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The Impact of Firm-Influenced Vocational Education on Labor Market and Demographic Outcomes

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The Impact of Firm-Influenced Vocational Education on Labor Market and Demographic Outcomes *

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Abstract

This paper examines the impact of a Swedish policy allowing manufacturing firms to influence the curricula of local educational institutions. Our analysis shows that the program has contributed to a significant reduction in youth unemployment, as well as an increase in marriage rates and male fertility rates at the municipality level. We further show that these positive labor market outcomes are due to improved quality and relevance of vocational education, rather than an increase in the number of graduates. However, using data covering the universe of Swedish firms, we find that manufacturing firms in neighboring municipalities saw declines in productivity, suggesting some negative spillover effects of the program.

JEL classification codes: E24, I26, J12, J24

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1 Introduction

It is well-known that the allocation of workers across jobs is critical, with job mismatch and skills shortages being negatively associated with firm productivity, GDP, employment, earnings, and overall efficiency (McGuinness et al., 2018). Findings suggest that skills shortages are becoming increasingly problematic in many countries (OECD, 2016). A practical consequence for firms is often the failure to match available positions with job-seekers. As an example, a 2023 survey of U.S. firms suggests that nearly 50% of companies report having recent job vacancies they are unable to fill. The primary reason cited for these unfilled positions is the lack of qualified labor (National Federation of Independent Business, 2023).

Concomitantly, many countries struggle with high levels of youth unemployment. For instance, in the European Union, the youth unemployment rate was 15% in December 2024, whereas it was close to 9% in the United States.[1] In both the European Union and the United States, these figures are considerably higher than the equivalent unemployment rates across the entire labor force. In addition, the labor market insecurities faced by young workers are considered to be one of the chief reasons behind the significant decreases in marriage and fertility rates observed in many developed countries over the last decades. These trends are particularly pronounced for individuals without college education.

In this paper, we evaluate a policy program in Sweden designed to decrease youth unemployment by facilitating matching between manufacturing firms and workers, and reduce skill shortages within firms. The purpose of the program, known as *TeknikCollege* (TC), is to allow for firms to influence the curricula of local vocational institutions, chiefly three-year public high schools. This is done through a formal agreement between firms, education providers, and municipalities. By adjusting vocational programs to align more with the demands of local firms, the structural mismatch in the local labor market is expected to decrease. We will consider aggregate skill shortages by examining the impact of the program on unemployment and vacancy rates. The key idea is that a situation in which unemployment and vacancy rates are simultaneously high signals a structural mismatch in the labor market. If the TC program is successful, we anticipate a decrease in unemployment rates, and an increase labor market participation among recent high school graduates. Additionally, an improvement in job matching should lead to a decrease in vacancy rates among local employers. Finally, we would expect marriage and fertility rates to increase in treated municipalities, as lower unemployment rates make previously unemployed workers more desirable on the marriage market, raising marriage rates and fertility.

A common challenge in evaluating labor market policies implemented at the local level is that municipalities tend to self-select into the policy. This is also true for the TC pro-

[1] Data sources: Eurostat and the U.S. Bureau of Labor Statistics, respectively.

gram. To address this issue, we use a feature shared by most participating municipalities, namely that they are small in terms of population and share a local labor market with neighboring communities. As a result, the implementation of the program in one municipality is likely to generate positive spillovers for the manufacturing sector in neighboring municipalities—such as a greater abundance of skilled workers—without the neighboring municipalities influencing the timing of treatment. Thus, instead of focusing only on the effect of the policy in the treated municipalities, we examine its impact on both the treated municipalities and their neighbors. To further address endogeneity concerns, we estimate a third specification that examines the impact on neighboring municipalities only.[2]

Estimating a staggered difference-in-differences model, our results indicate that the TC program contributes to a significant reduction of youth unemployment rates, both when considering treated and neighboring municipalities jointly, as well as separately. The effects on youth unemployment commence after about five years, which is expected given that Swedish high school education is normally three years. After eight years, youth unemployment rates are approximately two–three percentage points lower in both treated and neighboring municipalities. The decline in youth unemployment rates was particularly pronounced in municipalities with an above-median proportion of residents with a foreign background, as well as in those with an above-median share of highly educated residents. Turning our attention to demographic outcomes, we first show that the program increased marriage rates. The size of this effect is equivalent to a 5% increase relative to the average marriage rate. Finally, we show that the program is associated with a moderate increase in male fertility, while there are no significant effects on female fertility. The increase in male fertility is equal to around 0.03 children, which is equivalent to slightly less than 2% of the mean fertility.

Examining potential channels, we first show that labor market participation did not increase as a result of the program, suggesting that the program improved matching among workers already in the labor force, rather than increasing the size of the labor force. In addition, we show that the decrease in unemployment is limited to the 20–24 age group, indicating that there was no decrease in overall unemployment. We also provide some evidence in favor of decreasing vacancy rates, although the effects on vacancy rates are smaller in magnitude than the effects on youth unemployment. Taken together, these findings support the hypothesis that the observed decrease in youth unemployment is attributable to the TC program, rather than some other initiative aimed at reducing overall unemployment. To further address the concern about concurrent labor market interventions, our analysis shows no indication that the policy influenced munici-

[2] A similar empirical approach is employed, for instance, by Lieber (2014) to study the spillover effects on the quality of physicians following medical reforms in neighboring regions, and by Bratti et al. (2020) to study the effects of refugee allocation on neighboring municipalities.

pal spending on other labor market programs. Finally, there was no concomitant increase in the number of newly-established firms per capita, or in graduation rates from vocational schools. This result suggests that the TC program is associated with a qualitative increase in the education provided, not in the number of graduates.

We also analyze the effects on local manufacturing firms, focusing chiefly on firms in neighboring municipalities. While these municipalities benefit from lower youth unemployment rates, a potential issue arises if the TC program leads to an outflow of talented workers, causing negative effects for firms in these communities. Notably, workers may commute daily to TC-treated municipalities while continuing to reside in their home municipalities. Using a firm-level dataset covering the universe of Swedish manufacturing firms, we find a small and positive, albeit statistically insignificant, effect on profit margins for firms in treated municipalities. However, for firms in neighboring municipalities, we find significant negative effects on profit margins, productivity, and wages. The largest negative effects in neighboring municipalities are found for productivity, which decreased by approximately 1.6% following the implementation of the TC program. This outcome is consistent with talented workers taking jobs in TC-treated neighboring municipalities, rather than remaining in the manufacturing sector within their home municipalities.

This paper contributes to the literature in a number of different ways. The vocational education provided by TC is broadly a type of active labor market program (ALMP). There is a wide scholarly discussion on the effects of ALMPs on unemployment and job matching (see for example, Card et al. (2010), Card et al. (2018), or Vooren et al. (2019) for meta-analyses). Overall, the results of these previous studies suggest that there is considerable heterogeneity in terms of the success rate of ALMPs. This may be influenced, for instance, by timing, target group, and the institutional setting. An important difference between the TC program studied in this paper and traditional on-the-job training programs is that in the latter, training is provided by firms at the workplace. In the TC program, firms shape the high school education to better align with their needs. In addition, since first-year high school students in Sweden are typically 16 years old, this program feature enables firms to engage with potential future employees at an earlier stage, which facilitates early screening. Thus, the TC program differs in many aspects from other ALMPs previously studied in this literature.

Similarly, we contribute to a strand in the literature examining the impact of ALMPs that are particularly designed to target young or disadvantaged work seekers (Caliendo and Schmidl, 2016; Carranza et al., 2022; Wheeler et al., 2022). These programs are often considered to be particularly important, partially because of persistently high unemployment rates faced by young adults in most of Europe (OECD, 2016). In the Swedish context, two recent studies evaluate the effects of a public summer employment program for teenagers, and a public employment program targeted at immigrants, respectively (Mörk et al., 2022; Knutsson and Tyrefors, 2024). However, both of these studies find

that the long-term upside in terms of employment of such programs is relatively limited. An additional reason for the importance of ALMPs targeted towards young work seekers is their potential ability to improve marriage market outcomes, including fertility. As mentioned previously, global fertility rates have declined considerably over the past decades, and there is widespread agreement that economic insecurity is one of the chief reasons behind why couples delay family formation (Cohen et al., 2013; Modena et al., 2014; Clark and Lepinteur, 2022). Similarly, having a stable employment is regarded by many as being desirable, or even necessary, trait in a potential partner (McClintock, 2014). Thus, securing employment as a result of the TC program may increase an individual's prospect for success on the marriage market. We add to this literature by showing that the TC program contributes both to improving labor market outcomes, as well as increasing marriage rates and male fertility.

