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2024-12-18
Oxford University Press
http://hdl.handle.net/10138/589927
Mitrunen, M 2024, 'War Reparations, Structural Change, and Intergenerational Mobility*', Quarterly Journal of Economics. https://doi.org/10.1093/qje/qjae036

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WAR REPARATIONS, STRUCTURAL CHANGE, AND INTERGENERATIONAL MOBILITY *

MATTI MITRUNEN

From 1944 to 1952, largely agrarian Finland had to export, on average, 4% of its yearly GDP in industrial products to the Soviet Union as war reparations. To meet the reparation demands, the Finnish state needed to provide extensive temporary support to Soviet-assigned industries with insufficient production capacity. This article documents the long-term effects of this extensive and temporary industrial policy on industrial and local development and on individual outcomes. Using newly digitized data sets, I show in a difference-in-differences setup that the short-term nonmarket production persistently and significantly increased the employment and production of the manufacturing industries exposed to the policy. These industries plausibly benefited from large initial investments and exposure to export markets associated with the war reparations. The episode further led to local development and structural change, as the more exposed regions became persistently more industrialized. I substantiate these within-Finland results with triple-difference setups using comparable Norwegian data. I use Finnish administrative data to study the long-term individual effects of the episode. Tracking individuals over 30 years, I show that the initial state investments and the persistent change in the local industrial structure increased long-term incomes, led to more educational attainment, and promoted the upward mobility of children and young adults in the more exposed regions before the war reparations period. The

* I am grateful to Nathan Nunn, Larry Katz, and four anonymous referees for their many helpful comments and suggestions. I thank Andreas Madestam, Torsten Persson, David Strömberg, Ran Abramitzky, Daron Acemoglu, Ingvild Almås, Pol Antràs, David Atkin, Martina Björkman Nyqvist, Chris Blattman, Timo Boppart, Konrad Burchardi, Paula Bustos, Dave Donaldson, Melissa Dell, Taryn Dinkelman, Mitch Downey, Douglas Gollin, Gordon Hanson, Richard Hornbeck, Ruixue Jia, Réka Juhász, Nathan Lane, Jaakko Meriläinen, Joel Mokyr, Jonas Mueller-Gastell, Suresh Naidu, Arash Nekoei, Peter Nilsson, Oskar Nordström Skans, Krisztina Orbán, Jon de Quidt, James Robinson, Torsten Santavirta, Matti Sarvimäki, Abhijeet Singh, Anna Tompsett, Christoph Trebesch, Roope Uusitalo, Has van Vlokhoven, Eric Verhoogen, Tuomo Virkola, Fabian Waldinger, Dean Yang, and Noam Yuchtman, as well as various seminar participants for their helpful comments. I thank Nhi Cao for excellent research assistance. I thank the Yrjö Jahnsson Foundation for providing financial support.

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The Quarterly Journal of Economics (2024), 1–64. https://doi.org/10.1093/qje/qjae036.
Advance Access publication on October 29, 2024.

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observed effects are driven by the more advanced heavy industry, which received the majority of state assistance. *JEL codes:* O14, O25, I25, J24, J62, N14.

I. Introduction

Structural change is paramount to economic development (Lewis 1954; Rodrik 2013; Gollin, Lagakos, and Waugh 2014). This process includes industrial upgrading and the movement of workers from agriculture to more modern, higher-paying, and often more skill-intensive activities. Can such a development process be expedited by the state with initial nonmarket production? Despite the vast scholarly interest and the importance of the topic, empirical studies documenting the long-term effects of large-scale state industrial policies remain relatively scarce (see Krueger 1990; Wade 1990; Pack and Saggi 2006; Rodrik 2007; Harrison and Rodríguez-Clare 2009 for a discussion; Dell and Olken (2020) and Lane (2021) for recent empirical work).

I examine the long-term effects of one such large-scale state intervention: Finland's war reparations to the Soviet Union. From 1944 to 1952, Finland, which had 60% of its labor force in agriculture, was required to export an average of 4% of its yearly GDP in industrial products as reparations for losses caused during World War II (see Statistics Finland 1979; Heikkinen 2014). The Soviet Union dictated the structure of the war reparations, but the financial cost of the production was met by the Finnish state.

The Soviet Union placed most of the reparations burden on relatively advanced heavy industry items, such as ships, locomotives, cables, and engines—sectors in which Finland had little previous production experience. Figure I illustrates the stark difference between the reparations demanded and the structure of the Finnish economy before the war. While products from the metal sector, such as machinery and transport equipment, accounted for two-thirds of the reparations, they contributed to only 11% of prewar manufacturing output and 2.3% of the value of prewar exports. Despite the lack of heavy industry in Finland, the Soviet Union demanded these items because its own production was severely hindered by the ongoing war (Davies, Harrison and Wheatcroft 1994; Sutela 2014).

Due to the lack of overall industrialization and especially the underdeveloped production capacity in heavy industry,

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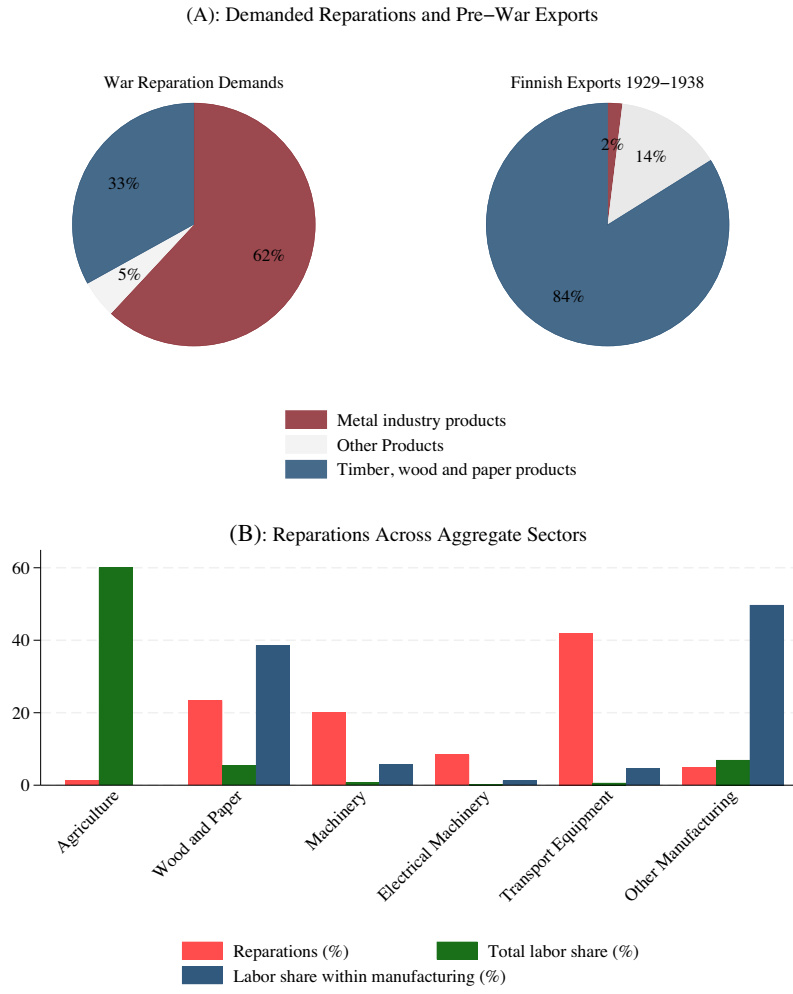

FIGURE I

War Reparations Relative to the Prewar Finnish Production Structure

The first pie chart in Panel A documents the structure of the war reparations payments Finland was ordered to make in 1944 in three industry groups; the second pie chart relates these values to the Finnish export structure in the decade before the war. The data are drawn from Auer (1956). Panel B relates the realized reparations to the 1934–1938 industrial structure based on official manufacturing censuses, where wood and paper products correspond to the two-digit groups 25 and 27, machinery to group 36, electrical machinery and cables to group 37, and transport equipment to group 38. Reparations in other manufacturing are grouped together. The primary production labor share is based on the 1940 population by industry data drawn from Statistics Finland (1979). Data are further described in Online Appendix C.

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the Finnish state had to substantially aid manufacturing in the Soviet-assigned sectors to meet the demands. Over the eight years of payments, the state paid companies for the products shipped to the Soviet Union; provided for initial capital, such as machinery; and helped in acquiring the inputs and skills needed to produce the required products. This was an enormous state effort, and on average, 25% of total state expenditure was spent on war reparations production in the early years from 1945 to 1947 and approximately 10% in the remaining period from 1948 to 1952 (Heikkinen 2014, 104–105).

I empirically examine the long-term effects of this temporary nonmarket production. I show that this specific industrial policy had lasting beneficial effects on the involved industries, local economic development, and exposed individuals. To document the enduring effects of the episode, I collect and digitize data sets of historical Finnish production at the industry and local levels spanning nearly 40 years. To study individual-level effects, I exploit Finnish administrative data that allow me to track individuals over time and examine the policy's long-term effects.

My empirical analysis proceeds in three steps. First, I examine the long-term effects of war reparations on industrial development. Using a detailed four-digit industrial data set from 1934 to 1970 and a difference-in-differences approach, I find that the temporary nonmarket production led to sustained increases in production and labor force size in the most affected industries relative to other Finnish manufacturing sectors. To validate the within-manufacturing comparison and the argument that the observed effect stems from the war reparations, I show that the more exposed industries did not exhibit differential trends before the episode.

Figure II graphically depicts these motivational industry trends. The graph shows that after the reparations period, the production of nonestablished war reparation industries, mostly industries in metal and heavy manufacturing, grew at a faster rate than other nonexposed manufacturing sectors and the established timber and paper reparation industries.

To further strengthen the empirical analysis, I create comparable historical data sets for Norway to estimate triple-difference specifications. This is to assert that these observed long-term industrial and local effects were driven by the war reparations, instead of, for example, inherent industrial characteristics or global

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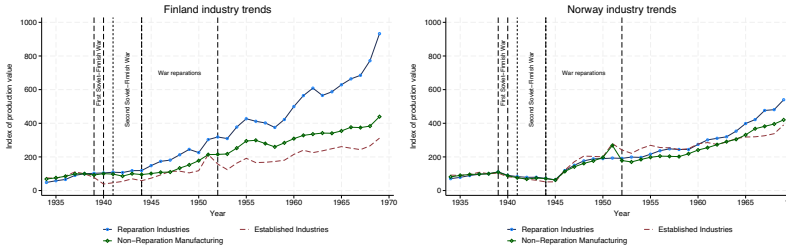

FIGURE II

Motivational Evidence of Finnish and Norwegian Aggregate Industrial Development

This figure presents the development of aggregate industry output value by war reparations exposure relative to the prewar year of 1938. Reparations industries include all Finnish four-digit manufacturing industries that produced war reparations for the Soviet Union, excluding the established timber and paper sectors. Also plotted are the output of the established timber and paper sectors and the output of the non–reparations-producing manufacturing sectors. For comparison, industrial trends using the same industry groupings are plotted for Norwegian industries, which did not produce any war reparations. Data are further described in Online Appendix C.

trends.[1] The industry-level triple-difference estimates are substantial and close to the within-Finland difference-in-differences estimates. A motivational within-Norway industry-level comparison is shown in Figure II.

Second, to assess whether the reparations further affected structural change—specifically, the reallocation of labor from agriculture to more modern activities—I examine the effects of nonmarket production on subsequent local industrialization. I compare the differential local development in manufacturing employment from 1920 to 1970 and show in a difference-in-differences setup that more exposed municipalities, as measured by their industrial composition before exposure to the reparations, became persistently more industrialized after the reparations period.[2] The local-level empirical setup follows the existing shift-share literature (Autor, Dorn, and Hanson 2013; Acemoglu

1. Norway is the closest country for which comparable industrial statistics are available. Norway also had a GDP per capita similar to that of Finland in 1944.

2. I construct the local labor market exposure for each Finnish municipality by calculating the proportion of the workforce working in the war reparations industries in 1939 and interact this calculation with the war reparations assigned to the industry.

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et al. 2016) and tackles possible endogeneity problems of policy assignment.

To substantiate the local-level empirical framework, I show that areas with varying levels of exposure were similar in observable variables and exhibited parallel trends before the reparations period. In addition, when combined with a comparative Norwegian local-level data set, I find comparable results on local industrialization in triple-difference estimations.

Third, as a final step, I combine the local-level empirical strategy with Finnish administrative data that allow me to reliably track individuals over time and examine the long-term individual-level effects of the episode. I present individual-level evidence that the war reparations fostered persistent local structural transformation and development by reallocating workers from lower-wage primary production (mainly agriculture) to higher-wage manufacturing and services. Specifically, I show that people were more likely to leave agriculture between 1939 and 1950 if their municipality of residence in 1939 was more exposed to the war reparations. Tracking individuals over censuses, I document that the transition was lasting and that the workers who lived in the more exposed municipalities in 1939 also had higher incomes in the 1970s.

The Finnish administrative data allow me to study the differential cohort responses to this episode of nonmarket production and further track the process of local structural change. Using a generalized difference-in-difference strategy, I find that younger cohorts living in the more exposed locations before treatment became more educated after the episode. The change in the local production structure especially incentivized the acquisition of higher education and increased upper-tail human capital, which is considered particularly important for subsequent economic development (Mokyr 2005; Squicciarini and Voigtländer 2015).[3]

I link parents to children and show that greater exposure to nonmarket production significantly increased absolute upward mobility. Specifically, I find that a child of a parent without primary education had, on average, a higher income rank, was more educated, and was more likely to have an executive occupation

3. These results contrast findings in some of the previous literature (e.g., Amsden 1992; Atkin 2016; Franck and Galor 2021). The present study complements these earlier works by providing evidence that increased industrial opportunities can lead to greater human capital investments.

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as an adult if their municipality of residence in 1939 had greater exposure to the war reparations than people with similar backgrounds elsewhere.

I examine the mechanisms behind the intergenerational effects of the episode. I provide evidence that the war reparations were associated with large local increases in new educational opportunities, such as technical colleges and vocational schools. An improvement in parent income stemming from the new industrial employment further mediated their children's educational attainment.

To determine the source of the observed effect and shed further light on the mechanism, I divide the exposed sectors into advanced and less advanced sectors. The effects are driven primarily by skill-intensive, advanced heavy industry sectors, such as shipbuilding and machinery. In the reparations period, these advanced sectors needed to substantially upgrade their production and employ more (skilled) labor. The less advanced exposed industries instead largely filled government orders using existing production capacity, which plausibly resulted in less enduring effects on the local production structure.

