The Local Scarring Effect of Negative Trade Shocks: Evidence from the Collapse of Finnish-Soviet Trade*

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Abstract

Do workers whose employers are more exposed to negative trade shocks suffer equally in all local labor markets or is there something distinct about their experience in more negatively affected markets? To answer this question, we study the impact of the collapse of Finnish-Soviet trade on the earnings trajectories of Finnish workers. Using separate measures of worker and market exposure to this large trade shock, we document that workers who are more exposed within a market not only experience lower earnings, but also that their drop in earnings is persistently larger in more exposed markets, a form of local scarring.

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1 Introduction

When imports surge in some sectors, either because of domestic tariff cuts or foreign productivity gains, regions with employment concentrated in those sectors experience worse labor-market outcomes (e.g. Topalova, 2010, Autor et al., 2013, and Kovak, 2013). But how do local labor markets actually shape the response to trade shocks? Are workers exposed to negative trade shocks suffering equally across regions or is there something systematically different about the experience of those workers in the most negatively affected markets?

The answers to the previous questions have direct policy implications. If empirical findings from so-called "shift-share" designs are merely about a greater number of workers being negatively exposed in the most affected regions, then national social programs designed to compensate workers for the adverse consequences of globalization may be well suited. If instead, such empirical findings partly reflect the fact that similar workers experience larger earnings losses in these regions, then there is scope for these programs to inherit characteristics of place-based policies, with assistance conditioning on local labor-market conditions, as advocated by Austin et al. (2018).

To make progress on these questions, we focus on a large trade shock: the collapse of the Finnish-Soviet bilateral trade agreement. Combining newly-digitized data on Finnish firms' licensed exports to the USSR with matched employer-employee data, we are able to construct measures of both worker and market exposure to the USSR shock and use them to study how the earnings trajectories of Finnish workers vary with their own exposure to the USSR shock as well as the exposure of the local labor market to which they belong. Our main empirical finding is that while more exposed workers experience systematically lower earnings after the shock, the negative effect of worker exposure is persistently larger in more exposed markets, a form of local scarring.

Section 2 first describes the historical background of the Finnish-USSR trade relationship and its termination. On December 6th, 1990, the Soviet Union unilaterally canceled the five-year trade agreement that had been signed the previous year. Finnish plants varied greatly in the intensity of their exports to the USSR, which we document by digitizing firm-level reports of transactions with the Soviet Union for the year 1989 from the Office of Licenses (Lisenssivirasto) and linking these to the Longitudinal Data on Plants in Finnish Manufacturing (LDPM). This heterogeneity allows us, in turn, to create two distinct measures of exposure to the USSR shock: (i) *worker exposure*, equal to the share of USSR exports in the sales of the plant in which a worker is employed, and (ii) *market exposure*, equal to the weighted average of USSR export shares across plants in a municipality, with weights equal to each plants' employment share. Worker exposure measures the direct exposure of the worker to the USSR shock, via the negative demand shock experienced by her plant, whereas market exposure reflects her broader exposure, via the sum of the negative demand shocks experienced by all plants in her local labor market.

Section 3 presents our empirical results about how worker and market exposures interact to shape the causal impact of the USSR shock on the earnings of Finnish workers. Our empirical design compares changes in earnings trajectories of workers who are more and less directly exposed—but similar in terms of other observable characteristics—in local labor markets with different exposures to the USSR shock, a tripe-difference strategy. While more directly exposed workers suffer more than less exposed workers within the same market, we find that this earnings gap is persistently larger in more exposed markets. In a municipality with almost zero market exposure, the earnings gap between unexposed workers and those at the 90th percentile of worker exposure—whose plants export about 20% of their sales to the USSR in 1989—goes from 607 euros in 1992 to 29 euros in 2004. In a municipality at the 90th percentile of market exposure—whose average plant exports about 1.8% of its sales to the USSR—the same earnings gap goes from 663 euros in 1992 to 94 euros in 2004. Across all years after the USSR shock, this amounts to an extra loss of 681 euros, or 2.7% of their pre-period annual income, for these exposed workers in the more exposed municipality.

Our analysis is related to a large shift-share literature using differences in market exposure (the share) to analyze the impact of trade and other negative labor demand shocks (the shift) on market-level outcomes. Well-known examples include Blanchard and Katz (1992), Topalova (2010), Autor et al. (2013), Kovak (2013), and Kovak and Dix-Carneiro (2017). Our work differs both because we directly observe the market-level shock, rather than construct it using regional shares and national shocks, and because we focus on worker-level outcomes, as in, e.g., Autor et al. (2014) and Yagan (2019). Although we share the same focus on worker-level outcomes as in these two papers, we differ from them in that we construct two measures of exposure for each worker: a market-level measure, similar to theirs, and a more granular worker-level measure, obtained from matching workers to plants and plants to USSR exports. This allows us to study whether workers directly exposed to a shock fare equally poorly across markets.[1]

[1] As should be clear, direct exposure to the USSR shock in our analysis always refers to direct export exposure, not import exposure or indirect export exposure through input-output linkages. In practice, Finnish workers and markets may also be differentially exposed because Finnish plants or their suppliers vary in the intensity of their imports from the USSR, mostly oil. Unfortunately, our dataset does not include information about oil purchases or input-output linkages between plants, as in Adao et al. (2021), Alfaro-Urena et al. (2021), and Dhyne et al. (2022), which prevents us from further exploring such considerations.

The trade shock that we focus on, the collapse of the Finnish-Soviet bilateral trade agreement, has featured prominently in analyses of the Finnish Great Depression, e.g., Honkapohja and Koskela (1999), Jonung et al., eds (2009), Gorodnichenko et al. (2012), and Gulan et al. (2021). The previous papers have studied whether the USSR shock contributed significantly to the collapse of Finnish GDP over that time period, which they explore using aggregate and sectoral data. In this paper we shed light instead on the distributional consequences of the USSR shock and the extent to which they might have been more severe within the most negatively affected markets, which we explore using firm-and-product-level exports to the USSR and matched employer-employee data.[2]

Our results are also related to the displacement literature pioneered by Jacobson et al. (1993). Our main empirical finding can be viewed as the spatial counterpart of the business cycle analysis of Davis and von Wachter (2011), Korkeamäki and Kyyrä (2014), Farber (2017), Huckfeldt (2022), and Schmieder et al. (2023). We find that negative plant-level demand shocks induce persistently larger earnings declines in more exposed labor markets (for workers who are employed in the affected plants ex ante), whereas they find that mass layoffs induce larger earnings losses during national recessions (for workers who are displaced ex post). The heterogeneous effects that we document across local labor markets also resonate well with the findings by Hyman (2018) that returns to trade adjustment assistance programs tend to be lower in regions with higher unemployment rates. Both our findings and his are consistent with the idea that workers who are fired because their employers are hit by negative trade shocks experience more difficulty finding jobs in the most negatively affected markets.

2 Historical Background and Data

2.1 The Collapse of the Finnish-Soviet Trade Agreement

Finland and the Soviet Union had a series of bilateral trade deals between 1951 and 1990. At its peak in the early- and mid-1980s, more than a quarter of Finland's exports went to the Soviet Union. As discussed in Eloranta and Ojala (2005) and Sutela (2005, 2014), the Finnish-Soviet trade agreement was in many ways similar to those between the Soviet Union and Eastern European communist countries. The composition of trade was agreed at the governmental level, and the aim was to keep trade strictly balanced each year. Finland's imports from the Soviet Union consisted almost entirely of energy, mostly

[2]The USSR shock is also used by Einiö (2018) as a shifter of the labor supply faced by Finnish plants in industries that do not export to the USSR, which he uses to estimate the elasticity of their labor demand.

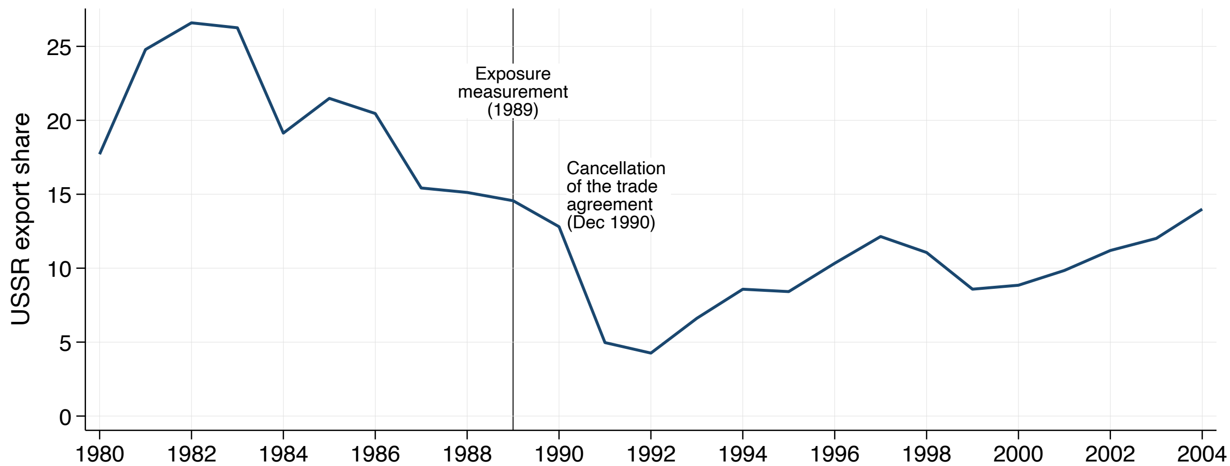


Figure 1: The USSR Shock

Notes: Share of Finnish exports sold to the USSR, or the fifteen former Soviet republics, from 1980 to 2004, as reported by OECD (2023b).

crude oil, which was valued at world prices. In return, Finland primarily exported manufacturing goods, as documented in Appendix Figure A.1. Consequently, world energy prices and Finland's energy use largely determined the total value of Finnish exports. This link between energy prices and Finland's exports to the USSR is visible in Figure 1, which shows a substantial increase in the share of Finland's exports destined for the USSR following the second oil crisis and a subsequent decline as energy prices fell.