Moreover, the paper relates to previous research about aggregate skill mismatch and skill shortages (Cappelli, 2015; Brunello and Wruuck, 2021; Baley et al., 2022), and in particular, the substrand that deals with its relationship with aggregate unemployment (Şahin et al., 2014; Barnichon and Zylberberg, 2019; Sasser Modestino et al., 2020). Overall, this literature suggests that skills mismatch is an important explanation behind structural, as well as frictional, unemployment. Our contribution to this literature is related to the role of the TC program in reducing skills mismatch. While the program has led to decreased youth unemployment and vacancy rates, there was no associated change in the labor market participation rates, suggesting that the program has decreased aggregate skills shortage. Thus, the majority of the reduction in youth unemployment can be attributed to a decrease in structural unemployment. However, our findings further suggest that the program also improves matching by letting firms meet the students at an early stage in their vocational education, thus facilitating screening and decreasing frictional unemployment. In this regard, our work is related to a wide set of papers examining various policy programs aimed at decreasing unemployment rates by alleviating labor market mismatches (Altmann et al., 2018; Marinescu and Rathelot, 2018; Ben Dhia et al., 2022; Kiss et al., 2023).

Finally, as the program involves manufacturing firms, the results of this paper relate to a subset of the literature about ALMPs targeted specifically at tis sector (Konings and Vanormelingen, 2015; Adhvaryu et al., 2023). While the manufacturing sector remains an important component of many Western economies, the share of the labor force employed in manufacturing has declined significantly over the past decades (Rodrik, 2016). Additionally, although many displaced manufacturing workers have found employment in other sectors, previous research has suggested that occupation switching due to deindustrialization is related to a wide range of negative consequences both for the individual and for society as a whole. These include wage losses (Ebenstein et al., 2014), higher levels of income inequality (Mehic, 2018), and increasing political polarization (Autor

et al., 2020). Considering that access to qualified labor is crucial for the competitiveness of the manufacturing sector, the findings in this paper suggest that vocational training programs such as the TC may help to alleviate some of the concerns about skills supply faced by firms. By extension, similar vocational training initiatives could also reduce the likelihood of firm closures or offshoring, as they address the important challenge of sourcing skilled labor.

The rest of the paper is structured as follows. Section 2 provides some institutional background. Section 3 presents the data, while Section 4 describes the empirical strategy. The results are presented in Section 5, with Section 6 discussing potential mechanisms. The paper concludes with Section 7.

2 Institutional Background

The *TeknikCollege* (TC) program was initiated in 2006 by the Swedish Industry Council, a non-profit organization composed of representatives from manufacturing firms and labor unions.[3] The purpose of the TC program is to facilitate labor market matching by involving local firms in the curricula of local educational facilities, as well as offering students internships and, potentially, employment after graduation. A vast majority, around 91%, of TC-certified institutions are senior high schools, where the students are aged 16–19. In Sweden, students who graduate from vocational high schools are not directly eligible for university education (MYH, 2021)[4]. Graduates from such programs are therefore more likely to enter the labor market immediately after completing their high school education.

As mentioned previously, receiving TC certification requires an agreement between schools and firms. Unless the educational facility is a charter school, the local municipality also needs to be part of the agreement.[5] In practice, most TC-certified schools are located in small municipalities heavily reliant on large manufacturing facilities owned by multinational firms. Notably, there are no TC-certified schools in Stockholm, which accounts for over one-third of Sweden's GDP. The focus on large multinational firms as partners is likely to be attributed both to the bureaucratic procedures required to establish connections with municipalities and educational institutions, as well as with

[3]The Industry Council was established in 1997, originally to monitor a major collective bargaining agreement between manufacturing firms and unions.

[4]Since 2023, regulatory changes have allowed graduates from vocational high schools to become eligible for university admission. However, this policy shift does not affect this study, as it focuses on a period prior to these reforms.

[5]Since the early 1990s, primary and secondary schools in Sweden have been the responsibility of the municipalities, and not the state. Primary education is nine years in length, while secondary education is normally three years.

the challenge small firms face in meeting students' expectations for internships.

While the TC program contains elements of traditional on-the-job training policies, such as firms offering internships and summer jobs to students enrolled in TC-certified institutions, the main novelty of the program involves firms influencing the structure of the courses offered to students. Based on our discussions with principals of TC-certified high schools, we identified several ways in which local manufacturing firms influence the educational programs. First, practical elements of the coursework are given directly on-site at the firms, with teachers often working at the firms. These teachers are often involved in in-service courses for employees in the firms, ensuring that the training provided to firm employees is also available to students. Secondly, employees at the firm may be involved in teaching at the school, and not just at the firm's premises. Finally, firms financially support the schools in purchasing machinery and other technical tools to ensure that educational content aligns with industry requirements.

The targeted high schools can be both municipality-operated schools, and charter schools, which receive government funding but are not directly operated by municipalities. Two examples of TC-certified charter schools are the Hitachi High School in Ludvika, and the Volvo High School in Skövde.[6] In these two cases, the entire school is TC-certified, and students are guaranteed a position at the respective firms after graduation. For municipality-operated high schools, which are normally larger in terms of the number of enrolled students, there could be certain vocational tracks that are TC-certified, while others are not.

Regardless of whether schools are public or charter-operated, admission to Swedish senior high schools is based solely on grades from junior high school (ninth grade). Since our analysis includes neighboring municipalities in addition to treated ones, it is important to note that students are allowed to apply to schools in other municipalities, not just those in their own. Also, if a student living in municipality A attends a high school in another municipality, say B, municipality A is required to compensate B for the cost of that student's education. This also includes the cost of public transport associated with the student's commute between the two municipalities (Ch. 16, § 50, Swed. Law 2010:800, 2010). Inter-municipal commuting for high school education is relatively common, and consequently, most municipalities cooperate regionally to facilitate admissions. For example, in Scania, Sweden's southernmost county, all 33 municipalities use a unified admissions website for senior high schools.

[6]The manufacturing sector in Ludvika (pop. 15,614) and Skövde (pop. 39,580) are dominated by Hitachi and Volvo, producing electrical transformers, and engines for cars and trucks, respectively.

3 Data

3.1 Policy Data

As of 2025, there are TC-certified schools cooperating with large multinational firms in 24 out of Sweden's 290 municipalities. An additional 124 municipalities border a TC-treated municipality. Most municipalities joined the program between 2006 and 2009, which results in a staggered treatment. Of the TC-certified vocational programs, 91 percent are at the high school level, while the remaining nine percent are at the vocational university level. The time period considered ranges from 1997 to 2021. Thus, the panel data tracks 290 municipalities over 25 years.

3.2 Outcome Variables and Covariates

Our study evaluates the policy effect primarily through labor market outcomes at the municipality level. For further analysis, we will also address demographic outcomes, as well as municipality spending on labor market programs. For the outcome variables, we draw data from the Swedish Statistics Agency. The labor market outcomes include the total unemployment rate, defined as all unemployed individuals in a municipality in a given year, and the total labor market participation rates, defined as all individuals in a municipality who have worked in a given year divided by the population. In addition to analyzing the effects on aggregate unemployment and labor market participation rates, we evaluate the effects on employment on the subgroup most likely to be impacted by the policy, namely those aged 20–24.

For the demographic outcomes, we use annual data on marriage rates and fertility for each municipality. The data on fertility refers to the total fertility rate, and is available for both males and females.[7] The educational outcomes include the share of individuals with a high school degree, and the share with a vocational university degree, respectively. These variables will allow us to examine if the willingness to study vocational education increased after the policy implementation. Finally, we use data on municipality spending on local labor market programs to rule out the impact of any labor market interventions other than TC on our results. Descriptive statistics for all outcome variables are reported in Table A1 of Online Appendix A.

[7] A note on terminology: While the total fertility rate (TFR) is normally defined as the average number of children that are born to a woman over her lifetime, the Swedish Statistics Agency also provides an analogous measure for male TFR, which is the average number of children fathered by a man over his lifetime. In developed countries, a female TFR of 2.1 births is required in order for the population to remain stable, assuming no migration.

3.3 Firm-Level Data

To analyze outcomes at the firm level, we use administrative data from the Swedish Statistics Agency. The dataset consists of yearly observations covering the universe of Swedish firms and includes firm-level variables such as wages, sales, the number of employees, value added, and several key financial ratios, including the profit margin. We restrict the sample to firms within the manufacturing sector, resulting in slightly fewer than three million observations. Using the municipality identifier for each firm, we classify firms based on whether they are located in treated or neighboring municipalities. However, since the data is anonymized, we cannot directly identify individual firms.

4 Empirical Strategy

The staggered implementation of the policy from 2006 to 2021 implies that municipalities were treated at different times. A potential problem with analyzing the causal effect of the policy arises from the fact that municipalities self-select to treatment, introducing the possibility of self-selection bias. In addition, many of the treated municipalities are small in terms of population, making it possible for workers to commute from neighboring municipalities to the treated ones. This suggests that neighboring municipalities are also likely to benefit from the policy, as the commuting of workers can spread the policy's effects beyond the treated municipality. Consequently, the results may be biased if the control group includes municipalities that are neighbors of the treated ones.

To address these potential issues, we examine the effects of the policy both on the treated and neighboring municipalities, as well as in the treatment and neighboring municipalities separately. Figure 1 illustrates the idea, displaying the northwestern part of Västra Götaland County, which is Sweden's second-largest county by population. There are two treated municipalities marked in gray, while the neighboring municipalities are in blue. The never treated municipalities, which serve as the control group in our staggered difference-in-difference framework, are marked in white. Figure A1 of Online Appendix A displays a similar map for the entire country.