The war reparation production, although punitive and straining to the Finns at the time, likely fostered the observed lasting industrial and local development through various channels. The state provided significant initial investments that persisted in industries and locations even after the war reparations concluded and facilitated later industrial production. The affected sectors benefited from the opportunity to upgrade their production and learn export-led manufacturing under nonmarket production. Complementary local transformations, such as the expansion of education, further introduced new and lasting local opportunities that had been less prominent in the previously agricultural society.

The Finnish war reparations (1944–1952) were a colossal undertaking, an important component of Finnish history, and a significant case of nonmarket production. The lasting effects of the episode have been the subject of extensive research and considerable debate among historians and other scholars (Auer 1956; Harki 1971; Kindleberger 1987; Fellman 1996; Rautakallio 2014; Sahari 2018). This article uses newly collected data to present the first empirical examination of the long-term economic effects of the Finnish war reparations.

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In addition to providing new information on an important historical episode, my findings complement several previous studies. A large body of scholarship has studied the effects of nonmarket production in shaping the structure of an economy (e.g., Wade 1990; Amsden 1992; Hausmann and Rodrik 2003; Pack and Saggi 2006; Rodrik 2007; Robinson 2009; Liu 2019; Lane 2021), but there are still relatively few empirical studies documenting the long-term effects of such interventions.[4] I complement this literature by examining a new context with high-quality data that enable the documentation of lasting industrial, local, and individual effects of large-scale nonmarket production. My findings inform us about the possible lasting and multifaceted effects of such state interventions. This article further contributes to the empirical work studying early industrial development (Juhász 2018; Giorcelli 2019; Dell and Olken 2020) and persistence in the allocation of economic activity (Davis and Weinstein 2002; Miguel and Roland 2011; Bleakley and Lin 2012; Donaldson 2018).[5]

My findings contribute to the literature on economic opportunity and intergenerational mobility (Chetty et al. 2014; Chetty and Hendren 2018a, 2018b) by showing that nonmarket production can lead to greater upward mobility. Rather than exploring the effects of moving to different localities with better opportunities on upward mobility and child outcomes (e.g., Chetty, Hendren, and Katz 2016; Nakamura, Sigurdsson, and Steinsson 2022), this study contributes to the literature by studying the long-term effects on children and young adults affected by structural change in their locality of origin. These intergenerational and potentially differential cohort effects of nonmarket production have received little attention in the previous industrial development literature, possibly owing to the high data requirements. A notable exception is the recent work by Garin and Rothbaum (2025), who study the intergenerational impacts of military in-

4. Other recent works studying industrial development include Criscuolo et al. (2019), Heblich et al. (2019), Hanlon (2020), Dell and Olken (2020), Kim et al. (2021), Choi and Levchenko (2021), and Giorcelli and Li (2021). Lane (2020) provides a review of more recent empirical work on the topic.

5. My findings also contribute to the literature on market failures, poverty traps, and the multiplicity of equilibria (see Azariadis and Stachurski 2005) and work discussing how large state investments can correct for market failures and expedite the industrialization process (Rosenstein-Rodan 1943; Hirschman 1958; Murphy, Shleifer, and Vishny 1989).

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vestments in the United States, finding comparable intergenerational results in a more industrialized setting.[6]

The rest of the article is organized as follows. Section II provides the historical context and further details on Finnish war reparations. Section III introduces the various data sets used in the study. Section IV explores the effects of the war reparations on industrial development, and Section V documents the local development and structural change stemming from the episode. Section VI focuses on individual effects. Section VII presents robustness checks and further analysis. Section VIII concludes.

II. Historical Context

> *Losses caused by Finland to the Soviet Union by the military operations and the occupation of Soviet territory will be indemnified by Finland to the Soviet Union in the amount of three hundred million dollars payable over six years in commodities (timber products, paper, cellulose, seagoing and river craft, sundry machinery).*
> —Article 11, 1944 Finnish-USSR Armistice

From 1939 to 1940 and 1941 to 1944, Finland was engaged in two separate wars against the Soviet Union. In 1944, as Finland was on the verge of military defeat, the Finnish delegation signed an armistice with the Soviet Union, which included war reparations valued at $300 million. Finland would pay these reparations in commodities chosen by the Soviet Union. The war reparations were a massive undertaking and largely targeted underdeveloped Finnish metal sectors (Auer 1956; Harki 1971; Rautakallio 2014).

II.A. Structure of the Reparations

The Finnish delegation agreed to the 1944 armistice without knowing the exact structure of the reparations it would need to produce. The wording in the treaty defined the war reparations commodities only as "timber products, paper, cellulose, seagoing and river craft, [and] sundry machinery" (Auer 1956, 12). Given

6. Finland had much less industrial capacity at the time of the intervention, and its GDP per capita in 1944 was approximately one-third that of the United States. One key consequence of these Soviet-determined war reparations in Finland, plausibly leading to upward mobility, was the significant local structural change away from agriculture, which was a substantially smaller sector in the United States before World War II (15% of the labor force relative to over 60% in Finland, according to Herrendorf, Rogerson, and Valentinyi 2014).

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TABLE I
STRUCTURE OF THE REPARATIONS DEMANDS AND FINAL SHIPMENTS 1944–1952

Products	Demands Value in $1,000	%	Actual shipment Value in $1,000	%
Various machinery	100,876	33.6	69,834.4	30.8
New ships	60,172	20.1	65,871.7	29.1
Paper products	59,000	19.7	34,865.4	15.4
Timber products	41,000	13.7	27,896.3	12.3
Cables	25,000	8.3	12,861.9	5.7
Ships in the Finnish merchant marine	13,952	4.6	13,957.3	6.2
Sundry deliveries	0	0	1,180.4	0.5
Total	300,000	100.0	226,467.41	100.0

Notes. The table presents the structure of the war reparations demands from 1944 to 1950 and the actual shipments from 1944 to 1952 in broad product groups in 1938 U.S. dollars. The data are drawn from Auer (1956). Online Appendix Table A.VII presents a full list of shipped products and the associated four-digit industries.

that Finnish manufacturing and exports before the war were geared toward timber and paper products and that the nation was largely agrarian, the final structure of the reparation demands came as a surprise to the Finnish state. One-third of the reparations were to be paid in paper or timber products, and two-thirds were to be paid in more advanced metal industry goods (Suviranta 1948, 52).

Table I illustrates the structure of the Soviet war reparation demands and the deliveries completed from 1944 to 1952 across seven broad industrial categories, as presented in Auer (1956, 215). Key reparation items included relatively advanced heavy industry products, such as ships, locomotives, engines, cables, and various other machinery.

As the victor, the Soviet Union was in a position to dictate the structure of the reparation payments. The Finnish state initially proposed shifting the structure of the reparations to focus mainly on the well-established timber and paper industries, but the Soviet Union had less interest in these items due to its own resources (Auer 1956, 15; Androsova 2014, 55). The Soviet Union had experienced a significant reduction in its nonmilitary heavy industry production during the war and needed to acquire these types of items from elsewhere (Harki 1971, 270; Davies, Harrison and Wheatcroft 1994, 243; Androsova 2014, 39; Sutela

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2014, 279).[7] Overall, the Soviet delegation paid little attention to reports detailing what types of production were plausible in Finland.[8] The Soviet Union had specific needs and little incentive to negotiate over the reparation demands.[9]

The structure of the original demands and finalized shipments, shown in Table I, ultimately differed due to later alleviations granted by the Soviets. The initial reparations plan stipulated that Finland would export $50 million of goods annually for six years. In 1945, the duration of payments was extended from six to eight years. The Soviet Union also granted relief from its reparation demands in 1948, which largely affected the more established timber and paper sectors, shown in Table I (Auer 1956, 241).[10]

To fulfill the reparation demands, Finland had to substantially scale up its manufacturing capacity in the highly affected heavy industry sectors, or as put in Suviranta (1948, 146), "Especially the debtor's position has been complicated by the fact that the grouping of war reparation goods did not correspond to the structure of the Finnish economy." Before the war, Finnish industry had produced some of the demanded metal and heavy industry items for domestic consumption, but it had limited experience in exporting them. The metal sector accounted for 2.3% of Finnish prewar exports, and the quality of Finnish production was largely insufficient to compete in the international market (Auer 1956, 26; Suviranta 1948, 53). Nevertheless, the Soviet

7. For example, according to Borisov, the head of the Soviet war reparations delegation, there was a glaring lack of cable in the Soviet Union in 1944, which the state desperately needed to import from other countries (Auer 1956, 59).

8. For instance, Finnish companies reported their maximum annual production capacity for power cables, a substantial reparation product category, to be 200 km. The Soviet Union still demanded annual war reparation shipments of 375 km of power cable, 200 km of other types of cable, and 4,250 tons of copper wire (Auer 1956, 59).

9. The rigidity of the reparations structure is depicted in a letter from Soviet engineer Antonenko, as cited in Holmström 1986, 39: "You have asked to negotiate about the war reparations payments. I personally do not understand what there is to negotiate. Finland has signed a peace treaty in which it has committed to carrying out certain indemnities to the Soviet Union. Finland can either carry out these reparations or be occupied."

10. This reduction may have been implemented to support the Finnish communist party in the 1948 elections. However, Romania and Hungary experienced similar reductions in their reparation obligations in the same year (Kindleberger 1987, 153).

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Union demanded advanced products that met high-quality standards (e.g., Sutela 2014, 287).

To put the structure of the reparations further into perspective, Figure I, Panel B provides a comparison between the prewar industry size and the reparations burden across major reparation industries in aggregate groups. The heavy manufacturing sectors, further divided here into machinery, electrical machinery, and transport, were responsible for two-thirds of the total war reparations, but according to official manufacturing censuses, they constituted 11% of the average prewar manufacturing labor share.

The underdevelopment of advanced manufacturing production was not the only challenge in fulfilling these demands; a broader issue was the overall lack of industrialization in Finland. In 1940, 60% of the Finnish labor force still worked in the agricultural sector, including forestry (Statistics Finland 1979). Many of these workers needed to swiftly move to manufacturing industries to provide enough labor for the rapidly increasing production needs.

The differential expansion of the reparation industries also did not occur during the war. There was an increase in the manufacturing of ammunition, rifles, and mortars, as well as food and clothing to support the war effort (Kinnunen 1967; Erjola 1988). However, wartime production was lighter and significantly less advanced than the heavy manufacturing required for reparations (Kinnunen 1967, 73). During the war, Finland faced shortages of labor and raw materials, and the state lacked the capacity to promote more advanced production (e.g., Erjola 1988, 179). The more advanced weaponry had to be imported from Germany (Erjola 1988, 169).[11]

II.B. War Reparations Payments from 1944–1952 and State Intervention

The war reparations payments and the associated industrial intervention imposed a significant financial burden on the Finnish government. Because of the underdeveloped production capability in the sectors chosen by the Soviet Union, the Finnish state had to pay for the shipped items and facilitate the investments necessary to upgrade production to the required level.

11. Advanced weaponry, including tanks and destroyers—which were less utilized in the type of warfare—were not produced at all in Finland (Erjola 1988).

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According to Heikinnen (2014, 100–105), the reparations accounted for, on average, 4% of the yearly Finnish GDP during the eight years from 1944 to 1952; at its peak, the war reparations effort constituted 25% of the government budget. In total, Finland shipped over 141,000 cargo carriages of reparations items to the Soviet Union (Harki 1971, 337). The final value of reparations shipped by Finland amounted to US$226.5 million based on 1938 prices (Heikkinen 2014, 97). This sum is equivalent to approximately US$4 billion in 2020 dollars.[12]

The Finnish state established a bureau called *Sotakorvausteollisuuden valtuuskunta* (Soteva) to oversee and organize the reparations effort (Auer 1956, 178). Soteva was a substantial organization that played an active role in production. The Soviet Union established its own organization in Finland called Karelia to oversee reparations production. The quality requirements were set and controlled by this Soviet organization along with Soteva and were considered by the companies to be extremely high and strict (Auer 1956, 148–152; Harki 1971, 327).

The state bureau, Soteva, acquired reparations products from private and publicly owned Finnish companies and then shipped them to the Soviet Union. The reparations-producing companies received production costs and a "reasonable" profit, at most 11%, which implies that the state also subsidized the capital and skill investments needed to produce the products (Harki 1971, 266). The Finnish state further provided favorable loans and paid for the products in advance, at the highest half of the final sum, allowing the companies to have a longer time horizon for their investments to improve production (Auer 1956, 186; Harki 1971, 275). Soteva also had the right to temporarily expropriate private factories for war reparations efforts when deemed necessary, although this action was seldom taken (Harki 1971, 80).

Soteva further determined which specific war reparation items each company would produce (Harki 1971, 79–80). Given the underdeveloped heavy industry, the responsibility was usually assigned to the plant with the closest previous production experience. Ilmari Harki, the vice president of Soteva, described the

12. The prices of the products were based on prewar 1938 levels, which were significantly lower than the postwar prices, resulting in a considerably greater burden on the Finnish state than the official $226.5 million. Auer (1956, 202) estimates the actual reparations sum to be between 445 and 570 million marks, or some US$8 to $10 billion, in 2020.

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situation in Harki (1971, 271): "Perhaps the essential new feature was that for the first time, the industry—and especially the metal industry—found itself in a situation where orders were more dictated than placed and where orders were, in most part, utterly separate from the manufacturer's present production capacity."

Most of the existing Finnish heavy manufacturing capacity needed to be harnessed and greatly developed to meet the reparations demands. The state decided that the most feasible way to increase production quickly was to focus on expanding and investing in existing production facilities instead of erecting new ones (Kinnunen 1967, 72–73).[13] The production volume was, however, much larger than before, and the demanded items were often more advanced than those previously produced in Finland, which often necessitated that plants undergo extensive upgrades to begin production. For instance, the production of large tonnage ships, which constituted the largest single reparation item category, surged from 14 units in 1924–1938 to 581 units during the reparations period of 1944–1952 (Auer 1956, 27).

The Finnish state ran into several issues when accelerating the production in these industries so rapidly. According to Harki (1971), the most significant initial bottlenecks in the war reparations effort were access to foreign capital, inputs, and skilled labor.

