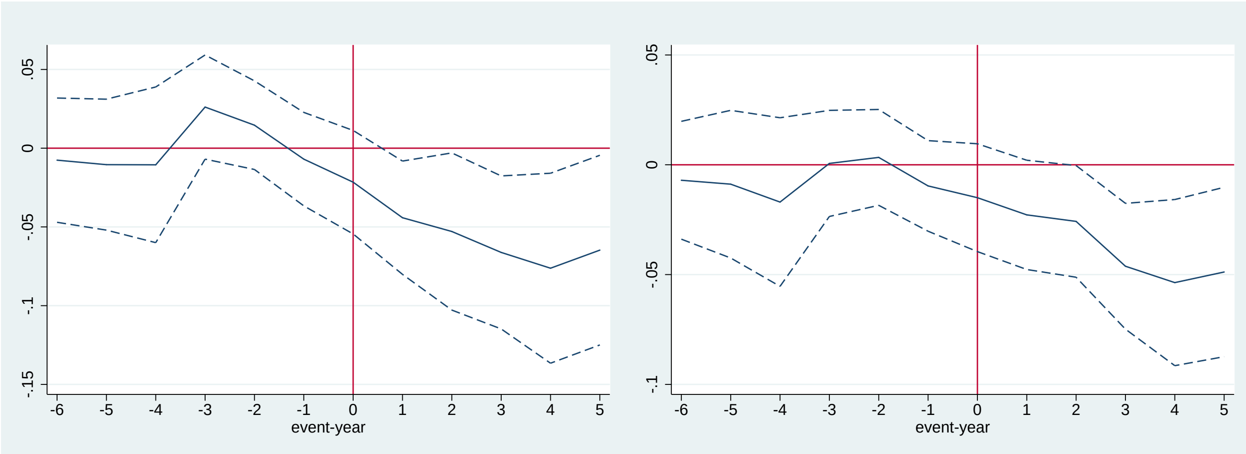
Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

[t-6,t+5], where t denotes the year of the closure. For early and late years outside this period I use the period dummies, as before. Figure 3 shows the yearly difference in sales and employment by plotting the estimated coefficients on the interaction terms of the event-year dummies with the treated dummy. The figures also include the 95% confidence intervals. The yearly patterns show that firms in treated locations start to sell less and employ relatively fewer people somewhat before the closure, and the gap between treated and control firms increases over time. The difference in sales and employment becomes significant only one and two years after the closure. Figure A4 in the Appendix show similar estimates for sales and employment separately, plotting the coefficients on event-year dummies and the sum of coefficients on event-year dummies and their interaction term with the treated dummy. The figures show that there are two reasons for the increase between treated and control firms after the plant closure. On one hand, treated firms have lower sales and employment compared to pre-closure levels. Second, control firms start to increase in the period after the closure. This pattern shows, that even simple within-treated comparisons show evidence for a negative effect of the plant closures on local firms. Assuming that the controls form a proper counterfactual, these figures also show that a simple within-treated comparison would underestimate the closure effect, as it doesn't account for the foregone potential increases in the post-closure period.

Using the estimates from the flexible specification I calculate the average annual growth rate lost due to the plant closure. I use the formula $\frac{1}{2}(e^{\delta_3} - e^{\delta_1}) - \frac{1}{7}(e^{\delta_1} - e^{\delta_{-6}})$, where δ_t is the coefficient on the interaction term of the treated dummy with the indicator of event-year t. I calculate that the annual growth rate of sales was 0.5 percentage point lower and the annual growth rate of employment was 0.9 percentage point lower in local firms after the plant closure. As a comparison for the magnitude of the effect, average yearly sales growth in the estimation sample 1-3 years after the closures is 1.5%, and the average yearly employment growth is 1%. As an additional comparison, Carvalho et al. (2014) find that the suppliers of those firms which exit due to the tsunami suffer a 6 percentage point decrease in sales growth after the exit. Barrot and Sauvagnat (2015) find 3.1 percentage points decrease in sales growth for customers of a firm which was hit by a natural disaster. The effect I estimate is lower, but its magnitude is still significant comparing to the average growth rate.

Figure 4 shows how the average unemployment rate evolved over time around the plant closure in treated and control cities. I estimate a flexible, case-level version of equation 3, with unemployment rate in the city as a dependent variable. As right-hand side variables I have event year dummies and their interactions with a dummy for treated cities, and I also include city fixed effects. I do the estimations for the period including five years before and after the plant closure. In order to show unemployment trends in the control cities I plot the estimated coefficients of the event-year dummies. The sum of the coefficients on event-year dummies and their interactions with the treated dummy shows unemployment patterns in the treated cities. The reference period is two years before the plant closure, as in some cases layoffs start even one year before the closure. Unemployment rate increases over time in both groups, but it clearly jumps up in the closure year in treated locations and stays at a relatively higher level even five years after the closure. Figure A5 of the Appendix shows that no similar pattern can be observed in the number of people moving out of the city. People don't move away after the closures.

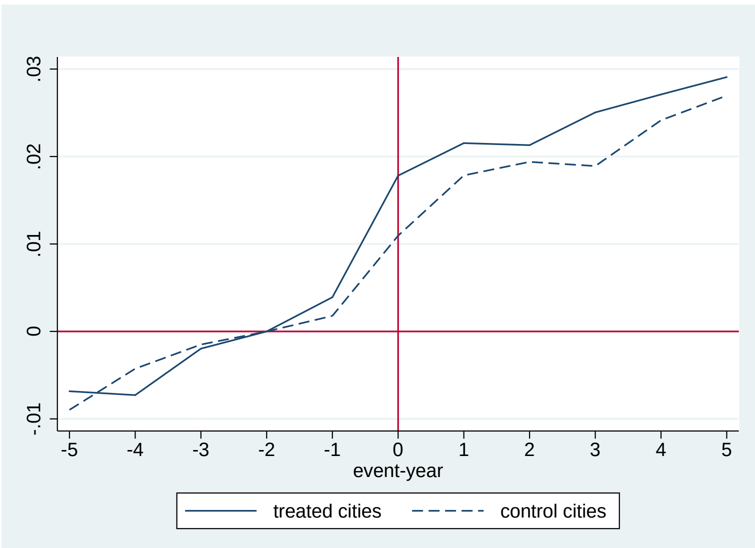
Figure 3: Baseline regression results with a flexible specification: triple interaction term coefficient estimates with 95% confidence interval



(a) Sales

(b) Employment

Figure 4: The average unemployment rate in treated and control cities around the plant closure, normalized to zero two years before the closure



VI.C Industry groups

In this section I look for evidence which supports the existence of the different channels through which a plant closure affects the local firms. Table 3 presents estimates of the heterogeneous effect by industry group. Employment of firms operating in local services or in the supplier industry of the closing plant decrease more than average. On the other hand, firms operating in the same industry as the closing plant significantly increase their employment compared to similar firms in the control locations. The effect on sales is not significantly different by industry group, but patterns are similar to the observed heterogeneity in the employment effect. Additionally, competitors exit in treated locations with a lower probability.

The estimates provide supporting evidence for three potential channels of the plant closure effect. First, estimated patterns suggest, that firms providing non-tradable local services are hurt more than average by the plant closure. This is in line with the assumption, that people getting unemployed or having jobs with lower wages consume less due to having lower income. Then demand from local consumption decreases, especially hurting those firms which sell mostly locally, like firms providing non-tradable local services. The estimated patterns support the existence of the "decrease in local purchasing power" channel. Second, firms operating in the same industry as the closing plant seem to benefit from the closure. The reason might be lower competition for local inputs, like labor. This is in line with the existence of the "increased local labor supply" channel. I expect that especially those firms can benefit, which employ people with similar skills and experiences as the closing plant, like firms operating in the same industry. Third, although results are weak, firms operating in the supplier industry of the closing plant seem to be hurt more than average. This supports the existence of the "input/output linkages" channel, hurting local firms which lose their business partners. I find no differential effects for buyer-industry firms. As the closing plants exported a lot, I expect that there were only very few local buyers. This explains why buyers are not hurt by lost local supplies.

VI.D Heterogeneity by the characteristics of the local firms

After looking at differential effects by industry, I allow for a heterogeneous effect by other characteristics of the local firms. Table 4 shows estimation results by ownership. I classify a local firm as foreign-owned if it had a majority foreign ownership 2 years before the plant closure. Though coefficients are only marginally significant, foreign-owned firms seem to lose less than domestic firms or even gain in terms of sales and employment. Foreign-owned firms also have higher productivity and lower exit probability after the treatment. Longer-run effects are not significant but have the same sign. These results are reasonable if foreign-owned firms are able to take advantage of increased local labor supply. After the large plant closure the local authorities might also put more effort in keeping these firms from relocating by providing more support or other local benefits.

In Table 5 I look at the plant closure effect by productivity group. I define productivity tertiles using estimated TFP values 2 years before the closure. I determine the cutoffs for the tertiles separately for each 2-digit industry. Coefficient estimates are rarely significant, but the patterns suggest, that low-productivity

Table 3: Heterogeneity of the effect by the industry of the local firms

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3)	-0.054** (0.027)	-0.019 (0.015)	-0.003 (0.012)	-0.006 (0.007)	-0.006 (0.009)	0.000 (0.003)
Treated x After(1-3) x LocalServices	-0.038 (0.027)	-0.044** (0.021)	-0.016 (0.022)	-0.001 (0.011)	-0.002 (0.015)	0.002 (0.006)
Treated x After(1-3) x Competitor	0.162 (0.119)	0.180** (0.086)	-0.076 (0.065)	-0.018 (0.035)	-0.015 (0.040)	-0.033** (0.015)
Treated x After(1-3) x Supplier	-0.045 (0.045)	-0.068* (0.041)	0.012 (0.028)	0.003 (0.018)	-0.015 (0.012)	-0.002 (0.006)
Treated x After(1-3) x Buyer	0.052 (0.066)	0.041 (0.041)	-0.015 (0.034)	0.007 (0.016)	0.025 (0.019)	0.010 (0.008)
Treated x After(4-5)	-0.070** (0.035)	-0.037 (0.027)	-0.011 (0.018)	-0.014 (0.012)	0.002 (0.013)	0.001 (0.004)
Treated x After(4-5) x LocalServices	-0.037 (0.048)	-0.037 (0.031)	-0.029 (0.030)	0.031 (0.021)	-0.017 (0.021)	-0.008 (0.008)
Treated x After(4-5) x Competitor	0.108 (0.135)	0.155 (0.107)	-0.008 (0.059)	0.017 (0.055)	-0.018 (0.049)	0.004 (0.023)
Treated x After(4-5) x Supplier	-0.044 (0.062)	-0.100* (0.058)	0.012 (0.033)	0.005 (0.032)	-0.020 (0.024)	0.005 (0.009)
Treated x After(4-5) x Buyer	0.029 (0.107)	0.067 (0.079)	0.040 (0.045)	-0.042 (0.029)	0.035 (0.032)	-0.011 (0.011)
Time period dummies	YES	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES	YES
Industry group dummies in interactions	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	359,826	353,768	326,784	330,158	353,607	332,702
Number of unique firms	26,434	26,512	25,914	26,142	26,527	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. LocalServices indicate to firms providing local services. Buyer and Supplier indicate firms operating in the buyer or supplier industries of the closing plant. Competitor indicates firms operating in the same industry as the closing plant. The other right-hand side variables are also interacted with the industry group dummies. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table 4: Heterogeneity of the effect by the ownership of the local firms

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3)	-0.079***	-0.038***	-0.019*	-0.005	-0.011	0.001
	(0.020)	(0.012)	(0.010)	(0.006)	(0.008)	(0.002)
Treated x After(4-5)	-0.113***	-0.063***	-0.023	-0.010	-0.013	-0.001
	(0.030)	(0.019)	(0.017)	(0.012)	(0.010)	(0.003)
Treated x After(1-3) x Foreign	0.144*	0.112*	0.093*	0.002	0.062*	-0.016*
	(0.079)	(0.059)	(0.050)	(0.023)	(0.035)	(0.010)
Treated x After(4-5) x Foreign	0.158	0.135	0.051	0.054	0.117	0.015
	(0.128)	(0.088)	(0.088)	(0.055)	(0.076)	(0.012)
Time period dummies	YES	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES	YES
Foreign dummy in interactions	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	272,760	268,326	250,249	252,388	271,633	257,250
Number of unique firms	14,690	14,700	14,542	14,688	15,326	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Foreign is an indicator of those firms which were foreign-owned 2 years before the closure. Interactions of the foreign dummy with all the other right-hand side variables are also included. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table 5: Heterogeneity of the effect by the productivity of the local firms