The conventional method to estimate the average treatment effect of a policy is through a two-way fixed effect regression (TWFE). This approach involves comparing outcomes of differently treated groups over time, while controlling for both group-specific and time-specific fixed effects. However, TWFE assumes a uniform treatment effect across groups and over time, and may be subject to bias with a staggered treatment (de Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2021). To circumvent this issue, we employ the methodology proposed by Callaway and Sant'Anna (2021). This method focuses on comparing those treated in a specific year to those not yet treated in that year. It begins by assessing the differences in outcomes between the post-treatment

year and the year before treatment for the treated group. These differences are then compared to those not-yet treated over the same period. We may then calculate the average treatment effect on the treated (ATT). Additionally, the average treatment effects for each treatment and outcome year combination are aggregated to produce an event-study estimate.

The event-study analysis in this paper is designed with a window of 15 pre-treatment and 15 post-treatment periods for the municipalities. This ensures a balanced count of treated municipalities in pre-treatment average treatment effects and captures the dynamic effects post-treatment. Finally, the standard errors are clustered on the municipality level. Thus, the model specification for the event-study model is

$$y_{it} = \alpha_i + \gamma_t + \sum_{e=-15}^{t=-1} \delta_e D_{it}^e + \sum_{e=0}^{15} \beta_e D_{it}^e + \varepsilon_{it} \tag{1}$$

Where y_{it} is the outcome for the municipality i at year t, α_i are the municipality fixed effects, γ_t are the time fixed effects, D_{it}^e is an indicator for a municipality i being e periods away from the initial treatment at year t, and ε_{it} is an error term. The coefficient of interest that estimates the average post-treatment ATTs is β_e where $e > 0$.

There are several ways of aggregating the group-time average treatment effects into an overall average treatment effect. A simple approach, which we denote ATT_{simple}, is to calculate the weighted average of all group-time average treatment effects. However, this approach tends to place more weight to municipalities treated earlier (Callaway and Sant'Anna, 2021). An alternative approach involves calculating the average effect for each municipality across all time periods, and then average these effects across all municipalities. The resulting average treatment effect, denoted ATT_{APT}, takes into account the dynamic structure of the model, and can be interpreted similarly to the average treatment effect in a standard difference-in-differences setup with two groups and two periods.

5 Results

5.1 Identifying Assumptions

The most crucial identifying assumption in a difference-in-differences analysis is the parallel trends assumption. This assumption implies that in the absence of treatment, the trend in outcomes for the treated group would have followed that of the untreated group, emphasizing that the treatment is the only differentiating factor. Although impossible to validate by definition, demonstrating no significant differences in trends prior to treatment can strengthen its validity. To evaluate this, we will use the Callaway and Sant'Anna (2021) event-study estimates of average pre-treatment ATTs and graphical analysis. The insignificant average pre-treatment ATTs in Table 1 and Table A2 of Online

Appendix A suggest that the parallel trends assumptions hold for all outcome variables at the municipality- and region-level. Evaluating the insignificant pre-treatment point estimates in Figures 2, and Figures 3 further validate these results.

Another essential assumption for the analysis is the absence of compositional changes in the municipalities pre- and post-treatment. This means the policy should not alter the characteristics of the municipalities beyond its intended effects. To verify this, we will examine the impact of the policy on net domestic migration per municipality.[8] If there are no compositional changes following the implementation of the policy, we would expect no significant change in migration patterns between municipalities. Table A3 of Online Appendix A when applying a similar event study approach as before, and find no statistically significant effects of the program on migration patterns.

5.2 Main Results

After providing evidence supporting the validity of our identifying assumptions, this subsection analyzes the effects of TC treatment in the labor markets of neighboring municipalities. First, we analyze the effect on the youth unemployment rate. The event-study plots for ten pre- and post-periods are shown in Figure 2, and are presented separately for the treated and neighboring municipalities, as well when considering the treated and neighboring municipalities jointly. Since high school education in Sweden is three years, immediate changes in youth unemployment are not expected. Consistent with this, the results in Figure 2 indicate that the negative effects on youth unemployment begin to emerge approximately five years after implementation. Because there are fewer treated municipalities than neighboring municipalities, the confidence intervals for treated municipalities are wider. However, the point estimates for treated municipalities suggest a larger negative effect, as anticipated. By the end of the ten-year period, youth unemployment rates are approximately three percentage points lower in treated municipalities and about two percentage points lower in neighboring municipalities, with the control group in both cases consisting of never-treated municipalities.

Figure A3 of Online Appendix A presents the corresponding event-study diagrams for the total unemployment rate. There are no significant effects on the total unemployment rate, with the point estimates positive in the first few years after implementation, and becoming marginally negative around eight years after implementation. While the increase in total unemployment may seem surprising, it is likely to be explained by firms substituting older workers, whose skills may be obsolete, with younger workers trained

[8]This variable refers to permanent migration and excludes, for example, students who commute between municipalities during the school day. Although the net domestic migration rate should be zero by definition, the average value of this variable is 0.27%. Since we are using unweighted values, this is in line with expectations, as smaller municipalities are more likely to have a positive emigration rate.

under the TC program. This substitution may cause short-term frictions, resulting in increased aggregate unemployment.

To summarize the results numerically, Table 2 presents the ATT estimates. We note a statistically significant decrease of approximately 1.5 percentage points in the unemployment rate among individuals aged 20–24 with a high school degree when treated and neighboring municipalities are analyzed jointly. For the total labor market participation rate, there is a decrease of approximately 0.3 percentage points for treated and neighboring municipalities combined, and a decrease of 1.0 percentage points when considering treated municipalities alone. The ATT estimates for the total unemployment rate and youth labor market participation rate are statistically insignificant and numerically close to zero.

Our main specifications do not include time-variant municipality covariates. Table A4 of Online Appendix A augments specification (1) by including the population, average income, working-age population share (aged 20–64), and the share of the population without a high school degree as covariates. The coefficient estimates are impacted only marginally by the inclusion of these covariates.

5.3 Additional Results

1. *Heterogeneous Effects*

We begin by examining whether there are any heterogeneous effects on youth unemployment rates depending on pre-treatment municipality characteristics. To do this, we split the sample based on whether the municipality is above or below the median value of the municipal characteristic in question. As municipality characteristics, we consider the population of the municipality, the share with foreign background, and the share with at least some college education.[9]

The results are presented in Table 4. Overall, there are significant heterogeneities across municipalities. Specifically, the effect of treatment on youth unemployment rates is only significant for municipalities with above-the-median populations, above-the-median shares with foreign background, and above-median shares with college education. The reduction in youth unemployment is approximately two percent in municipalities with an above-median proportion of residents with a foreign background. This suggests that the program may be a useful tool for facilitating the integration of immigrants. On the other hand, the decrease in youth unemployment is close to five percent in municipalities with above-median shares of college-educated residents. One possible reason for this is that the knowledge of the TC program is likely higher among students with college-educated parents, so that the program is less effective in areas with a lower proportion of college-educated individuals.

[9]See Online Appendix B for additional details on the definitions of these variables.

2. *Impact on Marriage and Fertility*

From here, we continue by evaluating the impact on demographic characteristics. The empirical strategy is the same as previously, with the left-hand side of (1) replaced by the marriage rate, and the male and female fertility rates. Table 5 reports these results. First, treatment is associated with, on average, a 0.024 percent age point increase in the marriage rate when considering the treated and neighboring municipalities jointly. This coefficient is significant at the 1% level. The average annual marriage rate is equal to around 0.44%, meaning that the coefficient is equivalent to a 5.5% increase relative to the mean. The results are similar when considering the treated and neighboring municipalities separately, with the coefficient slightly larger in magnitude for the treated municipalities.

The impact on fertility is more ambiguous, with a significant effect on female fertility on the 10% level only for the treated municipalities. However, the magnitude of the coefficient for male fertility is numerically slightly larger and significant. These estimates suggest that TC treatment increases male fertility by slightly less than 0.04 children. Since the mean fertility is 1.68 children per man, the treatment effect can alternatively be interpreted as being associated with a 2.2% increase in fertility relative to the mean. The larger magnitude of the coefficient for male fertility is expected, given that the manufacturing sector, which is the primary target of the TC program, is male-dominated.

5.4 Robustness Checks

In this section, we conduct several tests to ensure the robustness of our main findings. First, we assess the parallel trends assumption by analyzing pre-treatment ATTs, again using the Callaway and Sant'Anna (2021) event-study estimates. The insignificant pre-treatment ATTs, displayed in Table A2 of Online Appendix A, indicate no significant differences in outcome variables between the treatment and control groups prior to treatment, supporting the assumption for all outcome variables.

Second, we conduct a placebo test by estimating equation 1 with unemployment rate among individuals aged 20–24 with a university degree. Due to the nature of Swedish vocational education as discussed in Section 2, we would not expect the policy to significantly affect the labor market outcomes of university graduates. Firstly, we validate the parallel trends assumption of no significant pre-treatment average ATTs, as seen in Table A2 of Online Appendix A. Secondly, the results presented in Table A5 of Online Appendix A indicate no significant effect on the unemployment rate among individuals aged 20–24 with a university degree. This result, implies that our main results survive the placebo test which further emphasizes the robustness of our results.