Foreign capital was obtained as favourable loans from Sweden and, later, from the United States. The amount of foreign capital Finland received in the early war reparations period (before 1948) was $126 million, which would have covered approximately 60% of the reparations burden of those years.[14] These favourable foreign loans, often owing to the goodwill of the creditors, prevented the need to divert as much state expenditure from elsewhere (Kindleberger 1987, 152; Pihkala 1999, 46). In addition, the rising world market price and demand for timber postwar brought foreign capital to Finland (Pihkala 1999, 33).

To acquire raw materials and other inputs, Finland also relied on imports, largely from Sweden (Harki 1971, 104). Domestic production was especially lacking in intermediate inputs, which, due to the turbulent postwar market, were often unavail-

13. Nevertheless, in addition to the expansion, several new factories needed to be constructed for the reparations (Suviranta 1948, 57).

14. Calculated using the values of actual reparations costs for these years from Auer (1956) and information on foreign capital from Pihkala (1999, 31).

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able, causing delays in reparations shipments (Auer 1956, 240). Global input shortages were less pronounced after the immediate postwar period (1946–1948), and domestic production caught up, making the remaining war reparations more manageable for Finland in this respect (Harki 1971, 125–127).

To address the considerable shortage of skilled labor needed in production, new colleges and vocational schools were founded, and Soteva, along with many companies, established vocational programs to educate the workforce (e.g., Harki 1971, 229). Moreover, Soteva provided assistance in crucial, skill-intensive activities, such as engineering and legal help in obtaining foreign production licenses (Michelsen 2013, 253).

The Finnish state considered the reparations to be an issue of national security and thus was highly motivated to promote the associated production (Auer 1956, 180; Harki 1971, 341; Tiihonen 2014, 147). Because the reparations were a part of the armistice between Finland and the Soviet Union, the Finns feared that the country's sovereignty could be compromised if the reparations were not adequately completed.[15]

II.C. Why the Temporary Nonmarket Production Led to Lasting Effects

In a radio address in September 1952, as the final reparations shipment reached the Soviet Union, Prime Minister Urho Kekkonen emphasized various aspects of the episode that could lead to lasting effects (transcribed in Harki 1971, 350):

"*The war reparations payments have significantly advanced certain aspects of our economy that were previously overlooked. Specifically, the shipbuilding and machinery industries have experienced considerable growth, with the latter's production doubling. Importantly, the quality of production in these sectors and the overall war reparations industry has greatly improved. In this light, the compulsory nature of the war reparations has diversified our industrial capabilities and, in the long term, fostered better conditions for sustained economic growth. . . . It is worth recalling the initial confusion caused by the high-quality standards imposed on war reparations. Over time, however, these standards*

15. During the Tehran conference, the Soviets had explicitly stated that the war reparations were one of their conditions for peace with Finland and that the Soviet army would invade parts of Finland if the payments were not made on time (Kindleberger 1987, 153).

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have proven beneficial for the industry. The stringent quality requirements prompted industrial plants to modernize their machinery and refine their methods, ultimately leading to first-rate production. . . . The exposure of our metal industry, which previously catered only to domestic markets, to the forms and demands of international trade should not be underestimated. . . . The positive aspects mentioned above have been realized because we have honorably endured our war reparations."

The radio address underscores the importance of the large initial investments made during the episode that persisted in the exposed sectors and locations after the episode concluded. To comply with Soviet requirements, the establishment of new and adapted production facilities, machinery, and specialized expertise was essential. Suviranta (1948, 59) calculates that by 1947, these production upgrades alone accounted for approximately 5–7 billion marks, and Auer (1956, 85) suggests that the values reached as high as 12 billion marks, which would translate to approximately US$850 million in current dollars. Furthermore, substantial numbers of new laborers needed to be hired and trained for production (Auer 1956, 84). This development was reinforced by additional public coordination and inputs, such as the local expansion of educational opportunities, that also persisted in the exposed locations.

Similarly, an extensive literature (e.g., Hausmann, Hwang, and Rodrik 2007) states that exporting and export discipline are central for industrial development. During the episode, the involved sectors focused more on foreign markets than before. After the reparations production ceased, exports in these sectors continued (Harki 1971, 341–342). While the pressure from Soteva and Soviet quality requirements was substantial, the nonmarket reparations production still plausibly allowed the involved sectors more opportunities and time to develop new capacity and expertise than market production would have.[16]

In other words, the observed lasting effects can plausibly be attributed to a type of infant industry mechanism, where substantial initial nonmarket production aided sustained local industrialization and industrialization toward more advanced industries. Here, the main avenue was not through protecting indus-

16. Still, the policy is different from more traditional export promotion, such as in East Asian economies, as firms did not have to search for export markets for their products during the episode.

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tries from foreign competition, as seen in Juhász (2018). Instead, the episode of nonmarket production led to a significant increase in capital and skills that plausibly resulted in lasting effects. I provide substantial empirical evidence of the enduring effects of the war reparations, which is consistent with, while not proving, these outlined channels.

III. Data

To examine the long-term effects of the episode in detail, I use various data sets. Further details on the data and their construction can be found in Online Appendix C.

III.A. Reparation Products Shipped

Data on the reparation products shipped to the Soviet Union are digitized from Statistics Finland's foreign trade publications spanning 1944 to 1952.[17] These data contain the value of reparation products shipped, classified according to the detailed Finnish product classification (*Tavaralaji*). I map the value of the shipped reparations products to the four-digit codes of the International Standard Industrial Classification of All Economic Activities (ISIC) to measure the intensity of each industry's involvement in war reparations. Online Appendix C.A.1 provides further details on the product-to-industry mapping. Online Appendix Table A.VII presents the full list of shipped war reparation products and the associated four-digit industries.

III.B. Manufacturing Industry Panel Data

I digitized a data set detailing Finnish industrial production from Statistics Finland's original publications of industrial statistics and harmonized them across the study period, accounting for changes in industrial classification.[18] The final data set is a balanced panel of 162 manufacturing industries at the four-digit ISIC level spanning 1934–1970. This industrial data set includes annual variables for studying industrial development—namely, labor force, production value, and value added. I deflate all monetary values to 1935 Finnish marks. Further details on these data are provided in Online Appendix C.A.2.

17. Official Statistics of Finland, Foreign Trade 1944–1952, SVT I A:63–A:72.

18. Official Statistics of Finland, Industrial Statistics 1934–1970, SVT XVIII A:51–A:91.

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III.C. Municipality-Level Data

I collect information from Statistics Finland's industrial statistics publications, which include manufacturing surveys to measure the local manufacturing labor force and the number of establishments, covering 1934–1966.[19] The data set was digitized from the original machine-readable documents and harmonized across years.[20] More information on the process and examples of the original documents are provided in Online Appendix C.B.1.

I follow Sarvimäki (2011) and measure the labor share in manufacturing and primary production for 1920–1970 using a digitized Statistics Finland publication titled *Finnish Population by Industry* (Statistics Finland 1979). This publication provides the number of workers in five large industry groups for each decade. I use these data to construct the local labor share in manufacturing and agriculture for each municipality. I harmonize these local-level panel data over time to obtain constant municipal units that take into account municipal mergers.

For additional municipal-level covariates, I follow Sarvimäki (2011) and use the average local-level income taxes paid in 1929 and 1938 from Statistics Finland's Income and Property publications. I also employ municipal-level baseline information on arable land, the number of cows, and the number of tractors from Statistics Finland's agricultural censuses of 1930 and 1940. The construction of the local-level data is further detailed in Online Appendix C.B.2.

III.D. Individual Data from the 1950 Census

I use the proprietary 1950 census administrative data collected and digitized by Statistics Finland to study the individual-level effects. From the original household census cards, a 10% sample was digitized by selecting every 10th folder. Each folder included the entire household, which greatly facilitates linking within a family, that is, finding a given person's father. These administrative data are linked by Statistics Finland to the unique social security numbers of the respondents, facilitating further linking with later administrative data. The 1950 census mea-

19. Official Statistics of Finland, Industrial Statistics 1934–1966, SVT XVIII A:51–A:82.

20. The digitization of these municipal manufacturing surveys was a joint effort with Jonas Mueller-Gastell.

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sures basic individual variables, such as age, sex, education, municipality of residence, and industry in 1950.

The 1950 census also includes information on the municipality of residence, occupation, and industry of employment of the respondent in 1939 to compensate for the missed census in 1940. The 1939 industry and municipal information allows the tracking of individuals from the prewar period and the calculation of municipal industry shares in 1939. The 1950 administrative data are further detailed in Online Appendix C.C.1.

III.E. Individual Data from the 1970–1985 Census

I use full census information from Statistics Finland FOLK 1970–1985 proprietary administrative data. From these data, I use the 1970 reported industry and detailed educational attainment and occupational information to assess the long-term individual effects. I further employ individual income information in these FOLK administrative data from 1971 and 1975 to assess the long-term income effects. The 1970 administrative data are further detailed in Online Appendix C.C.2.

I link individuals in these 1970 data to their earlier 1950 and 1939 information using their unique encrypted social security numbers. These administrative data cover the entire Finnish population in 1970, and I can link 89% of the people in my 1950 extended sample and 82% of the working-age sample to the 1970 census.

III.F. Norwegian Industrial and Local Data

For comparison, I collected a separate data set covering historical manufacturing production in Norway at the four-digit level for 1934–1969. These data are digitized from Statistics Norway's publications on industrial production. The Finnish and Norwegian historical manufacturing data sets use similar industry codes over time, allowing me to assign Norwegian industries their counterfactual war reparations exposure. Due to slight differences in classification across the countries, the industrial data sets are not perfectly comparable. However, as a geographically close country with similar available statistics, these data arguably provide the best available comparison for Finnish industrial development. The collection and comparability of these Norwegian industrial data are further detailed in Online Appendix C.D.1.

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I further compiled a data set for local Norwegian structural transformation to enable triple-difference estimations. I use occupational data available in the Norwegian *Kommunendatabasen*, which offers information on the broad occupational structure of each Norwegian municipality from 1920, 1930, 1950, and 1960. To study local industrialization in Norway, I classify these occupations into broader agricultural and manufacturing sector employment, as outlined in Online Appendix C.D.2.

IV. Industrial Development

I examine the effects of war reparations on subsequent industrial development at the four-digit industry level. I perform the empirical exercise by comparing the reparations-producing industries with other manufacturing industries with similar baseline characteristics in a difference-in-differences setup.

1. *Industry-Level Reparations Measure.* As a measure for industry exposure to the war reparations, I use the sum of war reparations relative to the industry's 1943 labor force. The measure constructed in equation (1) proxies not only for the size of reparations but also for the amount of state aid necessary for production to reach the level needed to meet the Soviet demands—in other words, how large the shock was to industry k given its production capacity.[21]

$$(1) \quad Reparations\,Share_k = \left(\frac{Total\,Reparations_{1944-1952}}{Labor\,Force_{1943}} \right)_k .$$

Online Appendix Figure A.I, panel A presents the four-digit industry-level exposures using this measure. The most exposed industries included shipbuilding, strong current apparatus, insulated wires, and railroad equipment, broadly industries that were relatively skill-intensive heavy manufacturing industries. This corresponds closely to the historical narratives of the sectors that received large amounts of initial state promotion. Online Appendix Figure A.I, Panel B shows that the more estab-

21. This relative variable allows me to measure reparations exposure even if two industries with similar reparations burdens had different initial sizes. I include in the main analysis the more established timber and paper industries, but these industries have substantially smaller values of the $Reparations\,Share_k$ variable, because they already had higher employment in 1943. Omitting these more established industries from the analysis also has little effect on the results.

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lished timber and paper industries received smaller values in the scaled measure even though they exported substantial amounts of war reparations in absolute value.

IV.A. Industry-Level Difference-in-Differences Estimation

To compare the industrial development effects of this episode of industrial policy, I estimate the following difference-in-differences equation (2).

$$(2) \quad Y_{kt} = \beta \left(Reparations\, Share_k \times Post_t \right) + \gamma_k + \delta_t + \theta_t \mathbf{X}_k + \varepsilon_{kt}.$$

Here, Y_{kt} is the outcome variable for the value of production, the labor force, or the value added in industry k at time t, on a logarithmic scale. $Reparations\, Share_k$ is the sum of the industry's value of reparations shipped to the Soviet Union scaled by its labor force in 1943. $Post_t$ is an indicator of the time after the war reparations commenced, 1944 and after. The $Reparations\, Share_k$ variable is standardized, with a standard error of one and a mean of zero. The coefficient of interest β denotes the estimated differences in industries according to their reparations involvement relative to the prereparations period. γ_k presents the industry fixed effects to control for any time-invariant industry-specific factors. Year effects δ_t control for common time effects. To ensure the comparability of the industries, I further add elastic-net-selected 1943 control variables interacted with year effects $\theta_t \mathbf{X}_k$.[22] Finally, ε_{kt} is the error term. The standard errors are clustered at the industry level.

1. *Initial Differences and Parallel Trends.* The hypothesis to test is whether the reparations made the more exposed industries develop differently and whether the difference persisted after the nonmarket production ended. In my research setup, I compare the industries involved in meeting the demands of war reparations to other nonexposed manufacturing industries. To demonstrate the comparability and validity of the industry-level research design, I compare the levels and trends in these manufacturing industries before the war reparations began, as shown in Table II. Column (4) shows that in 1943, the manufacturing

22. These industry-level controls include a set of prereparations variables presented in Table II. The selected elastic-net controls are detailed in Table III. The results are robust to the selection of controls, as presented in Online Appendix D.A.

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TABLE II

BASELINE INDUSTRY CHARACTERISTICS AND BALANCE

	Mean (1)	Min (2)	Max (3)	$\beta^{Reparations\,share}$ (4)	$\beta^{Changes}$ (5)	Observations (6)
Reparations share	14.36	0.00	330.78			162
	[49.07]					
Power labor share	3.98	0.11	46.71	0.59	0.29	162
	[7.30]			(0.53)	(0.30)	
Skilled labor share	0.10	0.00	0.50	−0.00	−0.00	162
	[0.06]			(0.00)	(0.00)	
ln Labor	6.02	1.95	9.42	0.28**	0.06	162
	[1.51]			(0.13)	(0.06)	
ln Value added	17.42	13.53	20.77	0.26	0.03	162
	[1.60]			(0.17)	(0.07)	
ln Average wage	10.28	9.24	10.88	0.04***	−0.01	162
	[0.25]			(0.01)	(0.01)	
ln Establishments	2.40	0.00	5.75	0.07	0.02	162
	[1.19]			(0.09)	(0.04)	
ln Value of inputs	16.66	0.00	20.99	0.42**	0.04	162
	[3.52]			(0.19)	(0.06)	
ln Value of production	18.08	13.53	21.50	0.25	0.03	162
	[1.65]			(0.16)	(0.06)	

Notes. The unit of observation is the four-digit industry. Baseline industry characteristics are given in 1943 values. Column (1) reports average values for the variables, with standard deviations shown in brackets. Column (4) reports the level balance test with the coefficients of regressing the 1943 value of the variable with the standardized reparations share variable. Column (5) reports the trend test with the coefficients of regressing the change in the variable from the pretreatment period 1934 to 1943 with the standardized reparations share variable. Robust standard errors are in parentheses at *** 1%, ** 5%, and * 10% significance levels.