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3) x LowTFP	-0.107**	-0.041	-0.020	0.008	-0.017	-0.002
	(0.043)	(0.030)	(0.021)	(0.011)	(0.013)	(0.004)
Treated x After(1-3) x MediumTFP	-0.026	-0.014	0.017	-0.011	0.012*	-0.000
	(0.025)	(0.019)	(0.014)	(0.007)	(0.007)	(0.004)
Treated x After(1-3) x HighTFP	-0.037	-0.004	-0.018	0.006	0.001	-0.005
	(0.032)	(0.023)	(0.015)	(0.011)	(0.009)	(0.004)
Treated x After(4-5) x LowTFP	-0.107	-0.057	0.010	0.031	0.002	-0.009
	(0.066)	(0.047)	(0.030)	(0.021)	(0.023)	(0.006)
Treated x After(4-5) x MediumTFP	-0.030	0.003	-0.003	-0.000	0.018*	-0.000
	(0.035)	(0.029)	(0.024)	(0.019)	(0.010)	(0.006)
Treated x After(4-5) x HighTFP	-0.052	-0.037	-0.022	-0.017	-0.006	0.004
	(0.053)	(0.041)	(0.027)	(0.017)	(0.015)	(0.006)
TFP group dummies in interactions	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	359,826	353,768	326,784	330,158	353,607	332,702
Number of unique firms	26,434	26,512	25,914	26,142	26,527	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. LowTFP is an indicator of those firms which were in the lowest productivity tertiles of their 2-digit industry 2 years before the closure. MediumTFP and HighTFP stands for the middle and the highest productivity tertile. All the other right-hand side variables are included only in interactions with the productivity group dummies. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

firms lost the most after the plant closure. This pattern is especially clear for sales. Table A12 of the Appendix shows similar results for size groups. There I use fixed size cutoffs, resulting in decreasing group size for larger firms. Similarly to productivity, the estimated coefficients are rarely significant, but the patterns suggest that smaller firms were hurt more by the plant closure.

VI.E Heterogeneity by the characteristics of the plant closure

Next, I test if the effect of a plant closure depends on some characteristics of the closing plant or on the type of the treated location. I classify closing plants based on export intensity and size, and also group locations based on city size and pre-closure unemployment level, creating two groups for each. I define high export intensity if the export share of the closing plant's firm is higher than 50% 2 years before the plant closure. I define small plants as plants with at most 300 employees before the closure. The cutoff for city size is

Table 6: Heterogeneity of the effect by the characteristics of the location

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3)	-0.026	-0.016	0.008	-0.006	0.016*	0.001
	(0.026)	(0.018)	(0.015)	(0.010)	(0.009)	(0.003)
Treated x After(4-5)	-0.040	-0.007	-0.009	-0.019	0.018	0.002
	(0.039)	(0.027)	(0.024)	(0.016)	(0.012)	(0.004)
Treated x After(1-3) x HighUnemp	-0.060*	-0.020	-0.034**	-0.003	-0.038***	0.004
	(0.032)	(0.022)	(0.016)	(0.011)	(0.010)	(0.004)
Treated x After(4-5) x HighUnemp	-0.079	-0.094***	-0.002	0.022	-0.033**	0.001
	(0.049)	(0.035)	(0.027)	(0.017)	(0.015)	(0.006)
Number of observations	359,826	353,768	326,784	330,158	353,607	332,702
Number of unique firms	26,434	26,512	25,914	26,142	26,527	
Treated x After(1-3)	-0.047*	-0.001	-0.013	-0.008	-0.006	-0.000
	(0.027)	(0.019)	(0.014)	(0.008)	(0.008)	(0.004)
Treated x After(4-5)	-0.042	-0.006	-0.027	-0.015	0.003	0.002
	(0.041)	(0.035)	(0.017)	(0.012)	(0.012)	(0.005)
Treated x After(1-3) x SmallCity	-0.008	-0.055*	0.013	0.001	0.002	0.002
	(0.035)	(0.028)	(0.020)	(0.011)	(0.011)	(0.005)
Treated x After(4-5) x SmallCity	-0.017	-0.085*	0.043	0.004	0.000	-0.004
	(0.051)	(0.045)	(0.030)	(0.020)	(0.020)	(0.007)
Number of observations	359,826	353,768	326,784	330,158	353,607	332,702
Number of unique firms	26,434	26,512	25,914	26,142	26,527	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. SmallCity is an indicator of those cases where the the city of the closing plant had less than 40,000 working-age inhabitants. HighUnemp is a dummy for cases having a higher than median level unemployment rate in the 30 km agglomeration 2 years before the closure. Interactions of the case group dummy with all the other right-hand side variables are also included. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Column (6) includes firm-year-level characteristics as log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

at 40,000 working-age inhabitants in the year before the plant closure. I classify a location as having high unemployment share if the unemployment share in the 30 km agglomeration 2 years before the closure is above the median value of the 41 cases. The number of cases with the different characteristics can be found in Table A13 of the Appendix. Categories are not strongly overlapping.

The upper panel of Table 6 shows that plant closures in locations with worse initial economic conditions are hurt more by a plant closure. Sales, employment and productivity of local firms in a location with a high unemployment level decrease considerably more than in locations with a low level of unemployment. This is a reasonable finding, as local economies with a high unemployment level even before the closure are less capable to cope with the problem of new layoffs. The lower panel of Table 6 suggests that the effect on sales is uniform across cities with different size, but the employment effect is significantly larger in small cities. Table A14 of the Appendix shows that there are no significant differences in the effect of closures with high or low export share or by size of the closing plant. At the same time, the negative effect on labor productivity and average wage becomes significant for the cases with a less export-oriented closing plant. There is no wage effect where the closing plant is more export-oriented. A potential explanation might be that experience of the laid-off workers is valued more when the plant produced for export. This might have counterbalanced the wage-decreasing effect of the increased local labor supply.

I use three additional measures capturing the local importance of the closing plant to see if more important plants had a stronger effect when they closed. I group cases based on the relative size of the closing plant compared to the total employment of all other firms within the 10 km agglomeration. I use the median value (5%) and 15% as alternative cutoffs. Table A15 of the Appendix suggests that those plants which are larger compared to the local economy tend to have a stronger negative effect on local firms, but the difference is not significant. As alternative measures, I proxy the embeddedness of the plant in the local economy with the age of the plant and the length of operation as a foreign-owned firm. I expect that both are correlated with the strength of local links, but the second might be a better measure if the new foreign owners do not keep the old business links. For each measure I create two case groups using 10 years as the cutoff. Alternatively, I interact the number of years minus one with the treatment indicator, measuring the additional effect of an extra year the closing plant existed or was foreign. Table 7 shows that the negative effect on the sales of local firms is significantly larger for firms being present for a longer time, especially if they were also foreign-owned for longer. Older plants seem to have no additional effect on the employment of local firms, and the additional effect of plants being foreign owned for a longer time is not significant either.

I also check if the estimated effects differ by the activity of the closing plant. I create four industry groups. Food contains 11 closures in NACE category 15. Textile & leather contains 17 closures in NACE categories 17, 18 and 19. Machinery & equipment contains 8 closures in NACE categories 29, 30, 31, 32 and 34. The remaining 5 closures are in NACE categories 21, 25, 26 and 27. I present the results by case groups in Table A16 of the Appendix. The overall negative effect on sales and employment is not significantly different in the four industry groups. Still, the effects seem to disappear for plant closures in machinery and equipment industries. Most of these closures are in locations with a low unemployment rate before the closure, and all these firms had high export shares. Consequently, the laid-offs having valuable experiences at the foreign firm might have been able to find a new employment relatively easily in a location with better economic conditions.

Finally, I find some heterogeneity in the effect by the owner of the closing plant. I create four groups of owners: German-speaking countries (Germany, Austria and Switzerland), UK and the Netherlands, Mediterranean countries (Italy, Greece and Cyprus) and others including USA, Taiwan and global firms without a clear home country. Using the group of other owners as the baseline, Table A17 of the Appendix shows that the effect is not significantly higher for German-speaking firms where the distance to Hungary is the lowest. At the same time, the negative effect is somewhat stronger when the owners come from the UK or the Netherlands. Table A18 of the Appendix shows that the closing plants in this group operated and were foreign for a longer time, suggesting that they might have been more embedded in the local economy.

Table 7: Differences in the plant closure effect by the embeddedness of the closing plant in the local economy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Length of operation:	total		as foreign		total		as foreign	
VARIABLES	log sales				log employment			
Treated x After(1-3)	-0.029 (0.028)	0.014 (0.043)	-0.025 (0.023)	0.021 (0.039)	-0.028 (0.024)	-0.033 (0.034)	-0.016 (0.019)	-0.020 (0.031)
Treated x After(4-5)	-0.037 (0.036)	-0.012 (0.060)	-0.057* (0.031)	-0.015 (0.049)	-0.016 (0.033)	-0.005 (0.055)	-0.031 (0.026)	-0.024 (0.046)
Treated x After(1-3) x More than 10 years	-0.051 (0.034)		-0.075** (0.030)		-0.004 (0.029)		-0.030 (0.024)	
Treated x After(4-5) x More than 10 years	-0.062 (0.047)		-0.045 (0.050)		-0.056 (0.039)		-0.050 (0.036)	
Treated x After(1-3) x Length		-0.007* (0.004)		-0.009** (0.004)		0.000 (0.003)		-0.001 (0.003)
Treated x After(4-5) x Length		-0.006 (0.005)		-0.007 (0.006)		-0.004 (0.004)		-0.003 (0.004)
Treated, time period and case group dummies, also in interactions	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE, case FE, calendar year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	359,826	359,826	359,826	359,826	353,768	353,768	353,768	353,768
Number of unique firms	26,434	26,434	26,434	26,434	26,512	26,512	26,512	26,512

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. More than 10 years is an indicator for the closing plant having operated for more than 10 years (in columns (1) and (5)) or having been foreign for more than 10 years (in columns (3) and (7)). Length measures the number of years above one the closing plant has operated (in columns (2) and (6)) or has been foreign (in columns (4) and (8)). Length variables are also interacted with all other indicators. Fixed effects for firm, case and calendar year are also included. The unit of observation is firm-year-case. Standard errors in parentheses are clustered by city. *** p<0.01 ** p<0.05 * p<0.1.

VI.F Aggregate employment effect

In order to capture the aggregate employment effect of plant closures in the local economy, first I check the plant closure effect on the extensive margin. On average, I find no significant effect on either the number or the size composition of entering or exiting firms. Consequently, I only need to add up the within-firm effect I estimated for employment growth. As $E(log(y)) \neq log(E(y))$, I account for heteroskedasticity using the solution suggested by Silva and Tenreyro (2006). I estimate a Poisson regression using the functional form $E(y_i) = e^{\beta X_i}$ with βX_i specified as in equation 3. I add two modifications. First, for ease of computation I don't include firm-fixed effects, but I restrict the sample to firms being already present before the plant closure. As columns (2) and (3) of Table A19 in the Appendix show, OLS estimates with and without firm-fixed effects are similar. Second, I allow for heterogeneity in the effect by size, using 20 and 100 employees two years before the closure as size cutoffs.[20] Table A19 of the Appendix shows the estimated coefficients. For each firm located close to a closing plant I calculate the estimated difference in the period after the closure by subtracting the counterfactual employment level from the observed employment. Then I add up the differences to the level of each case. Firm-level counterfactuals are given by

$$y_{it}^c = \frac{\hat{y}_{it}}{e^{\beta_7 Size\_group_i}} | (Treated = 1, After = 1), \tag{5}$$

where $\hat{y}_{it}$ is the predicted employment for firm i in event-year t, β_7 is a vector of coefficients on the interaction terms of treated location indicator, after closure period indicator and the size group indicators, $Size\_group_i$. I use bootstrap to estimate a confidence interval for the aggregate effects. I find, that in the average case 354 new jobs are created among the incumbent firms 3 years after the closure. As the average number of people being laid off from a single plant is 341, this means that local firms absorb the laid-offs 3 years after the closure. Still, estimates are very noisy, the 95% bootstrap confidence interval is (-189, 897), and there is a large heterogeneity across cases. The aggregate effect of the median case is -187, and I estimate a negative aggregate effect in 27 out of the 41 cases, 22 located in small cities, though only 3 of them are significantly negative. A negative aggregate effect suggests that total employment losses in the local economy are larger than the initial layoff due to the plant closure. In additional 11 cases the aggregate effect on incumbents' employment is positive but significantly lower than the size of the initial layoff, suggesting a negative total effect on local employment. As a comparison, Gathmann et al. (2015) find, that the employment reduction was 3.7% of local employment four years after the layoffs. This is about twice as large as the size of the initial layoffs in their sample, which accounted for about 1.9% of local employment. At the same time, Jofre-Monseny et al. (2015) find, that the total employment effect is only 30-60% of the direct effect.