Another concern is related to spillovers from double-treatment. This occurs when a

municipality is adjacent to two municipalities that have been treated, rather than just one. Unless the neighboring municipalities receive TC certification in the exact same year, it would suggest that the labor markets of these double-treated municipalities might see an additional influx of more-qualified workers at a later stage than what is indicated a time 0 by the event-study diagrams in Figures 2. Table A6 of Online Appendix A reports the main results on youth unemployment and marriage rates when removing the 12 double-treated municipalities. There are only minor changes in the coefficient estimates when removing these municipalities.

Finally, we re-estimate the main specification when the using the alternative estimator proposed by de Chaisemartin and d'Haultfoeuille (2024). The findings, presented in Table A7 of Online Appendix A and using the definition of treatment that includes both treated and neighboring municipalities, indicate a reduction in the youth unemployment rate of approximately 1.73 percentage points, consistent with the Callaway-Sant'Anna results. Furthermore, the results suggest that the program had a negligible effect on total unemployment, while yielding positive and significant effects on marriage and male fertility rates. These findings are all similar to those obtained using the Callaway-Sant'Anna estimator.

6 Evidence on Mechanisms

In this section, we provide evidence on potential mechanisms. First, we examine the impact on the TC program on vacancy rates. Second, we evaluate whether the TC program increased the quality of graduates, or whether the effect is due to an increase in the number of graduates. We conclude by eliminating a number of alternative explanations.

6.1 Impact on Vacancy Rates

To evaluate whether the policy acts as a mechanism for enhancing competency, our analysis focuses on its impact on the vacancy rate. A challenge in this context is that data on vacancy rates are only available at the regional level.[10] We introduce two distinct treatment variables to assess the regional effects of the policy. The initial approach employs a binary treatment variable, activated when a minimum of 20 percent of the regional population is affected by the policy. A more conservative method is applied in the second approach, where the treatment variable is only activated if more than 30 percent of the region's population is affected by the policy. Both approaches utilize the model described by (1), albeit with an adjusted analysis window comprising five

[10]There are 21 regions, and with 290 municipalities in total, on average, one region comprises slightly more than 13 municipalities.

pre-treatment and 14 post-treatment periods due to data limitations. Additionally, we cluster standard errors at the regional level.

First, we provide evidence towards the parallel trends assumption by observing insignificant average pre-treatment ATTs in Table A2 of Online Appendix A. The main results, which are presented in column (1) of Table 6, indicate a reduction in the vacancy rate by approximately 0.4 percentage points when the policy impacts 20 percent of the regional population. This reduction is marginally less pronounced in the ATT_{simple} estimates shown in column (2). Moreover, the results in columns (3) and (4), which reflect the method where 30 percent of the population is affected, indicate a smaller but still significant decrease of 0.3 percentage points. Taken together, these findings and the previous results about unemployment suggest that the policy reduces both the unemployment rate and vacancy rate within a region. A caveat to note is that these results need to be interpreted with some caution due to the lack of municipality-level data. Still, the results provide support in favor of reduced labor market frictions by improved matching.

6.2 Alternative Mechanisms

We proceed by analyzing whether the decrease in unemployment and vacancy rates are due to a competence increasing effect or an effect through other mechanisms. More precisely, while it is possible that the TC program increased the quality of graduates, one alternative channel could be increased labor supply within the manufacturing sector following the introduction of TC. This would imply that after a municipality is treated, the number of students wishing to pursue a vocational education increases in neighboring municipalities. To test this, we replace the left-hand side of (1) with the share of graduates from vocational universities and high schools, and proceed as before. These results are reported in Table 3, and indicate no significant changes in the proportion of high school and vocational university graduates in neighboring municipalities post-treatment. This result suggests that the observed effects are unlikely due to an increase in enrollment in vocational education. Instead, it implies that the improvements are likely a result of changes in the quality and relevance of the education, improving the employability of recent graduates.

We also investigate the potential impact of other labor market programs introduced concurrently with the policy. To address this, we apply the difference-in-difference approach used previously to analyze municipality spending on labor market programs. While we would expect a positive effect on spending in treated municipalities–running a TC-certified educational program is costly, and there is a bureaucratic cost associated with forming partnerships with firms–no such effect should be present for the neighboring municipalities, as these municipalities do not contribute financially to the TC. The findings, as shown in Table 3, indicate no significant effects, implying that no other con-

current policies have influenced the labor market outcomes in neighboring municipalities during the same period.

In addition, we investigate whether the observed reductions in the unemployment and vacancy rates can be attributed to an rise in the number of newly-established firms in municipalities. On one hand, the skills acquired by students could potentially encourage entrepreneurship. On the other hand, these effects are possibly mitigated by the structure of the program, since it implies shifting a more general vocational education to a specialized, firm-specific education. We test this by replacing the left-hand side of (1) with the number of newly-registered firms per capita at the municipality level. Again, we standardize the data, and report the results in Table 3. The coefficient for the treated municipalities in column (2) is highly significant–the number of newly-registered firms per capita was about 0.20 standard deviations higher in treated municipalities compared to never-treated municipalities. However, for the neighboring municipalities, the coefficient is close to zero, and statistically insignificant. Taken together, these results suggest that while some of the positive effects on youth unemployment may be partially driven by entrepreneurship spillovers, this holds only for the treated municipalities.

6.3 Firm-Level Evidence

So far, we have found that youth unemployment rates decrease in both treated and neighboring municipalities. However, for neighboring municipalities in particular, the mechanisms through which the TC program affects local firms remain unclear. In principle, two channels could explain this effect. First, the program may generate positive externalities for manufacturing firms in neighboring communities. For example, the skills acquired by TC students may be transferable to firms in neighboring municipalities, leading to increased demand for these workers and improved firm productivity. Alternatively, workers from neighboring municipalities who complete the TC program may choose to accept jobs at TC-participating firms instead of taking manufacturing jobs in their home municipalities. Both channels are consistent with the observed decline in youth unemployment in neighboring municipalities.

To explore this further, we turn to firm-level data and conduct an event-study analysis similar to our earlier approach. Specifically, we examine the effects of the TC program on profit margins, productivity, and wage rates per employee for firms in treated municipalities, neighboring municipalities, and the combined group of treated and neighboring municipalities, using firms in never-treated municipalities as the control group across all three specifications. The estimated ATTs are presented in Table 7. Again, column (1) provides the combined estimates, while columns (2) and (3) give the corresponding estimates when examining treated and neighboring municipalities separately. The results for the neighboring municipalities are notable. In particular, there were significant declines

in profit margins, productivity, and wage rates, with the largest negative effect observed for productivity—a decline of approximately 1.6%. Thus, for neighboring municipalities, the TC program appears to involve a tradeoff: while the program contributes to lower youth unemployment rates and potentially higher tax revenues,[11] productivity in local manufacturing firms declines, as high-productivity workers take jobs in neighboring municipalities instead.

For the treated municipalities, the estimates for the profit margins, productivity, and wage rates are close to zero and statistically insignificant. Similar to the neighboring municipalities, any positive effects for the TC-treated firms are likely to be offset by negative effects suffered by other firms in the same municipalities, as skilled employees become scarcely available.

7 Concluding Remarks

This study shows that the TC program has significantly reduced youth unemployment in municipalities neighboring treated ones. This finding is consistent with prior research showing that job- or labor market training tailored to local industry can enhance job matching and local skill supply, especially through improved employer screening processes. The most pronounced effect is observed among recent vocational high school graduates, suggesting that TC influenced educational providers are better at producing employable graduates compared to standard vocational high schools. The lack of a significant impact on the overall unemployment rate is anticipated, given the targeted nature of the policy.

Additionally, we found no post-treatment increase in the number of students pursuing vocational university or high school education, nor the graduation rate within vocational universities. These findings provide evidence towards that the improvement in labor market outcomes is not due to an increased quantity of graduates with a vocational degree, but rather to the enhanced quality and relevance of their degree. Further, we see no evidence of other municipality-conducted labor market policies explaining this effect. The paper also shows that marriage and male fertility rates increased in areas bordering a TC treated municipality, suggesting that the TC program and similar ALMPs may alleviate some of the demographic concerns currently affecting most developed nations.

While the results of this paper indicate overall positive effects of the TC program, there are several potential questions for future research. One concern is the trade-off involved in the specialized vocational education provided by TC institutions, whereby a broader general education is replaced with training tailored to specific firms. If the firm-specific

[11] In Sweden, municipal income tax is paid to the municipality of residence, regardless of the municipality in which the workplace is located.

education is too specialized for the broader labor market, this may lead to occupation-switching problems for workers in case of plant shutdown. Finally, while this article evaluates aggregate outcomes at the municipality level, exploring long-term, individual-level outcomes for TC graduates presents another potential for further investigation.

