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ABSTRACT

Born under the Bad Sign: Intergenerational Effects of the Finnish Great Depression of the Early 1990s*

This paper investigates the effect of a major economic recession on the educational attainment of the next generation. Our analysis is based on nationwide longitudinal registry data on Finland. We focus on the heterogenous effects of the recession on households of different socioeconomic statuses. We find that the effects of the early 1990s recession on the educational attainment of the next generation were more severe for children with nontertiary-educated parents than those with tertiary-educated parents, implying that the recession aggravated the pattern of societal inequality in Finland. Importantly, the deterioration of the home environment was the primary mechanism through which the recession adversely affected the educational attainment of the next generation.

JEL Classification: I24, J12, O15

Keywords: early-life events, parental socioeconomic status, intergenerational effects, education, family dissolution, Finland

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I Introduction

Childhood experiences have long-lasting effects on economic and noneconomic outcomes in adulthood. The seminal study by Almond (2006) on the effects of the 1918 influenza pandemic inspired a body of literature in economics and other social sciences, focusing on the long-lasting impacts of low birth weight in adulthood. Economists have been concerned with the causes and consequences of different levels of human capital resources and their accumulation across individuals and over generations. These issues are highly relevant for policymaking aimed at achieving societal goals, such as economic inequality, as they may uncover a crucial mechanism that drives differences in human capital resources across individuals.

This literature utilizes mainly historical episodes, such as influenza pandemics and major famines, to investigate whether early-life exposure to such events leads to differences in health or human capital measures later (Almond 2006; Chen and Zhou 2007; Neelsen and Stratmann 2011; Lin and Liu 2014). Other studies have focused on more frequent and milder events such as macroeconomic downturns (van den Berg et al. 2006; Stuart 2022; Alessandrini and Diwakar 2022), climate changes (Deschenes et al. 2009), rainfall shortages (Maccini and Yang 2009; Shah and Steinberg 2017), endemic diseases (Barreca 2010), and cash transfer policies (Barham et al. 2013; Akee et al. 2018). Most of these studies found evidence supporting the long-lasting effects of early-life events on health and labor-market outcomes in adulthood. Almond and Currie

(2011) and Almond, Currie, and Duque (2018) provide comprehensive reviews of the literature.

In this paper, we utilize nationwide longitudinal registry data from Finland dating back to 1987. We provide evidence that the severe recession in the early 1990s—often referred to as the Finnish Great Depression—had markedly different effects on the educational attainment of the next generation, depending on the socioeconomic status (SES) of a household. It is a well-known fact that parental SES is positively associated with child health and labor-market outcomes, and there is also evidence supporting the causal link between them (Case, Lubotsky, and Paxson 2002; Currie and Stabile 2003; Currie 2009; Currie 2011). However, only a few studies have examined the long-lasting effects of early-life events on children from the perspective of different SESs.[2] A notable exception to this is the work by Havnes and Mogstad (2015), which examined the effect of a nationwide expansion of subsidized child care in Norway on educational attainment and earnings in adulthood across different levels of parental income. According to their findings, universal childcare increased educational attainment and earnings in adulthood; however, these benefits were only observed for children in low-income households.

[2] In the literature on the fetal origins hypothesis, two previous studies have dealt with the interaction between parental characteristics and child birth weight. Kelly (2011) discovered that British children exposed to the Asian flu in utero in 1957 were more likely to be born with low birth weight when mothers were short and smoked prior to pregnancy. Currie (2011) found that white college-educated mothers reduced the in utero exposure of babies to environmental hazards in comparison with black high-school dropout mothers; thus, the incidence of low birth weight is less likely for children from white college-educated mothers.

Quantifying the role of parental SES in determining the long-lasting effects of early-life events on outcomes in adulthood is challenging due to data and identification. Such analysis requires comprehensive longitudinal data along with a plausibly exogenous shock that alters the childhood environment. Linking childhood SES with adulthood outcomes requires data collections to be spaced far apart in time. Specifically, data on adulthood outcomes should be collected 10 to 30 years after the childhood SES data are gathered.

We highlight the significance of early-life events on adulthood outcomes in Europe. Our paper also contributes to the emerging literature on mechanisms that drive the correlation between parental SES and child outcomes in adulthood. The central question is "Through which mechanisms do differences in parental SES create differences in child education?" We find that the Finnish Great Depression was more likely to cause family dissolutions in low-SES households than in high-SES households. This substantially exacerbated the gap between low- and high-SES households in terms of the prevalence of family breakdown, leading to poorer home environment for children in low-SES households. Importantly, we find that the Finnish Great Depression had only a negligible impact on post-recession parental disposable income. This downplays the potential role of diminished financial and material resources that parents can invest in their children due to extended periods of income loss after the recession.

Besides the availability of rich nationwide longitudinal registry data, Finland is a useful setting to examine the potentially heterogeneous effects of a recession on the next generation's educational outcomes for also other reasons. In the early 1990s, Finland encountered an extraordinarily large recession regarded as one of the deepest recessions experienced by industrialized countries after World War II. Moreover, as the Finnish recession was largely caused by the collapse of the Soviet Union, it was an unpredictable shock to the small open economy, where its proportion of exports to the Soviet Union was approximately 20% of its total exports (Gorodnichenko, Mendoza, and Tesar 2012; Gulan, Haavio, and Kilponen 2021).

The generous education subsidies, earnings-related unemployment benefits, high income-tax rates, and extensive social income transfers in Finland create a suitable context for studying the effects of recessions on the educational attainment of the next generation across different SES households. Drawing on the theory of Becker and Tomes (1979), previous studies have identified two key types of investments that parents make to promote early childhood development and education—(1) acquiring goods and services that are beneficial for child development and (2) spending quality time with children. As Finland is a Nordic welfare state, the disposable (total) income of the bottom income decile did not decline significantly during the Finnish Great Depression (Uusitalo 1996). Similarly, the disparity in disposable income across households remained stable (Riihelä, Sullström, and Suoniemi 2001). Moreover, as free education is provided at all levels to all socioeconomic classes through

extensive public subsidies, we hypothesize that the primary mechanism affected by the recession would be a reduction in quality time spent with children, particularly in low-SES households.

The rest of the paper proceeds as follows. Section 2 summarizes the recession of the early 1990s in Finland. Section 3 introduces the register-based longitudinal data. Section 4 explains our empirical approach. In Section 5, we report the results and identify the key mechanism. Section 6 offers concluding remarks. Additional results are presented in the Appendix.

II Finnish great depression of the early 1990s

The Great Depression of the 1930s is generally considered the most severe peacetime economic crisis of the 20th century in almost all industrialized countries. However, Finland experienced its most devastating economic downturn not in the 1930s but rather in the early 1990s.

The depression of the early 1990s was triggered by a combination of macroeconomic shocks (see Honkapohja and Koskela (1999) for "a tale of bad luck and bad policies"). A crucial, Finland-specific external factor was the collapse of trade with the Soviet Union. As Finland exported as much as 20% of its goods to the Soviet Union, this event had a significant negative impact on the Finnish economy in 1991—an impact that was not experienced by other Western countries. Moreover, there was a broader economic slowdown among the OECD countries, which further diminished Finland's export opportunities. On the domestic front, a significant contributor to the early 1990s depression

was a boom-bust cycle in the financial sector brought by poorly designed financial regulations implemented during the 1980s.

Figure 1 displays the trends in Finland's real GDP and unemployment rate from 1980 to 2005. From 1991 to 1993, Finland experienced a sharp economic downturn, with its GDP plummeting by 14%. Moreover, the unemployment rate soared to an unprecedented high, reaching nearly 20%—up from a pre-crisis level of just 3.5%. Notably, the unemployment rate during the early 1990s was even higher than that observed during the Great Depression of the 1930s. As a result, among young workers aged 19–24 years, unemployment spiked at 40%. The reduction in employment was the largest in the private sector; however, public sector employment also declined for the first time in the postwar era.

Starting in 1994, the Finnish economy gradually recovered, and although unemployment steadily decreased, it remained relatively high, hovering around 10% by the late 1990s. Initially, the recovery was most prominent in the capital-intensive export sector. A devaluation of the Finnish currency further boosted export-driven recovery, which was largely spearheaded by the telecommunications industry, particularly Nokia. Later, the domestic service sector started to recover.

III Data

Data sources

Our main data source is the FOLK yearly panel data for the entire population of Finland, administered by Statistics Finland. In addition to the module containing basic demographic characteristics of individuals, there are several individual-level data modules, such as education, employment, and income, that can be linked with each other using an encrypted individual-specific identity code. In this study, we should link each child with the parent so that we can assign pre-recession parental occupations to the children. These linkages allow us to construct a measure of recession intensity that varies both by parental occupation groups and residential provinces.

Moreover, data are available on the living arrangements for children under 18. The data include annual information about who each child lived with on the last day of the year. We gather the following information: (1) whether the child lived together with the biological father and mother; (2) in the case of an adopted child, whether the child lived together with the adoptive father and mother; and (3) if neither biological nor adoptive parents lived together with the child, the identity codes of others who served as surrogate parents are available. Later, we consider post-recession changes in living arrangements, including parental separations caused by the recession. Our results, based on pathway analysis, suggest that changes in living arrangements appear to be a plausible

causal link between the Finnish Great Depression and reduced educational attainment in children.

The individual-level registry data of education attainment, employment, income, and living arrangements run yearly as far back as 1987. The education data cover all individuals aged over 15 years and contain all secondary and tertiary education records attained by them. The comprehensive income data are compiled by Statistics Finland from the Finnish Tax Administration's registers. The employment and unemployment data are from the Finnish Employment registers, the Ministry of Economic Affairs and Employment register of job seekers, and government-run pension registers. Data on living arrangements are maintained by the Digital and Population Data Services Agency under the Population Information System.

Figure 2 illustrates the timeline of our study. We focus on children born from 1967 to 1990—before the Finnish Great Depression that occurred from 1991 to 1993. In terms of parental SES data, they include information on parents' education, income, and (un)employment during the pre-recession period (1987–1990). The child outcome variables (educational attainment) are from 2020, so we can observe children's graduations from high schools by the age of 19 years and universities by the age of 30 years; the children in the youngest child-birth cohort in our data were 30 years old in 2020.

Measure of recession intensity

To capture recession intensity experienced by different Finnish households, we construct a measure that varies across 8 parental occupational groups and 12 provinces of residence (96 occupation–province groups).[3] We start with an individual-level variable denoting the number of unemployed months in a year. We divide this variable by 12 to calculate the annual share of unemployed months for each individual and then aggregate this share in each of the 96 occupation–province groups. Moreover, we calculate an aggregated share of the unemployment period for both the pre-recession ($unemp\ 1987-1990$) and the mid-recession periods ($unemp\ 1991-1993$). As a result, the measure of recession intensity is the difference in the aggregated share of unemployment between the mid-recession and pre-recession periods. Our measure of recession intensity ($\Delta unemp$) is defined as follows:

$$\Delta unemp_{j,p} = [unemp\ 1991-1993]_{j,p} - [unemp\ 1987-1990]_{j,p}$$

where j and p are the indices of the 8 parental occupation groups and 12 provinces, respectively.

Using this measure, we capture the plausibly exogenous change in the probability of losing a job caused by the Finnish Great Depression while we

[3] See Appendix A for more details on the occupation classification and administrative division of provinces.

exclude job losses arising from individual reasons, which may cause biased estimates.

Figure 3 depicts the distribution of recession intensity, $\Delta unemp_{j,p}$, experienced as a consequence of the Finnish Great Depression by the children under study. The mean and median levels of the shock (i.e., change in unemployment share) are approximately 0.061 and 0.048, respectively. A large fraction of the children experienced shocks with magnitudes below the mean, whereas a relatively small proportion of children (approximately 10%) experienced shocks with magnitudes above 0.1.

Appendix Figure A-2 presents the magnitudes and weights of the shocks for the 12 provinces and 8 occupation groups separately. In each subfigure, dots represent occupational groups, with two vertical broken lines indicating provincial mean (numbered 9) and overall mean (numbered 10). Shock magnitude and its weight to the total number of children are measured on the horizontal axis and vertical axis, respectively. In all provinces, the shock sizes are relatively smaller for occupation groups such as "Technical, research, and artistic work"; "Administrative, managerial, and clerical work"; and "Agriculture, forestry, fishing, and mining work," and relatively larger for "Manufacturing and related work."

We examine the recession effects on different SES households to detect whether the Finnish Great Depression exacerbated SES inequality by disrupting education more in low-SES households than in high-SES households. To this

end, we interact our measure of recession intensity with an indicator of parental SES (whether the parent is tertiary educated or not).

Recession intensity experienced by a parent

We link each child to the recession intensity ($\Delta unemp_{j,p}$) of whichever parent, either father or mother, experienced a smaller magnitude of the economic shock. This choice is based on the presumption that a household constitutes an insurance device against negative shocks. If one parent in a household is hit hard by a recession, the household manages to make a living as long as the other parent is only mildly hit by the recession; if both the parents in a household are hit hard by the recession, the household situation becomes worse.[4] Another issue is that we use biological parents when linking recession intensity with a child, implying that no matter with whom children lived at the onset of the Great Finnish Depression, children are linked to the recession intensity experienced by their biological parents. This is done for two reasons. First, data on child living arrangements are available only for children under 18 years; thus, if we use *de facto* parents to link children to recession intensity, we have to ignore children who are 18 years or older in our study. Second, according to data on child living arrangements in 1990, most children under 18 years lived with at least one biological parent (i.e., 83%, 16%, and 0.4% of children lived with both

[4] If the magnitude of recession intensity is the same between father and mother, we choose a parent with higher pre-recession income (average annual income from 1987 to 1990) to match her/his child. If in rare cases, both recession intensity and pre-recession income are the same between the two parents, we link a child to his/her father because fathers are usually the main breadwinners in Finland.

biological parents, one biological parent, and neither biological parent, respectively).

Descriptive statistics of the main variables

Table 1 presents the descriptive statistics of the main variables separately for children in tertiary-educated households (high-SES households) and children in nontertiary-educated households (low-SES households). We use pre-recession education records of the parent to categorize households as tertiary or nontertiary educated.

The two SES groups differ in many aspects. Regarding children's educational outcomes, the proportions of general high-school graduation by the age of 19 years are 63% and 36% for children in high- and low-SES households, respectively, and the proportions of university graduation by the age of 30 years are 52% and 24%, respectively. The average recession intensities children experienced are 4.3 and 6.8 percentage points (increases in parental unemployment probability) in high- and low-SES households, while the rates of their pre-recession (1987–1990) parental unemployment are 2.2% and 4.1%, respectively.

In low-SES households, more than 5% of children do not have records of their biological fathers, and the corresponding figure for children in high-SES households is less than 2%. For both households, the proportion of children with no records of biological mothers is less than 1%. The proportions of children who were born out of wedlock (neither parental cohabitation nor

marriage) are 9% and 19% for the high- and low-SES households, respectively. The proportions of children linked to their father's recession intensity are 61% and 46% in high- and low-SES households, respectively. Appendix Figure B-1 depicts the fraction of each birth cohort size in 1967–1990 to the total number of the subject children (1,543,233) separately for children in high- and low-SES households. Overall, approximately 69% of children are from low-SES households, but the proportion of children from low-SES households continuously becomes smaller for later birth cohorts—80% for the 1967 birth cohort and 64% for the 1990 birth cohort.

Regarding fathers' characteristics, income and asset values are higher in high-SES households than in low-SES households. The proportions of fathers being pensioners as of 1990 (immediately before the Finnish Great Depression) are 2% and 7% for high- and low-SES households, respectively. Most fathers did not graduate from tertiary-level schools in low-SES households, whereas it is opposite in high-SES households.[5] Similar patterns are observed for mothers.

Appendix Table A-1 presents the descriptive statistics of the residential province and fathers' and mothers' occupations. For low-SES households, the largest occupation group for fathers is manufacturing and related work (38%),

[5] The distinction between high- and low-SES households is based on the education record of the parent whose recession intensity is linked to a child. Thus, low-SES households include households where fathers graduated from tertiary schools but mothers did not graduate from tertiary schools, and mothers' recession intensities are linked to children. Similarly, high-SES households include households where fathers did not graduate from tertiary schools but mothers graduated from tertiary schools, and mothers' recession intensities are linked to children.

followed by agriculture, forestry, commercial fishing, mining, and quarrying work (13%), whereas for high-SES households, the largest occupation group is the technical, research, and artistic work (49%), followed by administrative, managerial, and clerical work (15%). The largest occupation groups for mothers in low-SES households are service work (22%) and the others category (21%), while mothers in high-SES households are mostly engaged in technical, research, and artistic work (44%) as well as administrative, managerial, and clerical work (25%).