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industries with larger reparations shares had, on average, more labor, higher wages and greater value of inputs but were otherwise initially statistically indistinguishable from the less exposed industries.

More important, for the difference-in-differences research design, there are no differential trends in any of the variables before the war reparations begin; that is, the strong parallel-trends assumption holds.[23] The identifying assumption is that without the reparations demands, the exposed industries would have developed similarly to the nonexposed ones after 1944. This assumption is supported by the estimates in Table II, column (5), where the prereparations changes in the variables are not significantly associated with the reparations payments of a given industry. These parallel-trend tests in Table II support the robustness of the industry-level comparison. I further establish parallel trends using event-study setups.

2. *Industry-Level Difference-in-Differences Results.* I present the industry-level difference-in-differences results in Table III, column (1). A one standard deviation increase in the $Reparations\,Share_k$ variable leads to an approximately 18 log point increase in production value and 16 and 14 log point increases in labor force and value added, respectively. Using the logarithm of the value of shipped reparations + 1 as the exposure variable results in consistent findings, as shown in Table III, column (3).

A potential concern in the analysis is that the baseline specification also includes the timber and paper industries (two-digit sectors 25 and 27). Including these industries in the sample could be problematic, as they were already well-established manufacturing sectors before the war and might be less comparable to the other manufacturing sectors. Moreover, these industries had very different types of exposure to the war reparations than the heavy manufacturing industries. Although the established timber and paper industries received substantial government reparation contracts, they did not require similar production upgrades to meet Soviet demands.

23. With continuous treatment, one needs a stronger parallel-trends assumption (Callaway, Goodman-Bacon, and Sant'Anna 2021). I show that the results are robust to binary (above-median) treatment with a less strong parallel-trends assumption in Online Appendix Figure D.VI.

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TABLE III

ESTIMATED DIFFERENCES IN INDUSTRIAL OUTCOMES BY REPARATIONS EXPOSURE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: ln Value of production								
Reparations share × Post	0.179***	0.174***			0.170***	0.066***		
	(0.050)	(0.045)			(0.045)	(0.022)		
ln(Reparations) × Post			0.029***	0.035***				
			(0.007)	(0.007)				
HS × Reparations share × Post							0.179***	0.172***
							(0.050)	(0.045)
LS × Reparations share × Post							0.016	0.060***
							(0.041)	(0.021)
N	5,994	5,254	5,994	5,254	4,921	4,477	5,994	5,254
Panel B: ln Labor force								
Reparations share × Post	0.161***	0.155***			0.153***	0.060***		
	(0.047)	(0.045)			(0.045)	(0.023)		
ln(Reparations) × Post			0.025***	0.033***				
			(0.007)	(0.006)				
HS × Reparations share × Post							0.161***	0.154***
							(0.048)	(0.045)
LS × Reparations share × Post							0.004	0.057***
							(0.044)	(0.021)
N	5,994	5,254	5,994	5,254	4,921	4,477	5,994	5,254

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TABLE III
CONTINUED

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel C: ln Value added								
Reparations share × Post	0.141***	0.137***			0.134***	0.059**		
	(0.036)	(0.032)			(0.032)	(0.023)		
ln(Reparations) × Post			0.024***	0.030***				
			(0.007)	(0.006)				
HS × Reparations share × Post							0.141***	0.136***
							(0.036)	(0.032)
LS × Reparations share × Post							0.013	0.055**
							(0.040)	(0.021)
N	5,994	5,254	5,994	5,254	4,921	4,477	5,994	5,254
Industries	162	142	162	142	133	121	162	142
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Omitted	None	Established	None	Established	Established+ LS exposed	Established+ HS exposed	None	Established

Notes. The unit of observation is the four-digit industry. The estimates are derived from equation (2). The Post interacted treatment is the industry's scaled reparation payments or log value of reparations shipments + 1. The estimations include year and industry fixed effects. Elastic-net-selected controls are the pretreatment 1943 characteristics interacted with year effects. The controls include skilled-worker share, log average wages and the power-to-labor ratio, ln(labor), and ln(value of production). The period of study is 1934–1970, and the reparations payments began in 1944. Post is a dummy indicating the period after 1943. Established denotes the established timber and paper industries. HS denotes a high-skill industry and LS a low-skill industry divided by U.S. average years of schooling. The 1980 U.S. two-digit industry-specific years of schooling are from Ciccone and Papaioannou (2009), translated into the corresponding historical industry groups. Robust standard errors are given in parentheses and are clustered at the industry level. *** 1%, ** 5%, * 10% significance levels.

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To mitigate these concerns and show that established timber and paper industries are not driving the results, I omit these industries from the analysis in Table III, columns (2) and (4). The estimated coefficients of the $Reparations\,Share_k$ variable remain highly similar to the baseline estimates in columns (1) and (3) after these omissions.

To delve deeper into which industries drive the observed effect, I divide the $Reparations\,Share_k$ variable into high-skill and low-skill sectors using the U.S. 1980 industry average years of schooling.[24] The aim is to discern whether the results are influenced primarily by low-skill manufacturing industries, such as basic metal manufacturing, which were technologically more attainable in the underdeveloped setting, or by high-skill, heavy manufacturing industries, which received the majority of state support but were further away from the required production capacity.

I first omit from the sample the low-skill industries involved in reparations production in column (5) and the high-skill industries involved in column (6) of Table III. I standardize the variables to obtain a standard deviation of one and mean of zero to make the estimates comparable. The coefficients in both cases remain statistically significant, meaning that both the high-skill and low-skill industries involved in reparations production grew more relative to the nonexposed industries, but the standardized estimates for the high-skill group are approximately 2.5 times larger. I observe similar estimates when calculating the $Reparations\,Share_k$ variables separately for the high-skill and low-skill industries and estimate standardized effects in Table III, columns (7) and (8). In column (7), I include the established timber and paper groups in the sample, where the coefficient sizes for high-skill groups remain very similar, but there is no observable effect for the lower-skill industries.

These results suggest that the observed industrial development effects presented in Table III are largely driven by relatively high-skill heavy manufacturing industries. The larger coefficient for the high-skill industries aligns with the historical narrative that these relatively advanced industries, such as machinery and transport equipment, were the primary industries affected by the

24. These average years of schooling at the two-digit industrial level are drawn from Ciccone and Papaioannou (2009) and presented in Online Appendix Figure A.II.

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war reparations. As heavy industry was initially less developed, it also received more government assistance to transform its industrial production.

3. *Event-Study Graphs.* To study the effects of the episode over time and further establish that the industries more exposed to war reparations did not have differential preexposure trends relative to other manufacturing sectors—for example, due to production during the war—I estimate a flexible equation (3), where I interact the *Reparations Share* variable with year fixed effects:

$$(3) \quad Y_{kt} = \beta_t \left(Reparations\, Share_k \times Year_t \right) + \gamma_k + \delta_t + \theta_t \mathbf{X}_k + \varepsilon_{kt}.$$

In this fully flexible estimation, the coefficients (β_ts) presented in Figure III denote the yearly estimated differences in industries by their reparations exposure relative to the omitted base year of 1943. The graph shows that prior to the reparations payments, the exposed and nonexposed industries had similar changes in outcomes; that is, there were no visible pretrends. The estimates in Figure III also affirm that the industries more involved in the war reparations payments did not exhibit differential trends during the war, for instance, due to war production.

Figure III further shows how war reparations payments had a statistically significant long-term effect on the size of the exposed industries that persisted after the episode. The enduring difference in production value relative to 1943, resulting from a one standard deviation increase in reparations exposure, is approximately 30 log points in 1970. The similar effect for the labor force is approximately 20 log points.

IV.B. Triple-Difference Estimation with Norwegian Industrial Data

To strengthen the industry-level empirical analysis, I conduct a triple-difference estimation using a comparable historical data set on Norwegian industrial activity. A possible concern with the previous difference-in-differences empirical evaluation is the potential correlation between postwar rebuilding efforts throughout Europe, encompassing both Soviet and Western European reconstruction demands. Given the possibility of an elevated postwar demand for war reparations items, such as products from the heavy manufacturing sectors, these industries might have experienced accelerated growth relative to other sectors even in the absence of state intervention.

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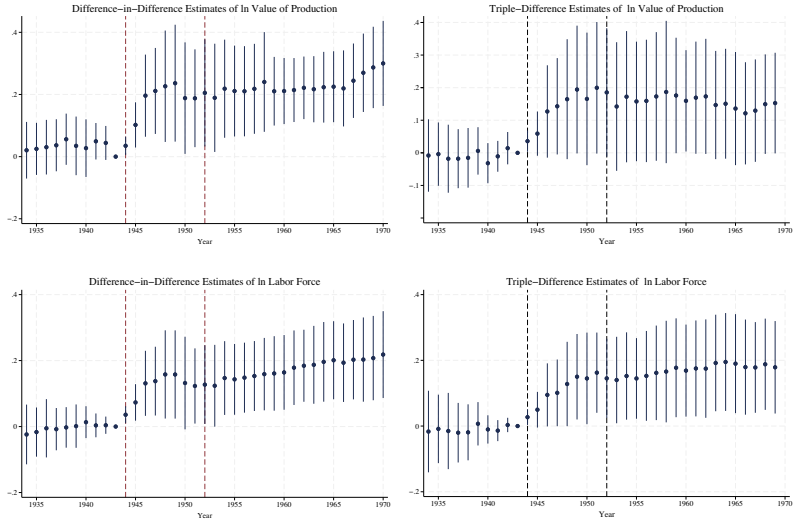

FIGURE III

Flexible Difference-in-Differences and Triple-Difference Estimates in Industry Output and Labor Force by War Reparations Exposure

This figure presents estimated flexible difference-in-difference and triple-difference estimates (β_ts) and 95% confidence intervals following equations (2) and (4). The outcome is regressed on the industry war reparations exposure interacted with year effects. The model also includes year fixed effects and industry effects, as well as elastic-net-chosen controls, interacted with year fixed effects. Differences are estimated relative to 1943. The sample includes 1934–1970 in Finland and 1934–1969 in Norway. The unit of observation is the four-digit industry. The dashed vertical lines present the start and end of the war reparations payments. The confidence intervals are based on standard errors clustered at the industry level.

To address such concerns, I perform a triple-difference estimation exercise using newly compiled Norwegian industrial data. I use Norway as the point of comparison for two reasons. The first reason is the availability and comparability of the data. Norwegian data employ a four-digit industrial classification similar to that of Finnish publications, and it is possible to construct yearly manufacturing data for a comparable period. The second reason is that Norway, as a Nordic country with a similar size and income, is a realistic counterpart to Finland.

1. *Industry-Level Triple-Difference Estimation.* I assign the same industry-level exposure to the corresponding Norwegian in-

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dustries and estimate the following triple-difference equation (4):

$$Y_{ktc} = \beta_1 \left(Reparations\,Share_{kc} \times Post_t \times Finland_c\right) + \beta_2 \left(Reparations\,Share_{kc} \times Post_t\right) + \gamma_{kc} + \delta_{tc} + \theta_t \mathbf{X}_{kc} + \varepsilon_{ktc}. \quad (4)$$

Here, subscripts k, t, and c denote industry, year, and country, respectively. Again, $Reparations\,Share_k$ is the measure of industry k reparations exposure, and $Post_t$ is an indicator variable representing the time from 1944 onward. Here, β_2 shows the difference in the more exposed industries relative to other industries within Norway, where β_1, the coefficient of interest, shows the triple difference, or how much larger the within-Finnish difference in outcome was relative to the within-Norway difference. The terms γ_{kc} and δ_{tc} denote country-industry fixed effects and country-year fixed effects. I include $\theta_t \mathbf{X}_{kc}$ industry log employment and the log value of production in 1943 interacted with year effects in the estimations. I cluster the standard errors at the industry-country level. I perform the analysis for nearly the same period as above, 1934–1969, for which information is available in both countries.

In the results shown in Table IV, the triple-difference estimates show that the within-Finland development of the exposed industries was considerably greater than the within-Norway change. The baseline estimates presented in column (1) for the log value of production and in column (5) for the log labor force are statistically significant, and the triple-difference estimates (0.16 and 0.16) are close to the difference-in-differences estimates presented in Table III.

The estimated within-Norway coefficients (β_2) in Table IV are small and statistically insignificant. These results indicate that the same industries did not develop noticeably faster than other manufacturing industries within Norway, thus suggesting that differential growth in the reparations-producing industries was not inevitable in postwar Europe.

I explore which industries drive the results. I omit the established timber and paper industries in columns (2) and (6) of Table IV, and the estimates remain roughly similar. I divide the industry-level war reparations exposure into high-skill and low-skill exposure, as in the previous section. The results presented in columns (3) and (4) and (7) and (8) are largely driven by the higher-skill industries. The estimates are similar in size to those in Table III, but the effects for the lower-skill industries are not statistically significant.