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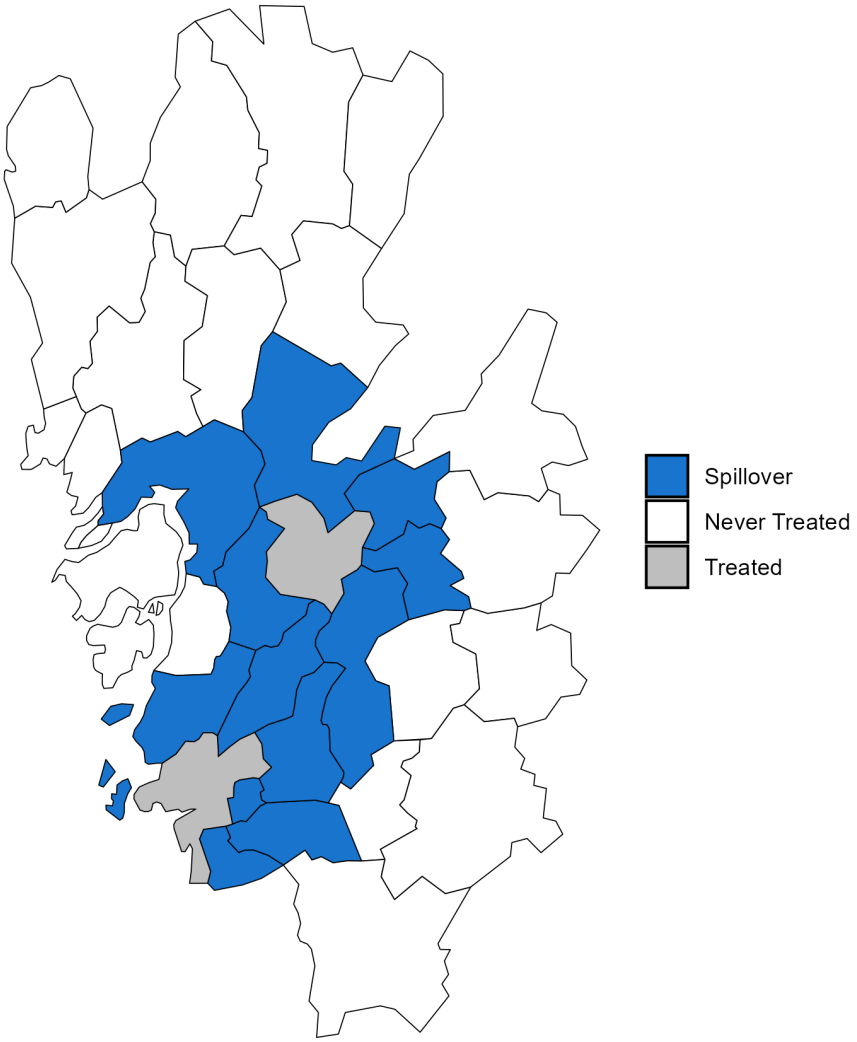
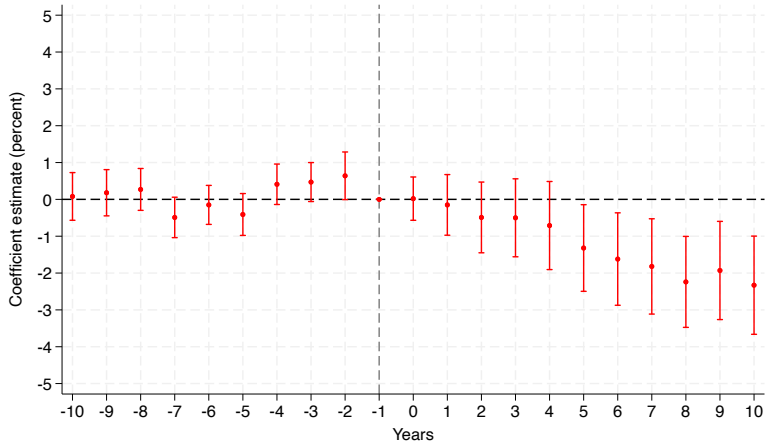


Figure 1: Map of the northwestern part of Västra Götaland County. In gray, the treated municipalities (Gothenburg and Trollhättan), in blue, the neighboring municipalities, and in white, the never treated municipalities.

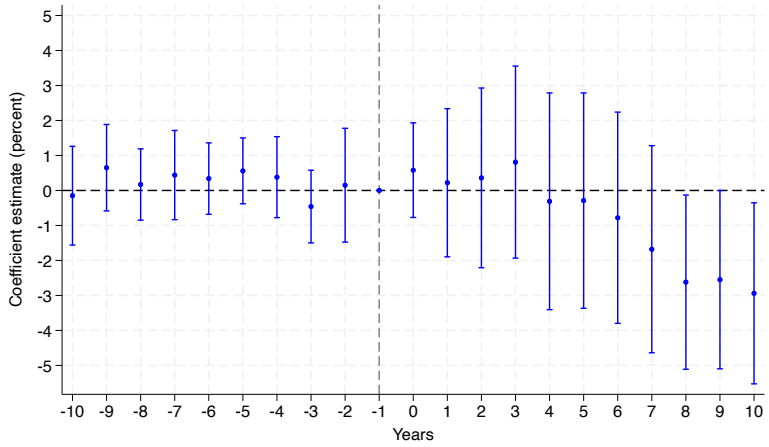
Table 1: Parallel trends assumption

	Pre-treatment ATT
Unemployment rate (total)	−0.039
	(0.033)
Unemployment rate (20–24)	−0.074
	(0.075)
Labor market participation rate (total)	0.000
	(0.029)
Labor market participation rate (20–24)	0.034
	(0.075)

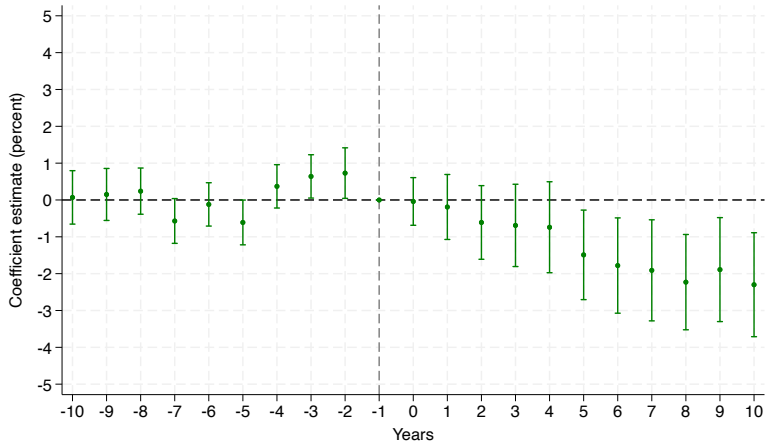
Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021) and utilizing both treated and neighboring municipalities, with the never treated as control group. *Total* refers to all ages and *20–24* refers to individuals aged 20 to 24. Standard errors clustered by municipality in brackets.



(a) Unemployment rate (20–24), when using both treated and neighboring municipalities, with the never treated as control group.

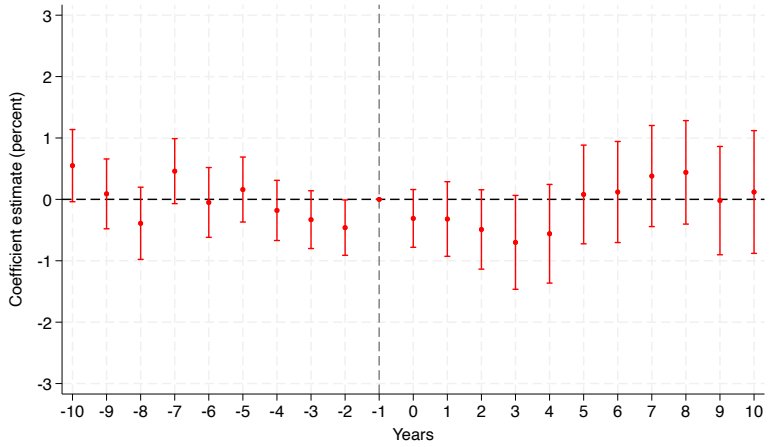


(b) Unemployment rate (20–24), when using only treated municipalities, with the never treated as control group and the neighboring municipalities excluded.

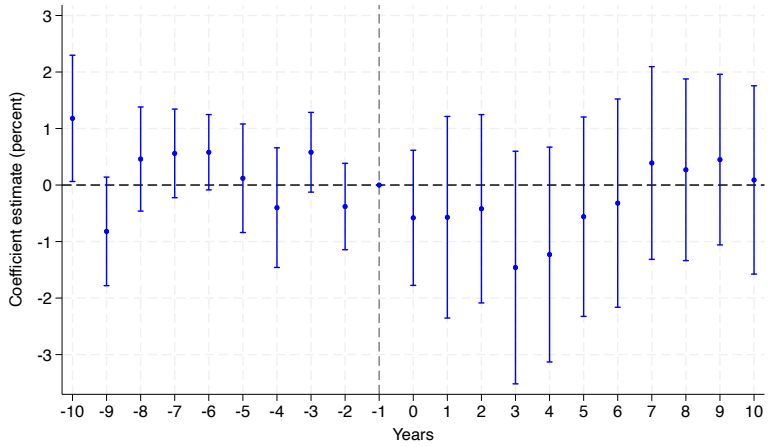


(c) Unemployment rate (20–24), when using only neighboring municipalities, with the never treated as control group and the treated municipalities excluded.