Appendix Table E-1 documents the descriptive statistics for the variables used in our mechanism analysis. These variables are (1) post-recession parental earned and disposable incomes from 1995 to 2018 and (2) a dummy for children who experienced changes in cohabitating status with fathers and mothers during the post-recession period from 1991 to 1995 (we discuss the exact definitions of these variables later). Throughout the post-recession period from 1995 to 2018, on average, high-SES households had higher earned and disposable incomes than low-SES households. Moreover, the proportion of children who experienced changes in living arrangements from 1991 to 1995 is lower in high-SES households (11%) than in low-SES households (18%).

IV Empirical approach

Identification

To identify the effect of the Finnish Great Depression on child educational outcomes, we employ a generalized difference-in-differences method. The first difference is based on the differential recession intensity experienced by different families. This varies across 96 occupation–province groups defined by pre-recession parental occupation and the province of residence. The second difference is based on the differences in recession exposure across different birth cohorts of children. Specifically, some birth cohorts are too old to be influenced by the depression as most individuals finish their education by a specific age. For example, our data reveal that more than 80% of high-school and university graduates finished their education by the age of 19 and 30 years, respectively. We utilize this empirical pattern to evaluate our identification strategy, where we expect no significant recession effect on the educational attainment of birth cohorts who were old enough at the onset of the depression.

Moreover, we analyze the recession effect on child educational outcomes separately for high- and low-SES households. We use a dummy for tertiary-educated parents as an indicator of high- or low-SES households. As discussed below, we use a three-way interaction model to identify different recession effects on child education outcomes separately for high- and low-SES households for each birth cohort. Using this approach, we examine the hypothesis that the Finnish Great Depression reduced the next generation's

educational achievements such that the intergenerational educational correlation became larger.

A potential threat to the identification of the causal effects is that unobserved pre-recession SES differences across households are significantly correlated with both child education outcomes and recession intensity experienced by parents. Specifically, a large recession tends to diminish employment opportunities more for parents in low-SES households than for those in high-SES households, while educational outcomes tend to be better for children in high-SES households than for those in low-SES households, causing a potential downward bias in estimating the causal effect of the recession intensity on child education outcomes.

To mitigate this concern, we use an extensive set of control variables, which are measured in the pre-recession period (1987–1990). We later describe a complete list of our control variables, but we briefly discuss only the most important ones here. First, the recession intensity differs across the 96 pre-recession parental groups, defined by 8 occupations and 12 provinces of residence. We use fixed effects to control for the permanent differences across parental occupations and the provinces of residence. Second, we control for pre-recession parental incomes and assets as these represent a critical measure of parental SES likely to correlate with both recession intensity and child education outcomes. Moreover, as the children under study were born from 1967 to 1990, pre-recession parental incomes and assets (measured from 1987

to 1990) would influence child education outcomes differently for different birth cohorts. For example, the 1976 and 1990 birth cohorts were 15 years and 1 year old, respectively, in 1991 at the onset of the depression. Pre-recession incomes and assets may influence the probability of a child's high-school graduation differently between the two birth cohorts. Therefore, the control variables for parental incomes and assets are interacted with birth cohort dummies. Finally, we control for the education level of parents. This is crucial because we include an interaction term between recession intensity and a dummy variable for parents with tertiary education. We assume that the interaction term is exogenous after controlling for other relevant covariates.

Econometric specification

We estimate the three-way interaction equation using ordinary least squares (OLS) to separately identify the effects of recession intensity on child educational outcomes for different birth cohorts and parental SES households (i.e., tertiary-educated parent or not):

(1) $$Child\_outcome_{i,j,p} = \beta_0 + \beta_1 \times \Delta unemp_{j,p} + \beta_2 \times \Delta unemp_{j,p} \times I[tertiary\ educ.parent_i = 1] + \beta_3 \times \Delta unemp_{j,p} \times I[child\ age_i = 18 - 20] + \beta_4 \times \Delta unemp_{j,p} \times I[child\ age_i = 18 - 20] \times I[tertiary\ educ.parent_i = 1] + \beta_5 \times \Delta unemp_{j,p} \times I[child\ age_i = 15 - 17]$$

$$+\beta_6 \times \Delta unemp_{j,p} \times I[child\ age_i = 15-17] \times I[tertiary\ educ.parent_i = 1]$$

$$\vdots$$

$$+\beta_{15} \times \Delta unemp_{j,p} \times I[child\ age_i = 0-2]$$

$$+\beta_{16} \times \Delta unemp_{j,p} \times I[child\ age_i = 0-2] \times I[tertiary\ educ.parent_i = 1]$$

$$(+CONTROLS) + \varepsilon_{i,j,p}$$

where the subscripts $i, j,$ and p represent the child, parental occupation group, and the province of residence, respectively.

The outcome variable, $Child\_outcome_{i,j,p}$ is a dummy for either general high-school graduation by the age of 19 years or university graduation by the age of 30 years. We choose these age limits because more than 80% of general high school and university graduates finished their education by these age limits. The outcome variables are measured in 2020. Although the dependent variables are binary, we employ linear probability models for their ease of interpretation and lower sensitivity to distributional assumptions.

$\Delta unemp_{j,p}$ is the labor-market shock experienced by child i's parent (based on the biological parent, whether father or mother, with a smaller magnitude of labor-market shock) as defined above. $I[tertiary\_educ.parent_i = 1]$ denotes tertiary-educated parent, which measures SES in 1990. $I[age_i = 0-2]$,..., $I[age_i = 18-20]$ are age group dummies based on child age in 1990 immediately before the onset of the

Finnish Great Depression. For example, $I[age_i = 18 - 20] = 1$ denotes the 1970–1972 birth cohort and 0 otherwise, and $I[age_i = 0 - 2] = 1$ denotes the 1988–1990 birth cohort and 0 otherwise. The 1967–1969 birth cohort is used as the reference group.

We utilize an extensive set of control variables as documented in Appendix C.[6] All the control variables are from the pre-recession years. The control variables include information on parental SES, age, location of residence, child birth year, gender, unemployment share for the occupation–province groups, and whether a child was born out of a wedlock.

As the measure of recession intensity varies by province–occupation groups, we cluster standard errors at the province–occupation level. As a result, the standard errors allow intra-cluster correlations of the error term ($\varepsilon_{i,j,p}$).

Table 2 presents the estimated effects for children, depending on their age in 1990 (8 age groups) and parental SES (2 groups). As the outcome variable is a dummy for general high-school graduation by the age of 19 years, the coefficient estimates for the 1967–1969 birth cohort (age 21–23 years in 1990), both $\widehat{\beta_1}$ and $\widehat{\beta_1} + \widehat{\beta_2}$, should not be statistically different from zero. We use this specification as a check for the validity of our identification strategy.

[6] Our 1,543,233 sampled children include 67,667 children with no father records and 11,624 children with no mother records (no children with neither father nor mother records). For such children, we use (1) dummy for no father records and (2) dummy for no mother records in the regression analysis. See Appendix C for further details about how to handle children without father or mother records.

V Results

We begin by presenting the results of the overall effects of the recession on children's education. After that, we delve into the mechanisms that explain these effects and present instrumental variable estimates using the recession intensity as an instrument.

Recession effects

Figure 4 and Appendix Table D-1 present the estimation results from the linear probability model, where the outcome variable is a dummy variable indicating general high-school graduation by the age of 19 years. The results are for children aged between 0 and 23 years in 1990, as indicated in Table 2 (N = 1,543,233). For children in low-SES households, our specification test finds an expected result where children aged between 21 and 23 years are not influenced by recession intensity experienced by their parents as they already passed the age threshold of 19 years before the onset of the depression. However, for the younger birth cohorts, the stronger recession intensities experienced by parents seemed to hinder their graduation from general high schools.

In Table 3, we calculate (1) the recession effect evaluated at the mean shock size and (2) the percentage recession effect evaluated at the mean shock size for different birth cohorts and SES households separately.[7] To illustrate the

[7] (1) The recession effect evaluated at the mean shock size is calculated as follows: (Effect evaluated at mean) = (Effect) × (Mean shock); and (2) the percent recession effect evaluated at the mean shock size as follows: (% Effect evaluated at mean) = (Effect) × (Mean shock) / (Share Graduation) × 100, where (Effect) is the coefficient

quantitative magnitude of the estimated effects, taking the 1982–1984 birth cohort (aged 6–8 years in 1990) from low-SES households as an example, their rate of general high-school graduation is 36.9% and the mean shock size of recession intensity their parents received is 0.066 (increase in unemployment probability). As a result, the mean recession effect for those aged 6–8 years in low-SES households is a reduction in general high-school graduation by 2.1 percentage points, and the percentage recession effect for the same group is a reduction in general high-school graduation by 5.8%.

Turning to the estimation results for children with high-SES households (tertiary-educated parents), Figure 4 and Appendix Table D-1 indicate that the specification test detects a positive and statistically significant coefficient estimate for those aged 21–23 years, which signals a potential bias in this coefficient estimate as it should not be theoretically different from zero. Although we are unable to pin point the specific reason for this unexpected result, if any bias exists, the statistically significant positive coefficient estimate for the reference group ($\widehat{\beta_1} + \widehat{\beta_2}$) implies that the direction of bias is upward rather than downward. Initially, our concern for identification was a downward bias, as illustrated in Figure 5, where unobserved pre-recession SES differences across parents are negatively correlated with recession intensities experienced by parents and positively correlated with a child's general high-school graduation. The positive coefficient estimate for the reference group ($\widehat{\beta_1} + \widehat{\beta_2}$)

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estimate from OLS.

suggests that the true recession impact on a child's general high-school graduation could be more negative than our estimation result, but it is unlikely that the recession effects found here for children with tertiary-educated parents are spuriously driven by unobserved pre-recession SES differences across households.

Among the younger birth cohorts from high-SES households, the coefficient estimates for age groups of 12–14 years and 9–11 years are negative and statistically significant at the 5% level. Table 3 indicates that in terms of both absolute magnitude and percentage reduction, the recession effects tend to be larger for children in low-SES households than for those in high-SES households.

Next, the outcome variable is a dummy for university graduation by the age of 30 years. The sample size is 1,763,288 (children aged between 0 years and 26 years in 1990 immediately before the depression). Figure 6 and Appendix Table D-2 present the result from estimating the linear probability model with the same set of control variables.

The coefficient estimates for some birth cohorts in both low- and high-SES households are positive and statistically significant at conventional levels, implying that our estimation result may underestimate the true recession effect. Overall, the estimation result for university graduation is similar to that for general high-school graduation, although the coefficient magnitudes are somewhat smaller for university graduation. For children in low-SES

households, age groups of 12–14 years and younger seem to be influenced by recession intensity experienced by their parents, while for children in high-SES households, the recession effect seems to be concentrated on primary and lower-high school children (aged 6–14 years) at the onset of the depression.

Table 4 presents (1) the recession effects evaluated at the mean shock size and (2) the percentage recession effects evaluated at the mean shock size for different age groups and SES households for the outcome of university graduation. Overall, the absolute magnitudes of the recession effects are somewhat smaller for university graduation than for general high-school graduation, whereas the percentage reductions of the recession effects are similar between the two child graduation outcomes because of lower shares of graduation from university than from general high school. In terms of differences in the recession effect between high- and low-SES households, the recession effect on university graduation is mostly more negative for children in low-SES households than for those in high-SES households, similar to the result for the outcome of general high-school graduation.

Mechanisms

Parents have two primary investment instruments at their disposal to support the physical and mental growth of their children—(1) purchasing goods and services for them and (2) spending quality time with them. We examine two mechanisms that correspond to these parental investments in children. The first mechanism is that the depression resulted in reduced financial resources for

parents to send their children to school. Both previous studies on the effect of a recession on the next generation's education outcomes using US data support the mediating role of income or wealth (Stuart 2022; Alessandrini and Diwakar 2022). However, research on the effect of parental job loss on child education outcomes provides inconclusive evidence regarding the mediating effect of income and wealth. Some studies found only limited mediating effects of income (Rege, Telle, and Votruba (2011) used data on Norway, and Gregg, Macmillan, and Nasim (2012) used data on the UK), whereas others provided evidence supporting the mediating role of income (both Oreopoulos, Page, and Stevens (2008) and Coelli (2011) used data on Canada).

In Finland, the government provides generous financial support to students in upper secondary and tertiary education (Kela 2022). Finnish citizens are eligible for free education at all levels. Besides free tuition and subsidized meals and school transport, students are typically given public financial aid so that they can make a living.[8] Considering the generous public subsidies, the mediating role of parental income in the effect of a recession on child

[8] Currently, university students (without children) can get up to 900 euros per month (250 euros from study grant and 650 euros from student loan). Students are also eligible for a 40% reduction of outstanding student loan amounts exceeding 2,500 euros if they complete university degrees within a target time frame. For students under age 18, their parents receive 101 euros per month as providers for students. Further, 17–19-year old students are paid study grants ranging from 8 to 39 euros per month if they live with their parents and up to 254 euros per month if they do not live with their parents. Supplementary allowance for the purchase of study materials is also available for some students under 20 (Kela 2022). This financial support scheme for students has not changed since 1992 (except for increases in nominal allowance level). Before 1992, the financial support was based more on subsidized bank loans and less on public financial aids. For the history of changes in student grants since 1992, see the study by Lahtinen (2021).

educational outcomes may be relatively limited in Finland.[9] As demonstrated below, our results support the minimal mediating role played by post-recession parental income in the effect of the depression on child education.

We also examine another plausible pathway through which the depression led to a reduction in the amount of quality time parents spend with their children. Previous studies have provided evidence that job loss increases the probability of divorce (Charles and Stephens 2004; Doiron and Mendolia 2012; Eliason 2012). We investigate this by utilizing information on the changes in children's living arrangements due to the depression. Utilizing register data, we measure post-recession changes in children's cohabitating status with their father and mother rather than marital dissolutions of parents. There are two reasons for this. First, approximately 15% of children in our data were born out of wedlock (neither marriage nor cohabitation). Thus, we have to exclude such children from our analysis if we measure family dissolution by marital or partner dissolutions of parents. Second, our data include children whose biological parents were already divorced or separated prior to the depression. We also need to exclude such children from the analysis if we measure family dissolution by parental divorce or separation. Excluding such children from the analysis can lead to endogenous selection in the sample because unobserved parental characteristics may affect both selection into the study sample and child

[9] Although Finnish public financial support for students have been generous, study grants alone have not covered the full living costs of students. Finnish students have typically taken loans or worked or both to augment their incomes (Blomster 2000 in Finnish).

educational outcomes. To avoid this, we measure family dissolution by post-recession change in child cohabitating status with parents (including surrogate parents), the precise definition of which would be discussed below.

To identify whether post-recession parental income and family dissolution are the causal pathway from the depression to child educational outcomes, we employ the same estimating equation (Equation 1), except that now the dependent variable is either parental income or family dissolution. Moreover, we interact labor-market shock only with a dummy for whether a parent received tertiary education; thus, the estimated effect is the average effect across all child age groups separately for children from households in which parents received or did not tertiary education.[10] The estimating equation is as follows:

$$(2)\ M_{i,j,p} = \gamma_0 + \gamma_1 \times \Delta unemp_{j,p} + \gamma_2 \times \Delta unemp_{j,p} \times I[tertiary\ educ.parent_i = 1] (+ Controls) + \delta_{i,j,p}$$

where the subscripts $i, j,$ and p indicate the child, parental occupation group, and the province of residence, respectively, and the dependent variable M is either post-recession parental income or a dummy for post-recession change in

[10] We also estimated the double-interaction specification where both dummies for child age groups and a dummy for parent being tertiary educated or not are interacted with labor-market shock. The result is discussed later.

the child's living arrangement. The remaining variables are the same as those in Equation (1) with δ being the error term.

We measure post-recession parental income in three ways: (i) combined annual earned income for father and mother during the following periods: (1) 1995–1997, (2) 1998–2000, (3) 2001–2003, (4) 2004–2006, (5) 2007–2009, (6) 2010–2012, (7) 2013–2015, and (8) 2016–2018; (ii) the total disposable income of the father and mother after taxes and benefits over the same eight periods;[11] (iii) the average annual combined parental disposable income from 1995 until a child turns 19. All income measures are deflated to 1987 euros using the consumer price index (CPI) by Statistics Finland. All three outcome variables are measured in natural logarithm form. The models are estimated using OLS and the standard errors are clustered at the occupation–province level.

