Neighborhood Effects and Children's Long-term Outcomes

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Abstract

Does growing up in a better neighborhood have positive consequences on long term labor market outcomes and educational attainment? We exploit a unique spatial dispersal policy that randomly resettled refugees across neighborhoods in Denmark from 1986-1998. We find that a higher quality neighborhood—as measured by the wage outcomes of children already living there—is significantly associated with increased market income in adulthood. Our mediation analysis reveals that the association between neighborhood quality and child adult income is fully mediated through the impact of assigned neighborhood on parental income.

JEL Codes: H0, H4, H7, I2, R0, R2, R3

Keywords: neighborhood effects, intergenerational mobility, refugees, dispersal policy

1 Introduction

In this paper, we study the long-run effects of growing up in a better quality neighborhood on the children of refugees and asylum seekers in Denmark. We exploit quasi-random variation in assigned locations among refugees arising from the Danish Dispersal Policy, which was carried out from 1986 to 1998. We analyze the long-run impacts of assignment to these neighborhoods on educational attainment, labor force participation, and adult earnings of refugee children growing up in the randomly-assigned neighborhoods in Denmark.

Recent studies in the literature have exploited the Danish refugee dispersal policy to analyze the role of neighborhood characteristics on refugee outcomes such as labor market outcomes (Damm (2014)); Damm (2009); Damm and Rosholm (2010); Azlor et al. (2020); Eckert et al. (2022)), labor market integration (Arendt (2022)), health (Hasager and Jørgensen (2021); Foverskov et al. (2022); Kim et al. (2023)), and participation in crime (Damm and Dustmann (2014)). Another strand of literature has used the dispersal policy to study the impact of refugees on natives' behavior and natives' outcomes such as voting behavior (Dustmann et al. (2019)) and skill acquisition (Foged and Peri (2016)).[1,2]

While these studies analyze the impacts of the dispersal policy on the outcomes of refugees, this paper is the first, to the best of our knowledge, to examine the intergenerational effects of the neighborhood assignment by analyzing the long-run impacts on the children of refugees in terms of earnings, educational attainment, and employment. To this end, we exploit

[1]Some previous papers have studied refugee dispersal policies in other countries. See Edin et al. (2003) for the causal effect on labor market outcomes of living in enclaves in Sweden; Chakraborty and Schüller (2022) for a similar analysis across numerous countries; Andersen et al. (2023) for integration of refugees in Norway; Kirstiansen et al. (2022) for the impact of neighborhood labor market characteristics on refugee employment outcomes in the Netherlands; Vogiazides and Mondani (2021) for determinants of inter-regional immobility of refugees in Sweden; Robinson et al. (2003) for an analysis of the dispersal policies in the Netherlands, Sweden, and the UK; Ravn et al. (2022) for the labor market policies for refugees in Denmark, Sweden, the Netherlands, and Germany. Brell et al. (2020) provide an overview of refugee labor market integration outcomes across nine different high-income countries. See Nielsen Arendt et al. (2022) for a review of the literature.

[2]Another strand of the literature focuses on the sample of natives and exploits the variations in neighborhood exposure among children of families who move across neighborhoods at different ages of children. See Eshaghnia (2021) for a critical review of this approach in the literature.

rich administrative panel data from Denmark. We use a mediation analysis framework to decompose the impacts of initial neighborhood assignment on child income in adulthood to the indirect impact through parents and the direct impact on children.

Exploiting the random assignment of refugees to Danish neighborhoods during the policy era, we find that the quality of the assigned neighborhood is positively and significantly related to both the parents' income and children's adulthood income. We find that assignment to a neighborhood where the mean income rank of children of permanent residents is 1 percentile higher (at a given level of parental income) increases child's income rank in adulthood by approximately .63 percentiles. In other words, children of refugees placed in better quality neighborhoods pick up 63% of the difference in permanent residents' outcomes associated with the assigned neighborhood.

To study the underlying mechanisms, we then conduct a simple mediation analysis. We find that these effects are fully accounted by the impact of assigned neighborhood quality on parental income. Our results provide evidence of significant neighborhood effects on the first generation of refugees in Denmark, while these translate to the second generation only through parents' labor market outcomes.

2 Dispersal Policy In Denmark

There have been heated debates about immigration policies among policy makers in many countries. In some Western European countries, policies around asylum seekers and refugees were politicized, where asylum seekers and refugees were perceived by some political parties as a burden. Some Western European governments used various policies to spatially "spread the burden" by dispersing ethnic minorities, especially asylum seekers and refugees (see Robinson et al. (2003) and Wren (2003)).