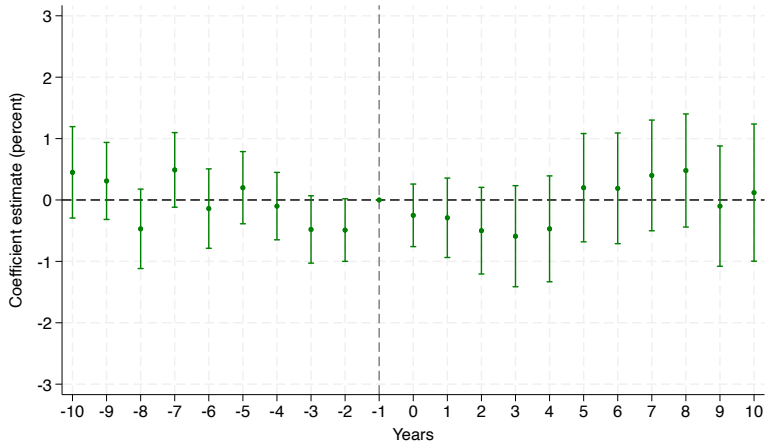
Figure 2: Event-study figures for the youth unemployment rate.



(a) Labor market participation rate (20–24), when using both treated and neighboring municipalities, with the never treated as control group.



(b) Labor market participation rate (20–24), when using only treated municipalities, with the never treated as control group and the neighboring municipalities excluded.



(c) Labor market participation rate (20–24), when using only neighboring municipalities, with the never treated as control group and the treated municipalities excluded.

Figure 3: Event-study figures for the youth labor market participation rate.

Table 2: Municipality Results

Effect on:	Unemployment rate (Total)			Unemployment rate (20–24)			Labor market participation (Total)			Labor market participation (20–24)		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Treatment	0.282	0.798*	0.183	−1.477**	0.175	−1.770***	−0.365*	−0.577*	−0.327	0.174	−0.648	0.320
	(0.262)	(0.473)	(0.274)	(0.652)	(0.960)	(0.652)	(0.187)	(0.342)	(0.199)	(0.401)	(0.713)	(0.430)
Mean dep. var.	14.58	14.58	14.58	32.28	32.28	32.28	78.08	78.08	78.08	72.74	72.74	72.74
Observations	7,066	4,001	6,466	7,066	4,001	6,466	7,066	4,001	6,466	7,066	4,001	6,466

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). Table A2 provides evidence towards the parallel trends assumption. (1): Treated and neighboring municipalities, with the never treated as control group. (2): Treated municipalities only, with the never treated as control group and the neighboring municipalities excluded. (3): Never treated as control group and the treated municipalities excluded. Standard errors clustered by municipality in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Mechanisms to the main results

Effect on:	High school and vocational college			Spending			New firms		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Treatment	0.079	0.020	0.102	0.160	0.404	0.072	0.069	0.132**	0.058
	(0.130)	(0.255)	(0.127)	(0.115)	(0.475)	(0.062)	(0.046)	(0.066)	(0.061)
Mean dep. var.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	1,854	1,174	1,621	1,854	1,171	1,621	3,810	2,399	3,540

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). Table A2 provides evidence towards the parallel trends assumption. (1): Treated and neighboring municipalities, with the never treated as control group. (2): Treated municipalities only, with the never treated as control group and the neighboring municipalities excluded. (3): Never treated as control group and the treated municipalities excluded. Standard errors clustered by municipality in brackets, **p<0.05.

Table 4: Heterogenous effects

Outcome variable:	Population		Share with foreign background		Share with college education	
Unemployment rate (20–24)	>median	≤median	>median	≤median	>median	≤median
Treatment	-2.658^{***}	-0.383	-1.891^{*}	-0.711	-4.736^{***}	-0.247
	(0.700)	(0.767)	(0.985)	(0.830)	(1.605)	(0.920)
Mean dep. var.	32.28	32.28	32.28	32.28	32.28	32.28
Observations	3,576	3,350	3.645	3,599	3,570	2,770

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). All estimates refer to treated and neighboring municipalities considered jointly, that is, specification (1). Standard errors clustered by municipality in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Demographic outcomes

Effect on:	Marriage rate			Male fertility			Female fertility		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Treatment	0.026***	0.010	0.028***	0.049**	0.041*	0.052***	0.040**	0.042*	0.040*
	(0.007)	(0.012)	(0.008)	(0.017)	(0.023)	(0.019)	(0.019)	(0.026)	(0.022)
Mean dep. var.	0.434	0.434	0.434	1.68	1.68	1.68	1.91	1.91	1.91
Observations	7,066	4,001	6,466	7,066	4,001	6,466	7,066	4,001	6,466

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). (1): Treated and neighboring municipalities, with the never treated as control group. (2): Treated municipalities only, with the never treated as control group and the neighboring municipalities excluded. (3): Never treated as control group and the treated municipalities excluded. Standard errors clustered by municipality in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Regional effects on vacancy rates

Effect on:	Vacancy rate (20%)	Vacancy rate (30%)
Treatment	−0.085	−0.165
	(0.001)	(0.159)
Mean dep. var.	0.000	0.000
Observations	272	272

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). The dependent variable is standardized with mean equal to zero, and standard deviation equal to unity. *20%* and *30%* refers to when 20 and 30 percent of the population is treated. Regional-level clustered standard errors in brackets.

Table 7: Firm-level evidence

	Profit margin (logs)			Productivity per employee (logs)			Wage rate per employee (logs)		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Treatment	−0.002	0.003	−0.004**	−0.013***	−0.002	−0.016***	−0.009*	−0.009	−0.014**
	(0.002)	(0.003)	(0.002)	(0.004)	(0.006)	(0.004)	(0.005)	(0.008)	(0.005)
Mean dep. var.	0.045	0.045	0.045	5.889	5.889	5.889	5.156	5.156	5.156
Observations	2,737,159	2,053,112	2,712,582	2,315,966	1,718,539	1,958,960	2,439,191	1,815,336	2,062,297

Note: (1): Firms in treated and neighboring municipalities. (2): Only firms in treated municipalities. Column (3): Only firms in neighboring municipalities. Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). All coefficients refer to the average post-treatment ATTs (ATT_{APT}). All estimates control for municipality-observed characteristics. Standard errors clustered by municipality in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Online Appendix [Not for Publication]

A Additional Empirical Results

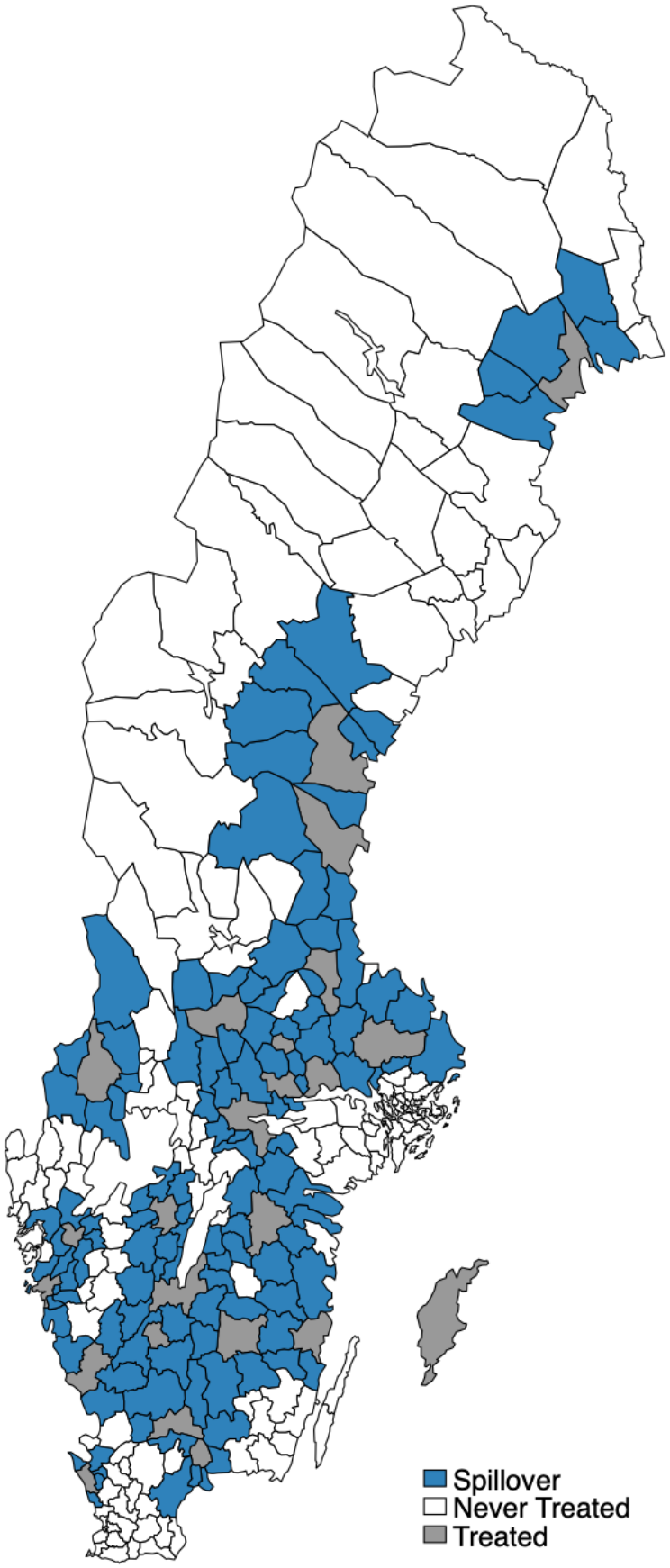


Figure A1: Graphical representation of treated municipalities (in gray), neighboring municipalities (in blue), and never treated municipalities (in white).