It is important to note, that the calculated numbers refers to jobs within 10 km agglomeration. It might be the case that local people getting unemployed found jobs outside this circle. While there is no sign of people moving out from these cities, people might travel more to their new workplace, which I cannot

[20] Experimenting with more size groups suggests that it is not worth to decrease group size by dividing the sample further. Estimated effects are similar for the groups 20-50 and 50-100, and there are no significant differences between groups 100-200 and above 200 either.

measure. Additionally, given the large heterogeneity across cases, new entrants might play an important role in some of the cases, even if I estimate no significant effect on average.

VI.G Robustness checks

In this section I show that the main results are robust to several specification changes. First, I include trends in the main specification as I presented in equation 4. Table A20 of the Appendix shows that pre-closure trends are significantly different in treated and control locations. Still, the average decrease in sales remains significant even after controlling for pre-trend differences. At the same time, the effect on employment is not significantly negative any more. Table A21 shows similar results estimating a heterogeneous effect by industry groups. The employment effect is still significantly larger for firms operating in local services and in the supplier industry. Estimated effects are not significantly different any more for firms operating in the same industry as the closing plant, but the patterns are similar to my previous estimates.

Table A22 and A23 of the Appendix show that my results are robust to the exclusion of closures in the crisis period and in the EU accession years. I consider 2003 and 2004 as EU accession years and 2008 and 2009 as the crisis years. There are 12 cases from EU accession years and 11 cases from closure years. The number of remaining cases after excluding these two groups is 18. The magnitude of the short-run effects is somewhat lower and results for firms in the same industry as the closing plant are not significant any more, but the main patterns stay the same. Similarly, Table A24 and A25 of the Appendix show the results after excluding those cases where indebtedness played an important role in the plant closure. There are 7 closures where the press announcements mentioned indebtedness as a crucial factor of the closure. Excluding these cases, average results become even stronger. Results for local services lose their significance, but the main patterns stay the same.

As a further robustness check I do the baseline estimates assigning multiple control cities to each treated city. I take all those cities as controls where a foreign-owned large plant operated in the same 2-digit industry as the closing plant but did not close. I run weighted regressions, where I create the weights using the distance of a control city from the treated in terms of propensity scores. Tables A26 and A27 in the Appendix present the results for all local firms and by industry categories. As the controls are less comparable to the treated, some of the estimated coefficients lose their significance, but the main patterns remain the same. Local firms sell less after the plant closure, firms in the local service industry lose more than the average firm, and firms in the same industry as the closing plant gain on average.

Finally, I look at the baseline effects in a different agglomeration. I take the 20 km radius agglomeration around treated and control cities, excluding the 10 km radius agglomeration I used so far. This shows if there are significant effects of the plant closure beyond a relatively limited area around the city. Table A28 of the Appendix shows the results. The upper panel of Table A28 suggests that the effect of a plant closure is highly concentrated in space. There are no significant differences between the 10-20 km areas surrounding treated and control locations. The lower panel of Table A28 shows similar patterns separately for different industry groups of the local firms. Yet, firms in the same industry as the closing plant seem to be affected negatively, and supplier-industry firms have lower productivity in treated locations. At the same time, most of these effects are only marginally significant.

VII Conclusion

In this paper I look at the effect of large foreign-owned plant closures on nearby firms. For this I use a difference-in-differences approach by comparing firms located near the closing plant and in comparable areas, comparing outcomes before and after the plant closure. I assign control locations to each case using propensity score matching. I find that overall, there is a significantly negative effect on sales and employment. These negative effects are significant even 4-5 years after the plant closure. Foreign-owned local firms are able to benefit from the closures. Low productivity and small firms are hurt the most. Effects are larger in smaller cities and locations with worse economic conditions. Firms providing local services or operating in supplier industries of the closing plant are hurt more than average by the plant closure. This pattern is in line with two potential channels: decreasing local purchasing power and lost input/output linkages. Firms in the same industry as the closing plant seem to gain from the closure. This result suggests that some of the local firms can benefit from the increasing local labor supply. Concerning aggregate effect, there is a large heterogeneity across cases. As a result I cannot find a negative aggregate effect on average, but small cities seem to lose even when looking at aggregates.

As I next step I plan to involve linked employer-employee data in the analysis. With the help of this database I will be able to check if laid-off employees of the closing plants were indeed predominantly employed by firms operating in the same industry. I can also investigate wage effects more precisely, accounting for composition changes in the employees of the affected firms.

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Appendix A - A simple model on the effect of a plant closure

The original model is from Acemoglu et al. (2015), based on the model of Long and Plosser (1983). Here I present a simplified and somewhat modified version, neglecting government purchases ($G = 0$ and $T = 0$). There is an economy with n sectors. Each sector is perfectly competitive, zero profit condition applies. Each sector has a Cobb-Douglas production technology, using labor (l_i) and the output of other sectors (x_{ij}) as input. The production function of sector i is

$$y_i = e^{z_i} l_i^{\alpha_i^l} \prod_{j=1}^{n} x_{ij}^{\alpha_{ij}}, \tag{6}$$

with $\alpha_i^l > 0$ and $\alpha_{ij} \geq 0$. There is a representative household supplying labor (l) and consuming production goods (c_i) with a Cobb-Douglas utility function

$$u = \gamma(l) \prod_{i=1}^{n} c_i^{\beta_i}, \tag{7}$$

where $\frac{\partial \gamma(l)}{\partial l} \leq 0$, $\beta_i \geq 0$, $\sum_{i=1}^{n} \beta_i = 1$, and the budget constraint is

$$\sum_{i=1}^{n} p_i c_i = wl. \tag{8}$$

Decision makers (producers and the representative household) take prices as given.
Compared to Acemoglu et al. (2015) I make two modifications in the model. First, I assume that there is decreasing returns to scale in production, i.e. $\alpha_i^l + \sum_{j=1}^{n} \alpha_{ij} < 1,\ \forall i$. Second, I assume a small open economy, trading with the rest of the world, including other parts of the country and foreign countries as well. Sales within the location occur at a price p_i, and the world price is fixed at p_i^w. I also assume that there is a positive iceberg-type transport cost for both exports (τ_x) and imports (τ_m). As local players are small, transport cost should be paid by them, and foreign transaction partners earn or pay exactly the world price. Then a local importer of a product of sector i has to pay $p_i^w + \tau_m$ and a local exporter in sector i receives $p_i^w - \tau_x$. Local buyers choose to import the product of sector i if $p_i^w + \tau_m \leq p_i$, and local sellers of sector i choose to export their product if $p_i \leq p_i^w - \tau_x$. Let p_i^e denote the equilibrium local price of sector i's product in case of a closed economy. If $p_i^e < p_i^w - \tau_x$, then after opening up the local price will be $p_i = p_i^w - \tau_x$ and there will be exports in sector i (local supply exceeding local demand). If $p_i^e > p_i^w + \tau_m$, then after opening up the local price will be $p_i = p_i^w + \tau_m$ and there will be imports in sector i (local demand exceeding local supply). Otherwise the local price will remain $p_i = p_i^e$ and there will be no trade with the rest of the world (local supply being equal to local demand). I assume that any amount can be exported or imported at the world price (equivalently, supply and demand in the local economy is small relative to the rest of the world).
There is no mobility of labor, the labor market clearing condition is

$$l = \sum_{i=1}^{n} l_i. \tag{9}$$

The market clearing condition in the goods market is

$$y_i = c_i + \sum_{j=1}^{n} x_{ji} + nx_i, \tag{10}$$

where nx_i denotes net exports in sector i. For a non-tradable sector $nx_i = 0$ and the goods market condition of the Acemoglu et al. (2015) paper still applies.
I assume that the closing plant's sector (denoted by i) is an exporter, i.e. $p_i = p_i^w - \tau_x$ and $nx_i > 0$. I also assume that there is relatively low local demand for sector i's product and its export share is large.
The equilibrium conditions are given by the input demand functions from the profit maximization problem

$$l_i = \alpha_i^l \frac{p_i y_i}{w},\ \forall i \tag{11}$$

$$x_{ij} = \alpha_{ij} \frac{p_i y_i}{p_j},\ \forall i, j, \tag{12}$$

the labor supply function from the household's optimization problem

$$-\frac{\gamma'(l) l}{\gamma(l)} = 1, \tag{13}$$

and the consumer's demand for goods from the household's optimization problem

$$c_i = \beta_i \frac{wl}{p_i}, \tag{14}$$

As in the original model, the labor supply function is independent of w or $\mathbf{p}$.

I model a plant closure in sector i as a decrease in the productivity of sector i, i.e. $dz_i < 0$.[21] As in the original model, from the production function we get that after a drop in productivity the supply of sector i decreases. As sector i was an exporter before, selling at price $p_i = p_i^w - \tau_x$, and local demand for sector i's product is low, the price won't change.[22] This results in decreasing revenues of sector i. The few local buyers can buy the product of sector i at the same price as before, so there is no downward propagation.

As sector i produces lower quantity on unchanged price $p_i^w - \tau_x$, it will decrease its demand for inputs x_{ij} and l_i. Supplier industries will get a negative demand-side shock, resulting in an upward propagation of the original shock. This is the channel of "input/output linkages". In this model only those supplier industries are hurt which didn't export before, as demand from the rest of the world substitutes for the lost local demand. Additionally, if there are imports in an industry and local supply is relatively low, a moderate drop in local demand will not affect the price, neither the quantity. In all the other cases (i.e. non-exporter and relatively low-scale importer industries) both equilibrium price and quantity decreases.

Demand for labor decreases, both by industry i and by the supplier industries. As labor supply is fixed, wage should either go down for a new equilibrium in the labor market, or there will be unemployment if the wage cannot decrease to its new equilibrium level. In any case, the income of the household decreases. If wage can adjust to some extent, labor will be cheaper for production and will be used more intensively by local firms. This is the effect of "increased local labor supply". As the income of the household decreases, the household budget constraint will tighten, and consumption from all sectors will decrease. This is the channel of "decreased local purchasing power", which affects the non-trading industries like local services.

Appendix B - Additional figures and tables

[21] Alternatively, I can model a plant closure as an exogenous decrease in the production of sector i. Results remain the same.

[22] The price could increase if local supply decreases so much that the new closed-economy equilibrium price is higher than the export price, but lower than the import price. Still, equilibrium quantity produced (y_i) would decrease even in that case. Then similar results would hold, but there would also be downward propagation of the shock.