On December 6th, 1990, the Soviet Union unilaterally canceled the five-year trade agreement that had been signed in the previous year. The share of Finnish exports to the USSR decreased from 14.6% in 1989 to 5.0% in 1991. In 1992, the share of exports to the fifteen former Soviet republics reached its nadir, at only 4.3%. The drop in the demand for Finnish products, which results from both the cancelation of the trade deal and the broader collapse of the Soviet economy, is what we will refer to as the "USSR shock" in the rest of our analysis.[3]

[3]Interestingly, while the share of Finnish exports to the fifteen former Soviet republics roughly returns to its 1989 value by 2004, the product-mix of Finnish exports to these countries does not. As can be seen in Appendix Figure A.2, about half of the rebound observed between 1992 and 2004 is driven by products that accounted for less than 5% of Finnish exports to the USSR in 1989. This is reassuring for our empirical analysis since it suggests that idiosyncratic institutional features of the Finnish-Soviet trade agreement shaped exposure to the USSR shock.

2.2 Exposure(s) to the USSR Shock

To measure exposure to the USSR shock, we first combine data on exports to the USSR at the firm-and-product level in 1989, the last year before the cancelation of the Finnish-Soviet trade agreement, with data on gross-output at the plant-and-product level in that same year. Using these two pieces of information, we infer the shares of USSR exports in gross output at the plant-level. We then match plants to municipalities and workers to create two distinct measures of exposure to the USSR shock, one at the market level and one at the worker level, which will be at the core of our empirical analysis.

Firm-and-Product Data. The Finnish authorities tightly controlled trade with the Soviet Union. Firms were obliged to formally notify the Office of Licenses (Lisenssivirasto) of all transactions with the Soviet Union; Lisenssivirasto published these transactions in bi-weekly reports. These reports include information on the exporting firm, 6-digit product, value, currency, and date of the transaction. In cooperation with the Central Archives for Finnish Business Records, we have digitalized all of these reports for the year 1989.[4] This provides us with the value of exports to the USSR of product p by firm f in 1989, which we denote x_{fp}.

Plant-and-Product Data. We have linked the previous exports data with the Longitudinal Data on Plants in Finnish Manufacturing (LDPM).[5] In 1989, the sampling frame of LDPM included all manufacturing plants with at least five employees. Firms were legally required to answer the survey, which included questions about their inputs, outputs, and background characteristics, including the municipalities in which their plants are located. For each plant j in the LDPM, we directly observe the value of gross output at the plant-and-product level in 1989, which we denote q_{jp}.

Plant Export Intensity. Consider a plant j belonging to a firm f that appears in both LDPM and Lisenssivirasto's records. If plant j belongs to a single-plant firm, we also directly observe the value of USSR exports at the plant-product-level, $x_{jp} = x_{fp}$. We can therefore compute the percentage of USSR exports in gross output at the plant level

[4]In total, these data include information on 3,380 transactions with a total value of 3.7 billion in 2010 euros. For comparison, Finland's exports to the USSR in 1989 were 4.29 billion and 4.24 billion according to the Finnish Customs and NBER-UN databases, respectively.

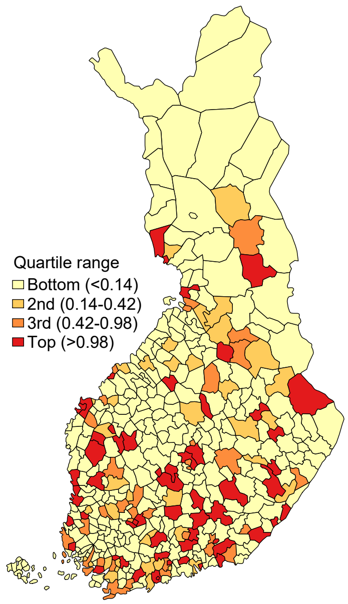
[5]We have used either firm names and product codes or annual reports of export cartels to link firm exports to manufacturing plants. In total, we were able to link 71% of the total value in our export data to manufacturing plants included in the LDPM. The remaining 29% are mostly construction companies, wholesalers, and trading companies, which were also active in the USSR trade, but are not included in the LDPM.

as $s_j \equiv (x_j/q_j) \times 100$, where $x_j \equiv \sum_p x_{jp}$ and $q_j \equiv \sum_p q_{jp}$ denote the total value across products of exports and gross output, respectively. If instead plant j belongs to a multi-plant firm, we do not directly observe the value of USSR exports at the plant level. We instead infer it from the firm-level values, x_{fp}, using the following proportionality rule, $x_{jp} \equiv x_{fp} \times (q_{jp}/q_{fp})$. Given these inferred export measures, we again compute the percentage of USSR exports in gross output for each plant as $s_j \equiv (x_j/q_j) \times 100$. For each plant j that belongs to a firm f that does not appear in either LDPM or Lisenssivirasto's records, we simply set $s_j = 0$. Appendix Table A.1 summarizes how characteristics of LDPM plants vary with their USSR export intensity, s_j. Compared to other plants, those exporting to the USSR were larger and more often belonged to multi-plant firms. Among the plants exporting to the USSR, those exporting more tended to be smaller and less capital intensive.

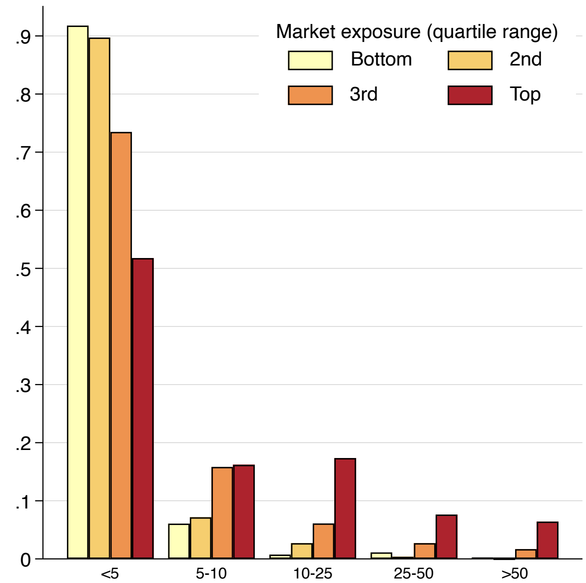
Market Exposure to the USSR Shock. For each municipality m, we observe the set of plants $j \in \mathcal{J}_m$ located in that municipality in 1989 as well as the employment share of each of these plants ω_j in the same year, available from the population linked employer-employee data discussed below. We then define market exposure to the USSR shock, S_m, as the employment-weighted average of the export intensity of market m's plants, $S_m \equiv \sum_{j \in \mathcal{J}_m} \omega_j s_j$. Figure 2a displays how exposure in 1989 varies across Finland's 431 municipalities. Although many municipalities have low levels exposure to the USSR shock, including 230 (typically small) municipalities without any exposure, $S_m = 0$, there is substantial variation across municipalities, with exposures at the 75th and 90th percentiles reaching 0.98 and 1.8, respectively[6]. Appendix Table A.2 reports how other municipality characteristics, also measured in 1989, vary with exposure to the USSR shock. Not surprisingly given the nature of the Finnish-Soviet trade agreement and the fact that we match our export information to firms in LDPM, market exposure, S_m, is positively correlated with the share of municipality employment in the manufacturing sector. It is also positively correlated with the share of the working-age population (18-64 years old) with at least a secondary education and negatively correlated with the average age of the working-age population (both measured in 1989).

Worker Exposure to the USSR Shock. For each worker i, we observe a (pseudonymized) personal identification number and (pseudonymized) firm and plant identifiers, made available to us by Statistics Finland, which we use to match workers to their employers in

[6]Throughout our analysis, we report percentiles of market exposure S_m that weigh municipalities by their 1989 employment



(a) Market Exposure (S_m)



(b) Worker Exposure ($s_i > 0$)

Figure 2: Exposure(s) to the USSR Shock

Notes: Figure 2a reports market exposure S_m to the USSR shock across Finnish municipalities, with each color corresponding to a different quartile range. Figure 2b reports the distributions of worker exposure s_i, among exposed workers in our baseline sample ($s_i > 0$), for each of these four groups of municipalities.

1989. We then define worker exposure to the USSR shock, s_i, as the export intensity of the plant j in which she is employed, $s_i \equiv s_j$. Figure 2b displays the histogram of worker exposure (conditional on $s_i > 0$) across municipalities falling into different quartile ranges of market exposure, S_m. Exposure to Soviet exports was extremely skewed both because only 31% of workers in our baseline sample (to be described below) were employed in LDPM plants in 1989 and because only 13% of LDPM plants exported to the USSR in that same year (although these plants employed 42% of the workers in LDPM plants). Even among exposed plants, exposure was uneven. For most plants trading with the USSR, exports to the USSR constituted less than a tenth of their total output. At the other end, a small number of plants exported more than half of their production to the Soviet Union in 1989. Appendix Table A.3 reports how worker characteristics in 1989 vary with exposure to the USSR export market. Compared to other manufacturing workers, more exposed workers have similar age and gender composition, but have higher incomes, are more educated and, given their level of education, are more likely to have obtained a degree in a technical field.