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TABLE IV

ESTIMATED TRIPLE DIFFERENCES IN INDUSTRIAL OUTCOMES BY REPARATIONS EXPOSURE

	ln Value of production			ln Labor force				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Reparations share × Post × Finland	0.160***	0.144**			0.160***	0.148***		
	(0.061)	(0.062)			(0.051)	(0.053)		
Reparations share × Post	0.042	0.045			0.030	0.036		
	(0.050)	(0.052)			(0.039)	(0.039)		
Reparations share × Post × Finland × HS			0.194***	0.164***			0.195***	0.173***
			(0.062)	(0.062)			(0.055)	(0.054)
Reparations share × Post × Finland × LS			−0.020	0.028			−0.043	0.016
			(0.074)	(0.066)			(0.075)	(0.064)
Reparations share × Post × HS			0.006	0.021			−0.006	0.005
			(0.053)	(0.054)			(0.045)	(0.042)
Reparations share × Post × LS			0.048	0.048			0.063	0.063
			(0.059)	(0.064)			(0.054)	(0.061)
N	9,972	8,820	8,820	7,668	9,972	8,820	8,820	7,668
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Year-country FE	✓	✓	✓	✓	✓	✓	✓	✓
Industry-country FE	✓	✓	✓	✓	✓	✓	✓	✓
Established	Yes	No	Yes	No	Yes	No	Yes	No

Notes. The unit of observation is the four-digit industry-country. The estimates are derived from equation (4). The Post and Finland interacted treatment is the industry's scaled reparations payments. The controls are pretreatment 1943 characteristics ln(labor) and ln(value of production) interacted with year-country fixed effects. The estimations include country-year and country-industry fixed effects. The more established timber and paper industries are omitted in the even columns. HS denotes a high-skill industry and LS a low-skill industry divided by U.S. average years of schooling. The 1980 U.S. two-digit industry-specific years of schooling are from Ciccone and Papaioannou (2009), translated into the corresponding historical industry groups. The period of study is 1934–1969, and the reparations payments began in 1944. Post is a dummy indicating the period after 1943. Robust standard errors are given in parentheses and are clustered at the industry-country level. *** 1%, ** 5%, * 10% significance levels.

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2. *Event-Study Graphs.* In Figure III, I present the flexible estimates (β_2's), where the reparations share variable is interacted with year fixed effects instead of the *Post* term in equation (4). These triple-difference estimates are similar to the difference-in-differences estimates, presented side by side in Figure III. The estimated coefficients are stable before the war reparations and diverge afterward, without presenting differential pretrends. Due to differences in the countries' historical industrial classifications, the linking of war reparation exposure to the Norwegian industries might be less accurate than the linking in the Finnish case. This inaccuracy might reduce the precision of the estimates.

V. Local Development and Structural Transformation

V.A. Local Exposure Intensity and Baseline Differences

1. *Local Exposure Intensity.* To study the effect of the war reparations on later local economic development and structural transformation, I construct a municipal-level measure of the intensity of the exposure at each location. I follow the comprehensive literature (Bartik 1991; Autor, Dorn, and Hanson 2013; Acemoglu et al. 2016) and calculate a shift-share measure as the sum of the interactions of the preexposure industry labor shares in the municipality and the industry's war reparations shipments:

$$Exposure_m = \sum_k \frac{L_{km}}{L_m} \frac{Reparations_k}{L_k}. \tag{5}$$

In the local exposure measure presented in equation (5), I use the 1939 industry (k) and municipality (m) information available in the 1950 census to measure what portion of the labor force (L) in a certain municipality worked in the exposed sectors before the reparation payments began. In equation (5), $\frac{L_{km}}{L_m}$ represents the share of workers in an industry in a municipality in 1939. $Reparations_k$ is the total number of reparations assigned to the industry. I follow Autor, Dorn, and Hanson (2013) and scale the industry shock with the initial labor force working in the industry L_k.[25] Figure IV maps the geographical variation in the exposure variable.

25. The 1950 population census uses a different industrial classification than the manufacturing census employed in the previous section. The 1950 population census includes 53 broader sectors of industrial activity and has information on nonmanufacturing sectors.

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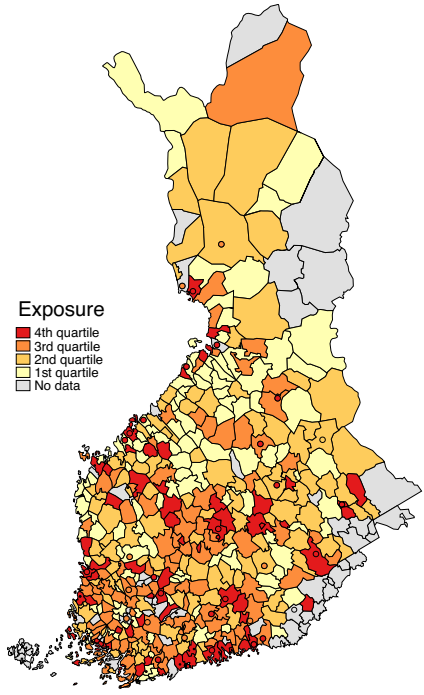

FIGURE IV

Geographic Distribution of Local War Reparations Exposure

The map presents the local exposure to war reparations production of Finnish municipalities measured using the $Exposure_m$ variable constructed in equation (5). Here, labor shares are calculated using the preexposure 1939 industry shares.

The exposure measure captures how much the reparations episode affected the specific municipality. Reparations led to an increased demand for goods from certain industries but were also associated with other substantial local changes, such as the upgrading of production facilities and investments in new machinery and education. This variable indicates how much overall exposure to nonmarket production the locality had during the episode. Because the reparations production was largely based on the massive extension and upgrading of the existing manufacturing base rather than the founding of new factories (Kinnunen 1967; Harki 1971), $Exposure_m$ is a good measure of which municipalities were more exposed to reparations payments.

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Using the exposure measure, which is calculated from preexposure industry shares, instead of actual factory locations, further addresses identification issues that could arise from the state's choice of preferred locations for production. It would be concerning for comparability if the state assigned reparations production to the locations it wanted to develop more. Even though there is no record of such preferential assignment in the historical literature, the fact that the exposure variable is measured using prereparations labor shares further mitigates such concerns.

2. *Local Preexposure Differences and Parallel Trends.* The hypothesis to be tested is whether local exposure to temporary nonmarket production made the more affected municipalities more industrialized and whether the structural change persisted after the episode ended. The identifying assumption is that the less exposed municipalities would have otherwise developed similarly to the more exposed municipalities after the war reparations. To assess the validity of this assumption and the comparability of the differentially exposed locations, I estimate equations (6) and (7) at the municipal level:

$$Y_{m(1940)} = \beta Exposure_m + \gamma_{r(m)} + \eta \mathbf{X}_m + \varepsilon_m, \tag{6}$$

$$Y_{m(1940)} - Y_{m(1930)} = \beta Exposure_m + \gamma_{r(m)} + \eta \mathbf{X}_m + \varepsilon_m. \tag{7}$$

The outcome in equation (6) is the preexposure level in 1940, and the outcome in equation (7) is the preexposure change in observed characteristics of municipality (m) in 1930–1940. $Exposure_m$ is the municipal-level measure of the intensity of exposure to the reparations as defined in equation (5). I standardize the $Exposure_m$ variable to have a mean of zero and a standard deviation of one. To explore variation arising from initial industrial composition, I control for the initial share of employment in manufacturing and agriculture in 1940, as well as urban fixed effects $\mathbf{X}_m$. I further control for 11 region fixed effects ($\gamma_{r(m)}$), determined by the municipality m.

The results of the comparability tests presented in Table V validate my empirical assessment. Municipalities differentially exposed to the reparations had similar observable characteristics and, more importantly for the difference-in-differences estimation, exhibited parallel trends prior to the episode.

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TABLE V

BASELINE MUNICIPALITY CHARACTERISTICS BY WAR REPARATIONS EXPOSURE

	Pretreatment 1940 mean and (std. dev.)	Observations	β^{Levels}	$\beta^{Changes}$
	(1)	(2)	(3)	(4)
ln Population	8.16	499	0.007	−0.010
	(0.96)		(0.043)	(0.007)
Share of population in services	0.06	499	−0.003*	−0.001
	(0.06)		(0.002)	(0.002)
Share of population in construction	0.01	499	0.000	0.001
	(0.01)		(0.000)	(0.001)
Share of Swedish population	0.11	499	0.018	−0.001
	(0.28)		(0.014)	(0.001)
Average income tax (marks)	19.45	499	−0.022	−0.054
	(3.78)		(0.120)	(0.082)
Share paying income tax	0.09	499	0.003*	−0.002
	(0.06)		(0.001)	(0.003)
ln Arable land	8.38	498	−0.006	−0.082
	(1.18)		(0.055)	(0.061)
Cattle relative to population in 1000s	425.14	498	−1.785	3.048
	(179.94)		(6.448)	(2.890)
Tractors relative to population in 1000s	2.61	499	0.029	0.049
	(3.63)		(0.115)	(0.090)
ln Manufacturing workers	4.51	304	0.195	−0.029
	(1.95)		(0.142)	(0.056)
ln Factories	1.57	304	0.163*	−0.032
	(1.27)		(0.094)	(0.038)
ln Manufacturing salary (marks)	1.87	304	0.280*	−0.077
	(2.27)		(0.164)	(0.068)
Share of population in agriculture	0.72	499		−0.001
	(0.25)			(0.004)
Share of population in manufacturing	0.10	499		−0.003
	(0.11)			(0.003)
ln Area	6.17	499	−0.012	
	(1.11)		(0.042)	
Latitude	62.24	499	0.016	
	(1.68)		(0.023)	
Longitude	24.73	499	−0.058	
	(2.26)		(0.042)	

Notes. The unit of observation is the municipality. The table presents the baseline 1940 mean and standard deviation of local variables. It includes the coefficients and standard errors from regressing observable variables in 1940, or their changes between 1930 and 1940, with the standardized treatment variable. The specifications also control for the 1940 manufacturing share and 1940 agricultural share, as well as region and urban fixed effects. The estimates are derived from equations (6) and (7). Average income tax and Share paying income tax are measured in 1929 and 1938. In manufacturing workers, factories, and manufacturing salary, the difference is between 1934–1940. In columns (3) and (4) robust standard errors are in parentheses. Significance levels: *** 1%, ** 5%, * 10%.

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V.B. Lasting Effects on Local Industrialization

1. *Local Difference-in-Differences Estimation.* I estimate the following difference-in-differences model (8) at the municipal level, where the outcome of interest (Y_{mt}) is the municipal employment share in manufacturing or agriculture, log municipal employment in manufacturing, or the log number of manufacturing establishments:

$$Y_{mt} = \beta\,(Exposure_m \times Post_t) + \gamma_m + \delta_t + \theta_t \mathbf{X}_m + \varepsilon_{mt}. \tag{8}$$

In equation (8), subscript m denotes the municipality and t denotes the year. $Exposure_m$ is the municipal-level reparations exposure as defined in equation (5), and $Post_t$ denotes the time after 1944 when the war reparations commenced. The coefficient of interest β is the difference-in-differences estimate. I standardize the $Exposure_m$ variable to have a mean of zero and a standard deviation of one. γ_m and δ_t represent the municipal and year fixed effects. Depending on the specification, I add either the baseline industrial structure controls or elastic-net-selected controls interacted with year effects $\theta_t \mathbf{X}_m$ to ensure comparability. I add urban fixed effects and 11 larger region fixed effects, which constrain the comparison to geographically nearby municipalities, interacted with the year. I weight the regressions with their 1939 census population and cluster the standard errors by municipality.

2. *Local Difference-in-Differences Results.* I report the difference-in-differences estimates from equation (8) in Table VI. Here, a one standard deviation increase in local exposure to war reparations production led to a 2 percentage point increase in the share of manufacturing labor and a 3 percentage point decrease in the agricultural labor share.

I validate the local-level industrialization findings using manufacturing surveys. These cover fewer municipalities but span more years. A one standard deviation increase in local exposure to war reparations led to an approximately 14 log point increase in manufacturing employment and a 9 log point increase in the number of establishments. The estimates presented in Table VI, both for specifications with baseline industrial structure controls and for those with elastic-net-selected controls, give similar results with the larger sample local industrial structure. However, for the smaller sample, the estimates for manufacturing employment and the number of establishment outcomes are similar

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TABLE VI

ESTIMATED DIFFERENCES IN LOCAL DEVELOPMENT AND STRUCTURAL CHANGE BY REPARATIONS EXPOSURE

	Manufacturing employment share				Agriculture employment share				ln Manufacturing workers				ln Establishments			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Exposure × Post	0.023***	0.023***	0.017**		−0.033**	−0.035***	−0.031**		0.082	0.146**	0.202**		0.052	0.091**	0.104**	
	(0.008)	(0.008)	(0.008)		(0.013)	(0.013)	(0.014)		(0.068)	(0.063)	(0.084)		(0.039)	(0.038)	(0.048)	
HS Exposure × Post				0.022***				−0.036***				0.196***				0.116***
				(0.008)				(0.013)				(0.068)				(0.038)
LS Exposure × Post				0.007				−0.004				−0.073**				−0.040*
				(0.005)				(0.007)				(0.030)				(0.021)
N	2,136	2,136	2,136	2,136	2,136	2,136	2,136	2,136	6,732	6,732	6,732	6,732	6,732	6,732	6,732	6,732
Municipalities	356	356	356	356	356	356	356	356	204	204	204	204	204	204	204	204
Established	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
E-net controls		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓

Notes. The unit of observation is the municipality. The sample includes the decades 1920, 1930, 1940, 1950, 1960, and 1970 in columns (1)–(8) and 1934–1966 in columns (9)–(16). The estimates are derived from equation (8). The post-1944 interacted treatment is the municipality's scaled reparation exposure. All regressions include municipality and year fixed effects, the baseline municipal-level controls of the agricultural share and manufacturing share in 1940, 11 region fixed effects, and urban fixed effects interacted with year effects. The term Established denotes the more established timber and paper industries, which are omitted from the exposure variable. HS denotes a high-skill industry and LS a low-skill industry, determined by U.S. average years of schooling. The elastic-net-selected controls also include the share of income tax payers. The manufacturing survey includes elastic-net-selected controls for the number of cattle relative to the population in 1940, Swedish speaking share in 1940, share of income tax payers, log value added and the value of product in 1943. Regressions are weighted by the 1939 municipal population. Robust standard errors are in parentheses and are clustered at the municipality level. *** 1%, ** 5%, * 10% significance levels.

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but not statistically significant when using only the baseline controls.

I again examine which industries drive the local industrialization in Table VI. I redefine $Exposure_m$ by omitting the established timber and paper industries from the measure. Omitting these industries does not substantially affect the estimates in Table VI, suggesting that these industries are not driving the observed effects arising from the studied episode.

I delve further to understand the source of the observed effect. I calculate separate local exposure measures using either high-skill or low-skill industries, as previously defined. I standardize these measures to have a mean of zero and a standard deviation of one to support the comparison. This exercise aims to disentangle the effects of different types of local exposure. The estimates presented in Table VI suggest that the effects on local structural change are driven primarily by exposure to high-skill, more advanced production. The exercise further suggests that the upgrades in production made in the more advanced sectors were more important than the overall increase in orders that affected both the more advanced and less advanced sectors.