Figure 7 presents the recession effects on post-recession parental earned income separately for tertiary- and nontertiary-educated households (Appendix Table E-2).[12] We find that the recession effect on post-recession income is strikingly different between tertiary- and non-tertiary-educated parents. For tertiary-educated parents, the intensity of the recession had no significant effect on post-recession earned income in all three-year periods from 1995 to 2018. However, for nontertiary-educated parents, a stronger intensity of the recession seems to lower post-recession earned income in all three-year periods from

[11] Data on disposable income are available from 1995 onward.
[12] We use the education status (tertiary educated or not) of a matching parent to determine a tertiary-educated household or not.

1995 to 2018. The quantitative magnitude of the recession effect attenuates as time passes, but the average recession intensity for nontertiary-educated parents (0.068) lowers earned income by 4.1%, 3.7%, and 2.7% in the 1995–1997, 2007–2009, and 2016–2018 periods, respectively.

Our result is consistent with that of Korkeamäki and Kyyrä (2014) and Huttunen and Kellokumpu (2016) in that the effect of job loss due to plant closings on subsequent earnings loss is larger for low-SES individuals than for high-SES individuals, based on a study of the working-age population during the Finnish Great Depression. However, both studies also found notable and statistically significant effects of job displacement on subsequent earned income even for high-SES individuals. The difference is that their study compared earnings between workers who were displaced and those who were not, whereas our study compares earnings of individuals who experienced varying recession intensities during the depression. In essence, our labor-market shock variable (which varies across the 96 occupation–province groups) is the average shock experienced by individuals in each group, consisting of both displaced and nondisplaced workers. Most studies have found that job loss leads to earnings loss in the short and long term despite differences in the estimated magnitude, but the heterogenous effects between SES groups are usually not examined (Von Wachter 2010).

Although a stronger intensity of the labor-market shock reduces post-recession earned income for nontertiary-educated parents, post-recession

disposable income was less influenced by the depression. Figure 8 and Appendix Table E-3 indicate that the magnitudes are much smaller, and most results are statistically not significant at conventional levels. Even for the statistically significant results, the recession effect is approximately a 1.4% reduction in disposable income.[13,14] Finally, as an alternative outcome variable, we use average annual parental disposable income until the child turns 19. This outcome variable captures the main source of financial and material resources to send children to general high schools and universities. The estimated recession effects are −0.152 (0.314) and −0.260 (0.238) for nontertiary and tertiary-educated households, respectively (p-values are in parentheses and the sample size is 964,307).[15] These coefficient estimates are not statistically different from zero at conventional levels. Based on these results, we conclude that parental financial and material resources are not the main mediating factor in the causal pathway from the depression to child educational outcomes.

[13] The mean shock size for nontertiary-educated parents is 0.0684. Mean reduction in disposable income from 2010 to 2012 for them is −0.206 × 0.0684 = −0.014 (1.4% reduction in disposable income).

[14] We also estimated the double-interaction specification where the labor-market shock variable is interacted with not only a dummy for tertiary-educated parents or not but also dummies for child age groups (8 groups in which child age group of 21–23 years in 1990 is the reference group and dummies for the other 7 groups are interacted). The results are presented in Appendix Figures E-1 (parental earned income) and E-2 (parental disposable income).

[15] The sample size here is smaller than the sample sizes in Appendix Tables E-2 and E-3. This is because data on disposable income are available for 1995 onward and the third outcome variable can be defined only for the 1976–1990 birth cohorts, who turned 19 in 1995–2009, respectively, while the first and second outcome variables can be defined for the 1967–1990 birth cohorts (the same children as in the main analysis estimating Equation (1)).

An additional mechanism that we examine in the pathway analysis from the recession to child educational outcomes is changes in child living arrangements caused by the recession. Annual panel data on child cohabitating status with biological, adoptive, and surrogate parents[16] are available for children under 18. We measure the change in child living arrangements as a dummy variable, which is equal to one if a child experienced any one of the following eight changes in living arrangements during the post-recession period from 1991 to 1995 and 0 otherwise: (1) change in living together with biological father (1→0 or 0→1); (2) change in living together with biological mother (1→0 or 0→1); (3) change in living together with adoptive father (1→0 or 0→1); (4) change in living together with adoptive mother (1→0 or 0→1); (5) change in "social" parent #1 (change in social parent's ID, including new and lost social parent); (6) change in "social" parent #2 (change in social parent's ID, including new and lost social parent); (7) change in adoptive father (change in adoptive father's ID, including new and lost adoptive father); and (8) change in adoptive mother (change in adoptive mother's ID, including new and lost adoptive mother).

We employ OLS to estimate Equation (2), with the dependent variable now representing the change in a child's cohabitating status with parents from 1991 to 1995. To ensure data availability, we narrow our focus to children born in 1979 or later. As cohabitation data are only available for children under 18,

[16] Surrogate ("social") parents are defined as parents who lived together with a child in childhood.

we observe the status from 1991 to 1995 only for children who were born in 1978 or later. To be consistent with a child's age group in the main analysis, we use the 1979 and younger birth cohorts as the sample to detect whether changes in child living arrangements are the causal pathway from the recession to child educational outcomes. We cluster standard errors at the occupation–province level.

Table 5 presents the estimated recession effects. These results reveal a notable difference between nontertiary- and tertiary-educated parents in the effect of recession intensity on the likelihood of post-recession change in living arrangements for their children. Evaluated at the mean recession intensity, the likelihood of children experiencing changes in living arrangements from 1991 to 1995 increased by 1.43 percentage points (7.76%) and 0.37 percentage points (3.37%) for children in nontertiary- and tertiary-educated households, respectively, and the former estimate is highly statistically significant while the latter is only marginally significant at the 10% level.

Appendix Figure E-3 depicts the heterogenous effects across child age groups. For children in tertiary-educated households, the coefficient estimates are mostly not statistically significant at the 5% level for all age groups ranging from 0 to 11. For children in nontertiary-educated households, the quantitative magnitudes of the estimated coefficients are larger for the younger age groups, implying that the overall effect of recession intensity on the likelihood of a child

experiencing a change in living arrangements is mainly driven by the two younger age groups.

Instrumental variable estimates

We estimated the effect of changes in living arrangements on educational outcomes using the two-stage least squares (2SLS) method. The second-stage regression is given by the following equation:

(3) $Child\_outcome_{i,j,p}$

$$= \pi_0 + \pi_1 \times M_{i,j,p} + \pi_2 \times M_{i,j,p} \times I[tertiary\ educ.parent_i = 1]$$

$$(+Controls) + \tau_{i,j,p}$$

where $M_{i,j,p}$ is post-recession changes in child living arrangements as defined above, and the rest of the variables are the same as before. Here, there are two endogenous independent variables, $M_{i,j,p}$ and $M_{i,j,p} \times I[tertiary\ educ.parent_i = 1]$. We use recession intensity ($\Delta unemp_{j,p}$) and recession intensity interacted with a dummy for a parent being tertiary educated or not as excluded instruments. The first-stage regressions are given by Equation (2) and Equation ($2'$), where the second first-stage regression is the same as Equation (2) except for the dependent variable, which is $M_{i,j,p} \times I[tertiary\ educ.parent_i = 1]$ instead of $M_{i,j,p}$.

Change in child living arrangements is endogenous because of unobserved household characteristics, determining both child educational outcomes and the likelihood of experiencing a change in living arrangements,

although we control for an extensive set of parental SES variables. The remaining unobserved SES differences across households influence the child educational outcomes and tendency for children to experience changes in cohabitating parents.

Utilizing recession intensity as an instrument, we can partially mitigate the bias caused by unobserved differences in parental SES. The econometric identification in the 2SLS method is based on predicted changes in living arrangements, induced by variations in recession intensity across 96 occupation–province groups. In theory, these variations should not be influenced by factors specific to individual households. However, the variation across the occupation–province groups may be systematically correlated with unobserved differences in parental SES. Low-SES occupation–province groups might have experienced larger magnitudes of the recession intensity. Although we control for occupation fixed effects, province fixed effects, pre-recession unemployment shares of the 96 occupation–province groups, and an extensive set of other parental SES characteristics (including education, income, and assets) at the baseline, we still cannot completely exclude the possibility of the remaining unobserved SES differences causing some bias in our estimation.

Another important point is the measure used to capture changes in living arrangements. We utilize changes in living arrangements to capture reduced parent–child quality time or, more generally, deterioration of the home environment. As the recession had only very limited effects on parental

disposable income and the costs of upper secondary and tertiary education are affordable to all SES segments of the Finnish society because of generous public financial support, a deteriorated home environment seems to be a plausible pathway from the recession to child educational outcomes. However, using register data, we cannot identify specific reasons for changes in living arrangements. Changes in living arrangements result from various life events induced by a recession, including marital or partner dissolutions (Charles and Stephens 2004; Doiron and Mendolia 2012; Eliason 2012), worsening health status, risky health behaviors such as excessive use of alcohol (Kuhn, Lalive, and Zweimüller 2009; Eliason and Storrie 2009), and residential relocations (Huttunen, Møen, and Salvanes 2018). As these stressful life events caused by the recession may influence child educational outcomes not only through a change in living arrangements but also directly without provoking change in living arrangements, our instrument may not satisfy the exclusion restriction. Therefore, caution needs to be exercised in interpreting our 2SLS results.

Appendix Table E-4 presents the 2SLS results for both general high-school graduation by the age of 19 years and university graduation the age of 30 years. The sample size is 763,533 for both outcomes (birth cohorts from 1979 to 1990 who were aged 11 to 0 years in 1990 immediately before the Finnish Great Depression). The excluded instruments are jointly highly significant in the first-stage regressions, as demonstrated by strong F statistics, which are 17 and 60 in Equation (2) and Equation (2’), respectively.

The estimated impact of the change in living arrangements on graduation from general high school by the age of 19 years is −1.535 and −1.431(= −1.535 + 0.103) for children in households with nontertiary- and tertiary-educated parents, respectively. The estimated impact on graduation from university by the age of 30 years is −1.145 and −1.118 (= −1.145 + 0.027) for children in households with nontertiary- and tertiary-educated parents, respectively. As a 2SLS estimator provides the local average treatment effect for the treated, these estimates are for children whose cohabitating statuses with parents were changed due to recession intensities experienced by their parents (Imbens and Angrist 1994). For such children, a change in living arrangements seems to impact educational outcomes regardless of parental education. The estimated magnitudes in the 2SLS estimation are much larger than the corresponding magnitudes in the OLS estimation, implying that the average impact of a change in living arrangements is much larger for children whose cohabitating statuses with parents were influenced by the recession than for other children, whether parents were tertiary educated or not.

Overall, the results highlight the deterioration of the home environment as an influential mechanism in the causal pathway from the recession to child educational outcomes. Strikingly, in contrast to previous studies on the recession effects on child educational outcomes using US data (Stuart 2022; Alessandrini and Diwakar 2022), post-recession parental income seems to play a negligible role in influencing child education outcomes in Finland. These results suggest that although a change in living arrangements reduces child

educational outcomes almost equally between children in households with tertiary- and nontertiary-educated parents, the likelihood of experiencing a change in living arrangements seems to be much lower for the former children than for the latter.

Potential role of local public finance for social and educational services

In Finland, municipalities provide basic social services to residents. Another potential pathway through which the depression may have reduced children's educational attainment involves cuts to municipal expenditures for social and educational services, particularly in municipalities severely affected by the depression. However, Finland upheld a national policy of providing universal social and educational services during the depression. Revenue-equalizing systems across municipalities enabled financially struggling areas to maintain services at levels and qualities similar to those provided by more affluent municipalities. In Appendix F, we examine whether recession intensity is correlated with post-recession municipal expenditure on education as well as social and health services. Our results are consistent with the state policy of providing homogenous services across municipalities within the country, even during times of depression.

VI Conclusion

We utilized nationwide longitudinal registry data from Finland to investigate the impact of a major economic recession on the subsequent generation's

educational attainment. Finland faced one of the gravest economic downturns of the 20th century in peacetime during the early 1990s. Our analysis delves into the effects of the recession on families with different SESs. Our primary finding is that children of nontertiary-educated parents experienced a more pronounced negative impact on their educational attainment due to the recession compared with those with tertiary-educated parents. This result implies that the great depression of the early 1990s exacerbated societal inequality, even in a Nordic welfare state like Finland.

We observed that the primary mechanism through which the recession negatively impacted the subsequent generation's educational attainment in Finland was the degradation of the home environment. In contrast, post-recession parental income had only minimal influence on children's educational outcomes. As the recession negatively impacted employment prospects for parents, their children faced a higher likelihood of changes in their cohabitation status with their parents. This effect was considerably more pronounced for children of nontertiary-educated parents than for those of tertiary-educated parents. Consequently, the two groups of children experienced distinct changes in their home environments due to the severe recession.

Our findings highlight the importance of social and family policies that facilitate less stressful child-rearing. These policies also align well with labor-market strategies that prioritize a better work–life balance. For instance, after-school care and extracurricular activities can assist parents in achieving a

better balance between their work and childcare responsibilities. Flexible work schedules also empower parents to manage their job and child-rearing duties more effectively (Jordan, Stewart, and Janta 2019). Policies geared toward easing the pressures of child-rearing would be particularly beneficial for lone, adoptive, and surrogate parents, helping them and their children sustain quality family relationships even after experiencing family disruption (Francesconi, Jenkins, and Siedler 2010). Moreover, these policies might reduce the likelihood of family breakups by alleviating the stress associated with child-rearing.

Finland stands out as one of the few countries where a major economic recession does not exert a prolonged impact on subsequent disposable incomes regardless of the SES of households. However, a significant economic downturn can still negatively affect the educational attainment of the next generation. This is particularly evident in the increased risk of family disruption and the consequent degradation of the home environment, especially for low-SES households. Recent evidence reveals that the coronavirus pandemic also had the most severe consequences for low-SES households (Agostinelli et al. 2022; Bacher-Hicks, Goodman, and Mulhern 2021; Grewenig et al. 2021). Both financial and time resources are crucial for adapting to macroeconomic disturbances, whether pandemics or recessions. To prevent such major economic setbacks from intensifying societal disparities, policy designs should not only revolve around conventional social safety nets and income redistribution mechanisms but also emphasize policies fostering a better work–

life balance. These policies would support family stability during economic hardships.

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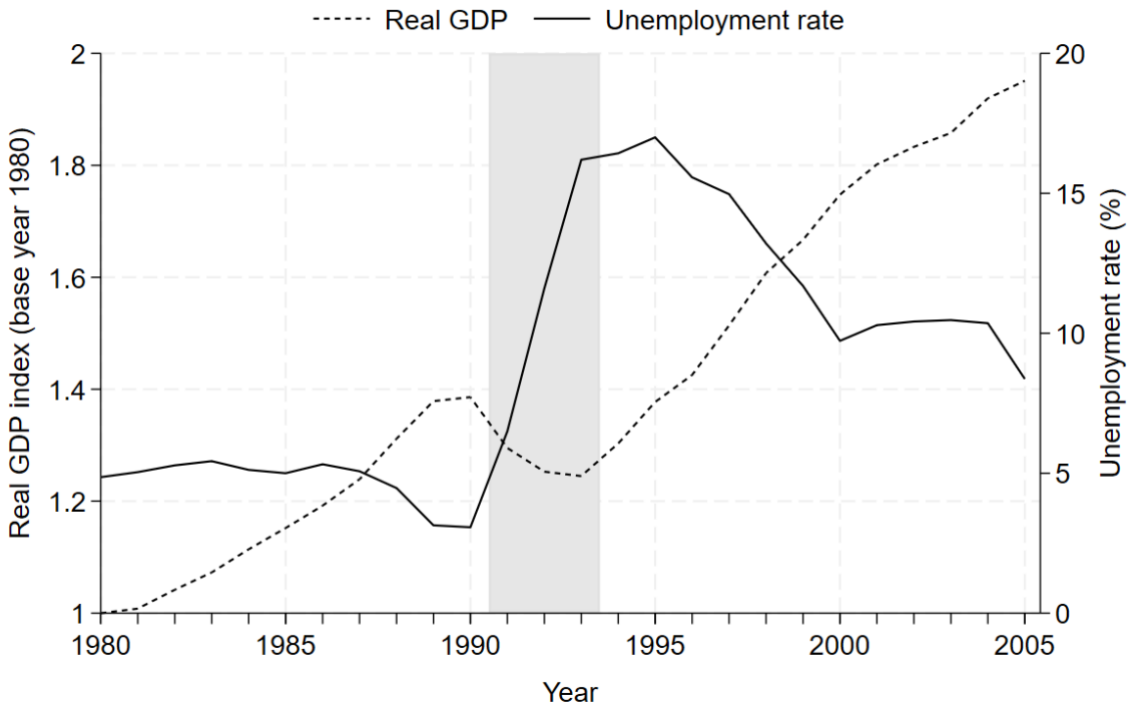
FIGURES AND TABLES

Figure 1. Real GDP and unemployment rate from 1980 to 2005



Notes: (1) The shaded area denotes the period of the Finnish Great Depression from 1991 to 1993; (2) the data source is the World Bank World Development Indicators (https://databank.worldbank.org/source/world-development-indicators accessed on December 20, 2022).