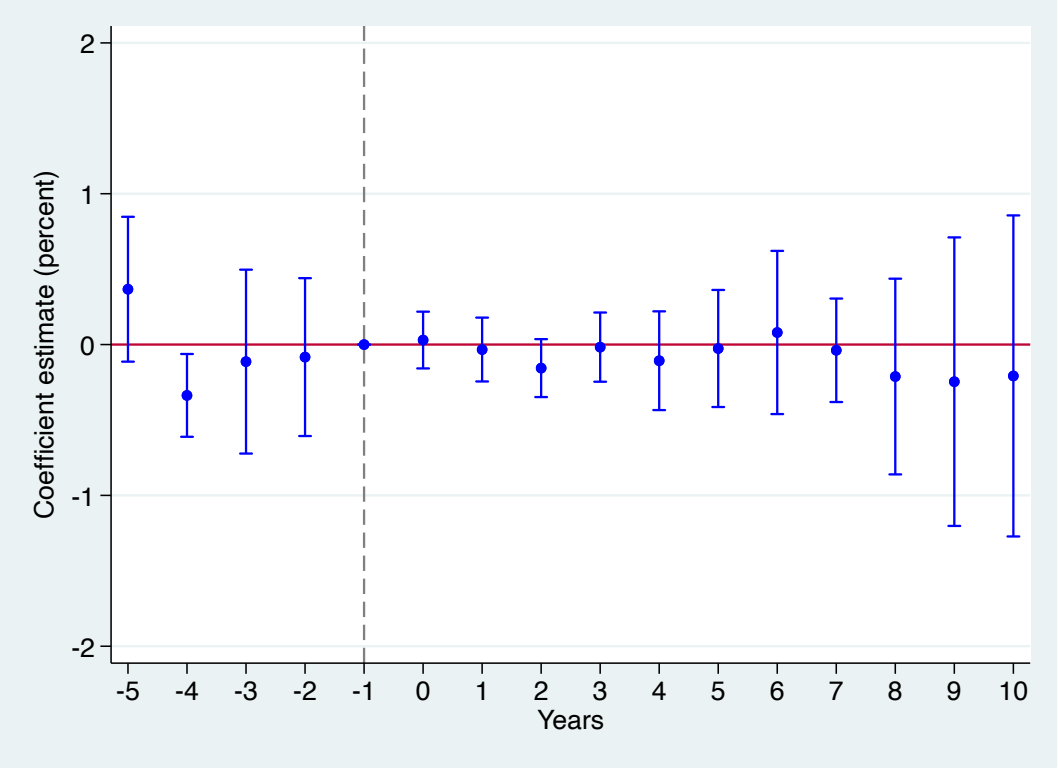
Table A1: Descriptive statistics

Variable	Mean	Std.dev.	Min	Max
Unemployment rate (total)	14.63	4.536	3.900	36.30
Unemployment rate (20–24)	32.33	12.61	5.500	80.20
Unemployment rate (university)	16.01	8.754	1.500	60.50
Labor market participation rate (Tttal)	77.99	4.377	51.40	89.10
Labor market participation rate (20–24)	72.59	7.511	31.10	93.80
Marriage rate (%)	0.436	0.109	0.112	1.05
Male fertility	1.677	0.231	1.03	2.83
Female fertility	1.908	0.254	1.17	3.15
High school graduates	0.150	0.0305	0.0640	0.225
Vocational University Graduates	0.0522	0.057	0	0.546
Vocational University Graduation Rate	0.281	0.191	0	1
Net domestic emigration (%)	0.273	0.279	–1.312	1.705
Share of population aged 20–64	0.553	0.0287	0.454	0.665
Share of population without a high school degree	16.77	6.581	2.300	39.70
Average income (log)	5.440	0.239	4.848	6.470
Population (log)	9.835	0.935	7.778	13.79
New firms (log)	5.169	0.288	3.758	6.791
Labor market program spending (log)	10.22	1.768	4.68	18.32

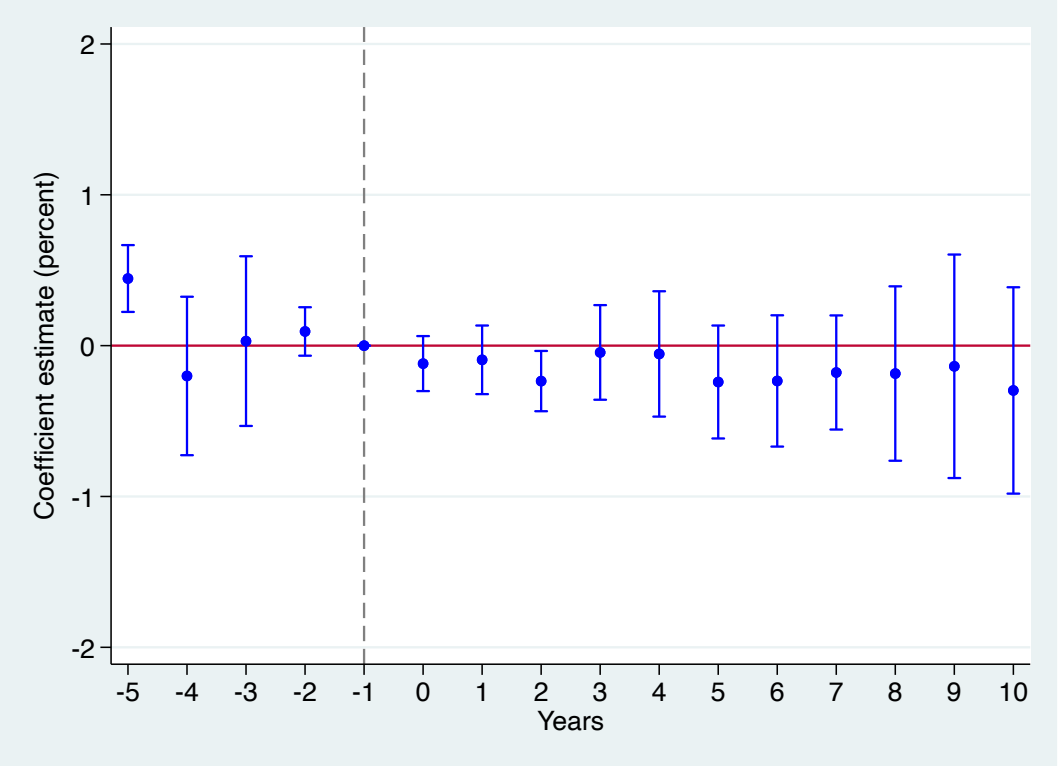
Table A2: Parallel trends assumption

	Municipality Pre-treat average
Non-resident municipality studies	0.000
	(0.000)
Net domestic migration	−0.007
	(0.007)
Domestic immigration	−0.009
	(0.029)
Domestic emigration	−0.045
	(0.029)
High school graduates	0.000
	(0.000)
Vocational university graduates	0.001
	(0.002)
Vocational university graduation rate	−0.006
	(0.025)
Labor market program spending	0.003
	(0.009)
Unemployment rate (university)	−0.110
	(0.133)
New firms	−0.003
	(0.009)
Vacancy rate	0.000
	(0.001)

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). Pre-treat Average coefficient shows the average pre-treatment ATTs. Standard errors clustered by municipality in brackets.