3. *Event-Study Graphs.* To study the local dynamic effects of exposure to war reparations, I estimate the year-interacted point estimates ($\beta_t s$), otherwise following equation (8). Figure V presents estimates for both the manufacturing employment share and log manufacturing employment outcomes. Both outcome variables exhibit a significant jump after the war reparations commenced in 1944. The event-study graphs in Figure V further underscore the comparability of the differently exposed municipalities. The yearly estimates in Panel B do not show a discernible pretrend before or during the war. This evidence strengthens the argument that it was the reparations, rather than, for example, wartime production, that catalyzed the observed surge in local industrialization.

4. *Local-Level Investments.* A plausible mechanism for the observed industrialization is that the state provided loans and advance payments to facilitate production upgrades and investments needed for the war reparations production (Auer 1956, 186). I empirically examine this intermediate step using local manufacturing power usage (in horsepower) drawn from the manufacturing censuses as a proxy for local capital accu-

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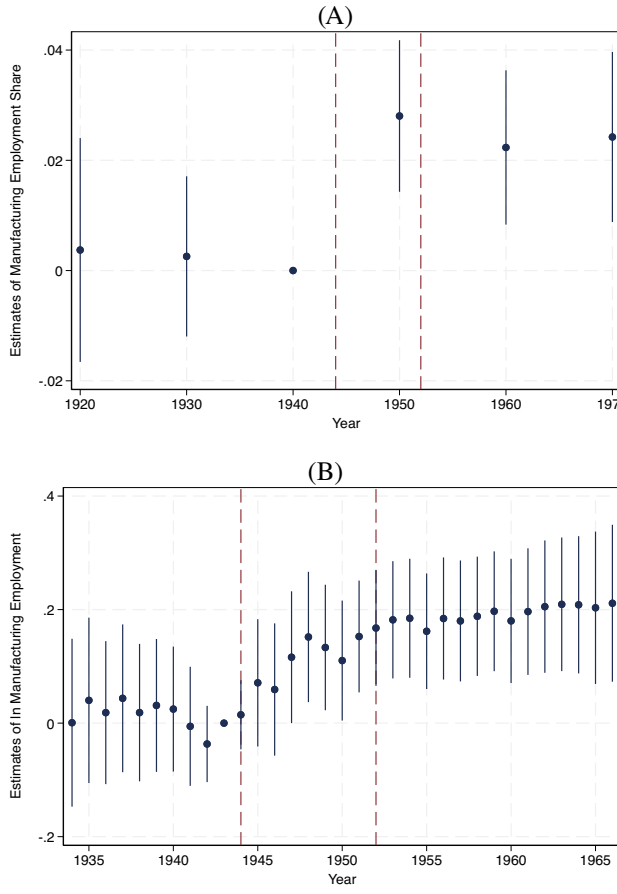

FIGURE V

Estimated Differences in Local Manufacturing Employment by Level of Exposure to War Reparations

The unit of observation is the municipality. The graphs present estimated difference-in-differences coefficients (β_t) from equation (8). The outcome is regressed on local reparations exposure interacted with year effects. The model also includes municipality and year fixed effects and elastic-net-selected controls, region fixed effects, and urban fixed effects interacted with year fixed effects. The lines present 95% confidence intervals, based on municipality-level clustered standard errors. The vertical dashed red lines present the start and end of the war reparations payments. Panel A uses data for each decade from the publication *Finnish Population by Industry*. Panel B uses data drawn from yearly manufacturing surveys. The sample includes 1934–1966 in the manufacturing survey data and the decades 1920, 1930, 1940, 1950, 1960, and 1970 in the occupational structure data.

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mulation.[26] The difference-in-differences estimates reported in Online Appendix Table A.I show that there was a differential increase in power usage after the reparation payments started in the localities with more exposure. When the local exposure measure is divided by skill intensity, the effect on capital increase is driven by the high-skilled local exposure measure in Online Appendix Table A.I.

V.C. Local-Level Triple-Difference Estimation Using Norwegian Data

I perform a triple-difference estimation with Norwegian local-level data. The purpose of this exercise is to further alleviate the concern that Finnish regions with a certain type of initial industrial structure were different in some unobserved way or were bound to develop differently after the war.

I create a Norwegian version of the local exposure variable equation (5) using the manufacturing structure of each Norwegian county (*fylke*) in 1939. This approach allows me to calculate a potential Norwegian local exposure to war reparations production variable similar to that in Finland. I assign the constructed shift-share measure to the Norwegian municipalities, which are a subset of counties, enabling me to obtain a Norwegian municipal-level measure of potential exposure to war reparations production comparable to that in Finland. As a Norwegian outcome variable, I use data available from the *Kommunendatabasen*, which offers information on the broad industrial structure of each Norwegian municipality.[27]

1. *Local Triple-Difference Estimation.* These additional data allow me to estimate a triple-difference model (9), where the outcome of interest Y_{mtc} is the municipal employment share in manufacturing or agriculture in either Norway or Finland, and $Exposure_m$ denotes the local potential-exposure variable.

$$Y_{mtc} = \beta_1 \left(Exposure_m \times Post_t \times Finland_c\right) + \beta_2 \left(Exposure_m \times Post_t\right) + \gamma_m + \delta_{tc} + \theta_t \mathbf{X}_m + \varepsilon_{mtc} \tag{9}$$

26. The manufacturing census does not directly report investments or capital over the entire study period.

27. The construction of the Norwegian data and shift-share measure is further explained in Online Appendix C.D.

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In equation (9), subscripts m, t, and c denote municipality, year, and country, respectively. Here, the coefficient β_2 represents the difference in the more exposed municipalities relative to other municipalities in Norway. The coefficient β_1 denotes the triple difference or how much larger the within-Finland difference in exposure is relative to the within-Norway difference. I standardize the $Exposure_m$ variable to have a mean of zero and a standard deviation of one. γ_m and δ_{tc} denote the municipality and country-year fixed effects, respectively. In the estimations, I include $\theta_{tc}\mathbf{X}_m$, the municipality's 1930 population, manufacturing and agricultural share and urban fixed effects interacted with year effects.[28] I weight the regressions with the 1930 municipal population and cluster the standard errors by municipality. I limit my sample to the years data are available for both countries, namely, 1920, 1930, 1950, and 1960.

In the triple-difference estimates reported in Table VII, I find no statistically significant effect on the $Exposure_m$ variable in Norway; in other words, there was no observable differential structural change in the Norwegian regions with initial production geared toward war reparations production. However, the triple-difference estimates of Finnish regions with such initial industrial composition are large and statistically significant. The estimated impact is a 5 percentage point increase in the share of labor in manufacturing and an approximately 3 percentage point decrease in the share of the labor force in agriculture.

As before, I create separate variables for nonestablished production, as well as high-skill and low-skill exposure, to examine what industries drive the observed effects. In Table VII, the estimated effects remain similar when excluding established timber and paper industries, suggesting that these sectors do not drive the results. In Table VII the effect on the manufacturing labor share is influenced primarily by higher-skill industries. The effect on the agricultural labor share is correspondingly greater for high-skilled workers.

The triple-difference estimates reported in Table VII are not perfectly comparable to the difference-in-differences estimates found in Table VI. This discrepancy is due to measurement and sample differences across countries; the limitation of the sample to the years data are available for both countries (1920, 1930,

28. In these estimations, I control for the 1930 local industry shares from both countries, as such information does not exist for Norway in 1940.

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TABLE VII

ESTIMATED TRIPLE DIFFERENCES IN LOCAL STRUCTURAL CHANGE BY REPARATIONS EXPOSURE

	Manufacturing employment share			Agriculture employment share		
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure × Post × Finland	0.050***	0.048***		−0.033**	−0.024*	
	(0.013)	(0.012)		(0.013)	(0.013)	
Exposure × Post	−0.011	−0.015		−0.006	−0.004	
	(0.010)	(0.011)		(0.009)	(0.009)	
HS exposure × Post × Finland			0.045***			−0.028**
			(0.013)			(0.013)
LS exposure × Post × Finland			0.015**			−0.013
			(0.007)			(0.008)
HS exposure × Post			−0.011			−0.006
			(0.010)			(0.009)
LS exposure × Post			0.002			−0.002
			(0.005)			(0.005)
N	4,400	4,400	4,400	4,400	4,400	4,400
Municipalities	1,100	1,100	1,100	1,100	1,100	1,100
Established	Yes	No	Yes	Yes	No	Yes
Municipality FE	✓	✓	✓	✓	✓	✓
Year-country FE	✓	✓	✓	✓	✓	✓
Municipality controls × Year	✓	✓	✓	✓	✓	✓

Notes. The unit of observation is the municipality either in Finland or in Norway. The sample includes the decades 1920, 1930, 1950, and 1960, when data are available for both countries. The estimates are derived from equation (9). The post-1944 interacted treatment is the municipality's potential reparations exposure calculated using pretreatment industry shares. Finland is a dummy indicating municipalities in Finland. All regressions include municipality and country-year fixed effects and the baseline municipal-level controls of population, agricultural share, and manufacturing share in 1930, as well as urban fixed effects interacted with year effects. The term Established denotes the more established timber and paper industries, which are omitted from the exposure variable. HS denotes a high-skill industry and LS a low-skill industry, determined by U.S. average years of schooling. Regressions are weighted by the 1930 municipal population. Robust standard errors are in parentheses and are clustered at the municipality level. *** 1%, ** 5%, * 10% significance levels.

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1950, and 1960) and the inclusion of a slightly different set of controls.[29] Nevertheless, the baseline local estimates reported in Tables VI and VII are qualitatively similar and statistically and economically significant.

VI. Long-Term Individual-Level Effects

VI.A. *Individual-Level Effects on Leaving Agriculture and Long-Term Incomes*

I deepen the analysis of the episode by employing Finnish administrative data that allow the tracking of individuals over time. I begin the individual-level examination by studying the effect of local exposure to reparations production in the sector in which a given individual worked in 1950 or 1970, as well as their long-term wages. I first focus on established workers aged 25–45 in 1950.[30] I estimate the following equation:

$$Y_{im} = \beta Exposure_m + \gamma_{r(im)} + \eta \mathbf{X}_m + \theta \mathbf{X}_i + e_{im}. \quad (10)$$

Here, outcome Y_{im} is a dummy variable that measures whether person i worked in agriculture or manufacturing in 1950 or 1970 or the person's average income from 1971 to 1975. $Exposure_m$ measures municipality m's (in which the person lived in 1939) war reparations exposure. I standardize the $Exposure_m$ variable to have a mean of zero and a standard deviation of one to facilitate the interpretation of the results. β is the coefficient of interest. I add baseline control variables $\mathbf{X}_m$ to account for the initial differences in industrial structure. I add urban and 11 Finnish region fixed effects ($\gamma_{r(im)}$) to account for any region-specific variation. Region fixed effects are determined by the person i and their municipality of residence in 1939 m. These municipal-level variables are assigned to the worker's 1939 municipality to account for selection. I also control for individual-level sex and age fixed effects $\mathbf{X}_i$.

In Table VIII, Panel A, I present the estimated effects of local

29. Furthermore, the divided estimates are potentially less informative in the Norwegian case, as I discuss in Online Appendix C.D, and there is less variation in the skill intensity within the Norwegian variables because the data are less detailed.

30. The oldest workers in the sample were likely to remain in the labor force until 1970, at which point I assess the long-term individual outcomes. The youngest individuals in the sample were 14 years old in 1939, which allows me to possibly link them to an industry of employment from that year.

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TABLE VIII

LOCAL REPARATIONS EXPOSURE AND ESTABLISHED WORKER OUTCOMES

	Agriculture				Manufacturing			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Outcomes in 1950								
Exposure	−0.121***	−0.086***	−0.110***		0.090***	0.046***	0.070***	
	(0.012)	(0.012)	(0.015)		(0.006)	(0.007)	(0.009)	
HS exposure				−0.107***				0.079***
				(0.011)				(0.006)
LS exposure				−0.049***				0.037***
				(0.006)				(0.004)
N	98,755	29,108	98,755	98,755	98,755	29,108	98,755	98,755
Sample	All	Agriculture 1939	All	All	All	Agriculture 1939	All	All
Established	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Y mean	0.400	0.821	0.400	0.400	0.236	0.070	0.400	0.400
Panel B: Outcomes in 1970								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exposure	−0.061***	−0.061***	−0.058***		0.041***	0.026***	0.030***	
	(0.006)	(0.008)	(0.007)		(0.004)	(0.005)	(0.005)	
HS exposure				−0.053***				0.038***
				(0.005)				(0.004)
LS exposure				−0.025***				0.012***
				(0.003)				(0.003)
N	98,756	29,108	98,756	98,756	98,756	29,108	98,756	98,756
Sample	All	Agriculture 1939	All	All	All	Agriculture 1939	All	All
Established	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Y mean	0.196	0.407	0.196	0.196	0.129	0.065	0.129	0.129

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TABLE VIII
CONTINUED

	Ln Income				Income rank			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel C: Outcomes in 1970				
Exposure	0.146***	0.108***	0.153***		2.436***	2.185***	2.544***	
	(0.019)	(0.021)	(0.023)		(0.391)	(0.358)	(0.481)	
HS exposure				0.136***				2.292***
				(0.019)				(0.378)
LS exposure				0.034***				0.494**
				(0.010)				(0.198)
N	66,759	19,907	66,759	66,759	81,027	23,926	81,027	81,027
Sample	All	Agriculture 1939	All	All	All	Agriculture 1939	All	All
Established	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Y mean	6.673	6.415	6.673	6.673	50.026	46.400	50.026	50.026

Notes. The unit of observation is the individual. The sample includes individuals aged 25–45 in 1950. The estimates are derived from equation (10). The outcomes are dummies denoting the industry in which the person worked in 1950 or 1970. Exposure is a municipality-level measure of the reparations shock according to the person's municipality in 1939. Income is measured as the average income between 1971 and 1975. All regressions include the baseline municipal-level controls of the agricultural share and manufacturing share in 1940, age and sex fixed effects, 11 region fixed effects, and urban fixed effects. HS denotes a high-skill industry and LS a low-skill industry, determined by U.S. average years of schooling. Robust standard errors are in parentheses and are clustered at the municipality of 1939 level. *** 1%, ** 5%, * 10% significance levels.