Figure 2. Timeline of the study

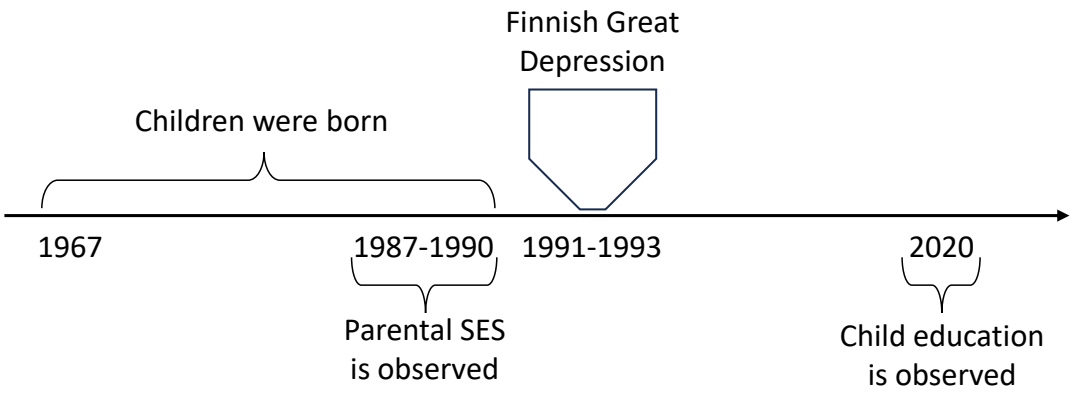
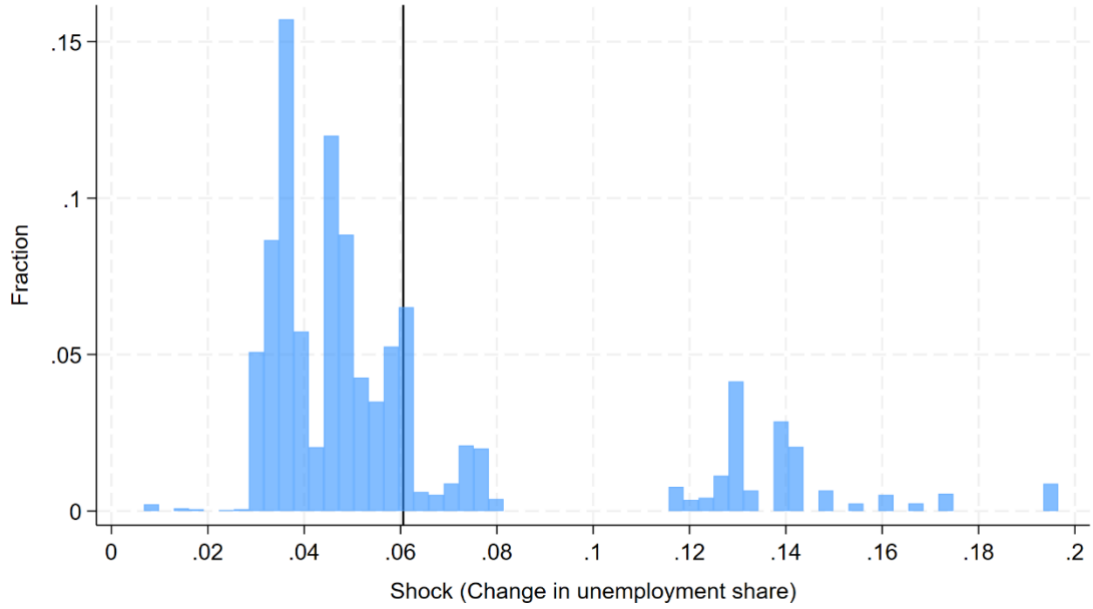
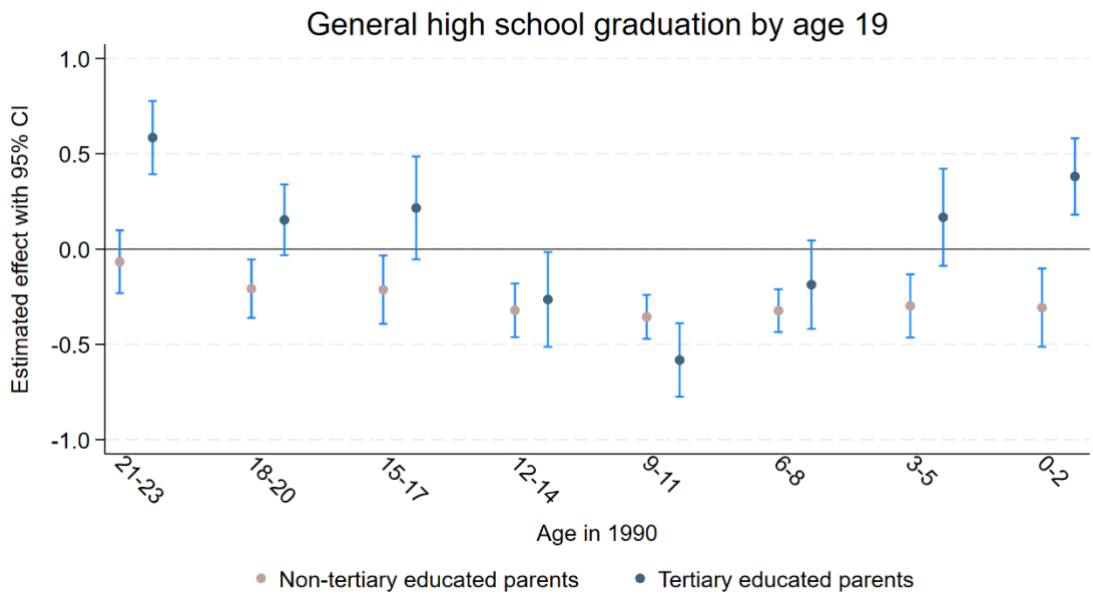


Figure 3. Distribution of the labor-market shock ($\Delta unemp_{j,p}$)



Note: The vertical line indicates the mean magnitude of the shock (=0.061).

Figure 4. OLS estimation results for general high-school graduation by the age of 19 years



Note: The results in table format are given in Appendix Table D-1.

Figure 5. Potential estimation bias

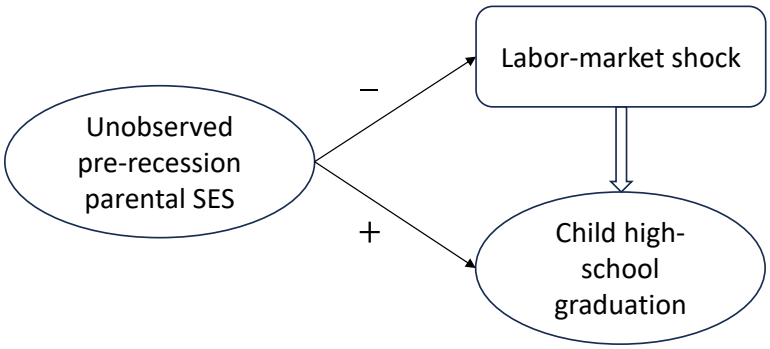
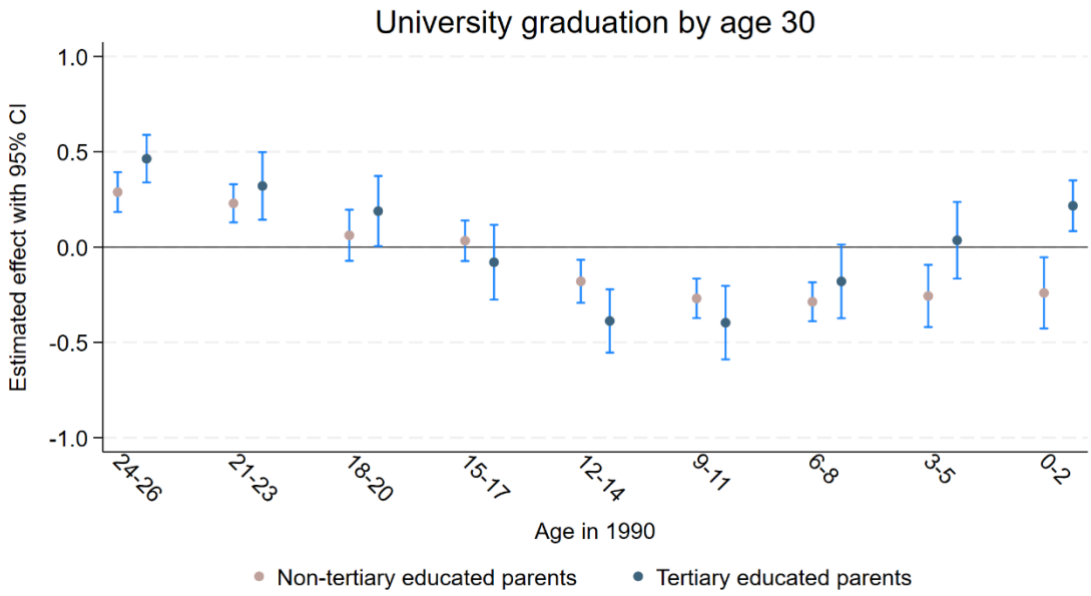
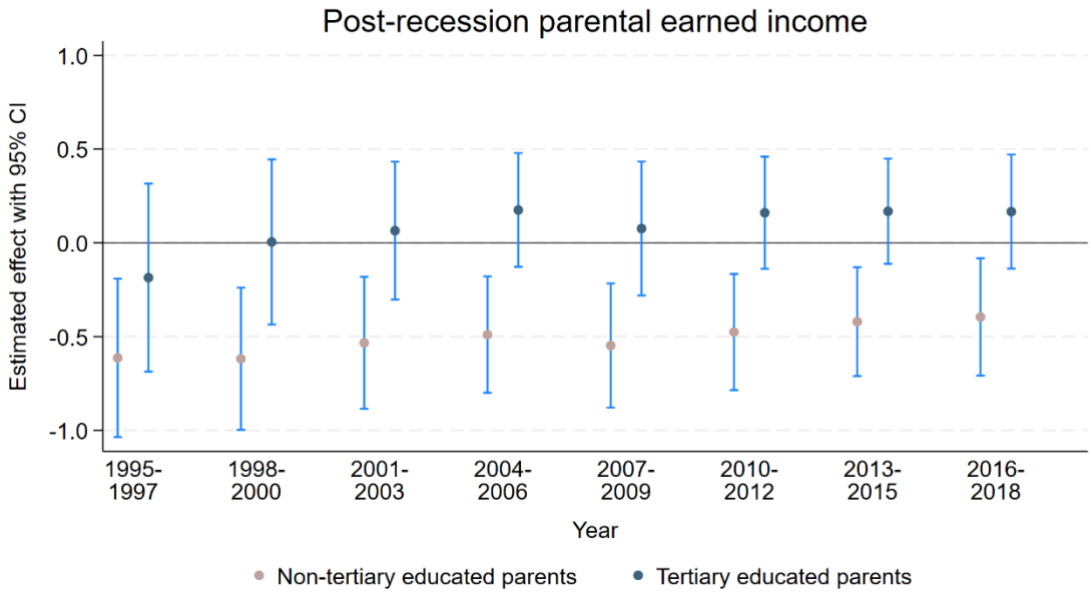


Figure 6. OLS estimation results for university graduation by the age of 30 years



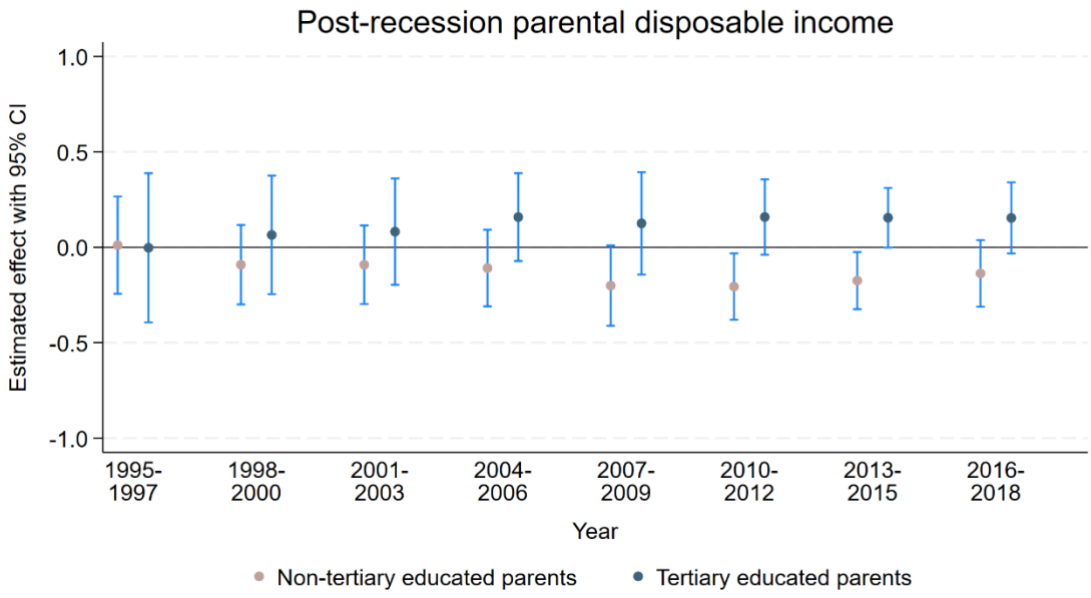
Note: The results in a table format are given in Appendix Table D-2.

Figure 7. OLS estimation results for post-recession parental earned income



Note: The results in a table format are given in Appendix Table E-2.

Figure 8. OLS estimation results for post-recession parental disposable income



Note: The results in a table format are given in Appendix Table E-3.

Table 1. Descriptive statistics of the main variables

	Nontertiary-educated parent		**Tertiary-educated parent**	
	N=1,071,209		N=472,024	
Variable	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**
General high-school graduation by the age of 19 years	0.356	0.479	0.629	0.483
University graduation by the age of 30 years	0.240	0.427	0.521	0.500
Recession intensity $\Delta unemp_{j,p}$ (#)	0.068	0.039	0.043	0.019
Prerecession parental unemployment share	0.041	0.034	0.022	0.018
Male child	0.511	0.500	0.511	0.500
No record of a biological father	0.055	0.228	0.018	0.134
No record of a biological mother	0.009	0.094	0.004	0.067
Child out of wedlock	0.188	0.391	0.094	0.291
Father (not mother) linked to child	0.456	0.498	0.605	0.489
Parental age in 1990 (linked parent) (#)	40.14	8.466	40.138	7.177
Fathers	**Nontertiary-educated parent**		**Tertiary-educated parent**	
	N=1,012,180		N=463,386	
Variable	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**
Father student (1990)	0.008	0.087	0.007	0.085
Father pensioner (1990)	0.069	0.254	0.020	0.141
Father log average annual earned income	8.705	2.313	9.572	1.553
Father log average annual taxable assets	5.699	4.302	5.907	4.322
Father's education				
Less than high school	0.492	0.500	0.087	0.281
High school	0.470	0.499	0.144	0.351
Two-year college	0.028	0.164	0.328	0.469
Four-year university degree or higher	0.011	0.105	0.442	0.497

Completed matriculation	0.040	0.195	0.409	0.492
Mothers	**Nontertiary-educated parent**		**Tertiary-educated parent**	
	N=1,061,687		N=469,922	
Variable	**Mean**	**Std. dev.**	**Mean**	**Std. dev.**
Mother student (1990)	0.026	0.158	0.024	0.153
Mother pensioner (1990)	0.040	0.196	0.011	0.103
Mother log average annual earned income	8.024	2.523	8.696	2.048
Mother log average annual taxable assets	5.051	4.106	6.637	3.794
Mother's education				
Less than high school	0.458	0.498	0.091	0.288
High school	0.495	0.500	0.198	0.399
Two-year college	0.037	0.189	0.418	0.493
Four-year university degree or higher	0.010	0.100	0.293	0.455
Completed matriculation	0.089	0.284	0.497	0.500

Notes: (1) (#) indicates a numerical variable, and all other variables are indicator variables (0/1); (2) all income and asset figures are deflated using CPI (unit: 1987 euros); (3) see Appendix Table A-1 for the descriptive statistics for the region of residence and father's and mother's occupation.