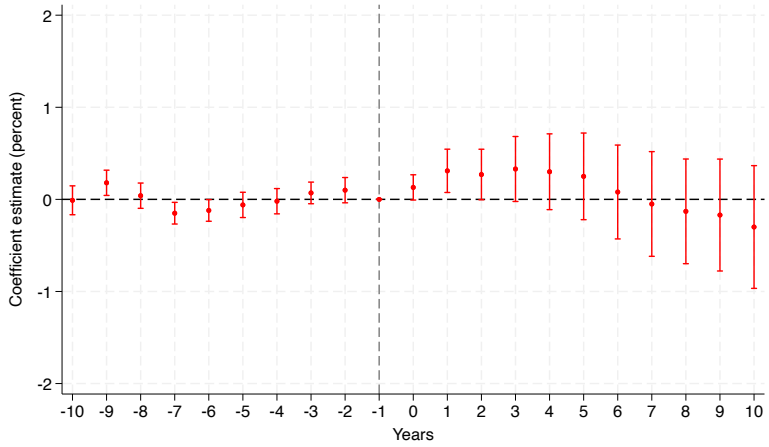


(a) Vacancy Rate (20%)

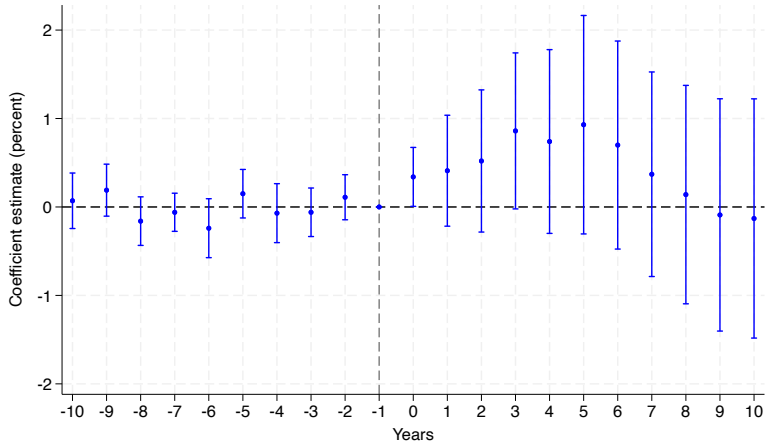


(b) Vacancy Rate (30%)

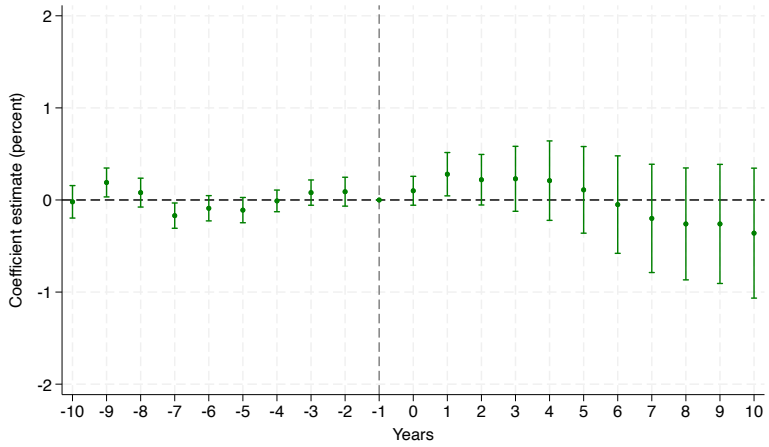
Figure A2: Event-study figures for the standardized vacancy rate. Panel (a): Vacancy rates with 20% of the region treated. Panel (b): Vacancy rates with 30% of the region treated.



(a) Total unemployment rate when using both treated and neighboring municipalities, with the never treated as control group.



(b) Total unemployment rate when using only treated municipalities, with the never treated as control group, and the neighboring municipalities excluded.



(c) Total unemployment rate when using only neighboring municipalities, with the never treated as control group, and the treated municipalities excluded.

Figure A3: Event-study figures for the total unemployment rate.

Table A3: Compositional change assumption

Effect on:	(1)	(2)	(3)
Treatment	−0.004	−0.011	−0.003
	(0.016)	(0.023)	(0.018)
Mean dep. var.	0.27	0.27	0.27
Observations	7,053	3,988	6,453

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). (1): Treated and neighboring municipalities, with the never treated as control group. (2): Treated municipalities only, with the never treated as control group and the neighboring municipalities excluded. (3): Never treated as control group and the treated municipalities excluded. Standard errors clustered by municipality in parentheses.

Table A4: Municipality results with covariates included

Effect on:	Unemployment Rate (Total)			Unemployment Rate (20–24)			Labor Market Participation (Total)			Labor Market Participation (20–24)		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Treatment	0.106	0.528	−0.006	−1.451**	−0.986	−1.599***	−0.365*	−0.577*	−0.327	0.174	−0.648	0.320
	(0.241)	(0.247)	(0.533)	(0.533)	(1.139)	(0.606)	(0.187)	(0.342)	(0.199)	(0.401)	(0.713)	(0.430)
Mean dep. var.	14.58	14.58	14.58	32.28	32.28	32.28	78.08	78.08	78.08	72.74	72.74	72.74
Observations	7,244	4,148	6,644	7,066	4,001	6,466	7,066	4,001	6,466	7,066	4,001	6,466

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). Table A2 provides evidence towards the parallel trends assumption. (1): Treated and neighboring municipalities, with the never treated as control group. (2): Treated municipalities only, with the never treated as control group and the neighboring municipalities excluded. (3): Never treated as control group and the treated municipalities excluded. Standard errors clustered by municipality in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Placebo Results

Effect on:	Unemployment Rate (University)		
	(1)	(2)	(3)
Treatment	−0.762	−0.684	−0.774
	(0.476)	(0.882)	(0.535)
Mean dep. var.	16.00	16.00	16.00
Observations	5,880	3,302	5,112

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). Table A2 provides evidence towards the parallel trends assumption. (1): Treated and neighboring municipalities, with the never treated as control group. (2): Treated municipalities only, with the never treated as control group and the neighboring municipalities excluded. (3): Never treated as control group and the treated municipalities excluded. Standard errors clustered by municipality in brackets.

Table A6: Excluding double-treated municipalities

Effect on:	Unemployment rate (20–24)	Marriage rate	Male fertility	Female fertility
Treatment	−1.528**	0.026***	0.045***	0.035*
	(0.639)	(0.008)	(0.017)	(0.020)
Mean dep. var.	32.28	0.434	1.68	1.91
Observations	7,066	7,066	7,066	7,066

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by Callaway and Sant'Anna (2021). Coefficients show the average ATTs of all post-treatment periods, using both treated and neighboring municipalities. Standard errors clustered by municipality in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table A7: Main results with the de Chaisemartin-d'Haultfoeuille estimator

Effect on:	Unemployment rate (20–24)	Marriage rate	Male fertility	Female fertility
Treatment	−1.734***	0.017***	0.037**	0.041**
	(0.494)	(0.007)	(0.017)	(0.019)
Mean dep. var.	32.28	0.434	1.68	1.91
Observations	7,066	7,066	7,066	7,066

Note: Coefficients are gathered from a staggered difference-in-differences using the method proposed by de Chaisemartin and d'Haultfoeuille (2024). Coefficients show the average ATTs of all post-treatment periods, using both treated and neighboring municipalities. *20–24* refers to individuals 20 to 24 years old. Standard errors clustered by municipality in brackets, *** p<0.01, ** p<0.05.

B Data Description

This section describes the construction of the variables used in the empirical analysis in additional detail. Except for the data on the timing of treatment, all municipal variables come from the Swedish Statistics Agency.

B.1 Policy Data

Data on the specific municipalities and the timing of their treatment were obtained through direct communication with the TC. The treatment variable is binary, assigning a value of 1 to a municipality bordering a treated municipality in a given year, and 0 for municipalities bordering either an untreated or not yet treated municipality in that year. A total of 124 out of Sweden's 290 municipalities are bordering a TC treated municipality during the study period.

B.2 Outcome Variables

The data on unemployment rate represents the proportion of individuals registered at the public employment service at least once in a given year, divided by the total population within a municipality. This study also categorizes the data by age and highest educational level. The data on labor market participation reflects the proportion of employed individuals in a specific year relative to the total municipality population, while the data on high school graduates refers to the percentage of individuals possessing a high school degree in a given year over to the overall municipality population. Data on vocational university graduates indicate the proportion of individuals graduating from vocational universities against the municipality population.

Turning to the demographic outcomes, the marriage rate is the total number of annual marriages in a municipality divided by the total population. The male fertility rate is the average number of children fathered by a man over his lifetime, while the female fertility rate is the average number of children born to a woman over her lifetime. As discussed in the paper, the latter measure is more commonly referred to as the total fertility rate (TFR).

The data on non-resident municipality studies represent the fraction of high school students attending schools outside their home municipality, relative to the municipality population. New firms data are defined by the number of newly established firms relative to the municipality population. The data are further logarithmically transformed. The data on vacancy rate is defined as the number of vacancies relative to the total number of employees. The data on municipality spending on labor market programs are collected through as expenditures categorized under "labor market measures" in municipal annual reports. Expressed in thousands of crowns, these figures are normalized by the

municipality population and logarithmically transformed.

B.3 Covariates

The data on population are defined as the number of individuals residing in a municipality or region during a specific year. The data on individuals within the working-age refer to the share of the population aged 20–64 years within a municipality or region for a given year. Data on individuals without a high school degree denote the proportion of the population whose highest educational attainment is below a high school degree. Finally, the income data represent the average income of residents in a municipality and is logarithmically transformed.

B.4 Firm Data

The firm-level data is from the *Serrano* database of the Swedish Statistics Agency. Since all firms in Sweden, regardless of the number of employees, are required to share their annual reports with the tax authorities and the Swedish Companies Registration Office, the data covers the universe of Swedish firms in the form of a panel from the year 1998 to 2021. However, we limit the analysis to include only firms within manufacturing. We are interested in three variables: the profit margin, the productivity (value added) per employee, an the wage rate per employee. The value added per employee, which is a proxy for the productivity per employee is calculated as the operating profit or loss + labor costs + depreciation and amortization, divided by the number of employees. The labor costs are calculated as the sum of salaries and social security contributions.