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exposure to reparations production on a person's sector of employment in 1950. The first column presents the estimates of working in agriculture for all workers.[31] Here, a one standard deviation increase in local exposure to reparations production is associated with a 12 percentage point lower probability of working in agriculture. In the second column, I restrict the sample to those who I know worked in agriculture in 1939, which means that I can identify any departures from agriculture between 1939 and 1950. The estimated effect in the subsample is 9 percentage points.

Similarly, a one standard deviation increase in local exposure to reparations production is associated with a 9 percentage point increase in the probability of working in manufacturing in 1950. In the subsample of initial agricultural workers, the estimated effect is around 5 percentage points.

I track the workers over censuses and first study the effect of the policy on workers' employment sectors in 1970. Table VIII, Panel B shows that workers more exposed to war reparations were still more likely than others to work outside agriculture and more likely to be working in manufacturing in 1970. Estimates of similar magnitude are found for the workers who can be identified as agricultural workers in 1939.

As a large body of literature has argued that agriculture is less productive than manufacturing (e.g., Gollin, Lagakos, and Waugh 2014), I also present the estimated reduced-form effects of the reparations exposure on a person's long-term income in Table VIII, Panel C. I take the average income of a person in 1971 and 1975 to minimize missing incomes. I again divide the sample into all workers and those working in agriculture in 1939. I find that the effect of a one standard deviation increase in local exposure is associated, on average, with a 15 log point increase in 1970 incomes. For the subsample of those who were agricultural workers in 1939, the estimated impact of a one standard deviation increase in the exposure measure is around 11 log points. I find consistent results when using income rank as an outcome in Table VIII, Panel C.[32]

31. Agriculture here also includes other forms of primary production, such as forestry.

32. Following the approach of Chetty et al. (2014), I categorize people into 100 evenly sized groups based on the national income distribution from the 1970s to analyse their income rank in each cohort.

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I go on to study which industries are driving these effects on established workers. In Table VIII, columns (3) and (7) after the established timber and paper industries are excluded from the local exposure measure, the standardized effects on all the outcomes remain similar. This result indicates that the established sectors are not the primary drivers of the observed results. When exposure by high- and low-skill industries in columns (4) and (8) are differentiated, the higher-skill industries seem to drive the effects. Although there are statistically significant effects for lower-skill industries, the standardized effects are smaller in magnitude than those arising from the higher-skill industries.

VI.B. Long-Term Effects on Education and Occupational Upgrading

1. *Individual-Level Difference-in-Differences.* Since increased manufacturing opportunities plausibly offer children and young adults more and different options than they offer the older generation, I can estimate a generalized difference-in-differences specification equation (11) to study how the postwar change in the local production structure affected occupational and educational choices by 1970. In this analysis, the sample comprises all individuals between the ages of 5 and 50 in 1944 who were included in the 1950 census.

$$Y_{imc} = \beta\,(Young_c \times Exposure_m) + \gamma_m + \gamma_c + \eta_c \mathbf{X}_m + \theta \mathbf{X}_i + \varepsilon_{imc} \tag{11}$$

Here, Y_{imc} is the educational or occupational measure of the individual i, in cohort c and municipality m, measured in 1970. $Young_c$ denotes those in cohorts c aged 5–25 in 1944, at the start of the reparations. The $Exposure_m$ variable is assigned to the individual's municipality m in 1939. β is the coefficient of interest reflecting the within-municipality impacts of war reparations exposure for younger cohorts in comparison to that for older cohorts.[33] The specifications include municipality fixed effects γ_m, which account for any time-invariant municipality-specific factors, and co-

33. The timing of the effect is complicated, given that delayed educational decisions and war reparations production necessitated skill upgrading and education for individuals across all age groups and provided new opportunities. Nevertheless, the difference-in-differences estimates, even without precise timing, provide further evidence by focusing on within-municipality changes in educational attainment.

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hort fixed effects γ_c, which account for common cohort effects. I further add urban fixed effects and region fixed effects interacted with cohort fixed effects. I also control for sex fixed effects in $\mathbf{X}_i$. I control for the baseline municipal agricultural and manufacturing labor share in 1940 interacted with cohort fixed effects to account for the initial differences in industrial structure.

The difference-in-differences results in Table IX, Panel A show that the younger cohorts in the more exposed locations increased their years of schooling due to the war reparations production. I use information from the 1970 administrative data to examine the effects on all reported degrees and on higher degrees.[34] There are especially pronounced effects on higher education. The impact of a one standard deviation increase in local exposure to war reparations on completing a higher degree is 0.6 percentage points, which amounts to 12.5% of the mean. Using all types of degrees as outcomes produces similar results, as shown in Table IX.

I examine the effects of local exposure to reparations production on occupational upgrading. I categorize the occupations into three larger groups based on socioeconomic rankings (blue-collar production occupations, white-collar office occupations, and executive occupations) provided by Statistics Finland and use the occupational group as an outcome in equation (11). The estimates presented in Table IX, Panel B suggest occupational upgrading. The younger cohorts in the exposed municipalities are less likely to be in production occupations and are instead more likely to hold executive and white-collar occupations.

I study which industries drive the results by excluding the established timber and paper industries and dividing the exposed industries into high-skill and low-skill industries. In Table IX, the estimates are once again minimally affected by the omission of the established industries, suggesting that these do not drive the results. The division into high-skill and low-skill industry exposure in Table IX reveals that the presented education estimates are driven by high-skill reparation production, while there is no impact of low-skill industry exposure.

34. These degrees correspond to codes 3–8 in the Finnish educational classification (*koulutusluokitus* 2003) available in the administrative data, which is similar to the International Standard Classification of Education (ISCED) but not perfectly comparable for historical degrees. Higher education degrees correspond to codes 6–8 in the Finnish educational classification system.

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TABLE IX

ESTIMATED DIFFERENCES IN EDUCATION AND OCCUPATION IN 1970 BY LOCAL EXPOSURE

	Years of schooling			Any degree			Higher degree		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Impacts on education									
Exposure × Young	0.092**	0.088**		0.012**	0.010**		0.006***	0.008***	
	(0.040)	(0.036)		(0.006)	(0.005)		(0.002)	(0.002)	
HS exposure × Young			0.102**			0.014**			0.006***
			(0.039)			(0.006)			(0.002)
LS exposure × Young			−0.029			−0.005			0.001
			(0.026)			(0.003)			(0.002)
N	168,966	168,966	168,966	168,966	168,966	168,966	168,966	168,966	168,966
Y mean	7.458	7.458	7.458	0.199	0.199	0.199	0.048	0.048	0.048
Established	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
Muni FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Panel B: Impacts on occupation									
	Production			White collar			Executive		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exposure × Young	−0.009*	−0.017***		0.020***	0.028***		0.007**	0.011***	
	(0.005)	(0.005)		(0.005)	(0.006)		(0.003)	(0.004)	
HS exposure × Young			−0.009*			0.018***			0.007**
			(0.005)			(0.005)			(0.003)
LS exposure × Young			−0.001			0.006*			0.001
			(0.004)			(0.003)			(0.002)
N	168,966	168,966	168,966	168,966	168,966	168,966	168,966	168,966	168,966
Y mean	0.287	0.287	0.287	0.207	0.207	0.207	0.063	0.063	0.063
Established	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
Muni FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes. The unit of observation is the individual. The sample includes individuals aged 5–50 in 1944. "Young" denotes being younger than 25 in 1944. The estimates are derived from equation (11). Higher degree or degree indicates a person's degree status in 1970. Exposure is a municipality-level measure of the reparations shock according to the person's municipality in 1939. HS denotes a high-skill industry and LS a low-skill industry determined by U.S. average years of schooling. All regressions include the baseline municipal-level controls of the agricultural share and manufacturing share in 1940 and 11 region fixed effects, interacted with age fixed effects, and sex and urban fixed effects. Robust standard errors are in parentheses, clustered at the municipality of 1939 level. *** 1%, ** 5%, * 10% significance levels.

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2. *Event-Study Graphs.* To further examine the differential cohort responses to the reparations, I estimate event-study specifications (12). Here, Y_{im} again denotes the education or occupational group of the individual i in 1970 from municipality m in cohort c. The local exposure variable is interacted with five-year cohorts to assess the flexible effects. Otherwise, equation (12) follows equation (11).

$$Y_{imc} = \beta_c \left(Cohort_c \times Exposure_m\right) + \gamma_m + \gamma_c + \eta_c \mathbf{X}_m + \theta \mathbf{X}_i + \varepsilon_{imc} \quad (12)$$

Online Appendix Figure A.III first presents cohort-specific estimates (β_c) and 95% confidence intervals for years of education and the completion of different types of degrees. The estimates are presented relative to the omitted 30–34-year-old cohort. Online Appendix Figure A.III illustrates that the educational effects in Table IX are largely influenced by the youngest cohorts, specifically those aged 5–9 in 1944, who experienced the most prolonged exposure to reparations production. In addition, there is no noticeable long-term trend in the estimated cohort effects in Online Appendix Figure A.III, suggesting that the observed educational effects follow from the studied episode.[35]

The pattern of the estimates for occupational groups presented in Online Appendix Figure A.III reveals further interesting cohort effects stemming from local reparation exposure. Older individuals are significantly more likely to become production workers if they are exposed to nonmarket production. However, the effect does not hold for younger cohorts. Furthermore, the older cohorts are not substantially more likely to become executives when exposed to the episode, while the younger cohorts are more likely to do so, echoing the education trends.

3. *Municipality-Level Increase in Degrees.* To better understand the timing of the local educational effect, I use the available graduation year information to estimate a municipal-level

35. The estimated impacts for the higher education degrees for the relatively mature 25- to 29-year-old group in Online Appendix Figure A.III result from the era's extraordinary circumstances. Education was greatly delayed for the cohorts most exposed to the war (aged 25–29 in 1944). Online Appendix Figure A.IV illustrates this delayed education, where the average age at higher education degree graduation, as available in the full 1970 census, was significantly older for these cohorts. According to the administrative data, 75% of higher degree holders who were aged 25–30 in 1944 graduated after the war.

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event-study specification (13).[36] Here, I aggregate the number of new higher education degrees from the administrative census to the level of graduation year and the person's municipality of residence in 1939. This gives a municipal-level panel of new higher education degrees in each year.

$$\ln\left(Higher\,Degrees+1\right)_{mt} = \beta_t(Year_t \times Exposure_m) + \gamma_m + \delta_t + \theta_t \mathbf{X}_m + \varepsilon_{mt} \tag{13}$$

In equation (13), the outcome $\ln\left(Higher\,Degrees+1\right)_{mt}$ denotes the log number of higher education degrees completed in year t by people from municipality m. Municipality denotes the individual's municipality of residence in 1939 to account for sorting. I group the years into five-year bins, as there are several year-municipality cells without observations, and estimate the interacted exposure effects in each group (β_t). Otherwise, equation (13) follows equation (8).

In the event-study estimates plotted in Online Appendix Figure A.V, there is a clear postwar increase in the number of attained higher degrees among the people living in the more exposed municipalities in 1939. In addition, there is no visible pretrend in new degrees in these municipalities before the war reparations payments started. Online Appendix Table A.II further presents the associated municipal-level difference-in-differences estimates.[37]

4. *New Educational Opportunities.* A feature of the episode that might explain the observed education effects was the substantial expansion of various educational institutes by the state and many reparations companies to quickly increase the availability of a skilled labor force. To study the local availability of later educational opportunities, I use a new data set drawn from Statistics Finland's *Oppilaitokset* (1972) publication and estimate equation (14). Here, the outcome variable $I\left(Institute\right)_m$ denotes a dummy variable indicating whether municipality m had a voca-

36. Available for a subset of degree holders. Here, I use the 1975 census information, with more graduation year observations.

37. As there are few higher degrees in the data, the data set contains many zeros, I explore the robustness of the difference-in-differences model for the log outcome in Online Appendix Table A.II. Following Chen and Roth (2024), I estimate a log effects with scaled and different calibrated extensive-margin values. The estimates remain positive and substantial with these alternative estimations.

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TABLE X

LOCAL REPARATIONS EXPOSURE AND LATER EDUCATION INSTITUTIONS

	HE institution (1)	University (2)	College (3)	Technical college (4)	Vocational (5)	Industry vocational (6)
Exposure	0.103***	0.021	0.055**	0.089**	0.178***	0.150***
	(0.033)	(0.022)	(0.021)	(0.035)	(0.035)	(0.035)
N	499	499	499	499	499	499
Y mean	0.050	0.010	0.020	0.048	0.020	0.052

Notes. The unit of observation is the municipality, with Exposure referring to standardized reparations exposure. Education institutions denote a dummy indicating whether the municipality had a certain education institution in 1971. Higher education (HE) institutions encompass universities, colleges, and technical colleges. All regressions include baseline municipal-level controls of agricultural and manufacturing shares from 1940, 11 regional fixed effects, and urban fixed effects. Regressions are weighted by the 1939 municipal population. Robust standard errors are in parentheses. *** 1%, ** 5%, * 10% significance levels.

tional or higher education institution in 1971 (university, college, technical college, or private or public vocational school).[38]

$$I(Institute)_m = \beta Exposure_m + \gamma_{r(m)} + \theta \mathbf{X}_m + \varepsilon_m \tag{14}$$

The results presented in Table X show a substantial and statistically significant association between higher local exposure to war reparations production and the later presence of higher education institutions in the municipality. A one standard deviation increase in exposure corresponds to a 10 percentage point increase in the likelihood of having a university, college, or technical college. No statistically significant effect is observed for traditional research universities in column (2), as most of the universities were established before the war reparations period. The effect on higher education primarily stems from new colleges (e.g., engineering universities and business schools) and technical colleges that grant bachelor-equivalent degrees, such as engineering degrees, largely founded after the war. Table X provides further evidence that in 1971, locations with greater involvement had more vocational training, particularly industry-provided training, which companies had initiated to meet the demands for a skilled workforce.

5. *Parent Income Channel.* Another plausible explanation for the observed human capital accumulation is the increase in

38. 1971 is the first year such local information on institutes is systematically available. In Online Appendix C.B., I provide further details regarding the classification of these institutes.

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parental income from industrialization, which would enable their children to pursue higher education. To explore this mechanism, I control for parents' income in the sample where parents are matched to children. However, interpreting these estimates is challenging, as both the child's education and parents' income are outcomes of war reparations exposure. Keeping this caveat in mind, I find that local exposure to reparations production remains a predictor of later education, even after accounting for parental incomes in Online Appendix Table A.III. Nevertheless, an increase in parents' income does mediate the accumulation of children's higher education.