Table 2. Different estimated effects for different children

Child age in 1990	Nontertiary-educated parent	Tertiary-educated parent
21–23	$\widehat{\beta_1}$	$\widehat{\beta_1} + \widehat{\beta_2}$
18–20	$\widehat{\beta_1} + \widehat{\beta_3}$	$\widehat{\beta_1} + \widehat{\beta_2} + \widehat{\beta_3} + \widehat{\beta_4}$
15–17	$\widehat{\beta_1} + \widehat{\beta_5}$	$\widehat{\beta_1} + \widehat{\beta_2} + \widehat{\beta_5} + \widehat{\beta_6}$
12–14	$\widehat{\beta_1} + \widehat{\beta_7}$	$\widehat{\beta_1} + \widehat{\beta_2} + \widehat{\beta_7} + \widehat{\beta_8}$
9–11	$\widehat{\beta_1} + \widehat{\beta_9}$	$\widehat{\beta_1} + \widehat{\beta_2} + \widehat{\beta_9} + \widehat{\beta_{10}}$
6–8	$\widehat{\beta_1} + \widehat{\beta_{11}}$	$\widehat{\beta_1} + \widehat{\beta_2} + \widehat{\beta_{11}} + \widehat{\beta_{12}}$
3–5	$\widehat{\beta_1} + \widehat{\beta_{13}}$	$\widehat{\beta_1} + \widehat{\beta_2} + \widehat{\beta_{13}} + \widehat{\beta_{14}}$
0–2	$\widehat{\beta_1} + \widehat{\beta_{15}}$	$\widehat{\beta_1} + \widehat{\beta_2} + \widehat{\beta_{15}} + \widehat{\beta_{16}}$

Table 3. Interpretation of OLS results (general high-school graduation by the age of 19 years)

Child age in 1990 (years)	Share Grad.	Effect	Mean shock	Effect at mean ($\times 10^{-2}$)	% Effect at mean (%)
Panel A: Nontertiary-educated parent					
21–23	0.310	−0.067	0.074	−0.49	−1.59
18–20	0.318	−0.208	0.068	−1.41	−4.42
15–17	0.343	−0.213	0.065	−1.38	−4.02
12–14	0.390	−0.321	0.064	−2.06	−5.29
9–11	0.396	−0.356	0.064	−2.29	−5.78
6–8	0.369	−0.323	0.066	−2.13	−5.78
3–5	0.377	−0.298	0.069	−2.05	−5.45
0–2	0.359	−0.307	0.076	−2.34	−6.52
Panel B: Tertiary-educated parent					
21–23	0.584	0.585	0.045	2.64	4.51
18–20	0.586	0.153	0.043	0.65	1.11
15–17	0.620	0.216	0.042	0.90	1.45
12–14	0.648	−0.264	0.042	−1.10	−1.70
9–11	0.640	−0.582	0.042	−2.44	−3.81
6–8	0.628	−0.187	0.042	−0.79	−1.26
3–5	0.653	0.167	0.043	0.72	1.10
0–2	0.644	0.381	0.044	1.69	2.63

Notes: (1) (Effect) is the coefficient estimate from OLS; (2) (Effect evaluated at mean) = (Effect) × (Mean shock); (3) (% Effect evaluated at mean) = (Effect) × (Mean shock) / (Share Grad.) × 100.

Table 4. Interpretation of OLS results (university graduation by the age of 30 years)

Child age in 1990 (years)	Share Grad.	Effect	Mean shock	Effect at mean ($\times 10^{-2}$)	% Effect at mean (%)
Panel A: Nontertiary-educated parent					
24–26	0.096	0.289	0.084	2.43	25.24
21–23	0.116	0.229	0.074	1.70	14.62
18–20	0.153	0.062	0.068	0.42	2.73
15–17	0.208	0.033	0.065	0.22	1.04
12–14	0.282	−0.180	0.064	−1.15	−4.09
9–11	0.315	−0.269	0.064	−1.74	−5.52
6–8	0.297	−0.287	0.066	−1.90	−6.38
3–5	0.298	−0.257	0.069	−1.77	−5.93
0–2	0.293	−0.241	0.076	−1.83	−6.24
Panel B: Tertiary-educated parent					
24–26	0.334	0.463	0.051	2.35	7.04
21–23	0.358	0.321	0.045	1.45	4.03
18–20	0.415	0.189	0.043	0.80	1.93
15–17	0.464	−0.080	0.042	−0.33	−0.72
12–14	0.539	−0.388	0.042	−1.62	−3.00
9–11	0.575	−0.397	0.042	−1.66	−2.89
6–8	0.567	−0.180	0.042	−0.76	−1.35
3–5	0.576	0.035	0.043	0.15	0.26
0–2	0.571	0.217	0.044	0.96	1.69

Notes: (1) (Effect) is the coefficient estimate from OLS; (2) (Effect evaluated at mean) = (Effect) × (Mean shock); (3) (% Effect evaluated at mean) = (Effect) × (Mean shock) / (Share Grad.) × 100.

Table 5. Interpretation of OLS results (change in child cohabitating status with parents)

Parental education	Effect	p-value	Share	Mean shock	Effect at mean (% points)	% Effect at mean (%)
Nontertiary educated	0.209***	0.000	0.184	0.068	1.43	7.76%
Tertiary educated	0.087	0.105	0.111	0.043	0.37	3.37%

Notes: (1) The outcome variable is a dummy for change in child cohabitating status with parents from 1991 to 1995; (2) N=763,533; (3) standard errors are clustered at the occupation–province level (# clusters = 96); (4) see Appendix C for a list of control variables used; (5) (Effect) is the coefficient estimate from OLS; (6) (Effect evaluated at mean) = (Effect) × (Mean shock) × 100; (7) (% Effect evaluated at mean) = (Effect) × (Mean shock) / (Share) × 100; (8) *** = Statistically significant at 0.001 risk level.

SUPPLEMENTARY ONLINE APPENDICES

Appendix A. Detailed information on recession intensity ($\Delta unemp$)

Parental occupations and provinces of residence

Based on the Finnish occupation classification in 1980 at the most aggregated level (one-digit level), the following eight occupation groups are identified:

1. Technical, research, and artistic work
2. Administrative, managerial, and clerical work
3. Sales work
4. Agriculture, forestry, commercial fishing, mining, and quarrying work
5. Transport and communication work
6. Manufacturing and related work
7. Service work
8. Other occupations

The eighth category includes workers not classified elsewhere and parents with no reports of occupations. Military work is classified in the eighth category (Other occupations) under the 1980 occupation classification; however, we follow the 1987 occupation classification to group military work into the seventh category (Service work) as this is more natural. This does not influence our results.

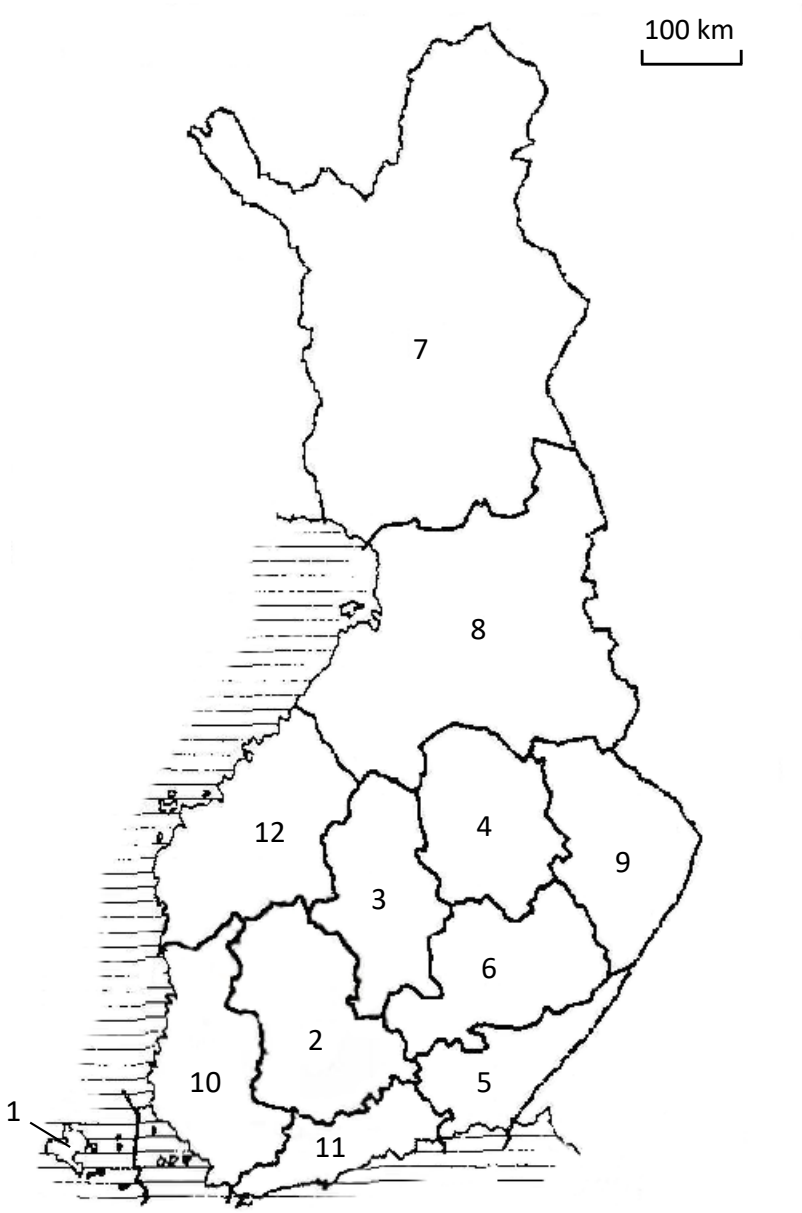
In 1990, the administrative division of 12 provinces was one of the main divisions. This classification of 12 provinces was based on cultural and linguistic borders, which had naturally arisen in the course of history.

These provinces ("läänit" in Finnish) were as follows:

1. Ahvenanmaa
2. Häme
3. Keski-Suomi
4. Kuopio
5. Kymi
6. Mikkeli
7. Lappi
8. Oulu
9. Pohjois-Karjala
10. Turku ja Pori
11. Uusimaa
12. Vaasa

In 1997, the number of provinces had reduced to six due to merger of some provinces. By the end of 2009, the administrative division of provinces was abolished.

Figure A-1. 12 provinces in 1990

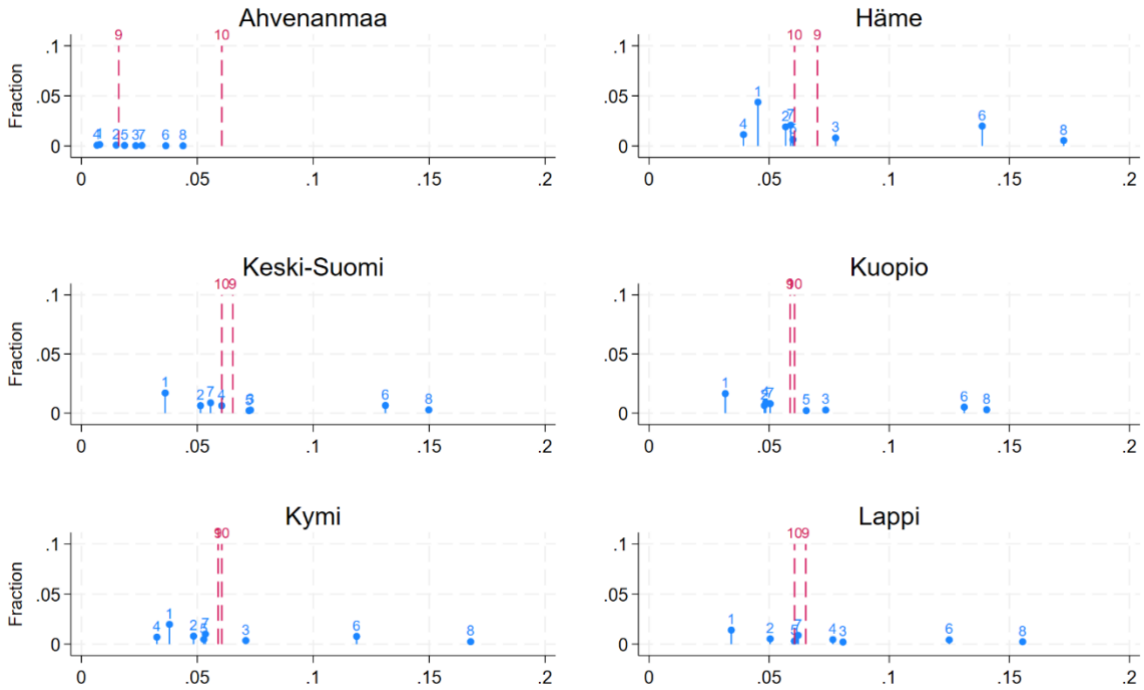


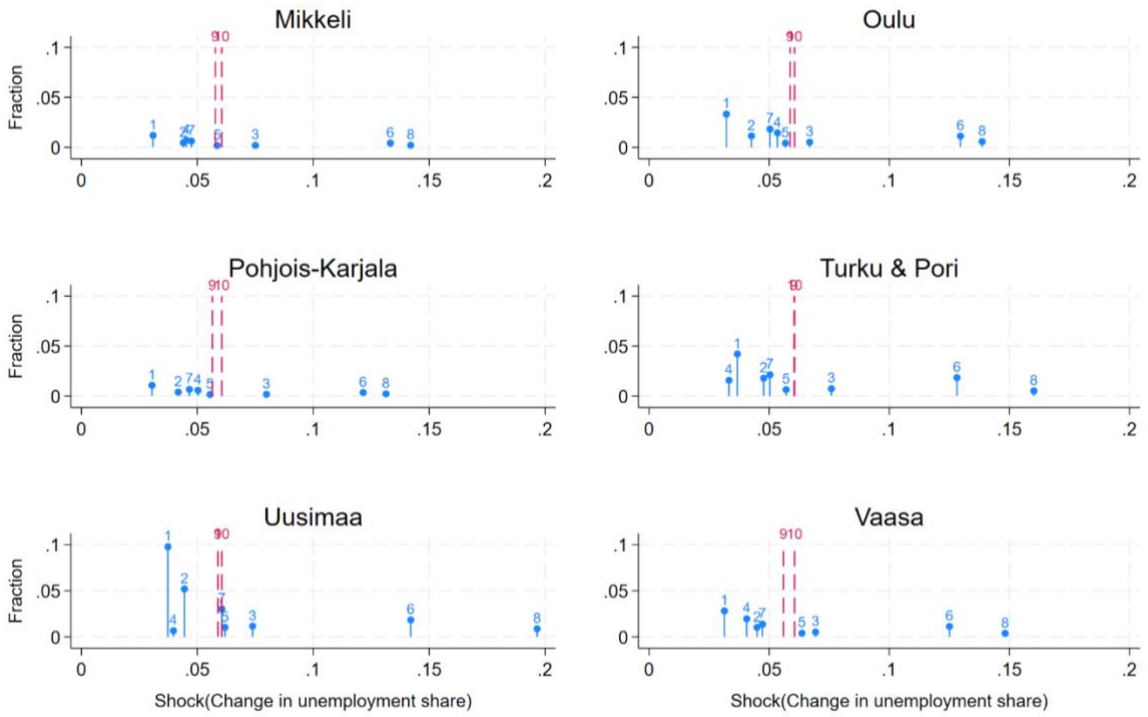
Notes: 1: Ahvenanmaan lääni, 2: Hämeen lääni, 3: Keski-Suomen lääni, 4: Kuopion lääni, 5: Kymen lääni, 6: Mikkelin lääni, 7: Lapin lääni, 8: Oulun lääni, 9: Pohjois-Karjalan lääni, 10: Turun and Porin lääni, 11: Uudenmaan lääni, 12: Vaasan lääni.

Shock magnitude and its weight by province

Figure A2 (below) depicts the shock magnitude and its weight by province. In this figure, the unit of analysis is child. Thus, the weight represents the fraction, where the numerator is the number of children under study whose parents resided in a particular province and had occupations classified into a particular occupation group, and the denominator is the total number of children under study. To link each child to parental occupation, we use the parental occupation (either father's or mother's) with a smaller shock or magnitude (a detailed description is provided in the main text).