2.3 Other Worker Data

Our other worker data are drawn from various administrative registers also made available to us by Statistics Finland. The main registers, described in more detail below, cover Finland's entire working-age population in 1985 and in every year from 1988 to 2004. Using each worker's personal identification number to merge data from different registers, we observe workers' earnings, socio-demographic characteristics, as well as various characteristics of their employers.

Worker Earnings. The outcome variable in our regressions is annual earnings, y_{imt}, as reported to the Finnish Tax Authority. It is equal to the total annual wage and salary income received in a given year t by a worker i employed in 1989 in municipality m. In order to compare the levels of earnings across years, we deflate all earnings to 2010 euros using the markka-euro exchange rate and Finland's Cost-of-living index. In order to limit the influence of outliers, we also follow Autor et al. (2014) and winsorize annual income at the top 1% within each year.

Worker Observable Characteristics. We observe gender, year of birth, and native language (in the Population Register) and level and field of education (in the Register of Completed Education and Degrees). In addition to these socio-demographic characteristics, we also observe a range of characteristics of the plant employing each worker: municipality, industry, average annual earnings of workers in the plant (from the Finnish Tax Authority), as well as plant gross output and capital-labor ratio (from the LDPM). We will use these to construct controls in our regressions, as discussed in Section 3.2 below.

3 Exposure(s) to Trade and Earnings Dynamics

The goal of our empirical analysis is to study how the interaction between worker and market exposures to the USSR shock, s_i and S_m, shape the causal impact of that negative trade shock on the path of Finnish workers' earnings, y_{imt}, over the 1985-2004 period.

3.1 Empirical Design

We follow closely earlier work using longitudinal worker data to estimate the impact of negative labor demand shocks at various time horizons (Jacobson et al., 1993; Autor et al., 2014; Yagan, 2019). Our empirical design compares changes in the earnings trajectories of workers who are more and less exposed—but similar in terms of other observable characteristics—in markets with different exposures to the USSR shock. For each sample year t, we separately estimate the following linear regression model,

$$\Delta y_{imt} = \beta_t \times s_i + \gamma_t \times (s_i \times S_m) + \delta_{mt} + (\text{Controls}_i)'\zeta_t + \varepsilon_{it}, \tag{1}$$

where $\Delta y_{imt} \equiv y_{imt} - \overline{y}_{im}$ is the difference between worker i's earning at date t, y_{imt}, and her pre-period average (across the years 1985, 1988, and 1989), $\overline{y}_{im}$; s_i denotes worker i's direct exposure to the USSR shock; S_m denotes the exposure to the USSR shock of the municipality m in which i was employed in 1989; δ_{mt} is a municipality-and-year fixed effect; Controls_i is a long vector of initial worker characteristics whose impact may also vary over time; and ε_{it} is a worker-and-year specific error term. Both the sample of workers and their characteristics are held fixed across all years.

The first regression coefficient β_t is the focus of the previous literature identifying the worker-level impact of negative labor demand shocks. It is identified from the double-difference between more and less directly exposed workers in the pre- and post-periods. The second regression coefficient γ_t is the main focus of our analysis. It is identified instead from variation in the previous double-difference between more and less exposed markets, a triple-difference strategy. We interpret γ_t as a measure of how the causal effect of worker exposure s_i to the USSR shock varies with the exposure of its municipality S_m at different time horizons t. Alternatively, γ_t could reflect different pre-existing trends (e.g., a downward pre-1989 trend in the earnings gap between more and less exposed workers in more exposed markets), omitted contemporaneous shocks (e.g., negative sector demand shocks that disproportionately hurt more exposed workers in more exposed markets in year t), or non-linearities in the causal effects of worker exposure (independent of the municipality where a worker is located). We revisit these alternative interpretations in Sections 3.3 and 3.4.

3.2 Worker Sample and Controls

Baseline Worker Sample. We restrict our sample to workers (i) who are employed in the private sector in 1989, (ii) who have high labor force attachment before the collapse of the USSR, and (iii) who remain of working-age throughout the period we examine. Private sector workers include all workers employed in a non-public establishment, not just those employed in LDPM plants. Following Autor et al. (2013), we define an individual to have a high labor force attachment if her annual earnings were at least the equivalent of 1,600 annual hours of work at the "minimum wage" in each of the pre-shock years (1985, 1988, and 1989). Since there is no mandated minimum wage in Finland, we measure the "minimum wage" as the first percentile of hourly wages among blue collar manufacturing workers.[7] We focus on workers born in 1945–1967. These birth cohorts were 18–40 years old at the start of our examination pre-period in 1985 and 37–59 years old at the end of our follow-up period in 2004. After eliminating workers from the previous birth cohorts who are in the public sector in 1989 or who do not have high labor force attachment, we end up with a total of 632,269 individuals in 1989 corresponding to 35 percent of these birth cohorts. This number falls to 607,958 by 2004, due to death and emigration.

Worker Controls. Our vector of worker controls, Controls$_i$, features various characteristics of worker i in 1989 built from the worker observables listed in Appendix Table A.3. Specifically, Controls$_i$ includes: a dummy variable for worker i being employed in the manufacturing sector; dummy variables for worker i belonging to multiple socio-demographic groups defined separately by gender, year of birth, five levels of education, five fields of education, three native languages, and ten deciles of earnings in 1989; and dummy variables for the plant employing worker i in 1989 having its pre-period gross output, capital-labor ratio, and average annual earnings in one of ten deciles.[8]

3.3 Local Scarring Effect

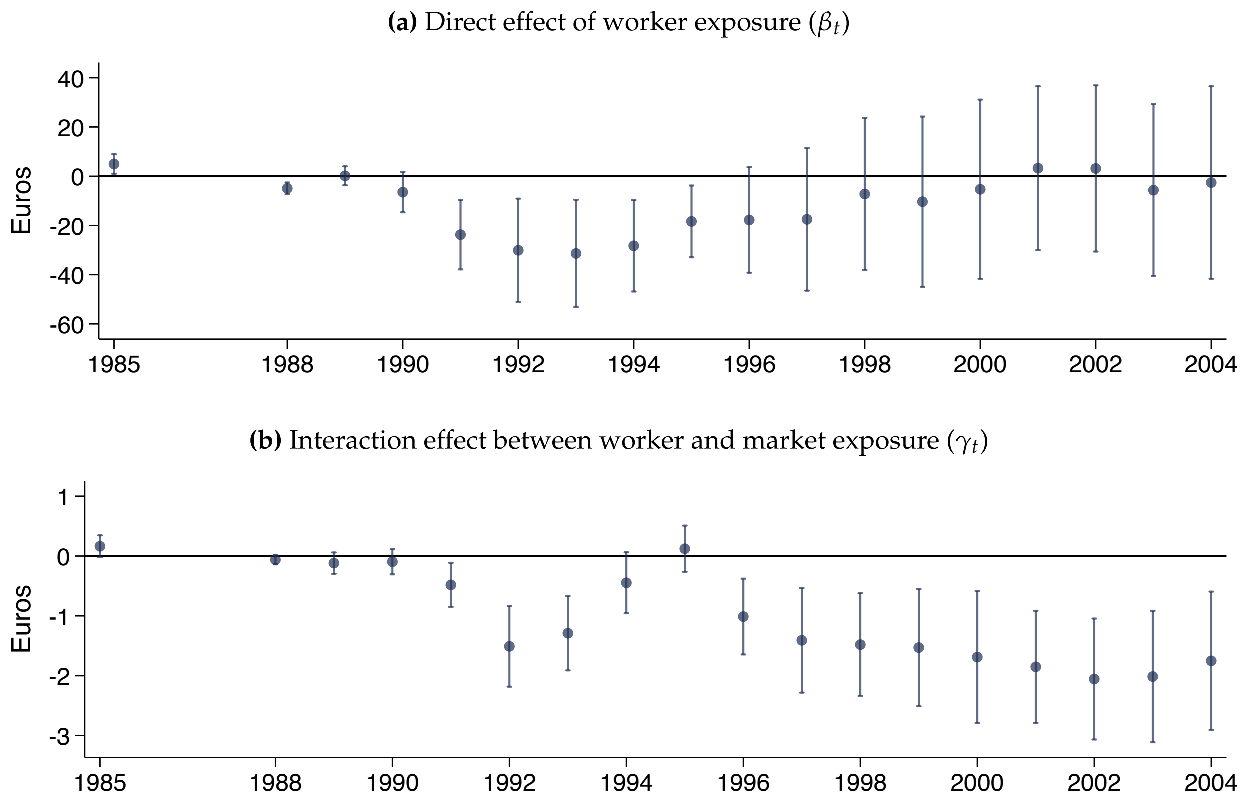
Figure 3 reports how worker and market exposures, s_i and S_m, shape the earnings trajectories of Finnish workers. Figure 3a focuses on the direct effect of worker exposure, as measured by the OLS estimate of β_t in equation (1), whereas Figure 3b focuses on the interaction effect between worker and market exposure, as measured by the OLS estimate of γ_t in equation (1). This second set of estimates is the main focus of our analysis.

Compared to observationally identical workers from the same municipality in 1989, Figure 3a shows that more directly exposed workers experience statistically significant declines in labor earnings following the trade collapse. These declines peak in 1992 and 1993, shortly following the nadir of Finnish-Soviet trade, and become progressively less severe thereafter. In spite of this, more exposed workers' earnings remain lower throughout the 1990s, although this difference becomes statistically insignificant by the late 1990s and remains so through the end the sample period. Figure 3a also shows no evidence of

[7]We obtain blue-collar manufacturing wages from the wage survey of the Confederation of Finnish Industry and Employers. This dataset covers approximately 75% of manufacturing employees. The resulting annual income cutoff for inclusion in our high-labor-force-attachment sample is 8,896 euros for 1985, 9,453 euros for 1988, and 9,318 euros for 1989, all in 2010 euros.