Figure A1: The number of cases per event-year which have settlement-level or firm-level data

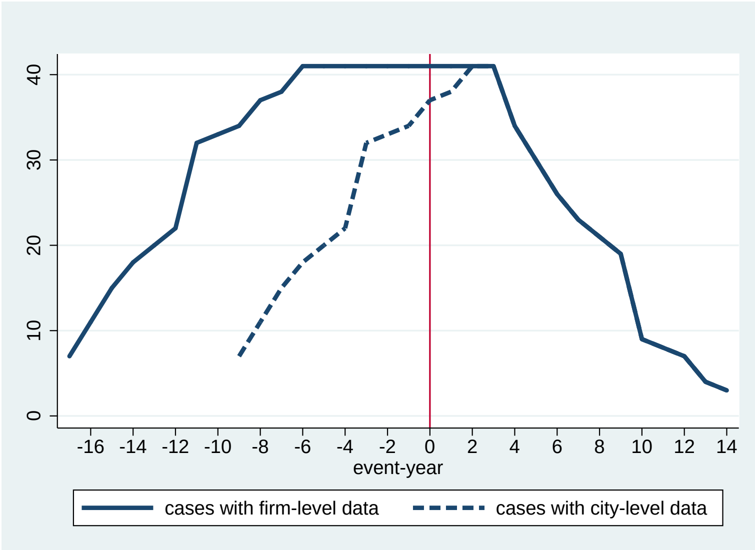
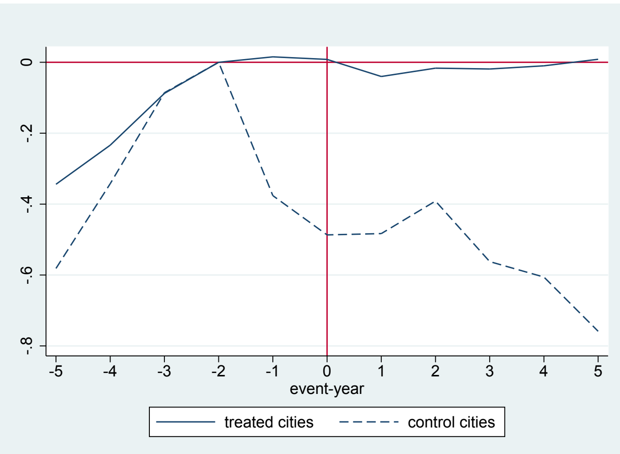
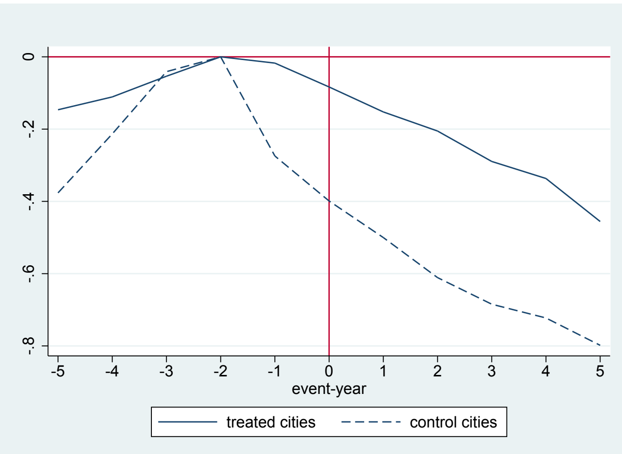


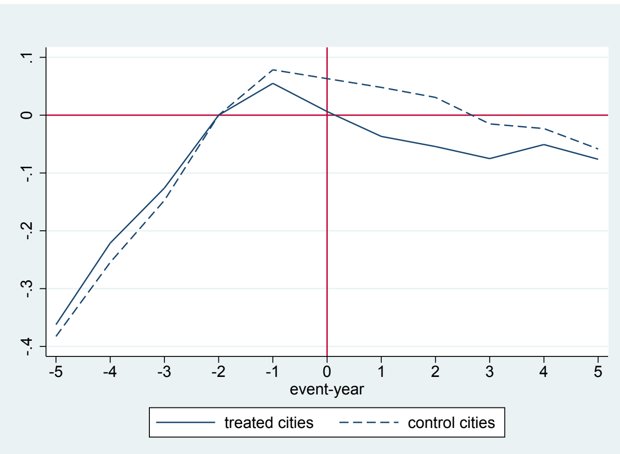
Figure A2: Case-level averages of the log of total employment and sales within 10 km agglomeration, excluding the closing plant, by size group



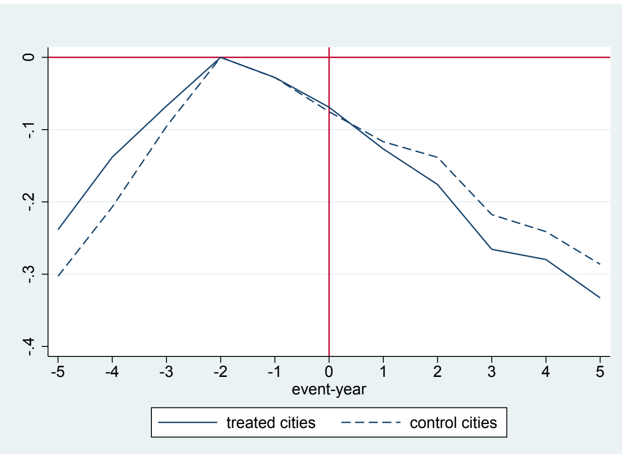
(a) Log sales of firms with more than 100 employees



(b) Log employment of firms with more than 100 employees

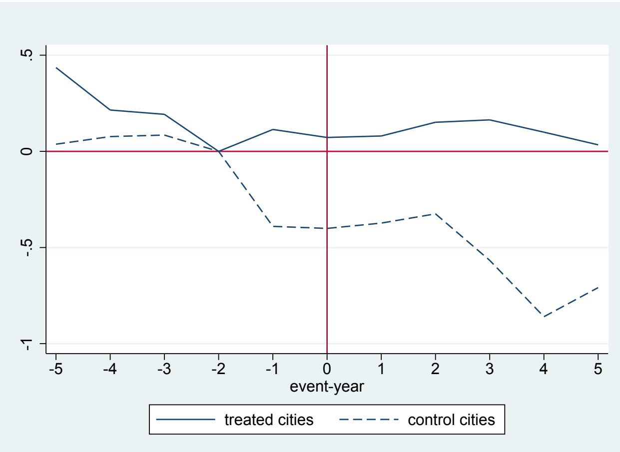


(c) Log sales of firms with 5-20 employees

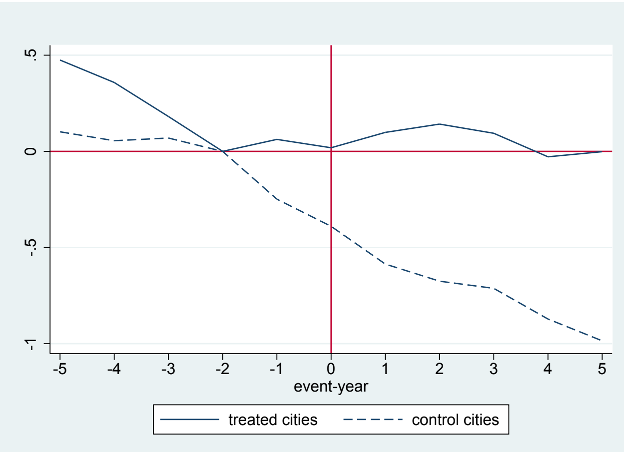


(d) Log employment of firms with 5-20 employees

Figure A3: Case-level averages of the log of total employment and sales within 10 km agglomeration, excluding the closing plant, by industry

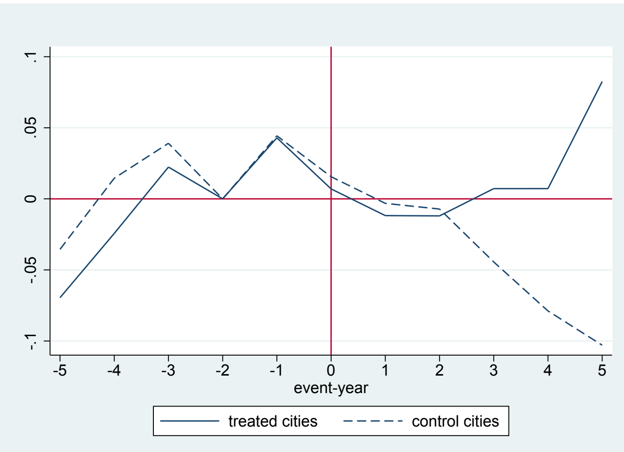


(a) Log sales of competitors



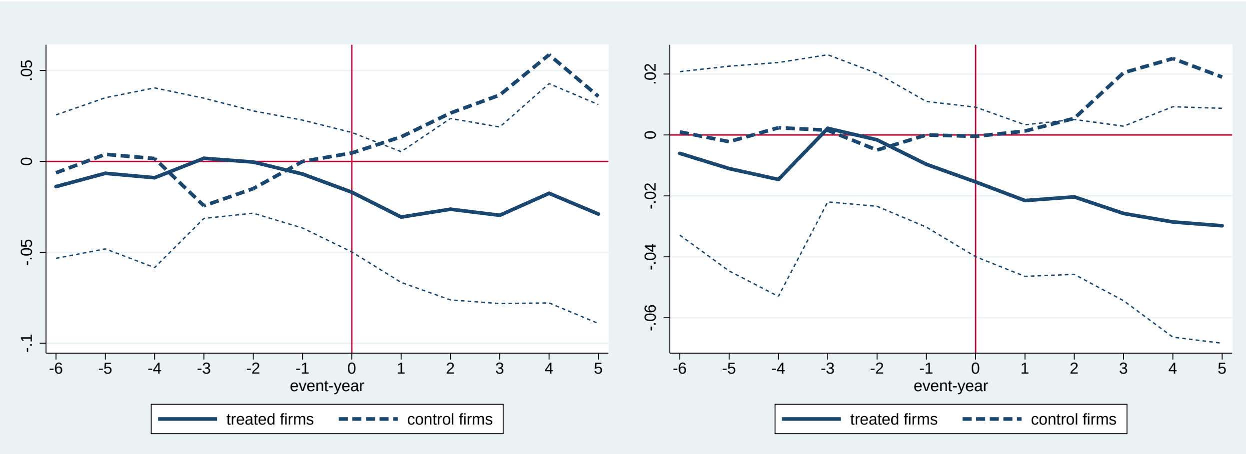
(b) Log employment of competitors

(c) Log sales of supplier-industry firms



(d) Log employment of supplier-industry firms

Figure A4: The yearly evolution of average log sales and employment in treated and control firms, with 95% confidence interval on the treated-control difference, and controls normalized to zero one year before the closure



(a) Sales

(b) Employment

Figure A5: The average move-out rate in treated and control cities around the plant closure

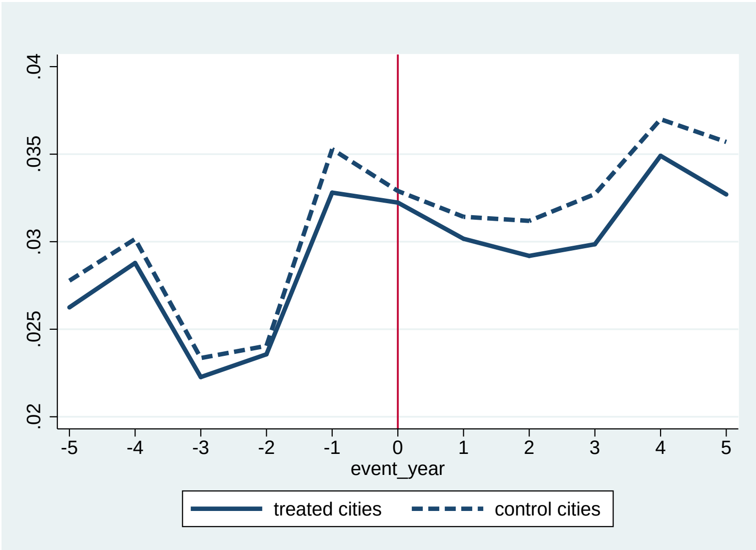


Table A1: The list of treated and control cities with attributes

industry	treated				control				closure date
	city	city size	plant	employees	city	city size	plant	employees	
NACE 1.1 - 15: Manufacture of food products and beverages									
	Nagykanizsa	33910	Dreher	289	Keszthely	13414	Helikorn	182	1999 Dec
	Sárvár	10106	Magyar Cukor (Agrana)	350	Siófok	14709	Sió Eckes	148	1999 Q1
	Jászberény	16972	Corona	180	Keszthely	13150	Helikorn	187	2003 Jan
	Zagyvarékas	2204	Hajdú-Bét	800	Szerencs	6318	Szerencsi Cukorgyár (Béghin-Say SA)	263	2002
	Pásztó	6043	Sole	110	Karcag	13209	Cargill	193	2004 Q1
	Pécs	93118	MiZo	238	Baja	22682	Bácska Agráripari Rt	118	2005 Oct
	Kaba	3924	Eastern Sugar	200	Szeged	100312	SOLE-MiZo	1380	2006 Q4
	Nagybánhegyes	860	Friesland	183	Zichyújfalu	617	Provimi	182	2007 Sept
	Szolnok	46539	Mátra Cukor (Nordzucker)	150	Baja	22662	Csabai Tartósipari Rt (Globus)	175	2007 Nov
	Mezőhegyes	3901	Eastern Sugar	224	Siófok	14709	Sió Eckes	143	1997 Dec
	Sarkad	6418	Eastern Sugar	239	Lajosmizse	6750	Olivia	160	1998 March
NACE 1.1 - 16: Manufacture of tobacco products									
	*Debrecen	128575	Reemtsma	380					2004 Apr
	*Eger	34996	Philip Morris	334					2005 May
NACE 1.1 - 17: Manufacture of textiles									
	Szombathely	52105	Savatex	200	Dombóvár	12874	Pasha	735	2001
	Dunaújváros	32382	Berwin	240	Dombóvár	12480	Pasha	344	2005 Dec
	Kaposvár	40932	Coats	195	Tolna	7345	Tolnatext	247	2007 Nov
NACE 1.1 - 18: Manufacture of wearing apparel; dressing and dyeing of fur									
	*Zalaegerszeg	38733	ZA-KO	1200					2002 Dec
	Bátonyterenye	9090	Hammer	160	Zalaszentgrót	4706	SH Rekord	219	2003 July
	Mezőkövesd	10423	Ruhaipari Szövetkezet	252	Zalaszentgrót	4706	SH Rekord	219	2003
	Ajka	20450	Shoe Makers	175	Zalaszentgrót	4706	SH Rekord	219	2003 Okt
	Vasvár	2842	Styl	160	Rajka	1704	Calida	298	2003 Q4
	Marcali	7738	Mustang	371	Nagykálló	6430	Olimpias	379	2007 March
	Kiskunhalas	18228	Levi Strauss	549	Zalaszentgrót	4515	SH Rekord	212	2009 June
	Nyíregyháza	74946	Berwin	395	Zalaszentgrót	4515	SH Rekord	212	2009 Jan
	Várpalota	13537	Berwin	162	Zalaszentgrót	4586	SH Rekord	212	2008 Sept