Figure A-2. Shock magnitude and its weight by province





Notes: 1. Technical, research, and artistic work; 2. Administrative, managerial, and clerical work; 3. Sales work; 4. Agriculture, forestry, commercial fishing, mining, and quarrying work; 5. Transport and communication work; 6. Manufacturing and related work; 7. Service work; 8. Others; 9. Provincial mean; 10. Overall mean.

Table A-1. Descriptive statistics of the occupational and regional variables

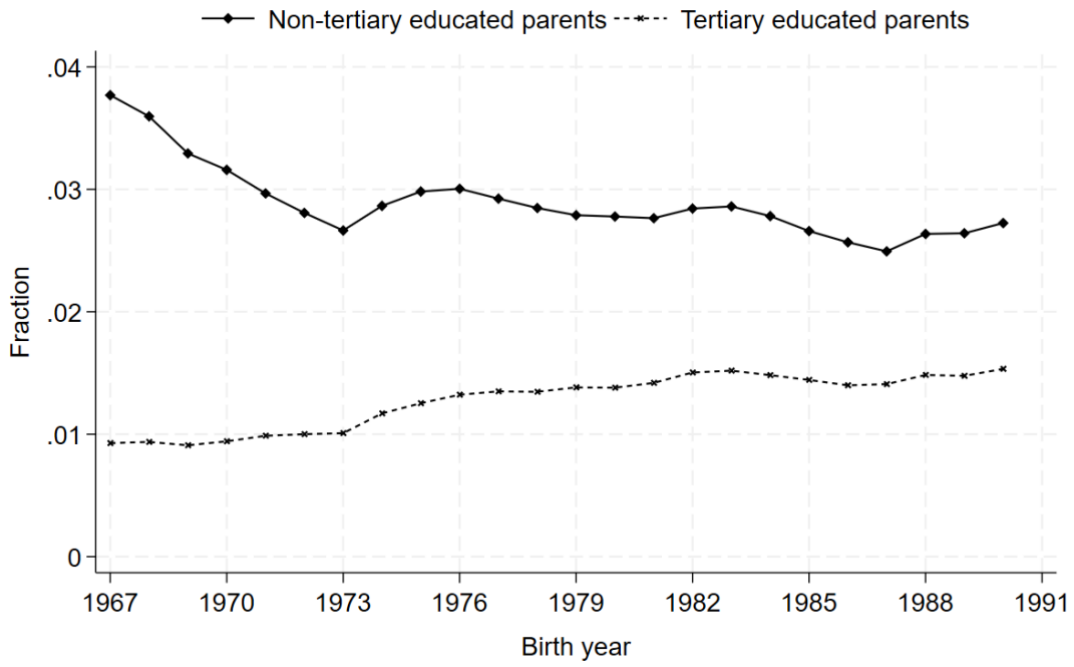
	Nontertiary-educated parent		**Tertiary-educated parent**	
	N=1,071,209		N=472,024	
	Mean	**Std. dev.**	**Mean**	**Std. dev.**
Province of residence (1990)				
Ahvenanmaa	0.005	0.073	0.004	0.064
Häme	0.135	0.342	0.134	0.340
Keski-Suomi	0.054	0.225	0.050	0.219
Kuopio	0.055	0.228	0.048	0.213
Kymi	0.066	0.248	0.058	0.233
Lappi	0.046	0.210	0.040	0.197
Mikkeli	0.043	0.203	0.034	0.182
Oulu	0.109	0.311	0.093	0.291
Pohjois-Karjala	0.039	0.194	0.030	0.169
Turku and Pori	0.136	0.343	0.130	0.336
Uusimaa	0.210	0.407	0.294	0.455
Vaasa	0.100	0.301	0.085	0.280
Urbanization of resident municipality (1990)				
Urban	0.499	0.500	0.640	0.480
Semi-urban	0.180	0.384	0.161	0.368
Rural	0.321	0.467	0.199	0.399
Father's occupation				
0. No record of a biological father	0.055	0.228	0.018	0.134
1. Technical, research, and artistic work	0.073	0.260	0.488	0.500
2. Administrative, managerial, and clerical work	0.037	0.188	0.146	0.353
3. Sales work	0.058	0.234	0.061	0.239
4. Agriculture, forestry, commercial fishing, mining, and quarrying work	0.126	0.332	0.039	0.195

5. Transport and communication work	0.100	0.300	0.038	0.192
6. Manufacturing and related work	0.377	0.485	0.111	0.315
7. Service work	0.055	0.228	0.046	0.210
8. Others	0.118	0.323	0.052	0.221
Mother's occupation				
0. No record of a biological mother	0.009	0.094	0.004	0.067
1. Technical, research, and artistic work	0.134	0.340	0.437	0.496
2. Administrative, managerial, and clerical work	0.124	0.330	0.247	0.431
3. Sales work	0.075	0.264	0.043	0.203
4. Agriculture, forestry, commercial fishing, mining, and quarrying work	0.105	0.306	0.025	0.157
5. Transport and communication work	0.025	0.156	0.011	0.105
6. Manufacturing and related work	0.098	0.297	0.020	0.139
7. Service work	0.218	0.413	0.060	0.238
8. Others	0.213	0.409	0.152	0.359

Note: (1) All variables are indicator variables (0/1).

Appendix B. Further information on the subject children

Figure B-1. Fractions of birth cohort sizes from 1967 to 1990



Notes: (1) Total number of children is 1,543,233; (2) each point (marked ◆ or x) represents the fraction of each birth cohort size to the total number of children (1,543,233) for children in households with nontertiary- and tertiary-educated parents, respectively.

Appendix C. Control variables

This is a complete list of the control variables. All the control variables are from the pre-recession years (mostly from 1990).

(1) dummy for no biological father record

(2) dummy for no biological mother record

(3) province fixed effects

(4) occupation group fixed effects for father and mother separately

(5) fixed effects of education groups for father and mother separately (either less than high school, high school, two-year college, or bachelor degree or higher)

(6) fixed effects of child birth years

(7) fixed effects of urbanization of residential municipalities (either urban, semi-urban, or rural)

(8) fixed effects of matriculation completion for father and mother separately

(9) pre-recession (1987–1990) unemployment share for the 96 occupation–province groups

(10) parental age in 1990 in cubic form

(11) male child dummy

(12) dummy for a child born out of wedlock (neither couple's living together nor married)

(13) father's annual earned income, average from 1987 to 1990, interacted with birth cohort dummies

(14) mother's annual earned income (as in father's earned income)

(15) father's taxable assets, average from 1987 to 1990, interacted with birth cohort dummies

(16) mother's taxable assets (as in father's taxable assets)

(17) dummies for a pensioner father in 1990 for those aged less than 55 and 55+ years separately

(18) dummies for a pensioner mother in 1990 for those aged less than 55 and 55+ years separately

(19) dummies for a student father in 1990 for those aged less than 30 and 30+ years separately

(20) dummies for a student mother in 1990 for those aged less than 30 and 30+ years separately

We deflate incomes and assets using CPI for the control variables (13)–(16) above (unit: 1987 euros).

The 1,543,233 sampled children include 67,667 children with no father records and 11,624 children with no mother records (there was no child with neither father's nor mother's records). For such children, we use (1) a dummy for no father records and (2) a dummy for no mother records in the regression analysis. Moreover, we create a separate 9th category named "no parent record" for each of the father's and mother's occupation groups. In the regression analysis, dummies for both the father's and mother's 9th category are not identified because they are perfect multicollinear with (1) a dummy for no father record and (2) a dummy for

no mother record, respectively. We handle other father- and mother-specific dummies in the same way, such as father's and mother's dummies for education, matriculation completion, pensioner status, and student status. For the father's and mother's pre-recession incomes and assets, if children have no father/mother records, we set them equal to the mean values of income and assets for fathers/mothers among children who have father/mother records. Then, we use (1) a dummy for no father records and (2) a dummy for no mother records in the regression analysis.

Appendix D. Supplementary tables for recession effects

Table D-1. OLS estimation results for general high-school graduation by the age of 19 years

Age in 1990 (years)	Nontertiary-educated parent			Tertiary-educated parent		
21–23	−0.067	(0.424)		0.585	(0.000)	***
18–20	−0.208	(0.008)	***	0.153	(0.104)	
15–17	−0.213	(0.020)	**	0.216	(0.116)	
12–14	−0.321	(0.000)	***	−0.264	(0.038)	**
9–11	−0.356	(0.000)	***	−0.582	(0.000)	***
6–8	−0.323	(0.000)	***	−0.187	(0.113)	
3–5	−0.298	(0.001)	***	0.167	(0.197)	
0–2	−0.307	(0.004)	***	0.381	(0.000)	***

Notes: (1) The outcome variable is a dummy for general high school graduation by the age of 19 years; (2) N=1,543,233; (3) p-values are in parentheses; (4) standard errors are clustered at the occupation–province level (# clusters = 96); (5) see Appendix C for a list of control variables used.

Table D-2. OLS estimation results for university graduation by the age of 30 years

Age in 1990 (years)	Nontertiary-educated parent			Tertiary-educated parent		
24–26	0.289	(0.000)	***	0.463	(0.000)	***
21–23	0.229	(0.000)	***	0.321	(0.001)	***
18–20	0.062	(0.363)		0.189	(0.045)	**
15–17	0.033	(0.536)		−0.080	(0.422)	
12–14	−0.180	(0.002)	***	−0.388	(0.000)	***
9–11	−0.269	(0.000)	***	−0.397	(0.000)	***
6–8	−0.287	(0.000)	***	−0.180	(0.067)	*
3–5	−0.257	(0.002)	***	0.035	(0.727)	
0–2	−0.241	(0.012)	**	0.217	(0.002)	***

Notes: (1) The outcome variable is a dummy for university graduation by the age of 30 years; (2) N=1,763,288; (3) p-values are in parentheses; (4) standard errors are clustered at the occupation–province level (# clusters = 96); (5) see Appendix C for a list of control variables used.

Appendix E. Supplementary figures and tables for mechanisms

Table E-1. Descriptive statistics for variables used in the mechanism analysis

	Nontertiary-educated parent			Tertiary-educated parent		
	Mean	**Std. dev.**	**N**	**Mean**	**Std. dev.**	**N**
Log average annual earned income (father and mother combined):						
1995–1997 (#)	9.892	0.569	1,063,289	10.402	0.518	469,383
1998–2000 (#)	9.922	0.596	1,060,487	10.456	0.517	468,556
2001–2003 (#)	9.951	0.598	1,056,839	10.492	0.532	467,955
2004–2006 (#)	9.974	0.609	1,052,292	10.528	0.541	467,345
2007–2009 (#)	9.962	0.619	1,046,065	10.518	0.560	466,507
2010–2012 (#)	9.934	0.608	1,037,440	10.486	0.563	465,166
2013–2015 (#)	9.893	0.588	1,025,904	10.431	0.558	463,179
2016–2018 (#)	9.841	0.579	1,009,903	10.367	0.557	460,069
Log average annual disposable income (father and mother combined):						
1995–1997 (#)	9.760	0.426	1,064,322	10.116	0.389	470,012
1998–2000 (#)	9.788	0.469	1,061,552	10.197	0.432	469,273
2001–2003 (#)	9.811	0.497	1,057,882	10.237	0.465	468,583
2004–2006 (#)	9.841	0.527	1,053,238	10.294	0.495	467,938
2007–2009 (#)	9.844	0.543	1,047,057	10.309	0.515	467,001
2010–2012 (#)	9.826	0.531	1,038,497	10.286	0.514	465,547
2013–2015 (#)	9.780	0.512	1,026,656	10.225	0.510	463,481
2016–2018 (#)	9.744	0.508	1,010,291	10.180	0.517	460,263
A child's post-recession experience of a change in living arrangement	0.184	0.387	495,942	0.111	0.314	267,591

Note: (1) (#) indicates a numerical variable, and the other variable is an indicator variable (0/1).

Table E-2. OLS estimation results for post-recession parental earned income

Year	Nontertiary-educated parent			Tertiary-educated parent		N
1995–1997	−0.613	(0.005)	***	−0.185	(0.465)	1,532,672
1998–2000	−0.618	(0.002)	***	0.005	(0.982)	1,529,043
2001–2003	−0.533	(0.003)	***	0.065	(0.726)	1,524,794
2004–2006	−0.489	(0.002)	***	0.176	(0.253)	1,519,637
2007–2009	−0.548	(0.001)	***	0.077	(0.671)	1,512,572
2010–2012	−0.476	(0.003)	***	0.161	(0.288)	1,502,606
2013–2015	−0.420	(0.005)	***	0.169	(0.236)	1,489,083
2016–2018	−0.395	(0.014)	**	0.167	(0.279)	1,469,972

Notes: (1) The outcome variable is log combined parental earned income (average annual amount deflated by CPI); (2) p-values are in parentheses; (3) standard errors are clustered at the occupation–province level (# clusters = 96); (4) see Appendix C for a list of control variables used.

Table E-3. OLS estimation results for post-recession parental disposable income

Year	Nontertiary-educated parents			Tertiary-educated parents			N
1995–1997	0.011	(0.933)		−0.003	(0.989)		1,534,334
1998–2000	−0.091	(0.385)		0.065	(0.681)		1,530,825
2001–2003	−0.092	(0.378)		0.082	(0.562)		1,526,465
2004–2006	−0.109	(0.283)		0.158	(0.176)		1,521,176
2007–2009	−0.201	(0.061)	*	0.125	(0.357)		1,514,058
2010–2012	−0.206	(0.021)	**	0.159	(0.114)		1,504,044
2013–2015	−0.175	(0.022)	**	0.155	(0.052)	*	1,490,137
2016–2018	−0.137	(0.123)		0.154	(0.104)		1,470,554

Notes: (1) The outcome variable is log combined parental disposable income (average annual amount deflated by CPI); (2) p-values are in parentheses; (3) standard errors are clustered at the occupation–province level (# clusters = 96); (4) see Appendix C for a list of control variables used.

Results of double-interaction specification

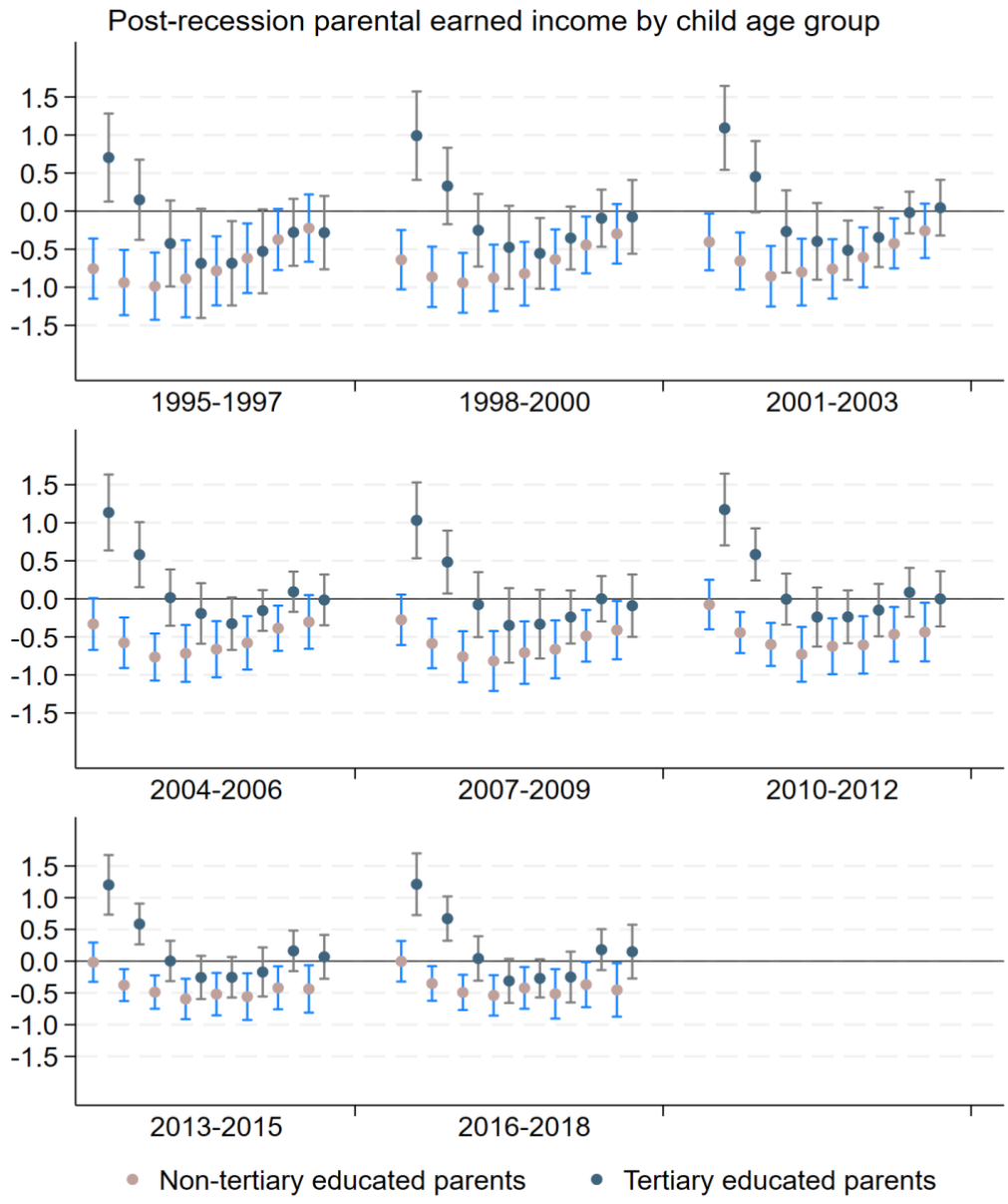
Here, we interact the labor-market shock variable with not only a dummy for a parent being tertiary educated or not but also with seven dummies for child age groups (age group 21–23 years in 1990 is the reference). The results are presented in Figures E-1 (parental earned income) and E-2 (parental disposable income).