[8]Since gross output and capital-labor ratio are only available for LDPM plants, we add a missing category, which we assign to workers not employed by an LDPM plant in 1989.

Figure 3: Incidence of the USSR Shock on Earnings



Notes: Figures 3a and 3b report the OLS estimates of β_t and γ_t in equation (1). Vertical lines indicate 95% confidence intervals on each coefficient. Robust standard errors are clustered by 1989 municipality.

pre-existing differential trends prior to 1989.[9]

Quantitatively, our 1992 estimate of β_t implies that in a municipality with almost no exposure to the USSR shock ($S_m \simeq 0$), a worker at the 90th percentile of direct exposure (among the exposed, i.e., someone who is employed in a plant whose percentage of sales to the USSR is $s_i = 20$) experiences a decline in earnings of 607 euros compared to an unexposed worker. This earnings gap is equivalent to approximately 2.4% of the average pre-period annual income of workers in our sample.[10] Summed across all years following

[9]Because the dependent variable Δy_{imt} is measured as the difference between y_{imt} and its average value before the USSR shock, the sum of the estimated coefficients across pre-shock years (1985, 1988, and 1989) is zero by construction. Pre-trends, if they existed, would manifest as a systematic decrease or increase in estimated coefficients across these three years.

[10]Typical estimates of earnings declines in the mass-layoff literature (e.g. Jacobson et al., 1993) are around 25% of yearly income. It should be clear, however, that the two sets of estimates are not directly comparable. The reason is that a plant with exposure $s_i = 20$ is unlikely to fire 100% of its workforce in response to the USSR shock. As a back-of-the-envelope calculation, suppose, following Figure 1, that sales to the USSR drop by 2/3 between 1989 and 1992. For a plant with 20% of its sales originally exported to the USSR, this implies a 13.3% drop in total sales. Suppose, in turn, that this plant fires 13.3% of its workforce and, for simplicity, that the earnings of the remaining workers in the plant do not change. Under these assumptions,

the USSR shock, this implies earnings losses of 3,824 euros or 14.9% of their pre-period annual income.

The negative response of workers' earnings to their exposure to the USSR shock is consistent with the results of Autor et al. (2014) about the impact of the China shock in the United States. Although we focus on a decrease in exports at the plant level rather than a surge in imports at the sector level, both can be thought of as negative labor demand shocks, with negative consequences for directly exposed workers within any given local labor market. The incidence of the USSR shock, however, is much smaller than the impact of the China shock documented by Autor et al. (2014). According to their estimates, when cumulated over a 16-year period, the earnings gap between unexposed workers and manufacturing workers at the 90th percentile of exposure to the surge in Chinese imports—whose industry experiences a 24.74 percentage point increase in import penetration—is equal to 170% of their initial yearly income.

Turning to our primary focus—the interaction effect between worker and market exposure in Figure 3b—we see that the OLS estimate of γ_t is negative and statistically different from zero in all post-shock years, except 1994 and 1995.[11] Despite the direct effect of worker exposure waning from 1997 to 2004, more exposed workers continue to experience declines in earnings over the same period in more exposed local labor markets, a form of local scarring. Going back to the comparison of a worker at the 90th percentile of worker exposure and an unexposed worker, our estimates of γ_t in 1992 imply that the earnings gap goes up from 607 euros in a municipality with $S_m \simeq 0$ to 663 euros in a municipality at the 90th percentile, for which $S_m = 1.77$. In 2004, the final year of our sample, the difference in the earnings gap across these two municipalities is almost unchanged, increasing slightly from 55 to 64 euros. Adding it up across all years from 1991 to 2004, this difference amounts to an extra loss of 681 euros, or 2.7% of their pre-period annual income, for exposed workers in the more exposed municipality.

The empirical finding that worker exposure to a negative trade shock has persistently larger negative earnings effects in more exposed municipalities can be viewed as a spatial counterpart of earlier results in the labor literature about the heterogeneous impact of mass layoffs over the business cycle, see, e.g., Davis and von Wachter (2011), Korkeamäki and Kyyrä (2014), Farber (2017), Huckfeldt (2022), and Schmieder et al. (2023). These papers compare workers fired after a mass-layoff event relative to other workers and

the average earnings losses for fired workers equal $\beta_t \times (20/13.3)$ euros. In 1992, this implies a decline in earnings of 18.3% of yearly income, broadly in line with existing estimates in the mass-layoff literature.

[11] The rebound in these two years is explained by more exposed workers experiencing an increase in earnings over that time period, as can be seen in Appendix Figure B.1. This coincides with an increase in employment of the plants exposed to the USSR in those same years, as can be seen in Appendix Figure B.2.

show that fired workers experience larger and more persistent earnings declines if that mass layoff occurred during a national recession. Provided that differential changes in the returns to the unobserved characteristics of fired and non-fired workers are orthogonal to the state of the national business cycle, this implies that the causal effect of being fired is more severe in bad times.

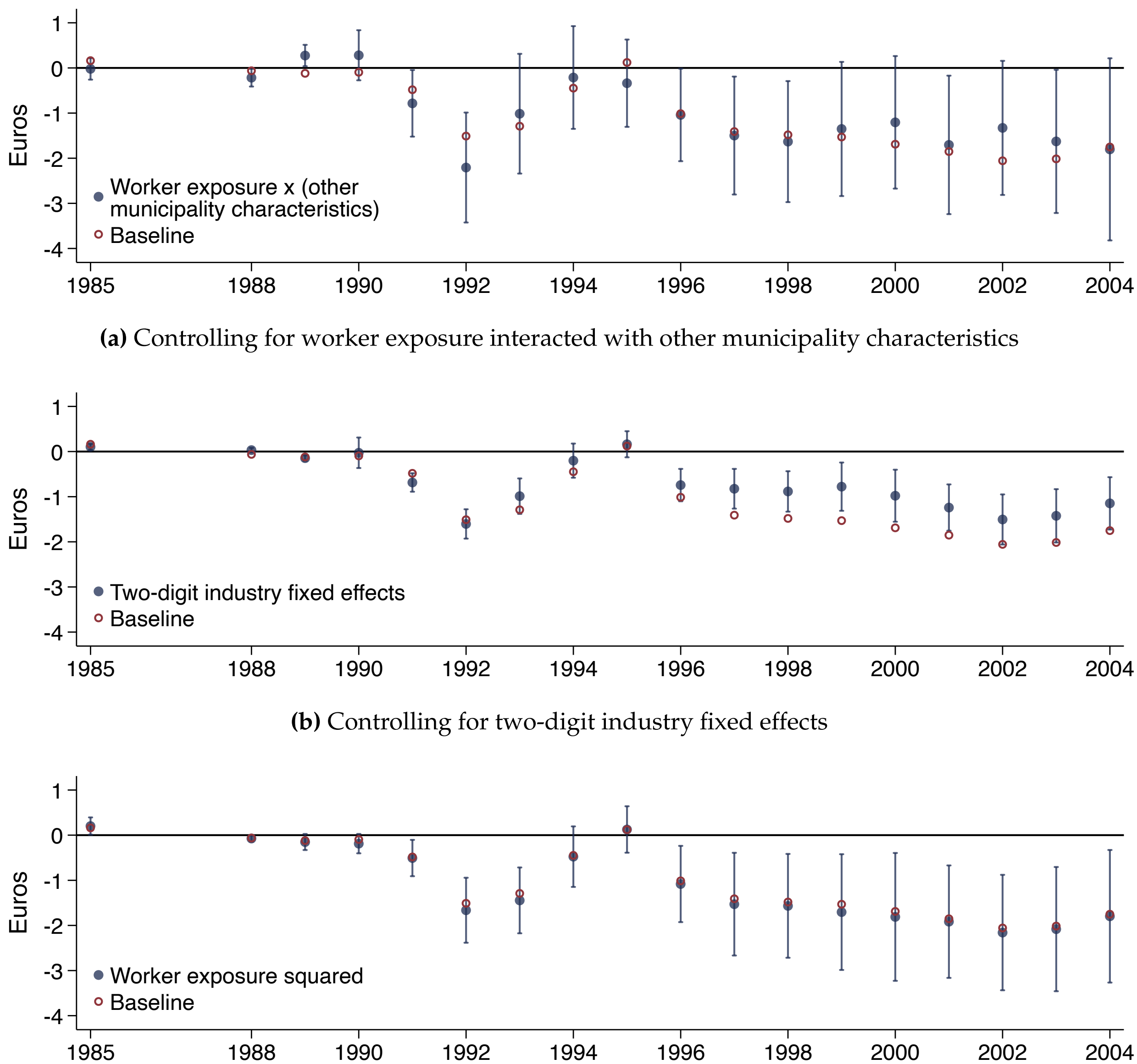
Our empirical analysis highlights similar heterogeneous effects across local labor markets, with market exposure to the USSR shock S_m playing the role of the severity of the recession and with worker exposure s_i playing the role of the dummy for whether or not a worker was fired as part of a mass layoff. A benefit of our research design is that s_i here is an ex ante characteristic, measured before the USSR shock, whereas the dummy for whether or not a worker was fired as part of a mass layoff is an ex post characteristic, which might also be affected by the national business cycle, potentially violating the aforementioned orthogonality condition. There is no counterpart to that ex post selection issue in the present context.

3.4 Sensitivity Analysis

The results presented in Figure 3 are robust to a variety of alternative specifications. Here, we report sensitivity of the local scarring effect displayed in Figure 3b, the primary focus of our paper. For the interested reader, sensitivity of Figure 3a can be found in Appendix Figure B.3.