Table A2: The list of treated and control cities with attributes - continued

industry	treated: city	treated: city size	treated: plant	treated: employees	control: city	control: city size	control: plant	control: employees	closure date
NACE 1.1 - 19: Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear									
	Bonyhád	9029	Salamander	640	Martfű	4555	Lorenz	706	2003 Oct
	*Szeged	100743	Mary 2000	220					2003 Q3
	Tiszakeszi	1648	Mary 2000	242	Martfű	4555	Lorenz	706	2003 Aug
	Beled	1806	Marc	200	Martfű	4555	Lorenz	706	2003 Q3
	*Körmend	7875	Marc	250					2003 Oct
	Őriszentpéter	793	Marc	200	Martfű	4516	Lorenz	638	2006 Jan
	**Szombathely	50520	Marc	1010					2004 Q4
	Vasvár	2811	Richter	180	Martfű	4418	Lorenz	654	2008 March
NACE 1.1 - 21: Manufacture of pulp, paper and paper products									
	Lábatlan	3232	Piszke Papír (Zeritis)	263	Ács	4250	Hartmann	496	2008 Dec
	Szolnok	46078	Mondi	265	Ács	4290	Hartmann	488	2008 June
NACE 1.1 - 25: Manufacture of rubber and plastic products									
	Komárom	12118	Perlos	1100	Szeged	100977	ContiTech	436	2009 July
NACE 1.1 - 26: Manufacture of other non-metallic mineral products									
	Bélapátfalva	2086	PannonCem	200	Nyergesújfalu	4926	Eternit	182	2000 Sept
	Salgótarján	23568	R-Glass	268	Tapolca	10569	Rockwool	183	2009 Nov
NACE 1.1 - 27: Manufacture of basic metals									
	Miskolc	103155	DAM 2004	878	Ózd	22375	ÓAM	470	2009 March
NACE 1.1 - 29: Manufacture of machinery and equipment n.e.c.									
	Szentgotthárd	5551	GFP Mezőgépgyár	150	Mezőtúr	11428	RAFI	212	2003 Sept
NACE 1.1 - 30: Manufacture of office machinery and computers									
	**Székesfehérvár	65420	IBM Data Storage Systems	3700					2003 Q1
NACE 1.1 - 31: Manufacture of electrical machinery and apparatus n.e.c.									
	Szeged	102218	Kábelgyár (Siemens)	245	Szentes	18877	Legrand	595	1998 Q3
	Szombathely	50520	Philips	800	Gyöngyös	20175	Magnetec	230	2004 Sept
	Eger	34396	Leoni	627	Gyöngyös	19286	Magnetec	260	2008 Aug
NACE 1.1 - 32: Manufacture of radio, television and communication equipment and apparatus									
	Sárbogárd	8012	Mannesmann	845	Tiszakécske	6940	Hechinger	310	2000 Oct
	Tatabánya	43682	Artesyn	370	Tiszakécske	6943	Hechinger	193	2005 Q4
	Kecskemét	68006	DDDK (Bosch)	500	Lőrinci	3499	Bumjin	448	2009 July
	*Szombathely	48189	Laird	700					2009 Q2
NACE 1.1 - 34: Manufacture of motor vehicles, trailers and semi-trailers									
	Székesfehérvár	65420	Ikarusbus	187	Rétság	1985	Enbi	250	2003 Aug

City size is given one year before the plant closure or in 2000 if closure occured before 2001. Plant size is also given around that time when information is available. Plant closures marked by a * are not involved in the final analysis as no comparable control locations could be matched. Plant closures marked by ** are jointly forming a case with another closure happening in the same city and in the same year.

Table A3: Why plants closed?

city	name	country of the owner	why did the plant close?
Ajka	Shoe Makers	Italy (Carmens Holding)	costs (goes to Romania)
Bátonyterenye	Hammer	Germany	costs
Bélapátfalva	PannonCem	Switzerland (Holderbank) and Germany (Heidelberger Zement AG)	market considerations
Beled	Marc	Switzerland (MSC Group)	costs, demand (imports from India)
Bonyhád	Bonsa	Germany (Salamander)	losses, restructuring activities
Debrecen	Reemtsma	UK (Imperial Tobacco Group)	tax increase, demand, EU-accession
Dunaújváros	Berwin	UK	cheap competition
Eger	Leoni	Germany	costs, low prices (goes to Poland)
Eger	Philip Morris	USA	tax increase, demand, EU-accession
Jászberény	Corona	Switzerland (Delimpex)	market conditions
Kaba	Eastern Sugar	UK (Tate&Lyle) and France (Saint Louis Sucre)	EU accession
Kaposvár	Coats	UK	costs, demand (imports from Africa and Asia)
Kecskemét	Digital Disc Drives	Germany (Bosch)	crisis, demand
Kiskunhalas	Levi Strauss	USA	cheap competition, demand
Komárom	Perlos	Taiwan	crisis, demand
Körmend	Marc	Switzerland (MSC Group)	costs, demand and legal issues (imports from Asia)
Lábatlan	Piszke	Greece (Zeritis-group)	making losses
Marcali	Mustang	Germany	costs, restructuring activities
Mezőkövesd	Ruhaipari Szövetkezet		
Mezőhegyes	Eastern Sugar	UK (Tate&Lyle) and France (Saint Louis Sucre)	EU accession
Miskolc	DAM 2004	Ukraine and Switzerland (Donbass-group)	crisis, demand
Nagybánhegyes	Friesland	The Netherlands	concentrate production (to Debrecen)
Nagykanizsa	Dreher	The Netherlands (Fienierr)	concentrate production (to Kőbánya)
Nyíregyháza	Berwin	UK	crisis
Őriszentpéter	Marc	Switzerland (MSC Group)	costs, demand (imports from India)
Pásztó	Sole	Italy	EU accession, concentrate production (to Szeged)
Pécs	MiZo	Cyprus	concentrate production (to Szeged), low prices

Table A4: Why plants closed? - continued

city	name	country of the owner	why did the plant close?
Salgótarján	R-GLASS	Slovakia	debts
Sárbogárd	Mannesmann	Germany	costs (goes to China)
Sarkad	Eastern Sugar	UK (Tate&Lyle) and France (Saint Louis Sucre)	EU accession
Sárvár	Magyar Cukor	Austria (Agrana)	EU accession
Szeged	kábelgyár	Germany (Siemens)	demand, restructuring activities
Szeged	MARY 2000	Italy	debts
Székesfehérvár	IBM	Germany	global demand
Székesfehérvár	Ikarusbus	Italy (IrisBus - Iveco)	competition, lost demand, bad management
Szentgotthárd	GFP Mezőgépgyár	Germany (Küpa)	relocation (goes to Latvia)
Szolnok	Mátra Cukor	Germany (Nordzucker AG)	EU accession
Szolnok	Mondi	international enterprise	low demand, competition
Szombathely	Philips	The Netherlands	relocation (to Székesfehérvár and China)
Szombathely	Marc	Switzerland (MSC Holding)	low demand, high costs, relocation (to China)
Szombathely	Savatex		debts
Szombathely	Laird	UK	lost demand, relocation (to China and Mexico)
Tatabánya	Artesyn	USA	lost demand, relocating buyers (to Romania)
Tiszakeszi	Mary 2000	Italy	debts
Várpalota	Berwin	UK	high costs, recession, drop in demand
Vasvár	Styl	Germany (Bäumler)	concentrate production (to Szombathely)
Vasvár	Richter	Austria	competition, high costs, relocation (to Slovakia)
Zagyvarékas	Hajdu-Bét		debts, competition
Zalaegerszeg	Za-Ko	Austria	debts

Table A5: Pre-closure similarity of treated and controls when multiple controls are assigned to each case

Controls: multiple controls are matched to each case

Pre-closure characteristics	Average for treated	Average for controls	P-value of H0: treated=control
Propensity score	0.31	0.08	0.23 (0.02)
Log working-age population in city	9.44	8.63	0.81 (0.14)
Log working-age population in 30 km	11.80	11.78	0.01 (0.05)
Unemployment rate in city	0.065	0.074	-0.0081 (0.0043)
Unemployment rate in 30 km	0.068	0.072	0.0041 (0.0036)
2-year change in city unemployment rate (pp)	0.0026	0.0012	0.0014 (0.0016)
2-year change in 30 km unemployment rate (pp)	0.0013	0.0012	0.0001 (0.0012)
Buyer-industry share in 30 km	0.090	0.081	0.009 (0.007)
Supplier-industry share in 30 km	0.122	0.116	0.006 (0.009)
Log total sales in 30 km	19.28	19.23	0.049 (0.088)
Average sales growth in 30 km	0.130	0.131	-0.001 (0.005)

Controls are cities with a foreign-owned large firm operating in the same industry as the closing plant. Regressions are weighted by the normalized distance of the controls' propensity score from the treated. Weights of controls within a case sum up to one. Pre-closure characteristics are measured one year before the plant closure. 2-year change in the unemployment rate refers to changes from t-3 to t-1 where t is the year of the plant closure, and it is expressed in percentage points. Working-age population refers to the number of people aged 18-59 on Dec. 31. of the given year. Unemployment rate is the number of registered unemployed on Dec. 20. of the given year, divided by the working-age population. Buyer-industry share is the employment share of firms operating in the buyer industries of the closing plant in total employment. Supplier-industry share is defined analogously. Buyers are industries which use more than 5% of the closing plant industry's output, suppliers are industries of which more than 5% of the closing plant industry's inputs come. Total sales and average sales growth is calculated omitting the closing plant's firm and the foreign-owned large firms in the control cities. Standard errors are in parentheses.