We find the following patterns in terms of differences in the estimation results across child age groups:

1) For both outcomes of earned and disposable incomes for both tertiary- and nontertiary-educated parents, the recession effect generally seems less salient for higher and lower child age groups (21–26 years and 0–5 years) and more salient for middle child age groups (6–20 years), so the graph is U-shaped.
2) For both outcomes of earned and disposable incomes for tertiary-educated parents, the recession effect is positive and statistically significant for higher child age groups (21–26 years).

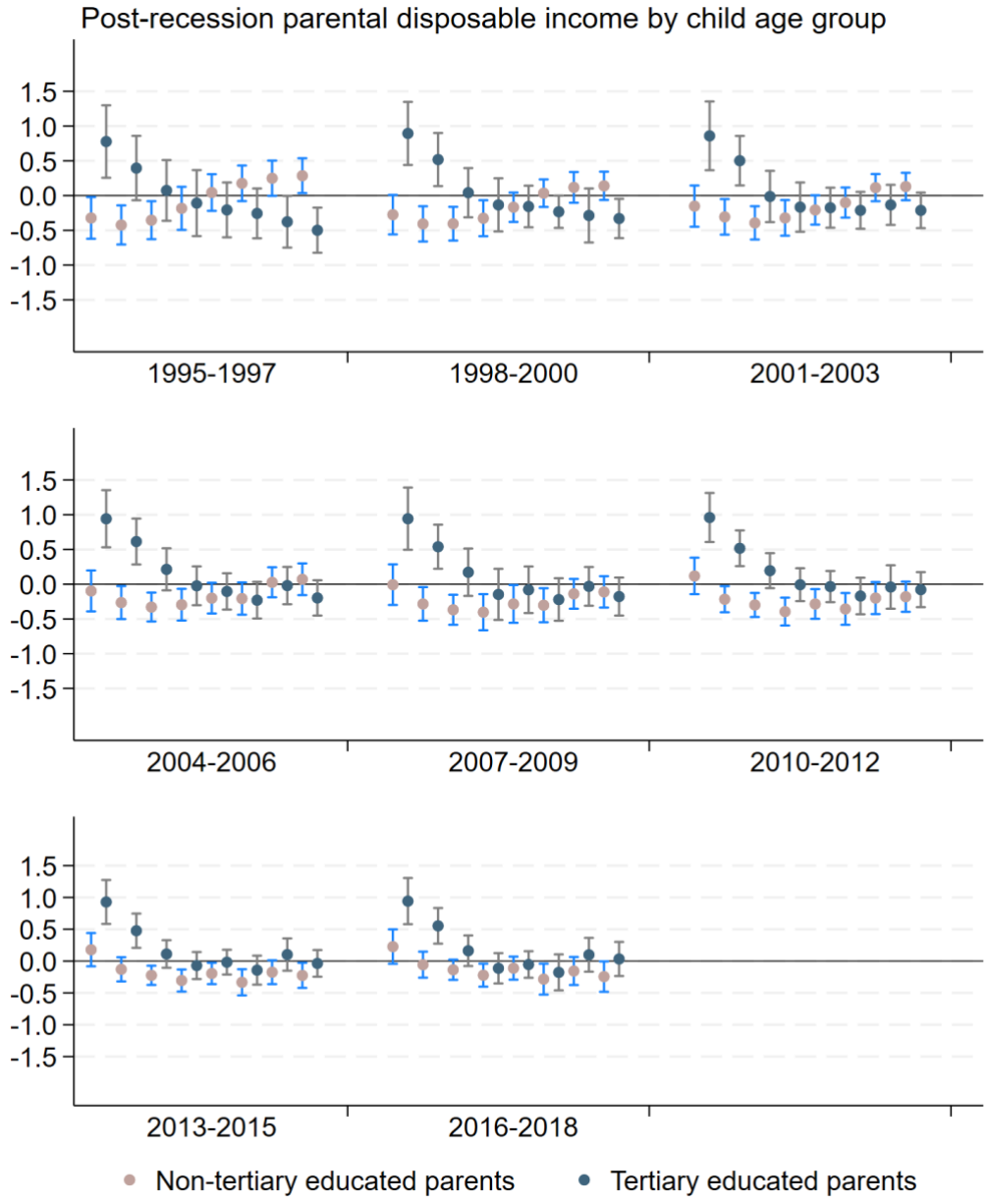
The second pattern may be driven by retirees with decent pension incomes because such individuals are grouped into the "Other" category in our occupation classification, and the "Other" category experienced the largest magnitude of the labor-market shock (Appendix Figure A-2).

Figure E-1. OLS estimation results for post-recession parental earned income for separate child age groups



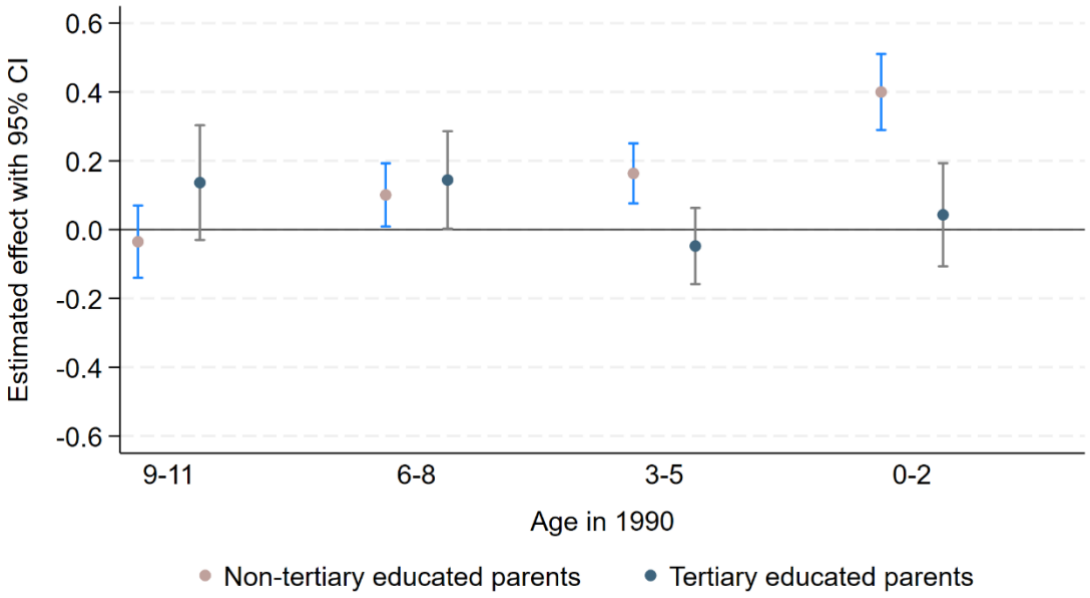
Notes: (1) Eight child age groups are defined based on child age in 1990: 21–23, 18–20, 15–17, 12–14, 9–11, 6–8, 3–5, and 0–2 years; (2) each dot in the figure represents one age group from the oldest (the most left) to the youngest (the most right); (3) each dot and the surrounding interval indicate the coefficient estimate with a 95% confidence interval for one child age group in a post-recession period.

Figure E-2. OLS estimation results for post-recession parental disposable income for separate child age groups



Notes: (1) Eight child age groups are defined based on child age in 1990: 21–23, 18–20, 15–17, 12–14, 9–11, 6–8, 3–5, and 0–2 years; (2) each dot in the figure represents one age group from the oldest (the most left) to the youngest (the most right); (3) each dot and the surrounding interval indicate the coefficient estimate with a 95% confidence interval for one child age group in a post-recession period.

Figure E-3. OLS estimation results for post-recession changes in child living arrangement for separate child age groups



Note: (1) Each dot and the surrounding interval indicate the coefficient estimate with a 95% confidence interval.

Table E-4. 2SLS estimates of the effect of change in living arrangements on child educational outcomes

1st stage regressions	Instruments	Estimate (p-value)	F stat. (p-value)
$M_{i,j,p}$ (change in living arrangement)	$\Delta unemp_{j,p}$	0.209 (0.000) ***	Robust F(2, 95)=
	$\Delta unemp_{j,p} \times I[tertiary\ educ.parent_i = 1]$	−0.122 (0.001) ***	16.992 (0.000) ***
$M_{i,j,p} \times I[tertiary\ educ.parent_i = 1]$	$\Delta unemp_{j,p}$	−0.169 (0.007) ***	Robust F(2, 95)= 60.138 (0.000) ***
	$\Delta unemp_{j,p} \times I[tertiary\ educ.parent_i = 1]$	1.998 (0.000) ***	
2nd stage regression	Endogenous variables	2SLS (p-value)	OLS (p-value)
General high-school graduation by the age of 19 years	$M_{i,j,p}$	−1.535 (0.005) ***	−0.090 (0.000) ***
	$M_{i,j,p} \times I[tertiary\ educ.parent_i = 1]$	0.103 (0.020) **	0.009 (0.057) *
University graduation by the age of 30 years	$M_{i,j,p}$	−1.145 (0.019) **	−0.075 (0.000) ***
	$M_{i,j,p} \times I[tertiary\ educ.parent_i = 1]$	0.027 (0.497)	−0.009 (0.062) *

Notes: (1) The outcome variable is either a dummy for graduation from general high school by the age of 19 years or a dummy for graduation from university by the age of 30 years; (2) The sample size is 763,533 for both outcomes; (3) The first-stage regressions are Equations (2) and (2′) in the main text. The second-stage regression is Equation (3) in the main text; (4) p-values are in parentheses; (5) Standard errors are clustered at the occupation–province level (# clusters = 96); (6) See Appendix C for a list of control variables used; (7) The OLS result of Equation (3) is given at the bottom right corner; (8) The estimated effect of change in living arrangements on general high-school graduation by the age of 19 years for children in households with tertiary-educated parents is given by −1.535+0.103=−1.431 (0.013)** for 2SLS estimation and −0.090+0.009=−0.081 (0.000)*** for OLS estimation. The estimated effect of change in living arrangements on university graduation by the age of 30 years for children in households with tertiary-educated parents is given by −1.145+0.027=−1.118 (0.031)** for 2SLS estimation and −0.075−0.009=−0.084 (0.000)*** for OLS estimation.

Appendix F. Post-recession municipal expenditure in social, health, and educational services

In this Appendix, we show evidence that municipalities that were hit hard by the Finnish Great Depression were not likely to reduce municipal expenditure on educational, health, and social support in the post-recession period in comparison with other municipalities that were less hit. Thus, the reduced child educational achievement was not due to reduced municipal services in educational, health, and social welfare caused by the recession.

Municipal services and financing

In Finland, municipalities, jointly with the state, are responsible for providing basic social services. Municipal services cover extensive areas of residents' daily lives, including education,[1] public health, social welfare,[2] housing and town planning, public sanitation, culture, leisure, sports, traffic and transport, and economic services (Council of Europe 2010).

[1] The national government is responsible for providing higher education.

[2] The national government is responsible for national pensions and guarantee pensions, which are provided to pensioners with no or small earnings-related pensions below a certain threshold. The national government is also responsible for the national unemployment insurance. The unemployed are entitled to unemployment benefits from the national unemployment insurance if earnings-related unemployment benefits (from unemployment funds contributed by both employers and employees) are below a certain threshold, which is determined by the number of children in the care of the recipient.

Finnish municipalities have a statutory authority to tax their residents. In 2008, Finnish municipalities earned half of their revenues from taxes (48%)[3], while the remaining sources of revenues are state grants (18%), fees and sales incomes (26%), borrowing (4%), and other (4%) (Council of Europe 2010). The national government monitors municipalities to ensure that municipal services to residents satisfy the national standard set by the Local Government Act. To maintain such service levels across municipalities, the central government gives out state grants. For the sector grants, the amount of grants to each municipality is determined mainly by age structure. The per-resident costs of educational, social, and health services are higher for municipalities with higher proportions of children and elderly individuals. There is also a system of revenue equalization between municipalities. This is a system of revenue transfers from rich to poor municipalities so that all municipalities have revenue levels of at least 91.86% of the average municipal revenue on a per-resident basis (Moisio 2002; Moisio, Loikkanen, and Oulasvirta 2010).[4]

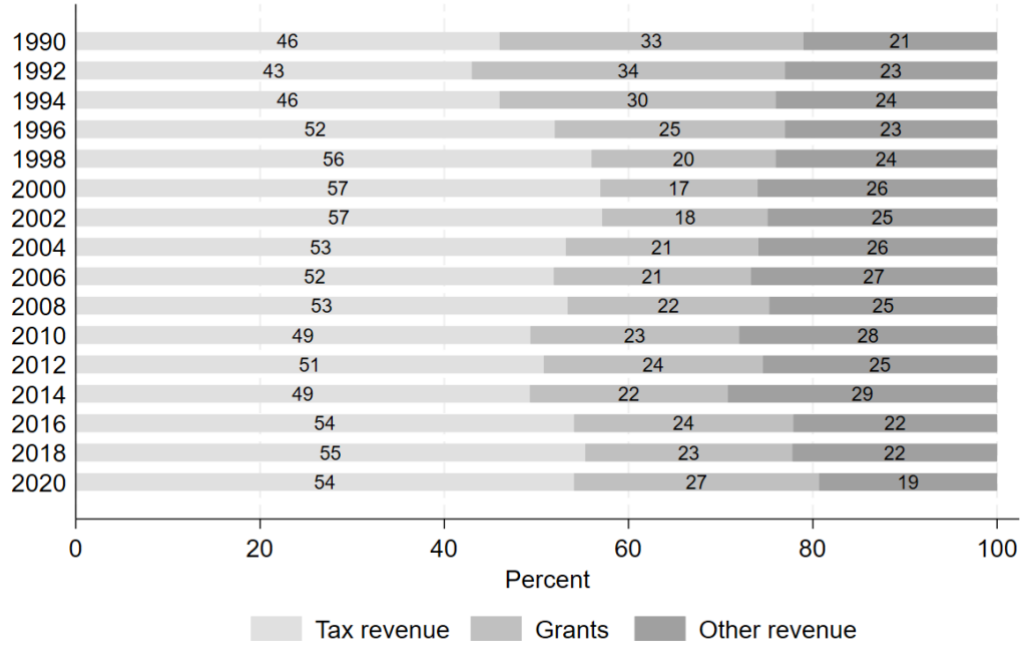
[3] A large majority of municipal tax revenue is from income tax (86% in 2008), while the remaining sources are municipal share of corporate income tax (9% in 2008) and real estate tax (5% in 2008) (Council of Europe 2010).

[4] There was a drastic change in the method of distributing state grants to municipalities in 1993. Before 1993, state grants to municipalities were of the matching type. However, the previous method of state-grant allocation also incorporated a system of revenue equalization across municipalities. Matching rates were determined by the economic situation of each municipality. The richer a municipality, the less state support to the municipality due to the lower matching rate. Before 1993, there was also another revenue-equalizing system across municipalities based on population density. (Moisio 2002; Loikkanen and Nivalainen 2011).