One general concern related to the identification of γ_t is that the interaction term $(s_i \times S_m)$ is picking up heterogeneous effects of worker exposure s_i across municipalities that differ in various characteristics that are correlated with market exposure S_m, but omitted from our baseline regression. As discussed in Section 2.2, market exposure is correlated with the initial manufacturing share of employment, the share of the working-age population with at least a secondary education, and the average age of the working-age population in a given municipality. To address this potential source of bias, we add the interaction between worker exposure s_i and each these three municipality characteristics to the baseline specification described in equation (1). Reassuringly, Figure 4a shows that the point estimates of γ_t remain broadly unchanged, despite standard errors increasing somewhat.[12]

[12] One may also worry that the same municipalities that were exposed to the USSR shock were later exposed to (negative) changes in their exports to other Eastern European countries or (positive) changes in their exports to the European Union. To alleviate such concerns, we also consider an alternative specification in which we add to the baseline specification described in equation (1) two interaction terms: $s_i \times$ (Share of municipality m's output exported to the USSR satellites in 1989) and $s_i \times$ (Share of municipality m's output exported to the EU15 in 1989). The results are similar and reported in



(a) Controlling for worker exposure interacted with other municipality characteristics

(b) Controlling for two-digit industry fixed effects

(c) Controlling for worker exposure squared

Figure 4: Sensitivity of Interaction Effect (γ_t) to Alternative Controls

Notes: This figure reports the OLS estimates of γ_t in equation (1) with alternative vectors of controls, Controls_i. Figure 4a controls for the interaction between s_i and the following three municipality characteristics, each measured in 1989: the share of employment in manufacturing, the share of the working-age population with at least a secondary education, and the average age of the working-age population. Figure 4b replaces the manufacturing dummy with a full set of two-digit industry dummies. Figure 4c includes s_i^2 as an additional control. Blue dots display point estimates associated with alternative specifications, whereas red circles display baseline estimates from Figure 3b. Vertical lines indicate 95% confidence intervals on each alternative coefficient. Robust standard errors are clustered by 1989 municipality.

Related to the previous concern, industries may be experiencing different wage and employment trends not captured by the manufacturing fixed effect included in Controls$_i$. If so, heterogeneous effects of worker exposure s_i across markets with different exposures S_m may simply reflect the heterogeneous paths of different industries in which municipalities are specialized rather than different impulse responses to the USSR shock. To control for such considerations, we replace the manufacturing fixed effect with two-digit industry fixed effects. Again, we see in Figure 4b that the negative effect of worker exposure is persistently larger in more exposed markets. Even after controlling for two-digit industry fixed effects, though, we continue to observe the rebound in 1994 and 1995. This is consistent with plant-level demand shocks within each industry evolving over time for idiosyncratic reasons, but this evolution being correlated in 1994 and 1995 with 1989 plant-level exposure to the USSR shock, as suggested by Appendix Figure B.2.

Another concern is that the interaction term $(s_i \times S_m)$ may be picking up non-linear direct effects of worker exposure, since s_i is correlated with S_m by construction. To explore the potential importance of such non-linearities, we add the square of worker exposure s_i^2 to the baseline specification described in equation (1).[13] Figure 4c again shows that the sign and time path of γ_t remain broadly unchanged.

As a final set of robustness checks, we explore the sensitivity of our results to using relative rather than absolute levels of earnings, as well to considering different worker samples, either all private sector workers or the subset of workers from our baseline sample initially employed in manufacturing. The results of these alternative specifications can be found in Appendix Figures B.5 and B.6. In all cases, the local scarring effect of negative trade shocks documented in Figures 3 and 4 can be observed.

4 Concluding Remarks

What role do local labor markets play in propagating trade shocks? Is recent empirical evidence about significant differences in the incidence of trade shocks across markets merely reflecting the fact that more exposed markets are inhabited by a greater share of equally affected workers or is there something distinct about the experience of workers exposed to trade in the most exposed markets? From a policy perspective, are national social programs well suited to compensate workers for the adverse consequences of globalization or should such programs inherit characteristics of place-based policies, with assistance to

Appendix Figure B.4.

[13] Note that any non-linear effect of S_m that would uniformly affect all workers in a municipality is already absorbed by the municipality-and-year fixed effect δ_{mt} in equation (1)

negatively affected workers conditioning on local labor-market conditions?

To make progress on these questions, we have combined newly-digitized export data with employer-employee data to construct measures of worker and market exposure to a large trade shock, the collapse of the Finnish-Soviet Trade Agreement. We have documented that worker exposure to the USSR shock lowers earnings throughout the post period, but persistently more so in more exposed markets, a form of local scarring that provides a potential rationale for place-based unemployment insurance and trade adjustment assistance programs.

Although the present analysis is silent about the economic origins of the local scarring effect, one enticing possibility—that we touch on in our working paper Costinot et al. (2022) and that is potentially salient in many countries, including Finland—is the existence of wage rigidity. Intuitively, if wages adjust downward slowly in response to negative shocks, then unemployment will be observed in the short run, and more exposed workers—who are more likely to lose their jobs—will tend to experience longer unemployment spells and larger decreases in earnings. Furthermore, in more exposed markets, where unemployment is higher and, therefore, job-finding rates are depressed, one may expect unemployment effects and, in turn, earnings losses to be more severe. We view the development of trade and spatial models with wage rigidity, as in the recent work of Rodríguez-Clare et al. (2022) and Kim et al. (2023), as an exciting area for future research.

References

Adao, Rodrigo, Paul Carrillo, Arnaud Costinot, Dave Donaldson, and Dina Pomeranz, "Imports, Exports, and Earnings Inequality: Measures of Exposure and Estimates of Incidence," *mimeo MIT*, 2021.

Alfaro-Urena, Alonso, Isabela Manelici, and Jose P Vasquez, "The Effects of Multinationals on Workers: Evidence from Costa Rican Microdata," Technical Report 2021.

Austin, Benjamin A., Edward L. Glaser, and Lawrence H. Summers, "Jobs for the Heartland: Place-Based Policies in 21st Century America," *NBER Working Paper 24548*, 2018.

Autor, David H., David Dorn, and Gordon H. Hanson, "The China syndrome: Local labor market effects of import competition in the United States," *American Economic Review*, 2013, *103* (6), 2121–2168.

_ , _ , _ , and Jae Song, "Trade Adjustment: Worker-Level Evidence," *Quarterly Journal of Economics*, 2014, *129* (4), 1799–1860.

Blanchard, Olivier Jean and Lawrence F. Katz, "Regional Evolutions," *Brookings Papers on Economic Activity*, 1992, *23* (1), 1–76.

Costinot, Arnaud, Matti Sarvimaki, and Jonathan Vogel, "Exposure(s) to Trade and Earnings Dynamics: Evidence from the Collapse of Finnish-Soviet Trade," *MIT working paper*, 2022.

Davis, Steven J. and Till von Wachter, "Recessions and the Costs of Job Loss," *Brookings Papers on Economic Activity*, 2011, pp. 1–72.

Dhyne, Emmanuel, Ken Ayumu Kikawa, Toshiaki Komatsu, Magne Mogstad, and Felix Tintelnot, "How Do Firms Respond to Demand Shocks? A Network Perspective," *mimeo University of Chicago*, 2022.

Einiö, Elias, "Estimating Labor Demand Elasticities from Asymmetric Product Market Shocks," *mimeo VATT Institute for Economic Research*, 2018.

Eloranta, Jari and Jari Ojala, "Converta - A Finnish Conduit in the East-West Trade," in Jari Eloranta and Jari Ojala, eds., *East-West Trade and the Cold War*, Jyväskylä Studies in Humanities, 2005.

Farber, Henry S., "Employment, Hours, and Earnings Consequences of Job Loss: US Evidence from the Displaced Workers Survey," *Journal of Labor Economics*, 2017, *35* (S1), S235–S272.

Gorodnichenko, Yuriy, Enrique G. Mendoza, and Linda L. Tesar, "The Finnish Great Depression: From Russia with Love," *American Economic Review*, 2012, *102* (4), 1619–44.

Gulan, Adam, Markus Haavio, and Juha Kilponen, "Can large trade shocks cause crises? The case of the Finnish-Soviet trade collapse," *Journal of International Economics*, 2021, *131*, 103480.

Honkapohja, Seppo and Erkki Koskela, "The Economic Crisis of the 1990s in Finland," *Economic Policy*, 1999, *14* (29), 401–436.

Huckfeldt, Christopher, "Understanding the Scarring Effect of Recessions," *American Economic Review*, April 2022, *112* (4), 1273–1310.

Hyman, Benjamin G., "Can Displaced Labor be Retrained? Evidence from Quasi-Random Assignment to Trade Adjustment Assistance," *mimeo*, 2018.

Jacobson, Louis S., Robert J. Lalonde, and Daniel G. Sullivan, "Earnings Losses of Displaced Workers," *American Economic Review*, 1993, *83* (4), 685–709.

Jonung, Lars, Jaakko Kiander, and Pentti Vartia, eds, *The great financial crisis in Finland and Sweden: The nordic experience of financial liberalization*, Edward Elgar Publishing, 2009.

Kim, Bumsoo, Marc de la Barrera, and Masao Fukui, "Currency Pegs, Trade Deficits and Unemployment: A Reevaluation of the China Shock," *MIT working paper*, 2023.

Korkeamäki, Ossi and Tomi Kyyrä, "A distributional analysis of earnings losses of displaced workers in an economic depression and recovery," *Oxford Bulletin of Economics and Statistics*, 2014, *76* (4), 565–588.