Table A6: The list of supplier industries

List of supplier industries by 2-digit industry
15. Manufacture of food products and beverages
1. Agriculture, hunting and related service activities
51. Wholesale trade and commission trade, except of motor vehicles and motorcycles
74. Other business activities
16. Manufacture of tobacco products
1. Agriculture, hunting and related service activities
21. Manufacture of pulp, paper and paper products
24. Manufacture of chemicals and chemical products
51. Wholesale trade and commission trade, except of motor vehicles and motorcycles
74. Other business activities
92. Recreational, cultural and sporting activities
17. Manufacture of textiles
18. Manufacture of wearing apparel; dressing and dyeing of fur
24. Manufacture of chemicals and chemical products
36. Manufacture of furniture; manufacturing n.e.c.
40. Electricity, gas, steam and hot water supply
18. Manufacture of wearing apparel; dressing and dyeing of fur
17. Manufacture of textiles
31. Manufacture of electrical machinery and apparatus n.e.c.
51. Wholesale trade and commission trade, except of motor vehicles and motorcycles
74. Other business activities
19. Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
17. Manufacture of textiles
18. Manufacture of wearing apparel; dressing and dyeing of fur
74. Other business activities
21. Manufacture of pulp, paper and paper products
40. Electricity, gas, steam and hot water supply
51. Wholesale trade and commission trade, except of motor vehicles and motorcycles
25. Manufacture of rubber and plastic products
24. Manufacture of chemicals and chemical products
74. Other business activities
26. Manufacture of other non-metallic mineral products
14. Other mining and quarrying
23. Manufacture of coke, refined petroleum products and nuclear fuel
24. Manufacture of chemicals and chemical products
40. Electricity, gas, steam and hot water supply
45. Construction
51. Wholesale trade and commission trade, except of motor vehicles and motorcycles
60. Land transport; transport via pipelines
74. Other business activities

Table A7: The list of supplier industries - continued

List of supplier industries by 2-digit industry	
27. Manufacture of basic metal	
	23. Manufacture of coke, refined petroleum products and nuclear fuel
	40. Electricity, gas, steam and hot water supply
	51. Wholesale trade and commission trade, except of motor vehicles and motorcycles
29. Manufacture of machinery and equipment n.e.c.	
	27. Manufacture of basic metal
	28. Manufacture of fabricated metal products, except machinery and equipment
	31. Manufacture of electrical machinery and apparatus n.e.c.
	51. Wholesale trade and commission trade, except of motor vehicles and motorcycles
	74. Other business activities
30. Manufacture of office machinery and computers	
	32. Manufacture of radio, television and communication equipment and apparatus
	74. Other business activities
31. Manufacture of electrical machinery and apparatus n.e.c.	
	25. Manufacture of rubber and plastic products
	27. Manufacture of basic metal
	28. Manufacture of fabricated metal products, except machinery and equipment
	32. Manufacture of radio, television and communication equipment and apparatus
	74. Other business activities
32. Manufacture of radio, television and communication equipment and apparatus	
	31. Manufacture of electrical machinery and apparatus n.e.c.
34. Manufacture of motor vehicles, trailers and semi-trailers	
	28. Manufacture of fabricated metal products, except machinery and equipment
	29. Manufacture of machinery and equipment n.e.c.
	31. Manufacture of electrical machinery and apparatus n.e.c.

Table A8: The list of buyer industries

List of buyer industries by 2-digit industry
15. Manufacture of food products and beverages
1. Agriculture, hunting and related service activities
5. Fishing, fish farming and related service activities
55. Hotels and restaurants
85. Health and social work
16. Manufacture of tobacco products
-
17. Manufacture of textiles
18. Manufacture of wearing apparel; dressing and dyeing of fur
19. Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
18. Manufacture of wearing apparel; dressing and dyeing of fur
17. Manufacture of textiles
19. Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
19. Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
36. Manufacture of furniture; manufacturing n.e.c.
21. Manufacture of pulp, paper and paper products
16. Manufacture of tobacco products
22. Publishing, printing and reproduction of recorded media
25. Manufacture of rubber and plastic products
31. Manufacture of electrical machinery and apparatus n.e.c.
33. Manufacture of medical, precision and optical instruments, watches and clocks
45. Construction
85. Health and social work
26. Manufacture of other non-metallic mineral products
14. Other mining and quarrying
45. Construction
27. Manufacture of basic metal
10. Mining of coal and lignite; extraction of peat
28. Manufacture of fabricated metal products, except machinery and equipment
29. Manufacture of machinery and equipment n.e.c.
31. Manufacture of electrical machinery and apparatus n.e.c.
35. Manufacture of other transport equipment
37. Recycling
29. Manufacture of machinery and equipment n.e.c.
11. Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying
14. Other mining and quarrying
34. Manufacture of motor vehicles, trailers and semi-trailers
30. Manufacture of office machinery and computers
-

Table A9: The list of buyer industries - continued

List of buyer industries by 2-digit industry
31. Manufacture of electrical machinery and apparatus n.e.c.
18. Manufacture of wearing apparel; dressing and dyeing of fur
29. Manufacture of machinery and equipment n.e.c.
32. Manufacture of radio, television and communication equipment and apparatus
33. Manufacture of medical, precision and optical instruments, watches and clock
34. Manufacture of motor vehicles, trailers and semi-trailers
35. Manufacture of other transport equipment
32. Manufacture of radio, television and communication equipment and apparatus
30. Manufacture of office machinery and computers
31. Manufacture of electrical machinery and apparatus n.e.c.
33. Manufacture of medical, precision and optical instruments, watches and clock
34. Manufacture of motor vehicles, trailers and semi-trailers
50. Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel

Table A10: The average number of firms per case in different industry categories

Average number of firms per case within 10km agglomeration

	All	Local services	Competitors	Buyers	Suppliers
Treated locations	602	111	10	35	84
Control locations	361	71	11	42	54

I include firms used in the analysis, i.e. with median employment of 5 or more, omitting outliers with very large sales, firms with a closing plant and foreign-owned large firms in the control settlements. I use the baseline version where I match a single control to each case.

Table A11: Descriptive statistics of firms

Variable	Mean	Standad deviation	Number of observations
sales (1000HUF)	450,915	4,325,328	796,655
employment (capita)	35	266	782,759
per capita yearly wage (1000 HUF)	552	549	714,197
value added per capita (1000 HUF)	2,502	11,402	733,660
total factor productivity	11,587	263,081	719,239
export sales (1000 HUF)	119,340	1,868,755	686,861
exitor dummy	0.10	0.30	797,551
age (years)	8.9	7.4	797,551
capital to labor ratio	6,111	297,261	757,124

Descriptive statistics are based on the largest sample of firms used in the analysis: all firms within the 30 km agglomeration of treated and control cities, when I assign multiple controls to each case. As in the analysis, I exclude the firms of the closing plants and the foreign-owned large firms in the control cities. I also exclude firms with sales in the highest 0.5 percentile. I only include firms with a median employment of at least five. Age is winsorized from above at 65.

Table A12: Heterogeneity of the effect by the size of local firms

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3) x Size(5-20)	-0.076*	-0.031	-0.019*	-0.007	-0.007	-0.001
	(0.040)	(0.029)	(0.010)	(0.009)	(0.005)	(0.003)
Treated x After(1-3) x Size(20-100)	-0.046	-0.023	0.005	0.011	-0.020	-0.008
	(0.035)	(0.021)	(0.022)	(0.009)	(0.019)	(0.005)
Treated x After(1-3) x Size(100-500)	0.068	0.010	-0.001	-0.011	0.042	0.001
	(0.112)	(0.091)	(0.050)	(0.025)	(0.027)	(0.013)
Treated x After(1-3) x Size(500-)	0.639	0.582*	-0.021	0.014	0.219	0.022
	(0.422)	(0.300)	(0.081)	(0.022)	(0.267)	(0.017)
Treated x After(4-5) x Size(5-20)	-0.057	-0.022	-0.031	-0.002	0.006	-0.005
	(0.058)	(0.040)	(0.021)	(0.022)	(0.008)	(0.004)
Treated x After(4-5) x Size(20-100)	-0.126**	-0.070	0.006	0.010	-0.044	0.004
	(0.052)	(0.042)	(0.029)	(0.016)	(0.030)	(0.007)
Treated x After(4-5) x Size(100-500)	-0.039	-0.033	-0.010	-0.025	0.044	0.012
	(0.124)	(0.133)	(0.063)	(0.032)	(0.041)	(0.018)
Treated x After(4-5) x Size(500-)	0.623	0.542*	0.281	0.198	0.116	0.016
	(0.545)	(0.299)	(0.247)	(0.199)	(0.315)	(0.018)
Size group dummies in interactions	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	359,826	353,768	326,784	330,158	353,607	332,702
Number of unique firms	26,434	26,512	25,914	26,142	26,527	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Size(5-20) is an indicator of those firms which had 5-20 employees 2 years before the closure. Size(20-100), size(100-500) and size(500-) are defined in a similar way. All the other right-hand side variables are included only in interactions with the size group dummies. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A13: The number of cases by different categorizations

Number of cases per categories

		Unemployment rate in 30 km agglomeration 2 years before the plant closure	
		low	high
Population of the city 1 year before the plant closure	low	14	15
	high	5	7

		Export share of the closing plant	
		low	high
Size of the closing plant	small	10	14
	large	3	11

Table A14: Differences in the plant closure effect by characteristics of the closing plant

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3)	-0.069*** (0.024)	-0.047*** (0.017)	-0.026** (0.012)	-0.023*** (0.007)	-0.006 (0.010)	0.001 (0.003)
Treated x After(4-5)	-0.099*** (0.029)	-0.088*** (0.024)	-0.013 (0.016)	-0.025** (0.011)	0.004 (0.013)	-0.002 (0.004)
Treated x After(1-3) x HighExpShare	-0.020 (0.038)	0.027 (0.026)	0.016 (0.019)	0.023** (0.011)	-0.017 (0.016)	0.003 (0.005)
Treated x After(4-5) x HighExpShare	-0.014 (0.053)	0.045 (0.037)	-0.006 (0.028)	0.021 (0.024)	-0.024 (0.023)	0.007 (0.007)
Number of observations	328,604	322,860	298,490	301,525	322,823	303,817
Number of unique firms	25,816	25,894	25,306	25,533	25,903	
Treated x After(1-3)	-0.055** (0.027)	-0.023 (0.016)	-0.017 (0.012)	-0.011* (0.006)	-0.008 (0.011)	0.002 (0.003)
Treated x After(4-5)	-0.080** (0.033)	-0.055** (0.022)	-0.015 (0.014)	-0.008 (0.010)	-0.000 (0.012)	0.002 (0.004)
Treated x After(1-3) x LargePlant	-0.019 (0.036)	-0.023 (0.022)	0.017 (0.016)	0.009 (0.010)	0.006 (0.011)	0.001 (0.004)
Treated x After(4-5) x LargePlant	0.001 (0.055)	0.013 (0.034)	0.002 (0.028)	-0.003 (0.019)	-0.001 (0.018)	-0.004 (0.006)
Number of observations	359,826	353,768	326,784	330,158	353,607	332,702
Number of unique firms	26,434	26,512	25,914	26,142	26,527	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. HighExpShare is an indicator of those cases where the closing plant's export share was more than 50% 2 years before the closure. LargePlant is a dummy for cases where the closing plant has more than 300 employees. Interactions of the case group dummy with all the other right-hand side variables are also included. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Column (6) includes firm-year-level characteristics as log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A15: Differences in the plant closure effect by the share of the closing plant in the local economy

Dep. var.:	(1)	(2) Log sales	(3)	(4)	(5) Log employment	(6)
Case group:	baseline	plant share> median	plant share> 15% of 10km employment	baseline	plant share> median	plant share> 15% of 10km employment
Treated x After(1-3)	-0.061***	-0.041	-0.054***	-0.030**	-0.015	-0.033***
	(0.020)	(0.025)	(0.019)	(0.012)	(0.018)	(0.012)
Treated x After(4-5)	-0.077**	-0.033	-0.058**	-0.049**	-0.022	-0.046**
	(0.030)	(0.034)	(0.027)	(0.019)	(0.025)	(0.020)
Treated x After(1-3) x Group		-0.040	-0.052		-0.024	0.034
		(0.038)	(0.076)		(0.030)	(0.060)
Treated x After(4-5) x Group		-0.070	-0.102		-0.026	0.004
		(0.055)	(0.072)		(0.038)	(0.068)
Treated, time period and case group dummies, also in interactions	YES	YES	YES	YES	YES	YES
Firm FE, case FE, calendar year FE	YES	YES	YES	YES	YES	YES
Observations	359,826	359,826	359,826	353,768	353,768	353,768
Number of unique firms	26,434	26,434	26,434	26,512	26,512	26,512

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Group indicator refers to those cases where the share of the closing plant in the local economy is larger than the median share in columns (2) and (5) or larger than 15% in columns (3) and (6). Share is defined as the size of the closing plant compared to the total employment of all other firms within 10 km of the plant. Case group dummies are also interacted with all other indicators. Fixed effects for firm, case and calendar year are also included. The unit of observation is firm-year-case. Standard errors in parentheses are clustered by city. *** p<0.01 ** p<0.05 * p<0.1.