In response to the rising costs of providing municipal services, historically, Finnish municipalities have raised municipal income-tax rates. The average municipal income-tax rate was 17.53% in 1995, 18.45% in 2007, and 19.97% in 2020 (Matikka 2015).[5] Appendix Figure F-1 presents the revenue structure of Finnish municipalities from 1990 to 2020. During the era of the Finnish Great Depression (1991–1993), the share of tax revenue to total revenue was relatively low at 43–46%, whereas the share of grants was relatively high at 30%–34%. In the post-recession period, until the early 2000s, the share of tax revenue increased to 57%, whereas the share of grants decreased to 17%–18%. After the early 2000s, the tax share of total revenue gradually declined to 49% from 2002 to 2014 and remained stable at around 54% until 2020. After the early 2000s, the grant share of total revenue was stable at 21%–24%, except for 27% in 2020, driven by increased grants in response to the outbreak of the coronavirus pandemic. The share of other sources of revenue (mainly from user fees, sales incomes, financial incomes, and sales of assets and equipment) increased gradually from 21% in 1990 to 29% in 2014 and was 19%–22% from 2016 to 2020.

[5] The 2020 figure is from the following website of the Finnish Ministry of Finance: https://vm.fi/en/taxation-of-earned-income (accessed, May 12, 2023)

Figure F-1. Municipal revenue structure



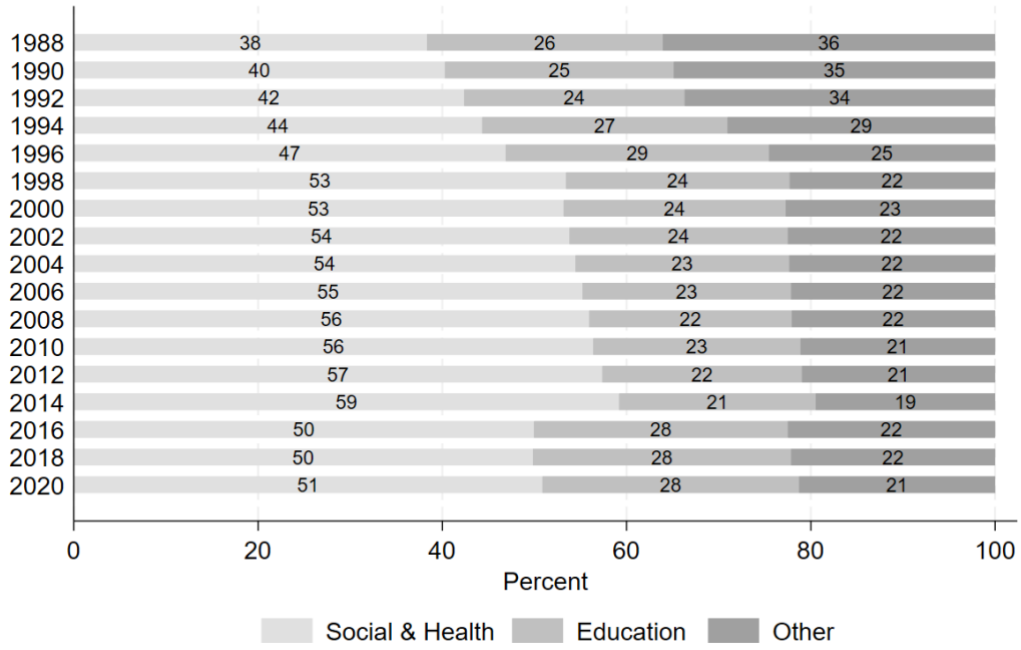
Notes:

1. Total revenue does not include proceeds from borrowings.
2. Most tax revenue is from municipality income tax, and the remaining sources are property tax, the municipality's share of corporate income tax, and other taxes.
3. Most grants are from the national government, and the remaining grants are from the European Union, municipalities, municipal associations, and others.
4. Other revenue mainly includes user fees, sales incomes, financial incomes, and sales of assets and equipment.
5. The percentage figures are from the study by Loikkanen (2011) from 1990 to 1998 and our own calculations for 2000–2020 using Statistical Finland's financial data reported by municipalities and municipal associations.

For municipal expenditure, in the post-recession period, roughly half of the total municipal operating expenditure has been used for social and health services, and the remaining half has been roughly equally divided between education and other services.

Appendix Figure F-2 depicts the shares of (1) social and health services, (2) educational services, and (3) other services in total municipal operating expenditure (not including capital expenditure) from 1988 to 2020. There were changes in bookkeeping rules in the municipal financial report to the state government in 1993, 1997, and 2015. Thus, the municipal expenditure for each service category is not rigorously comparable across different periods corresponding to different bookkeeping rules. Due to population aging, there has been a gradual increase in the share of social and health services.

Figure F-2. Municipal expenditure structure



Notes:

1. Total expenditure (100%) is operating expenditure, not including capital expenditure.
2. There were changes in bookkeeping rules in the municipal financial report to the state government in 1993, 1997, and 2015. Thus, municipal expenditure of each service category is not rigorously comparable across different periods corresponding to different bookkeeping rules.
3. Educational expenditure covers not only formal education but also wider education and cultural activities, such as liberal adult education, arts education, libraries, sports, museums, theaters, and music activities.
4. Other expenditure includes general administration, business promotion, maintenance of local infrastructure, operation of public safety, water supply, waste disposal, and others.

5. The percentage figures are our own calculations using Statistical Finland's financial data reported by municipalities and municipal associations.

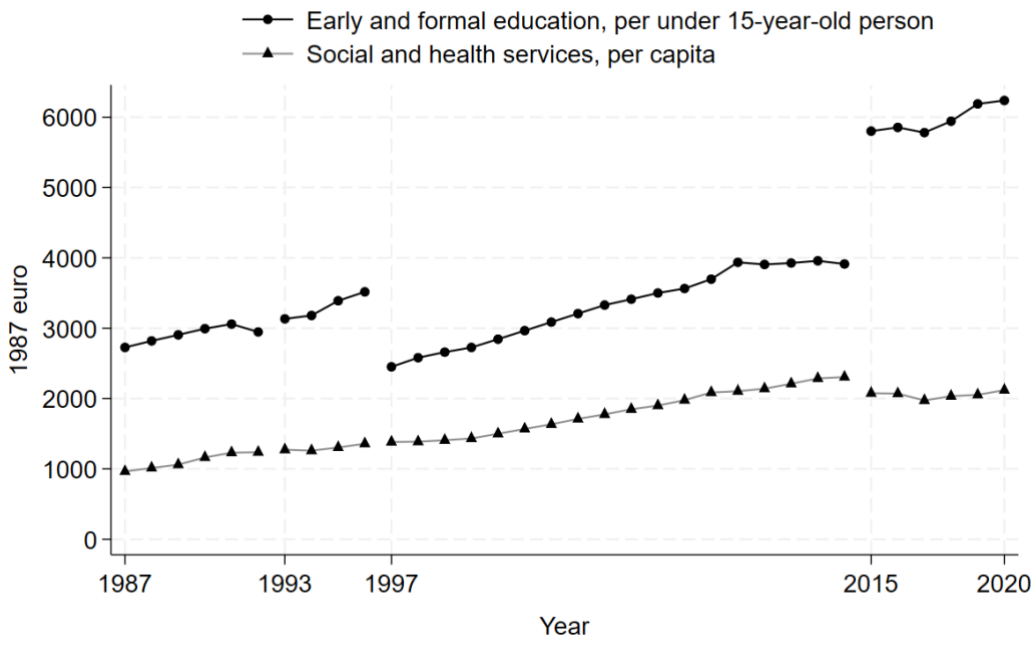
Pathway analysis through municipal services

To examine whether reduced municipal services is a pathway through which the Finnish Great Depression decreased children's educational attainment, we focus on municipal expenditures on (1) social and health services and (2) early and formal educational services. In particular, the relevant functions of municipal services are preschool education, primary education, secondary education, and vocational and technical education in educational services, as well as health care and health protection, family welfare services, welfare homes, and social security in social and health services.

Appendix Figure F-3 depicts (1) the per capita municipal expenditure on social and health services and (2) the per-under-15-person municipal expenditure on early and formal educational services from 1987 to 2020. Municipal expenditures are summed together over all municipalities to obtain total municipal expenditures at the national level for each year from 1987 to 2020, and per capita and per-under-15-person figures are calculated using the total population and under-15 population of each year at the national level. Municipal expenditure figures are deflated using the CPI deflator (unit: 1987 euro). There were changes in bookkeeping rules in the municipal financial report to the state government in 1993, 1997, and 2015. Thus, municipal expenditure of each service category is not rigorously comparable across different periods corresponding to different

bookkeeping rules. There are clear discontinuities in 1993, 1997, and 2015 in both time series of expenditures on (1) social and health services and (2) early and formal educational services, but it is clear that per capita expenditures on both services follow increasing trends.

Figure F-3. Municipal expenditures on (1) social and health services and (2) early and formal educational services



Notes:

1. Municipal expenditures are summed together over all municipalities to obtain the total municipal expenditures at the national level for each year from 1987 to 2020, and the per capita and per-under-15-person figures are calculated using the total population and under-15 population of each year at the national level.
2. There were changes in bookkeeping rules in the municipal financial report to

the state government in 1993, 1997, and 2015.

3. All expenditure values are deflated using the CPI deflator (unit: 1987 euro).
4. The data are from Statistical Finland's financial data reported by municipalities and municipal associations.

We merge yearly panel data of municipal expenditures with municipality-level data on recession intensity to determine whether municipalities that were hit hard by the recession were more likely to reduce municipal services in (1) social and health services as well as (2) early and formal educational services in the post-recession period in comparison with municipalities that were less hit. Below are descriptions of the data and estimating equation:

- Data on municipal expenditures are from Statistical Finland's financial data reported by municipalities and municipal associations. This is a yearly dataset for all municipalities in Finland back until 1987.
- The number of Finnish municipalities has gradually declined from 461 in 1987 to 309 in 2021 as some municipalities consolidated with other municipalities (no single municipality became separated into multiple municipalities).
- Our municipal data are based on municipal boundaries as of January 1, 2021. However, the municipality of Längelmäki was consolidated into two different municipalities (Jämsä and Orivesi) in 2007. As we cannot tell the part of Längelmäki that was consolidated into Jämsä and the remaining part that was consolidated into Orivesi in terms of municipal financial operations, we treat

the combined area of Jämsä and Orivesi as one municipality in our data analysis. Thus, our data are balanced yearly panel data where the number of cross-sectional units is 308 municipalities and the number of years is 34 years from 1987 to 2020.

- Our outcome variables are (1) per-resident municipal expenditure on social and health services and (2) per-under-15-resident municipal expenditure on early and formal educational services.
- Before 2000, municipal expenditures were reported in marrka (FIM). We use €1=5.94573 FIM (exchange rate at the time of Finland's adoption of the euro in 2002) to convert FIM into euro.
- All expenditure values are deflated using the CPI deflator (unit: 1987 euro).
- There were changes in 1993, 1997, and 2015 in bookkeeping rules in the municipal financial report to the state government. Thus, the expenditure figures are not precisely consistent across different periods corresponding to different bookkeeping systems. Therefore, we divide our data period into the following five groups: t=0 (1987–1990, pre-recession period); t=1 (1991–1992); t=2 (1993–1996); t=3 (1997–2005); t=4 (2006–2014); and t=5 (2015–2020).
- Our estimating equation is as follows:

$$Log(expense(t)_m) = \beta_0 + \beta_1 \times \Delta unemp_m + \beta_2 \times Log(expense(0)_m) + \varepsilon_m$$

where the subscript m indicates each municipality (308 municipalities in total); $expense(t)_m$ is average municipal expenditure in period t=1,…, 5; $expense(0)_m$ is the average municipal expenditure in pre-recession period

t=0; and $\Delta unemp_m$ is recession intensity experienced by municipality m. This is consistent with the measure of recession intensity used in our main analysis. However, here, this measure is computed for each of the 308 municipalities. Thus, $\Delta unemp_m$ is change in the share of unemployment between the pre-recession (1987–1990) and mid-recession (1991–1993) periods for each municipality.

- Pre-recession municipal population (1987–1990) is used as OLS regression weight. For social and health expenditure, municipal population (average in the pre-recession period (1987–1990)) is used as OLS regression weight. For early and formal educational expenditure, the municipal population of individuals under 15 (average in the pre-recession period (1987–1990)) is used as the OLS regression weight.

Appendix Table F-1 presents the descriptive statistics of the variables used in the regression analysis. The sample size is 308. Pre-recession municipal population and municipal population of individuals under 15 are used as weights for (1) social and health expenditure and (2) early and formal educational expenditure, respectively (average population from 1987 to 1990). Consistent with observation in Appendix Figure F-3, on average, both types of per capita deflated municipal expenditures gradually increased across the six periods from 1987 to 2020, except for municipal expenditure on early and formal education, which seems to be due to a change in bookkeeping system in municipal financial reporting in 1997. The mean size of the recession intensity is somewhat larger than the size reported in

Table 1 in the main analysis.[6] This is probably because younger and older individuals were more likely to be unemployed during the Finnish Great Depression (Huovinen and Piekkola 2001; Kyyrä 2001) and such individuals were less likely to have children who are up to 26 years old (the age of children in 1990 in our study).

Table F-1. Descriptive statistics of municipal expenditures and recession intensity

	t	Mean	Std. deviation
(1) Log per-resident municipal expenditure on social and health services	t=0 (1987–1990)	6.933	0.210
	t=1 (1991–1992)	7.096	0.204
	t=2 (1993–1996)	7.159	0.140
	t=3 (1997–2005)	7.329	0.114
	t=4 (2006–2014)	7.642	0.178
	t=5 (2015–2020)	7.646	0.175
(2) Log per-under-15-resident municipal expenditure on early and formal educational services	t=0 (1987–1990)	7.944	0.176
	t=1 (1991–1992)	7.995	0.174
	t=2 (1993–1996)	8.097	0.158
	t=3 (1997–2005)	7.944	0.251
	t=4 (2006–2014)	8.236	0.210
	t=5 (2015–2020)	8.699	0.144
(3) Recession intensity		0.073	0.012

[6] The mean and standard deviation of recession intensity do not change much no matter the population weight (municipal population or municipal under-15-year-old population) used.

Appendix Table F-2 presents the results of the OLS regression. For both categories of municipal services, recession intensity is mostly not correlated with post-recession municipal expenditures at conventional levels. Exceptions to these are social and health expenditures for the last two periods (2006–2014 and 2015–2020) and early and formal educational expenditures during the recession (1991–1992) and in the last period (2015–2020). For the former, a positive correlation is observed, implying that municipalities that were hit hard by the recession tended to spend larger amounts on social and health services on the per capita basis than municipalities that were less hit. For the latter, the correlation is negative, suggesting that municipalities that were hit hard by the recession may have reduced expenditures on early and formal education on a per-child basis more than municipalities that were less hit, although the correlation is only marginally significant at the 10% level.

Table F-2. OLS regression results

Outcome = Log per-resident expenditure on social and health services						
	$\Delta unemp_m$			Log base expense 1987–1990		
t	coef.	p-value	sig.	coef.	p-value	sig.
1 (1991–1992)	−0.083	0.699		0.949	0.000	***
2 (1993–1996)	0.064	0.832		0.600	0.000	***
3 (1997–2005)	0.408	0.235		0.427	0.000	***
4 (2006–2014)	1.652	0.058	*	0.130	0.007	***
5 (2015–2020)	2.456	0.004	***	−0.087	0.066	*

Note: Outcome = Log per-under-15-resident expenditure on early and formal education services						
	$\Delta unemp_m$			Log base expense 1987–1990		
t	coef.	p-value	sig.	coef.	p-value	sig.
1 (1991–1992)	−0.441	0.105		0.945	0.000	***
2 (1993–1996)	−0.122	0.811		0.683	0.000	***
3 (1997–2005)	−0.147	0.886		0.807	0.000	***
4 (2006–2014)	0.075	0.934		0.571	0.000	***
5 (2015–2020)	−1.147	0.077	*	0.355	0.000	***

Notes:

1. The sample size is 308 for all OLS regressions.
2. Regression weight is applied. For the outcome of social and health expenditure, the pre-recession municipal population (average from 1987 to 1990) is used as the OLS regression weight. For the outcome of early and formal educational expenditure, the pre-recession municipal population of under 15 individuals (average from 1987 to 1990) is used as the OLS regression weight.

In Finland, the central government has monitored the level and quality of services provided by municipalities, and state grants and revenue-equalizing systems across municipalities have made the level and quality of municipal services to its residents homogenous across different municipalities. Our regression result in this Appendix is generally consistent with this traditional state policy. Some municipalities with rising unemployment may have reduced educational expenditure in the chaos of the Finnish Great Depression and occasionally at subsequent times; however, such potential deviations from the state policy of homogenous municipal services in the county lasted at the most for a few years. We conclude that reduced municipal services were not the main pathway through which the Finnish Great Depression exerted a negative influence on the next generation's educational achievement.