Kovak, Brian, "Regional Effects of Trade Reform: What is the Correct Measure of Liberalization?," *American Economic Review*, 2013, *103* (5), 1960–76.

_ **and Rafael Dix-Carneiro**, "Trade Liberalization and Regional Dynamics," *American Economic Review*, 2017, *107* (10), 2908–2946.

OECD, "Harmonised System 1988. International Trade by Commodity Statistics (database)," 2023. doi.org/10.1787/data-00060-en.

— , "Trade in value by partner countries. OECD Quarterly International Trade Statistics (database)," 2023. doi.org/10.1787/data-00700-en.

Rodríguez-Clare, Andres, Mauricio Ulate, and Jose P. Vasquez, "Trade with Nominal Rigidities: Understanding the Unemployment and Welfare Effects of the China Shock," *NBER Working Paper 27905*, 2022.

Schmieder, Johannes F., Till von Wachter, and Jörg Heining, "The Costs of Job Displacement over the Business Cycle and Its Sources: Evidence from Germany," *American Economic Review*, May 2023, *113* (5), 1208–54.

Sutela, Pekka, "Finnish trade with the USSR: Why was it different?," 2005. BOFIT, Bank of Finland.

— , *Trading with the Soviet Union: The Finnish Experience 1944-1991*, Helsinki: Aleksanteri Institute, 2014.

Topalova, Petia, "Factor Immobility and Regional Impacts of Trade Liberalization: Evidence on Poverty from India," *American Economic Journal: Applied Economics*, 2010, *2* (4), 1–41.

Yagan, Danny, "Employment Hysteresis from the Great Recession," *Journal of Political Economy*, 2019, *127* (5), 2505–2558.

Online Appendix

The Local Scarring Effect of Negative Trade Shocks: Evidence from the Collapse of Finnish-Soviet Trade

Arnaud Costinot, Matti Sarvimäki, and Jonathan Vogel

A Online Appendix: Summary Statistics

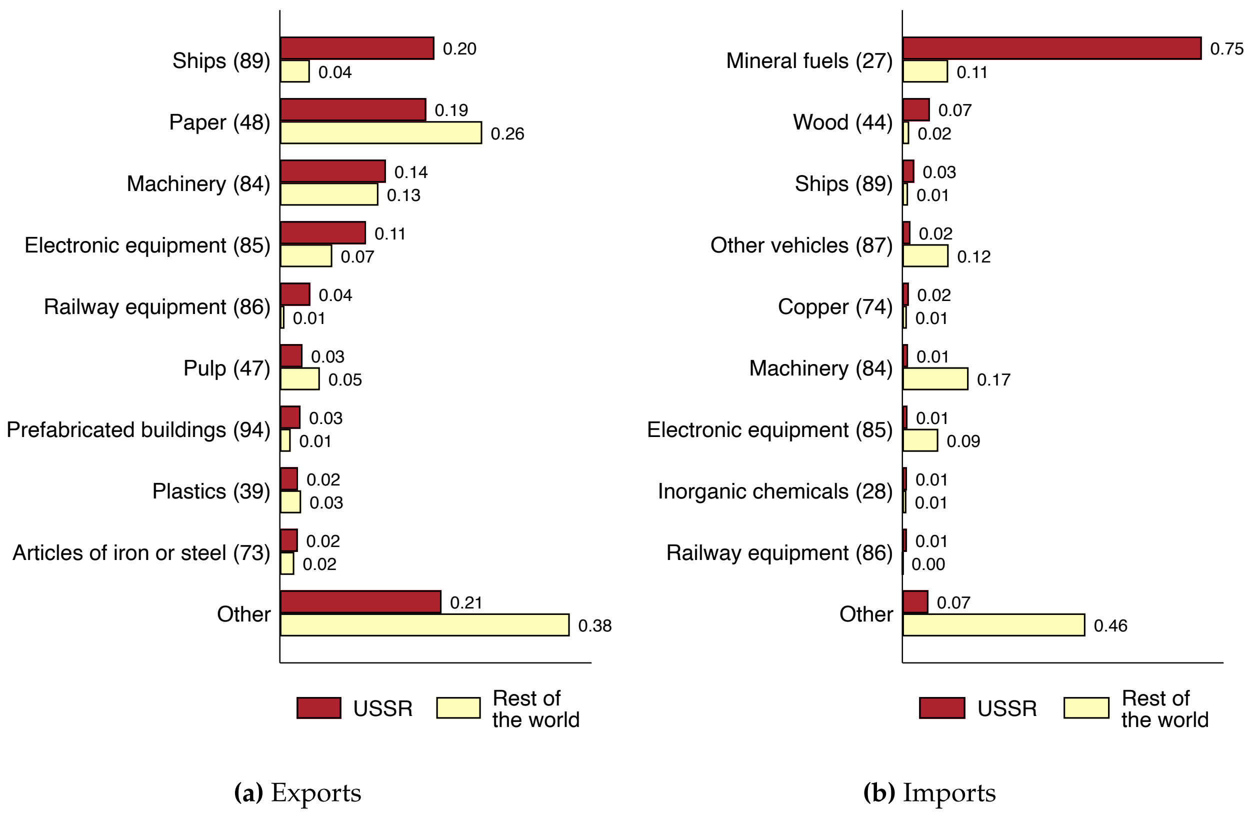


Figure A.1: Sectoral Composition of Finland's Exports and Imports, 1989

Notes: Figure A.1a reports the shares of Finnish exports to the USSR accounted by different 2-digit (HS88) sectors (in red) as well as the same shares for Finnish exports to the Rest of the World (in yellow). Figure A.1b reports the shares of Finnish imports to the USSR (in red) and imports to the Rest of the World (in yellow). All trade data are from 1989, as reported in OECD (2023a).

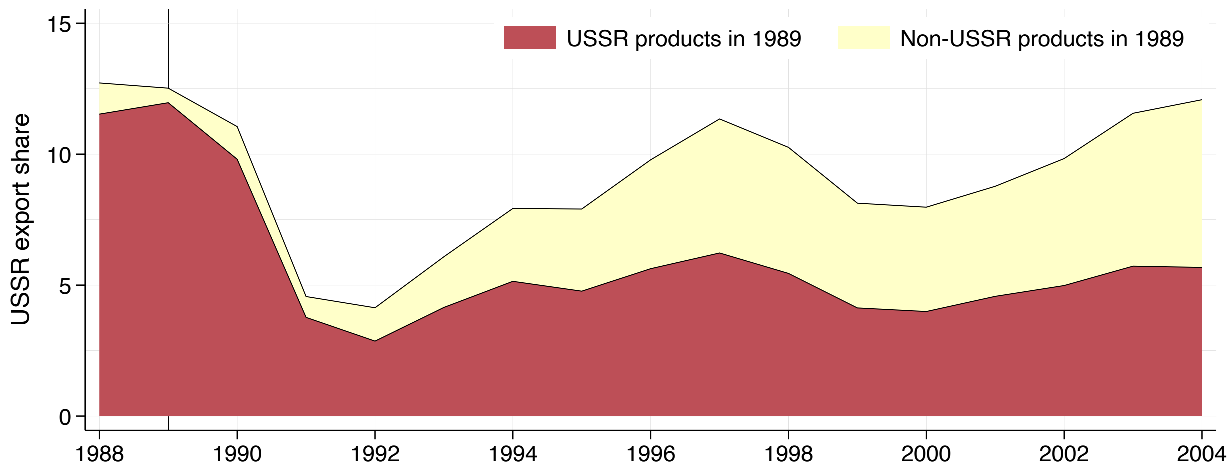


Figure A.2: Product Composition of the USSR Export Rebound

Notes: The share of Finnish exports to the USSR, or the 15 former Soviet republics, is decomposed into exports of "USSR Products in 1989" in the bottom shaded area (in red) and "Non-USSR Products in 1989" in the top shaded area (in yellow). "USSR Products in 1989" is defined as the set of 6-digit (HS88) products with USSR exports at least 5% of their total exports in 1989 whereas "Non-USSR Products in 1989" corresponds to all other products. All data are from OECD (2023a).

Table A.1: LDPM Plants by USSR Export Intensity, 1989

	All	By share of gross output exported to the USSR in 1989			
		0%	0–10%	10–50%	50–100%
A: Average Plant characteristics					
Gross output	9,493	5,774	39,167	44,276	18,063
Value-added	3,204	1,995	12,886	13,772	6,955
Number of workers	58.9	38.3	221.8	245.7	144.0
Value-added per worker	50.9	48.8	67.7	52.9	47.4
Capital / labor ratio	69.7	68.5	81.6	66.0	48.0
Plant age	10.5	10.2	12.9	12.6	12.5
Multi-plant firm	0.31	0.25	0.82	0.67	0.58
Share of output exported to the USSR	0.9	0.0	1.6	24.3	82.1
B: Group Size					
Share of output	1.00	0.54	0.39	0.06	0.01
Share of workers	1.00	0.58	0.36	0.05	0.01
Share of USSR exports	1.00	0.00	0.30	0.44	0.26
No. of plants	6,865	5,989	734	99	43

Notes: This table reports how characteristics of LDPM plants vary with their export intensity (in panel a) as well as the shares of output, employment, and USSR exports accounted by groups of plants with different export intensity (in panel b). All monetary values are expressed in thousands of 2010 euros.