VI.C. Upward Mobility

To study upward mobility effects of the episode, I exploit the household information in the administrative data and link the younger cohorts (aged 5–25 in 1944) to their father in the same household according to the 1950 census. As before, I assign local exposure to war reparations production in the person's 1939 municipality to avoid selection to the more exposed areas. To estimate the effects on absolute upward mobility, I restrict the sample to those whose father had not completed primary education in 1950. I use information on parental education instead of parental income, as the earliest individual-level income data are from the 1970s. I track the individuals over censuses and estimate the following equation:

$$\begin{aligned}\left(Y_{im} \mid Father\ without\ primary\ education_i\right) &= \beta Exposure_m \\ &+ \gamma_{r(im)} + \eta \mathbf{X}_m + \theta \mathbf{X}_i + \varepsilon_{im}. \end{aligned} \tag{15}$$

Here, outcome Y_{im} denotes whether individual i in municipality m has a higher degree, indicates whether they work in an executive or white-collar occupation, or measures their years of schooling or income rank. I follow Chetty et al. (2014) and rank the children into 100 equally sized groups in the national income distribution in the 1970s to study their position in the income distribution within the cohort.[39] Otherwise, equation (15) follows equation (10).

Table XI, Panel A presents the estimated upward mobility results. For the children whose fathers did not have a primary education, a one standard deviation increase in reparations exposure

39. I take the average of 1971 and 1975 taxable income to create the income ranks.

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TABLE XI

LOCAL REPARATIONS EXPOSURE AND UPWARD MOBILITY

	Income rank		Years schooling		Higher degree		White collar		Executive	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: Father in the lowest education group										
Exposure	2.581***		0.162**		0.006**		0.020***		0.010***	
	(0.371)		(0.065)		(0.003)		(0.006)		(0.003)	
High-skill exposure		2.367***		0.186***		0.006**		0.020***		0.009***
		(0.358)		(0.066)		(0.003)		(0.006)		(0.003)
Low-skill exposure		0.683*		−0.057		−0.000		0.001		0.002
		(0.404)		(0.036)		(0.002)		(0.005)		(0.003)
N	19,175	19,175	19,176	19,176	19,176	19,176	19,176	19,176	19,176	19,176
Y mean	45.401	45.401	7.252	7.252	0.023	0.023	0.154	0.154	0.039	0.039
Panel B: Father in one of the two highest education groups										
Exposure	0.515		0.300*		0.031**		−0.003		0.019	
	(1.226)		(0.166)		(0.015)		(0.016)		(0.014)	
High-skill exposure		0.102		0.264		0.023		−0.004		0.014
		(1.230)		(0.160)		(0.016)		(0.016)		(0.014)
Low-skill exposure		1.448*		0.125		0.028		0.003		0.017
		(0.754)		(0.131)		(0.017)		(0.013)		(0.016)
N	1,901	1,901	1,901	1,901	1,901	1,901	1,901	1,901	1,901	1,901
Y mean	69.409	69.409	13.088	13.088	0.459	0.459	0.286	0.286	0.521	0.521

Notes. The unit of observation is the individual. The sample includes individuals aged 5–25 in 1944 linked to their fathers within their 1950 households and divided by their father's educational attainment. The estimates are derived from equation (15). Exposure is a municipality-level measure of the reparations exposure according to the person's municipality in 1939. Income rank denotes the rank within a cohort by average income between 1971 and 1975. Higher degree and degree indicate degree status in 1970. Years of education is an imputed measure from the 1970 census. White-collar and executive denote occupational status in 1970. HS denotes a high-skill industry and LS a low-skill industry, determined by U.S. average years of schooling. All regressions include the baseline municipal-level controls of the agricultural share and manufacturing share in 1940, age and sex fixed effects, parent occupation and education effects, 11 region fixed effects, and urban fixed effects. Robust standard errors are in parentheses and are clustered at the municipality of 1939 level. *** 1%, ** 5%, * 10% significance levels.

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was associated, on average, with an income rank that is 2.5 points higher. Similar exposure was associated with 0.16 more years of schooling and a 0.6 percentage point increase in the probability of having higher education. A one standard deviation increase in reparations exposure was further associated with a 1 percentage point increase in the probability of holding an executive occupation and a 2 percentage point increase in having a white-collar occupation.

I divide the exposure measure into high-skill industry exposure and low-skill industry exposure by the associated industry skill level to examine what type of involvement drives the results. I find that the observed upward mobility impacts in Table XI, Panel A are driven entirely by high-skill industries.

I examine the relative effect of exposure on young cohorts with more prosperous backgrounds in Table XI, Panel B. Here, I restrict the sample to individuals whose fathers had at least an upper school or high school diploma, the two highest educational categories available in the 1950 census, and again estimate the conditional outcomes in 1970. The estimates are small relative to the mean and mostly statistically insignificant. These results suggest that the episode of nonmarket production especially benefited those from less privileged backgrounds.

These upward mobility results in Table XI are broadly in line with the seminal work of Kuznets (1955), who argues that in the long run, industrialization can reduce income inequality because it expands professional and income opportunities, which he calls service income, more for the lower-income population than for higher-income elites. For all mobility measures—income rank, years of schooling, having a higher degree, and having an executive or white-collar occupation—the effect is larger relative to the mean for the group where the parent had less than a primary school education. These results support Kuznets's point that industrialization can benefit lower-income groups more, as these new opportunities may not similarly help groups that already have high income.

The long-term effects on education attainment and upward mobility highlight important auxiliary effects of the episode of nonmarket production. The long-term effects on younger cohorts suggest that the change in the local production structure imposed by the war reparations affected the opportunities of these cohorts.

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VII. Further Analysis

VII.A. Robustness

I perform a series of robustness checks on the estimated results, which I briefly outline here and detail more thoroughly in Online Appendix D. In Online Appendix D.A, I report the robustness of the industry-level difference-in-differences estimates to different control variables and alternative specifications, yielding consistent results. In Online Appendix D.B, I demonstrate the robustness of the baseline local development estimates and flexible difference-in-differences estimates to alternative controls, showing consistent results.

I continue by assessing the robustness of the individual-level results in Online Appendix D.C. In Online Appendix Table D.X, I report alternative specifications for the results given in Table VIII, and in Online Appendix Table D.XI, I assess the robustness of Table XI. The results are little affected by the addition of the elastic-net-chosen control variables and are robust to using an indicator for levels of exposure instead of the continuous variable and to defining young people as alternative age groups. I study the robustness of the upward mobility results in Online Appendix Table D.XII. The specifications without controls, with data-driven controls, and with nonlinear controls yield results similar to those of the baseline specification. Similarly, the results remain consistent when the sample includes all those whose fathers had a primary school education, in addition to those whose fathers had no education, as shown in Online Appendix Table D.XII.

Recent studies (Adão, Kolesár, and Morales 2019; Goldsmith-Pinkham, Sorkin, and Swift 2020; Borusyak and Hull 2021; Borusyak, Hull, and Jaravel 2022) promote further important robustness tests when using a shift-share measure. I provide these robustness checks and additional shift-share analysis in Online Appendix D.D, Tables D.XVI–D.XIX.

VII.B. Local Industrial Development and Linkages

I continue by examining whether the locations that experienced more substantial war reparations exposure also diversified into other related industries or spurred further local industrial development. I study such additional local industrial development following the methodology of Dell and Olken (2020) and calculate local variables indicating how many workers in 1970

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were employed in industries downstream and upstream from the industries initially involved in meeting the war reparations demands.[40] To study the persistence of industrial development, I calculate the capital and education intensity of the local industrial structure in 1970. I explain the construction of these local-level measures in detail in Online Appendix E.

Online Appendix Table A.VI presents the estimated association between the local war reparations exposure and subsequent local industrial development. In the estimations, I control for baseline municipal controls of the agricultural and manufacturing labor shares in 1940 as well as urban and 11 regional fixed effects. The estimates presented in Online Appendix Table A.VI, columns (1)–(4) show that municipalities that had been more involved in reparations production also had more workers employed in sectors upstream or downstream from war reparation industries in 1970. The estimates presented in Online Appendix Table A.VI, columns (5)–(8) further show that industries in the more exposed locations had higher capital intensity and human capital intensity in 1970. The local development results remain when I further control for the preexposure values of the local development indicators in the even columns of Online Appendix Table A.VI. These results suggest that the temporary war reparations production led to lasting local development and structural transformation, not only toward the initially promoted industries but also in other related and more advanced industries.

VII.C. Heterogeneity of Local Effects by Baseline Characteristics

In Online Appendix F, I study the heterogeneity of the local-level results. To better understand whether some factors correlate with the policy's success, I interact the local exposure variable with one of three preexposure municipal characteristics: average income, railway access, or education level. Overall, the results presented in Online Appendix Tables D.XX and D.XXI suggest that the initial industrial surge from nonmarket production was greater in initially less developed areas. The long-term local educational effects vary, but the increase in upward mobility was more substantial in initially less educated areas.

40. Following work on upstream and downstream linkages of industrial development (Hirschman 1958; Liu 2019; Lane 2021).

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VII.D. Impacts on Within-Manufacturing Productivity

I study whether the productivity in the targeted manufacturing sectors also increased differentially relative to that in other manufacturing sectors due to nonmarket production. I estimate the productivity impacts of the policy following the earlier difference-in-differences setup, equation (2), where the outcome is the log of value added per laborer. The estimates presented in Online Appendix Table A.V are positive; however, they are rather noisy and not statistically significant at any traditional level. A common problem with such productivity estimation is that sectors could add or retain their labor because of increased productivity, possibly biasing the estimates. This simple analysis still suggests that the primary observed impact of the episode was the significant increase in more productive industrial production in the exposed localities and sectors, leading to increased productivity and wages, rather than a relative productivity increase in the targeted sectors compared with other manufacturing industries.

VII.E. Later Foreign Trade

I estimate the long-term effects of an industry's exposure to war reparations production on subsequent exports to the Soviet Union and the rest of the world using data from the COMTRADE data set (United Nations 2020) for the available years of my study period, 1963–1970. The results indicate that war reparations contributed to an increased value of later exports to the Soviet Union and other nations. As shown in Online Appendix Table A.IV, a one standard deviation increase in war reparations led to a 58 log point increase in the value of Soviet trade and a 30 log point expansion in the value of exports to other non-Soviet countries. The observed later foreign trade is substantial, given the limited exports in these industries before the war reparations. The later non-Soviet trade is especially significant, given that there was nothing in the episode that directly promoted such exports.

Following the successful completion of war reparations, the Soviet Union began importing Finnish-produced goods, particularly from the industries most involved in the reparations payments. The subsequent Soviet trade partially accounts for the observed persistence. The Finnish postwar exports to the Soviet Union can be attributed to the countries' geographical proximity and postreparations trade agreements, as well as exposure to the Soviet market during nonmarket production.

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However, it is crucial to note that on average, some 20% of the value of exports in the involved industries and 25% in the highly involved industries were shipped to the Soviet Union, as presented in Online Appendix Table A.IV, while the rest was shipped to other countries.[41] This finding suggests that although the Finnish-Soviet trade in the involved sectors was substantial after the reparations ended, largely originating from the successful completion of the reparations shipments, it cannot fully explain the enduring effects of war reparations on the targeted industries.[42]

VIII. Conclusions

This article examines the long-term industrial, local, and individual-level effects of the war reparations Finland paid to the Soviet Union from 1944 to 1952, which forced the Finnish state to significantly promote the designated sectors. I combine historical data sets and Finnish administrative data to document the lasting effects of this episode of industrial policy.

I show that the temporary industrial intervention permanently increased production and the labor force in the involved industries. Reparations production further promoted local development and industrialization, which increased people's long-term incomes, education levels, and upward mobility. The war reparations payments and the associated state investments, in essence, managed to persistently push resources into more modern and more productive sectors.

The mechanism for the enduring effect plausibly operated through sustained initial investments and exposure to foreign trade. The state intervention further provided coordination and other important support for local development, for example, by offering new educational opportunities.

In examining the long-term effects of this episode, I do not claim that any kind of further industrialization could not have happened without the nonmarket production. That is not the

41. Here, the means are calculated for the whole group exposed and for the high-skill and low-skill production groups separately. The continuous variables are made into indicators.

42. Soviet trade accounted for approximately 15% of Finland's total foreign trade between 1952 and 1991, and the foreign policy aim was to keep this share below 20% to prevent excess dependency (Sutela 2014, 284, 286).

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counterfactual here. Rather, my examination posits that the targeted nonmarket production expedited the local industrialization process and industrialization toward more advanced Soviet-selected industries. This type of industrialization was not inevitable, as suggested by the comparative Norwegian evidence.

Often, the justification for effective industrial policy is the existence of some type of externality (e.g., Harrison and Rodríguez-Clare 2009).[43] This article adds to the literature by showing the auxiliary effects of an industrial intervention on individual-level incomes, education, and social mobility. These are important development outcomes and not something that benefits only directly targeted industries.

Importantly, the results of this study should not be taken as an endorsement of foreign power extraction. Instead, I provide an analysis of a case where a state initiated nonmarket production due to external factors. It is the consequences of the state response that are studied here, not the initial cause. When evaluating the long-term effects of this episode, one must also consider the financial and emotional costs. The reparations took a substantial portion of the government budget and effort, especially in the early postwar years.[44]

The Finnish postwar economic performance is often considered a success story where the country coupled rapid structural transformation and a vast increase in human capital with high upward mobility (see Ojala, Eloranta, and Jalava 2006). For example, the labor share in agriculture in Finland decreased from 60% in 1940 to approximately 20% in 1970 (Statistics Finland 1979). The results presented here show that the industrial intervention associated with the war reparation payments affected all of these aspects of the society. The Finnish experience of war reparations serves as an example of how large-scale industrial interventions can lead to lasting and multifaceted impacts. These policies warrant further study.

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43. For example, Lane (2021) shows such externalities in industrial linkages to upstream and downstream production, which I also show locally in Section VII.B.

44. The aid in the form of the foreign loans, which the Finnish government received because of the war reparations in a time when credit was difficult to obtain, however, makes it likely that this was significant extra capital infused into the economy rather than capital displaced from other sources.

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Supplementary Material

An Online Appendix for this article can be found at *The Quarterly Journal of Economics* online.

Data Availability

The data underlying this article are available in the Harvard Dataverse, https://doi.org/10.7910/DVN/XABPWK (Mitrunen 2024).

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