Table A16: Differences in the plant closure effect by the industry of the closing plant

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3)	-0.063*	-0.042*	-0.025	-0.002	-0.003	0.002
	(0.038)	(0.024)	(0.020)	(0.010)	(0.011)	(0.004)
Treated x After(1-3) x Food	-0.012	-0.017	0.007	-0.020*	-0.000	0.000
	(0.037)	(0.034)	(0.025)	(0.011)	(0.010)	(0.006)
Treated x After(1-3) x Textile&Leather	-0.052	0.006	0.018	-0.010	-0.039*	-0.003
	(0.051)	(0.035)	(0.029)	(0.020)	(0.023)	(0.006)
Treated x After(1-3) x Machinery&Equipment	0.043	0.042	0.020	0.009	0.011	0.001
	(0.053)	(0.037)	(0.024)	(0.017)	(0.016)	(0.006)
Treated x After(4-5)	-0.096	-0.046	-0.016	0.001	-0.017	0.006
	(0.091)	(0.052)	(0.031)	(0.025)	(0.034)	(0.011)
Treated x After(4-5) x Food	0.009	-0.061	0.017	-0.016	0.030	-0.007
	(0.089)	(0.056)	(0.036)	(0.027)	(0.034)	(0.011)
Treated x After(4-5) x Textile&Leather	-0.053	-0.011	0.005	-0.007	-0.028	-0.006
	(0.095)	(0.056)	(0.034)	(0.027)	(0.033)	(0.010)
Treated x After(4-5) x Machinery&Equipment	0.026	0.039	-0.033	-0.021	0.023	0.002
	(0.093)	(0.055)	(0.034)	(0.027)	(0.036)	(0.010)
Time period dummies	YES	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES	YES
Industry group dummies in interactions	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	359,826	353,768	326,784	330,158	353,607	332,702
Number of unique firms	26,434	26,512	25,914	26,142	26,527	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Food, Textile&Leather and Machinery&Equipment indicate cases with a closing plant in the corresponding industry. The other right-hand side variables are also interacted with the industry group dummies. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A17: Differences in the plant closure effect by the owner of the closing plant

VARIABLES	(1) log sales	(2) log employment	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3)	-0.071	-0.048**	0.000	0.003	0.030**	0.004
	(0.054)	(0.021)	(0.018)	(0.010)	(0.012)	(0.005)
Treated x After(4-5)	0.024	-0.014	-0.035	-0.043	0.075**	0.004
	(0.065)	(0.048)	(0.046)	(0.029)	(0.033)	(0.012)
Treated x After(1-3) x German-speaking	0.039	0.034	-0.019	-0.006	-0.045	-0.002
	(0.049)	(0.029)	(0.022)	(0.012)	(0.028)	(0.006)
Treated x After(4-5) x German-speaking	-0.063	-0.016	0.023	0.033	-0.088*	-0.003
	(0.068)	(0.053)	(0.050)	(0.041)	(0.047)	(0.014)
Treated x After(1-3) x UK & the Netherlands	-0.059	-0.013	-0.010	-0.030**	-0.048***	-0.004
	(0.058)	(0.029)	(0.024)	(0.013)	(0.018)	(0.007)
Treated x After(4-5) x UK & the Netherlands	-0.180**	-0.088	0.003	0.025	-0.079**	0.003
	(0.079)	(0.055)	(0.049)	(0.034)	(0.037)	(0.013)
Treated x After(1-3) x Mediterranean	0.025	0.036	0.002	0.006	-0.036	-0.002
	(0.070)	(0.041)	(0.026)	(0.014)	(0.026)	(0.007)
Treated x After(4-5) x Mediterranean	-0.092	-0.036	0.022	0.041	-0.087*	-0.002
	(0.081)	(0.073)	(0.053)	(0.032)	(0.047)	(0.013)
Time period dummies	YES	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES	YES
Foreign dummy in interactions	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	334,980	329,436	304,092	307,301	328,871	309,317
Number of unique firms	25,417	25,491	24,921	25,130	25,482	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. German-speaking, UK & the Netherlands and Mediterranean are indicators for a closing plant with owners from specific country groups. German-speaking refers to Germany, Austria and Switzerland, Mediterranean refers to Italy, Greece and Cyprus. Owner group dummies are also interacted with all other indicators. Fixed effects for firm (or 2-digit industry instead in column (6)), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A18: Different characteristics of plant closures by country group

Case group by the owner:		German-speaking	UK & the Netherands	Mediterranean	Others
Number of cases		18	9	6	8
Industry share	Food & tobacco	0.22	0.44	0.33	0.13
	Machinery & equipment	0.28	0.11	0.17	0.13
	Paper & materials	0.11	0	0.17	0.38
	Textile & shoe	0.39	0.44	0.33	0.38
Average years of operation		12.2	13.7	11.5	11.8
Average years of operation as foreign		10	11.4	10	10
Share of cases where plant size compared to the employment within 10km < 15%		0.68	0.78	0.83	0.88
Share of cases where city size < 40,000		0.79	0.67	0.67	0.63
Share of cases with above median pre-closure unemployment rate		0.53	0.56	0.5	0.63

German-speaking group refers to owners from Germany, Austria and Switzerland. Mediterranean group refers to owners from Italy, Greece and Cyprus. Others refer to owners from Taiwan, the USA and multinationals without a clear source country. The employment within 10 km agglomeration is calculated one year before the plant closure and excludes the closing plant. City size and pre-closure unemployment rate also refer to data one year before the plant closure.

Table A19: Comparing OLS and Poisson estimates by size groups for the aggregation

	(1)	(2)	(3)	(4)
Sample	All firms	Firms existing before the closure		
Dep. var.:	Log employment			Employment
Regression:	OLS			Poisson
Treated x After(1-3)	-0.031***	-0.032**	-0.027***	-0.052**
	(0.012)	(0.012)	(0.010)	(0.025)
Treated x After(1-3) x Size(20-100)	0.006	0.007	0.010	0.046
	(0.024)	(0.025)	(0.021)	(0.031)
Treated x After(1-3) x Size(100-)	0.100	0.101	0.077	0.123
	(0.067)	(0.068)	(0.059)	(0.077)
Treated x After(4-5)	-0.037**	-0.035*	-0.025*	-0.016
	(0.018)	(0.020)	(0.015)	(0.028)
Treated x After(4-5) x Size(20-100)	-0.040	-0.045	0.000	0.003
	(0.041)	(0.043)	(0.034)	(0.041)
Treated x After(4-5) x Size(100-)	0.041	0.035	0.008	0.119
	(0.101)	(0.103)	(0.093)	(0.114)
Treated, time period and case group dummies, also in interactions	YES	YES	YES	YES
Case and year FE	YES	YES	YES	YES
Firm FE	YES	YES	NO	NO
Observations	372,121	276,514	276,514	276,514
Number of unique firms	27,787	15,090		

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. In columns (2)-(4) only firms already existing before the plant closure are included. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Size(20-100) refers to firms with 20-100 employees two years before the closure, Size(100-) refers to firms with more than 100 employees. Size group dummies are also interacted with all other indicators. Fixed effects for case (firm in column (1) and calendar year are also included. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(3) standard errors are clustered by city, in cloumn (4) I show robust standard errors. *** p<0.01 ** p<0.05 * p<0.1.

Table A20: Baseline estimates, controlling for pre-trend differences

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated	0.019	-0.036	-0.021	0.012	-0.011	0.002
	(0.074)	(0.035)	(0.036)	(0.014)	(0.024)	(0.002)
Treated x Trend	-0.009*	-0.007**	-0.001	-0.001	0.000	0.001**
	(0.005)	(0.003)	(0.003)	(0.002)	(0.002)	(0.001)
Treated x After	-0.032**	-0.004	-0.011	-0.007	-0.009*	0.001
	(0.016)	(0.010)	(0.012)	(0.007)	(0.005)	(0.004)
Treated x Trend x After	0.001	-0.002	-0.001	0.001	0.002	-0.002*
	(0.008)	(0.005)	(0.004)	(0.003)	(0.003)	(0.001)
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	215,248	213,011	196,210	200,808	211,906	201,259
Number of unique firms	21,687	21,685	21,044	21,402	21,692	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Observations are included only in the period [t-6,t+5], where t denotes the year of the plant closure.Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. After indicates the period [t+1,t+5]. The baseline time period is [t-6,t]. Trend is a simple time trend. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A21: Heterogeneous estimates by industry group, controlling for pre-trend differences

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After	-0.031	0.006	-0.003	-0.007	-0.012	0.003
	(0.024)	(0.015)	(0.016)	(0.008)	(0.009)	(0.004)
Treated x After x Trend	0.001	-0.002	-0.001	0.001	0.002	-0.002*
	(0.008)	(0.005)	(0.004)	(0.003)	(0.003)	(0.001)
Treated x After x LocalServices	-0.070	-0.049*	-0.047*	-0.002	0.001	-0.007
	(0.043)	(0.026)	(0.025)	(0.015)	(0.016)	(0.006)
Treated x After x Competitor	0.093	0.148	-0.050	-0.034	0.020	-0.029*
	(0.131)	(0.105)	(0.062)	(0.038)	(0.069)	(0.015)
Treated x After x Supplier	-0.068	-0.098*	0.006	-0.001	-0.017	0.001
	(0.054)	(0.055)	(0.027)	(0.024)	(0.021)	(0.006)
Treated x After x Buyer	0.062	0.038	0.060*	-0.024	0.049**	0.004
	(0.085)	(0.053)	(0.036)	(0.023)	(0.025)	(0.008)
Treated x After x Trend	-0.070**	-0.037	-0.011	-0.014	0.002	0.001
	(0.035)	(0.027)	(0.018)	(0.012)	(0.013)	(0.004)
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	215,248	213,011	196,210	200,808	211,906	201,259
Number of unique firms	21,687	21,685	21,044	21,402	21,692	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Observations are included only in the period [t-6,t+5], where t denotes the year of the plant closure. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. After indicates the period [t+1,t+5]. The baseline time period is [t-6,t]. Trend is a simple time trend. LocalServices indicate to firms providing local services. Buyer and Supplier indicate firms operating in the buyer or supplier industries of the closing plant. Competitor indicates firms operating in the same industry as the closing plant. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A22: Baseline estimates, excluding EU accession and crisis years

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated	0.027	0.014	0.009	0.010	-0.002	-0.001
	(0.024)	(0.012)	(0.011)	(0.008)	(0.007)	(0.002)
Treated x After(1-3)	-0.047*	-0.033**	-0.010	-0.010	-0.001	0.005
	(0.025)	(0.015)	(0.016)	(0.007)	(0.009)	(0.003)
Treated x After(4-5)	-0.081**	-0.064***	-0.019	-0.007	0.007	0.003
	(0.033)	(0.023)	(0.017)	(0.011)	(0.011)	(0.004)
Time period dummies	YES	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	165,076	162,410	149,905	151,236	162,501	152,682
Number of unique firms	13,682	13,721	13,410	13,523	13,714	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. I exclude those cases where the plant closure occured during the crisis (2008-2009) or around the EU accessior (2003-2004). Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A23: Heterogeneous estimates by industry group, excluding EU accession and crisis years