Table A.2: Correlation Between Market Exposure and 1989 Characteristics

	1. S_m	2. $Manu_m$	3. Edu_m	4. Age_m
1. Exposure (S_m)	1	0.25	0.13	0.09
2. Share in manufacturing ($Manu_m$)		1.00	0.22	0.23
3. Share with secondary degree or more (Edu_m)			1.00	-0.25
4. Average age (Age_m)				1.00

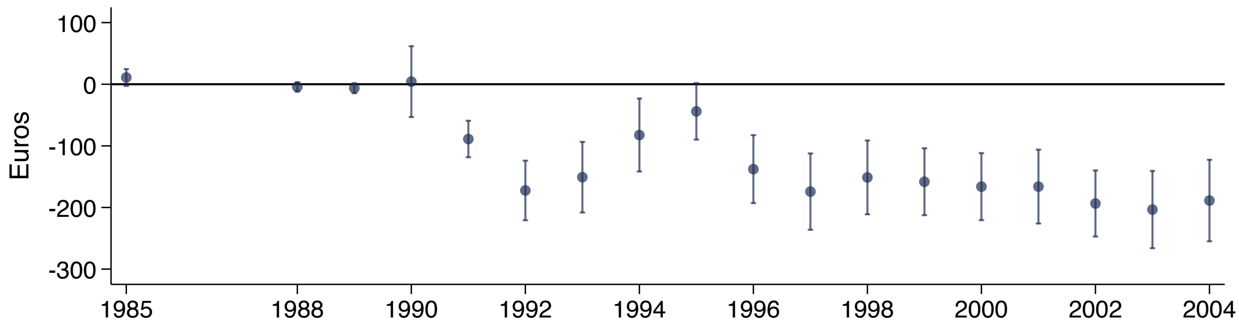
Notes: This table reports the correlation between market exposure to the USSR shock and other municipality characteristics in 1989. Municipalities are weighted by their employment in 1989.

Table A.3: Worker Characteristics by Worker-Level Exposure to USSR Shock, 1989

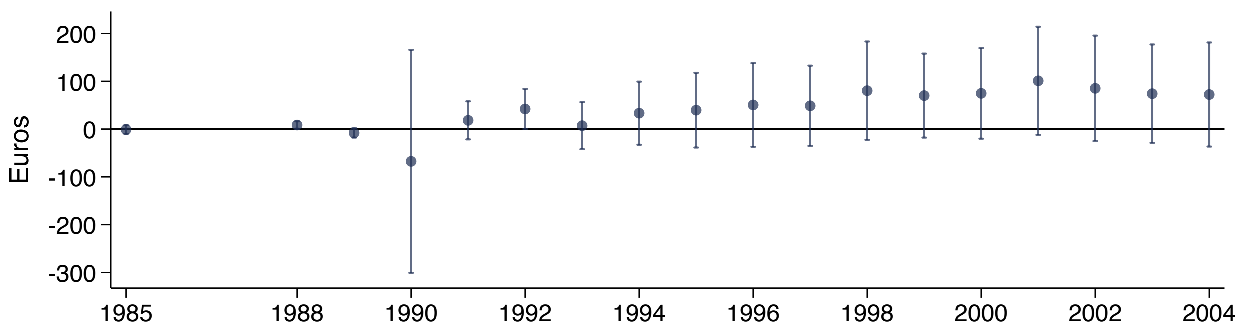
		By worker-level exposure			
	All	0%	0–10%	10–50%	50–100%
A: Employer characteristics					
Average annual earnings	17,310	17,144	18,287	18,394	17,725
Gross output (LDPM)	77,957	39,561	132,657	113,210	70,224
Capital-labor ratio (LDPM)	73.9	71.0	79.7	70.5	53.7
B: Worker socio-demographics					
Year of birth	1953.9	1954.1	1953.2	1953.2	1953.3
Female	0.36	0.37	0.26	0.28	0.30
First language Finnish	0.95	0.94	0.97	0.96	0.97
First language Swedish	0.05	0.06	0.03	0.04	0.02
Other first language	0.003	0.003	0.002	0.001	0.003
Less than secondary/unknown degree	0.32	0.32	0.33	0.31	0.23
Lower secondary degree	0.38	0.37	0.43	0.45	0.44
Upper secondary degree	0.20	0.20	0.14	0.14	0.17
Lower tertiary degree	0.05	0.05	0.05	0.05	0.08
Higher tertiary degree	0.06	0.06	0.06	0.06	0.07
Business degree	0.16	0.17	0.08	0.08	0.08
Technical degree	0.36	0.34	0.51	0.55	0.62
Degree in other fields	0.16	0.17	0.08	0.07	0.07
Degree unknown / missing	0.32	0.32	0.33	0.31	0.23
Annual earnings	28,091	27,973	28,879	28,708	28,665
C: Sector of employment					
Manufacturing	0.36	0.27	0.98	1.00	1.00
Observations	632,269	547,134	70,841	11,369	2,925

Notes: This table reports how the characteristics of workers in our baseline sample vary with their exposure to the USSR shock. Annual earnings are expressed in 2010 euros. Gross output is in thousands of 2010 euros.

B Online Appendix: Additional Results



(a) Exposed workers



(b) Non-exposed workers

Figure B.1: Earnings of Exposed vs. Non-Exposed Workers

Notes: This figure reports the OLS estimates of β_t in the following worker-level regression: $\Delta y_{it} = \beta_t S_m + Controls_i' \zeta_t + \epsilon_{it}$. Figure B.1a considers the subsample of exposed workers ($s_i > 0$), whereas Figure B.1b considers the subsample of non-exposed workers ($s_i = 0$). Vertical lines indicate 95% confidence intervals on each coefficient. Robust standard errors are clustered by 1989 municipality.

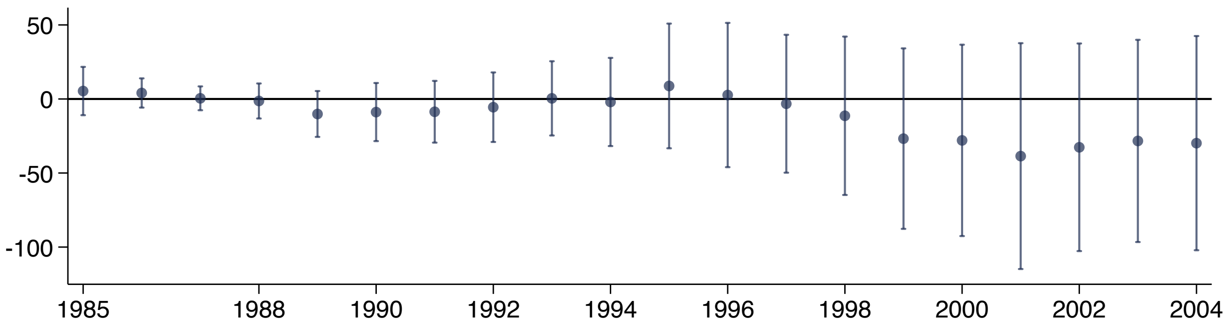
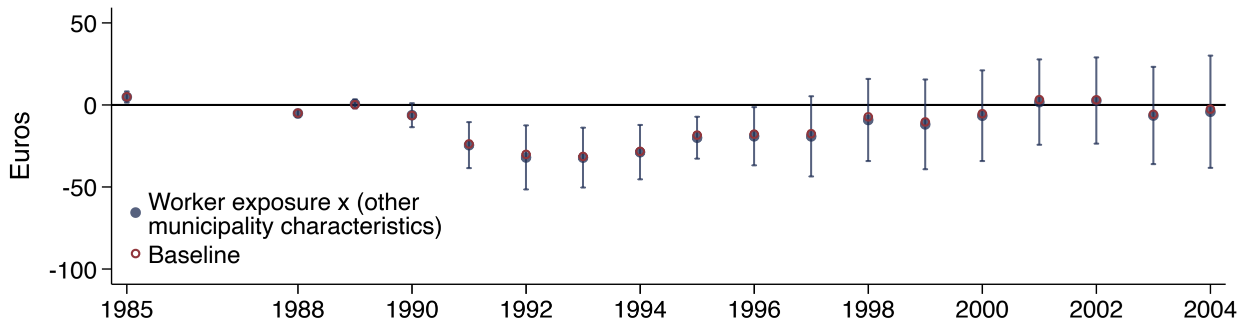
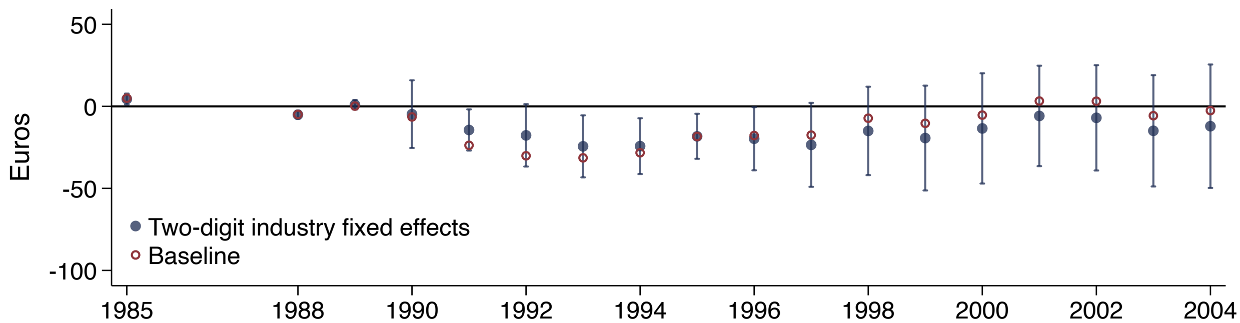


Figure B.2: Plant-Level Regressions

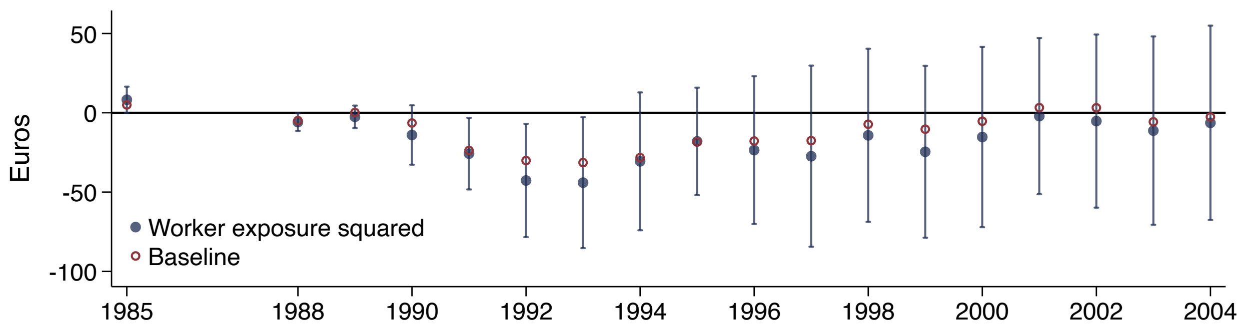
Notes: This figure reports the OLS estimates of β_t in the following plant-level regression: $\Delta emp_{jmt} = \beta_t \times s_j + \delta_{mt} + (\text{Controls}_j)'\zeta_t + \varepsilon_{jt}$, where Δemp_{jmt} denotes employment in plant j in municipality m in year t minus its average value across the pre-USSR-shock years (1985, 1988, and 1989). Plant-level controls include two-digit industry dummy variables as well as decile dummy variables for gross output, capital-labor ratio, number of workers, and workers' average annual earnings. Vertical lines indicate 95% confidence intervals on each coefficient. Robust standard errors are clustered at the plant level.



(a) Controlling for worker exposure interacted with other municipality characteristics



(b) Controlling for two-digit industry fixed effects



(c) Controlling for worker exposure squared

Figure B.3: Sensitivity of Direct Effect (β_t) to Alternative Controls

Notes: This figure describes how the direct effect of worker exposure varies with the alternative worker controls from Figure 4. Figure B.3a controls for the interaction between s_i and the following three municipality characteristics, each measured in 1989: the share of employment in manufacturing, the share of the working-age population with at least a secondary education, and the average age of the working-age population. Figure B.3b replaces the manufacturing dummy with a full set of two-digit industry dummies. Figure B.3c includes s_i^2 as an additional control. Blue dots display the direct effect of worker exposure in these alternative specifications measured as: β_t plus the sum across all three municipality characteristics of the estimated coefficient for that characteristic times the average value of the characteristic in Figure B.3a; β_t in Figure B.3b; β_t plus twice the estimated coefficient on the quadratic term times the average worker exposure (among exposed workers) in Figure B.3c. Red circles display baseline estimates of β_t from Figure 3a. Vertical lines indicate 95% confidence intervals on each alternative coefficient. Robust standard errors are clustered by 1989 municipality.

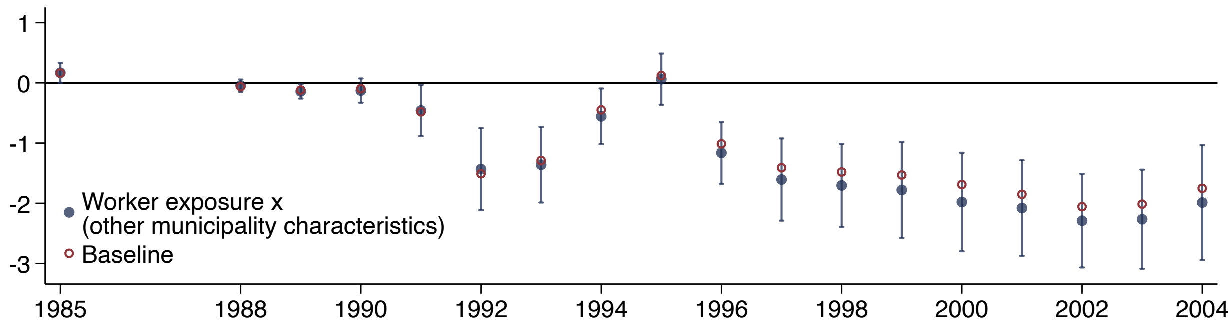


Figure B.4: Sensitivity of Interaction Effect (γ_t) to Additional Trade Controls
Notes: This figure reports the OLS estimates of γ_t in equation (1) with an alternative vectors of controls, Controls$_i$, that also includes the interaction between s_i and the share of municipality m's output exported to the USSR satellites in 1989 and the share of municipality m's output exported to the EU15 in 1989. Blue dots display point estimates associated with this alternative specification, whereas red circles display baseline estimates from Figure 3b. Vertical lines indicate 95% confidence intervals on each alternative coefficient. Robust standard errors are clustered by 1989 municipality.

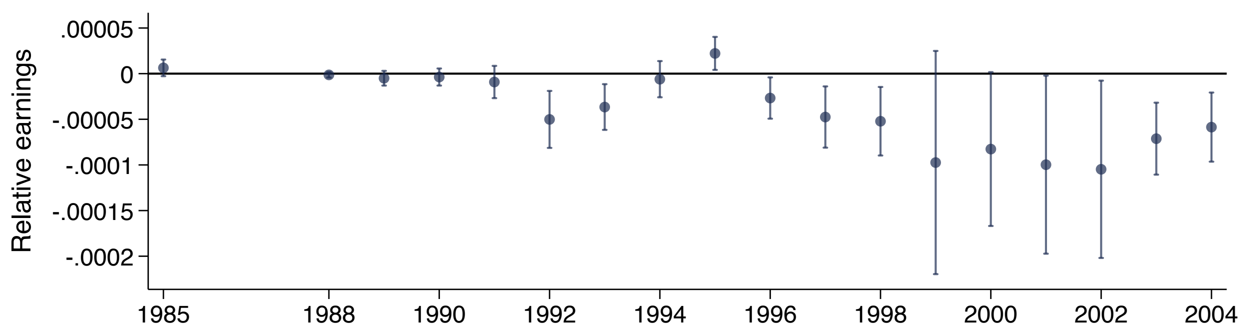
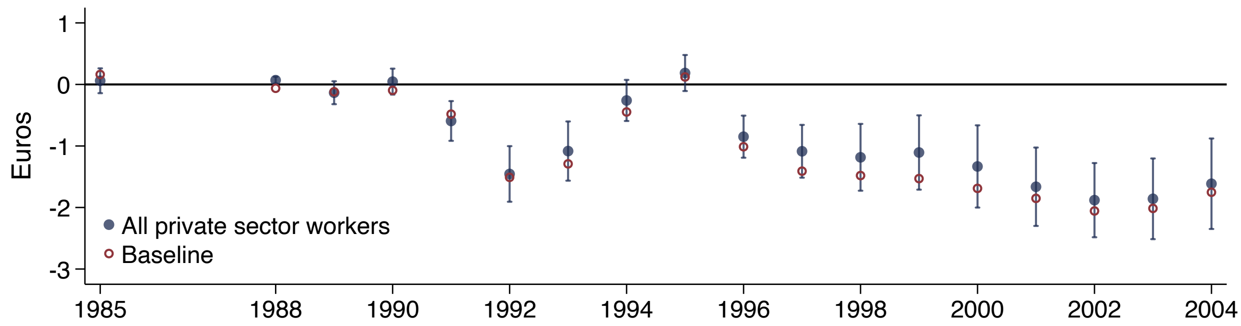
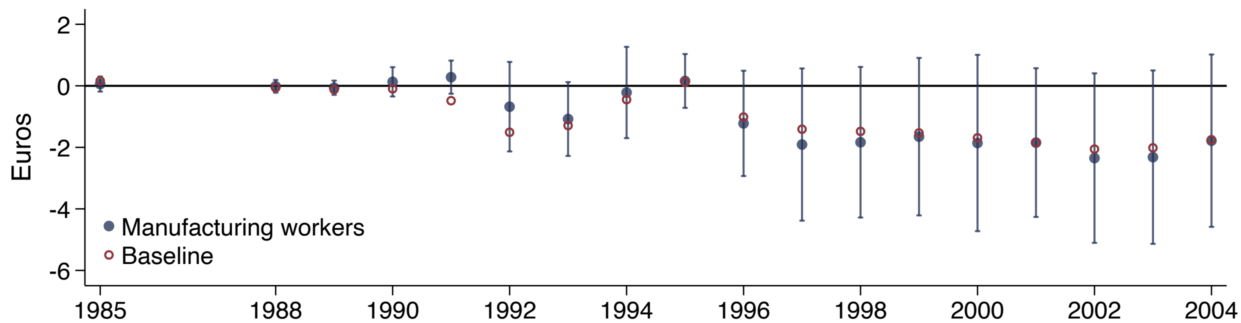


Figure B.5: Sensitivity of Interaction Effect (γ_t) to Alternative Specification
Notes: This figure reports the OLS estimates of γ_t in equation (1) defining the dependent variable as $\Delta y_{it} \equiv y_{it}/\overline{y}_i$ instead of as $\Delta y_{it} \equiv y_{it} - \overline{y}_i$. Vertical lines indicate 95% confidence intervals on each coefficient. Robust standard errors are clustered by 1989 municipality.



(a) All private sector workers



(b) Only manufacturing workers

Figure B.6: Sensitivity of Interaction Effect (γ_t) to Alternative Worker Samples

Notes: This figure reports the OLS estimates of γ_t in equation (1) for different samples of workers. Blue dots display point estimates associated with alternative samples, whereas red circles display baseline estimates from Figure 3b. Vertical lines indicate 95% confidence intervals on each alternative coefficient. Robust standard errors are clustered by 1989 municipality.