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3)	-0.028	0.005	-0.002	-0.010	0.005	0.002
	(0.026)	(0.018)	(0.014)	(0.010)	(0.010)	(0.004)
Treated x After(1-3) x LocalServices	-0.016	-0.059*	-0.044	0.005	-0.004	0.001
	(0.037)	(0.031)	(0.029)	(0.016)	(0.013)	(0.008)
Treated x After(1-3) x Competitor	0.056	0.092	-0.086	-0.060	-0.020	-0.007
	(0.134)	(0.109)	(0.068)	(0.058)	(0.046)	(0.021)
Treated x After(1-3) x Supplier	-0.089	-0.173***	0.068***	0.033	-0.026	0.001
	(0.064)	(0.043)	(0.024)	(0.026)	(0.027)	(0.009)
Treated x After(1-3) x Buyer	-0.068	0.021	-0.101**	-0.025	-0.057*	0.005
	(0.108)	(0.068)	(0.043)	(0.022)	(0.031)	(0.012)
Treated x After(4-5)	-0.052	-0.021	-0.023	-0.008	0.012	0.003
	(0.034)	(0.031)	(0.018)	(0.013)	(0.017)	(0.005)
Treated x After(4-5) x LocalServices	-0.026	-0.079**	-0.042	0.023	-0.016	-0.009
	(0.065)	(0.035)	(0.034)	(0.024)	(0.018)	(0.010)
Treated x After(4-5) x Competitor	-0.074	0.048	0.005	0.038	-0.042	0.030
	(0.171)	(0.120)	(0.067)	(0.078)	(0.091)	(0.027)
Treated x After(4-5) x Supplier	-0.182***	-0.210***	0.045	0.017	-0.023	0.015
	(0.069)	(0.055)	(0.040)	(0.031)	(0.025)	(0.011)
Treated x After(4-5) x Buyer	0.010	0.089	0.040	-0.066**	-0.021	-0.019
	(0.155)	(0.111)	(0.064)	(0.033)	(0.034)	(0.014)
Time period dummies	YES	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES	YES
Industry group dummies in interactions	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	165,076	162,410	149,905	151,236	162,501	152,682
Number of unique firms	13,682	13,721	13,410	13,523	13,714	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. I exclude those cases where the plant closure occured during the crisis (2008-2009) or around the EU accession (2003-2004). LocalServices indicate to firms providing local services. Buyer and Supplier indicate firms operating in the buyer or supplier industries of the closing plant. Competitor indicates firms operating in the same industry as the closing plant. The other right-hand side variables are also interacted with the industry group dummies. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A24: Baseline estimates, excluding indebted plants

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated	0.007	0.002	0.004	-0.003	-0.003	-0.002
	(0.009)	(0.007)	(0.005)	(0.003)	(0.004)	(0.002)
Treated x After(1-3)	-0.070***	-0.041***	-0.006	-0.007	-0.002	0.003
	(0.023)	(0.012)	(0.010)	(0.005)	(0.007)	(0.002)
Treated x After(4-5)	-0.072**	-0.060***	-0.012	-0.009	0.007	0.004
	(0.030)	(0.020)	(0.015)	(0.009)	(0.011)	(0.003)
Time period dummies	YES	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	323,548	318,182	293,684	296,863	317,745	298,933
Number of unique firms	25,025	25,097	24,532	24,744	25,105	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. I exclude those cases where indebtedness played an important role in the closure. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A25: Heterogeneous estimates by industry group, excluding indebted plants

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3)	-0.067**	-0.031*	0.000	-0.004	-0.002	0.001
	(0.030)	(0.017)	(0.012)	(0.006)	(0.008)	(0.003)
Treated x After(1-3) x LocalServices	-0.023	-0.036	-0.012	-0.007	-0.002	0.000
	(0.029)	(0.022)	(0.021)	(0.011)	(0.010)	(0.006)
Treated x After(1-3) x Competitor	0.181	0.234**	-0.099	-0.038	-0.018	-0.031*
	(0.134)	(0.093)	(0.065)	(0.038)	(0.043)	(0.016)
Treated x After(1-3) x Supplier	-0.054	-0.072*	0.010	-0.001	-0.021	-0.005
	(0.044)	(0.042)	(0.027)	(0.019)	(0.015)	(0.007)
Treated x After(1-3) x Buyer	0.067	0.052	-0.024	0.009	0.016	0.010
	(0.069)	(0.043)	(0.035)	(0.017)	(0.019)	(0.008)
Treated x After(4-5)	-0.066*	-0.047	-0.011	-0.009	0.011	0.005
	(0.035)	(0.030)	(0.018)	(0.011)	(0.011)	(0.004)
Treated x After(4-5) x LocalServices	-0.017	-0.026	-0.031	0.029	-0.020	-0.010
	(0.048)	(0.032)	(0.031)	(0.022)	(0.014)	(0.008)
Treated x After(4-5) x Competitor	0.153	0.228**	-0.025	0.002	-0.018	-0.008
	(0.156)	(0.111)	(0.066)	(0.062)	(0.069)	(0.023)
Treated x After(4-5) x Supplier	-0.057	-0.110**	0.013	-0.013	-0.036**	0.004
	(0.061)	(0.054)	(0.034)	(0.032)	(0.017)	(0.009)
Treated x After(4-5) x Buyer	0.005	0.057	0.034	-0.043	0.021	-0.010
	(0.111)	(0.083)	(0.047)	(0.030)	(0.025)	(0.011)
Time period dummies	YES	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES	YES
Industry group dummies in interactions	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	NO
Case FE	YES	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO	YES
Firm-year-level characteristics	NO	NO	NO	NO	NO	YES
Number of observations	323,548	318,182	293,684	296,863	317,745	298,933
Number of unique firms	25,025	25,097	24,532	24,744	25,105	

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. I exclude those cases where indebtedness played an important role in the closure. LocalServices indicate to firms providing local services. Buyer and Supplier indicate firms operating in the buyer or supplier industries of the closing plant. Competitor indicates firms operating in the same industry as the closing plant. The other right-hand side variables are also interacted with the industry group dummies. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A26: Baseline estimates with multiple controls

VARIABLES	log sales	log empl	log labor productivity	log per capita wage	exit
Treated	0.010	0.005	0.007	0.003	-0.000
	(0.008)	(0.007)	(0.004)	(0.004)	(0.001)
Treated x After(1-3)	-0.036**	-0.015	-0.016**	-0.005	0.001
	(0.016)	(0.009)	(0.008)	(0.005)	(0.002)
Treated x After(4-5)	-0.036	-0.021	-0.016	-0.010	0.003
	(0.023)	(0.018)	(0.012)	(0.008)	(0.002)
Time period dummies	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Case FE	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO
Firm-year-level characteristics	NO	NO	NO	NO	NO
Number of observations	1,052,303	1,034,647	955,048	964,780	969,656

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Multiple control cities are used, weighted by the distance of propensity score estimates from the treated propensity scores. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A27: Heterogeneous estimates by industry group with multiple controls

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) exit
Treated x After(1-3)	-0.024 (0.018)	-0.010 (0.014)	-0.006 (0.010)	-0.003 (0.005)	-0.002 (0.002)
Treated x After(1-3) x LocalServices	-0.057** (0.023)	-0.021 (0.019)	-0.026 (0.019)	-0.005 (0.010)	0.003 (0.005)
Treated x After(1-3) x Competitor	0.159 (0.104)	0.161** (0.077)	-0.064 (0.061)	-0.017 (0.029)	-0.019 (0.014)
Treated x After(1-3) x Supplier	-0.024 (0.033)	-0.035 (0.035)	0.010 (0.021)	-0.006 (0.014)	0.000 (0.005)
Treated x After(1-3) x Buyer	0.032 (0.050)	0.032 (0.039)	-0.012 (0.032)	0.017 (0.017)	0.006 (0.007)
Treated x After(4-5)	-0.017 (0.025)	-0.012 (0.021)	-0.011 (0.015)	-0.007 (0.010)	0.003 (0.003)
Treated x After(4-5) x LocalServices	-0.076* (0.042)	-0.022 (0.030)	-0.024 (0.030)	0.004 (0.020)	-0.008 (0.006)
Treated x After(4-5) x Competitor	0.133 (0.124)	0.144 (0.099)	0.028 (0.051)	-0.019 (0.043)	0.018 (0.019)
Treated x After(4-5) x Supplier	-0.030 (0.038)	-0.069 (0.042)	0.007 (0.022)	-0.017 (0.025)	0.005 (0.007)
Treated x After(4-5) x Buyer	-0.004 (0.064)	0.045 (0.056)	0.020 (0.034)	-0.014 (0.027)	-0.001 (0.009)
Time period dummies	YES	YES	YES	YES	YES
Treated x Far-away period dummies	YES	YES	YES	YES	YES
Industry group dummies in interactions	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Case FE	YES	YES	YES	YES	YES
Calendar year FE	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO
Firm-year-level characteristics	NO	NO	NO	NO	NO
Number of observations	1,052,303	1,034,647	955,048	964,780	969,656

Sample: firms within a 10 km radius agglomeration, with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. Multiple control cities are used, weighted by the distance of propensity score estimates from the treated propensity scores. LocalServices indicate to firms providing local services. Buyer and Supplier indicate firms operating in the buyer or supplier industries of the closing plant. Competitor indicates firms operating in the same industry as the closing plant. The other right-hand side variables are also interacted with the industry group dummies. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.

Table A28: Baseline estimates in the 10-20 km agglomeration

VARIABLES	(1) log sales	(2) log empl	(3) log labor productivity	(4) log per capita wage	(5) log TFP	(6) exit
Treated x After(1-3)	0.005	0.003	-0.004	-0.004	-0.003	-0.000
	(0.019)	(0.011)	(0.010)	(0.006)	(0.005)	(0.002)
Treated x After(4-5)	0.023	0.005	0.007	-0.001	-0.008	-0.003
	(0.024)	(0.015)	(0.013)	(0.008)	(0.007)	(0.003)
Number of observations	368,143	361,951	332,611	337,580	359,457	337,697
Number of unique firms	21,298	21,375	20,866	21,050	21,349	
Treated x After(1-3)	0.029	0.017	0.013	-0.003	0.005	-0.002
	(0.022)	(0.012)	(0.012)	(0.006)	(0.006)	(0.003)
Treated x After(4-5)	0.043	0.023	0.015	-0.007	0.000	-0.005
	(0.032)	(0.017)	(0.015)	(0.009)	(0.011)	(0.004)
Treated x After(1-3) x LocalServices	-0.037	-0.017	-0.017	-0.018	0.004	0.002
	(0.034)	(0.029)	(0.025)	(0.016)	(0.009)	(0.006)
Treated x After(1-3) x Competitor	-0.125	-0.126*	-0.030	0.035	-0.077**	-0.015
	(0.087)	(0.065)	(0.060)	(0.032)	(0.032)	(0.017)
Treated x After(1-3) x Supplier	-0.039	0.002	-0.052*	0.013	-0.033*	0.003
	(0.042)	(0.040)	(0.028)	(0.021)	(0.017)	(0.007)
Treated x After(1-3) x Buyer	-0.054	-0.042	0.031	-0.003	-0.003	0.013
	(0.057)	(0.049)	(0.042)	(0.022)	(0.018)	(0.009)
Treated x After(4-5) x LocalServices	-0.054	-0.051	0.006	-0.001	0.010	0.003
	(0.051)	(0.034)	(0.034)	(0.018)	(0.014)	(0.007)
Treated x After(4-5) x Competitor	0.030	-0.180	0.071	0.028	-0.060	-0.007
	(0.171)	(0.120)	(0.077)	(0.047)	(0.046)	(0.019)
Treated x After(4-5) x Supplier	-0.026	0.018	-0.050	0.023	-0.043	0.010
	(0.061)	(0.053)	(0.042)	(0.028)	(0.032)	(0.009)
Treated x After(4-5) x Buyer	-0.004	-0.024	0.050	0.019	0.001	-0.004
	(0.089)	(0.079)	(0.076)	(0.026)	(0.030)	(0.011)
Number of observations	368,143	361,951	332,611	337,580	359,457	337,697
Number of unique firms	21,298	21,375	20,866	21,050	21,349	

Sample: firms within a 10-20 km radius agglomeration (excluding the 10 km radius agglomeration), with a median level of employment of at least 5, excluding very large firms, firms with a closing plant and foreing-owned large firms in the control locations. LocalServices indicate to firms providing local services. Buyer and Supplier indicate firms operating in the buyer or supplier industries of the closing plant. Competitor indicates firms operating in the same industry as the closing plant. The other right-hand side variables are also interacted with the industry group dummies. Treated is an indicator of firms being located in the 10 km agglomeration of the closing plant. I include four separate time period dummies: After(1-3), After(4-5) and two Far-away period dummies. The baseline time period is [t-6,t], where t denotes the year of the plant closure. Far-away periods refer to separate dummies for the period more than 6 years before and more than 5 years after the closure. After(1-3) denotes the period [t+1,t+3] and After(4-5) denotes the period [t+4,t+5]. I also include Far-away time period dummies interacted with the Treated dummy. Fixed effects for firm (or 2-digit industry instead in column (6), case and calendar year are also included. Firm-year-level characteristics include log employment, age, log capital/labor ratio, log per capita wage, log TFP and yearly exporter status. The unit of observation is firm-year-case. Standard errors are in parentheses. In columns (1)-(4) standard errors are clustered by city, in cloumn (5) I show bootstrap standard errors and in column (6) standard errors are clustered by firm. *** p<0.01 ** p<0.05 * p<0.1.