Denmark is one of the European countries that has adopted a refugee dispersal policy. As

in many other European countries, the number of refugees increased sharply in Denmark during the 1980's. In this paper, we focus on the Danish Dispersal policy, which was in place between 1986 and 1998.

Prior to the reform in 1986, refugees were allowed to choose where to settle, which led to a concentration of refugees in larger cities. A national dispersal policy implemented in 1986 aimed to distribute refugees more evenly across spatial units so that the costs of integration of immigrants could be more evenly allocated across municipalities.[3] The dispersal policy succeeded in achieving a more dispersed geographical distribution of refugees.[4]

Damm (2005) investigates whether the Danish Dispersal Policy on new refugee immigrants carried out from 1986 to 1998 can be regarded as a natural experiment and whether refugees were randomly assigned to a location. She documents that the actual settlement has been influenced by five refugee characteristics and concludes that the initial location of new refugees 1986-1998 may be regarded as random, when controlling for age, origin, year of assignment, household size, and marital status – all of which are observable.

[3]First, the policy distributed refugees across the 15 Danish counties proportional to the number of inhabitants. Then, refugees were allocated to municipalities within counties (with a total of 278 municipalities) according to population size (but also considering ethnic networks, access to education and job opportunities, as well as the availability of suitable housing). See Council (1996) for details.

[4]Damm and Dustmann (2014) report that after 8 years, one in two households still lived in the area of initial assignment.Wren (2003) studies if the dispersal policy in Denmark has achieved its goals at macro vs micro levels. She argues that while, at a national level, the policy has achieved its objectives, at a regional scale the policy has effectively resulted in socio-ethnic spatial segregation in areas experiencing pre-existing deprivation and social exclusion.

3 Data and Measures of Neighborhood Quality and Outcomes

3.1 Main Samples

Our main sample of analysis comprises all individuals whose parents were assigned quasi-randomly to neighborhoods in the first phase of the Danish dispersal policy from 1986 and 1998 and for whom we observe their later life outcomes. Outcomes are last observed in the administrative registers between 2016 and 2021 depending on the specific variable of interest, which enables us to observe outcomes of the children of assigned refugees around the age of 30 years old.

Below, we describe how we construct our neighborhood quality measure, as well as outcome variables.

3.2 Neighborhood Quality

Our measure of neighborhood quality is inspired by Chetty and Hendren (2018). Using the sample of native Danes, we compute the expected income rank of children of permanent residents (at age 30) in each neighborhood, conditional on their parental income rank and birth cohort.

Formally, let y_i denote the child's adult percentile rank based on their position in the national income distribution relative to all others in her birth cohort. Also, for child i, let $p(i)$ be the parents' percentile rank in the national distribution of parental income for the child i's birth cohort. Now, let $\bar{y}_{pks}$ denote the mean rank of children with parents at percentile p of the income distribution, residing in the neighborhood k for the entire childhood stage (from age 0 to 18), and birth cohort s. The mean child rank, given parents' rank in each neighborhood

k and birth cohort s is approximated by a linear form:

$$y_i = \alpha_{ks} + \psi_{ks} p_i + \epsilon_i \,. \tag{1}$$

We obtain estimates of $\bar{y}_{pks}$ from the fitted values of the linear regression while restricting the sample to the native Danes:

$$w_{kp} \equiv \bar{y}_{pks} = \hat{\alpha}_{ks} + \hat{\psi}_{ks} p \,. \tag{2}$$

We obtain estimates of intercept α and slope ψ for each neighborhood using the sample of permanent resident Danes. Then, for a given refugee family with parental income rank p, we compute the quality of the assigned neighborhood (w_{kp}) from equation 2.

3.3 Outcome Variables

We turn to describe the different outcomes we analyze.

Economic Outcomes In our main analyses, we focus on two definitions of children's adult economic outcomes. We study wage income excluding transfers and taxes to focus on earnings potential. Henceforth, we refer to this income definition as *pre-tax* income. This income measure is contrasted with a measure of annual net income, to account for the significant tax and transfer system in Denmark. Henceforth, we refer to this income definition as *post-tax* income. Finally, we consider the employment status of the child. All these measures are computed at age 30 of the child.

Years of Education To capture human capital accumulation, we further compute a measure of individuals' years of education, by converting the degree completed to the theoretical years of completion. This measure is captured at age 28 of the child.

Tables A1, A2 and A3 in the Appendix report summary statistics for our sample.

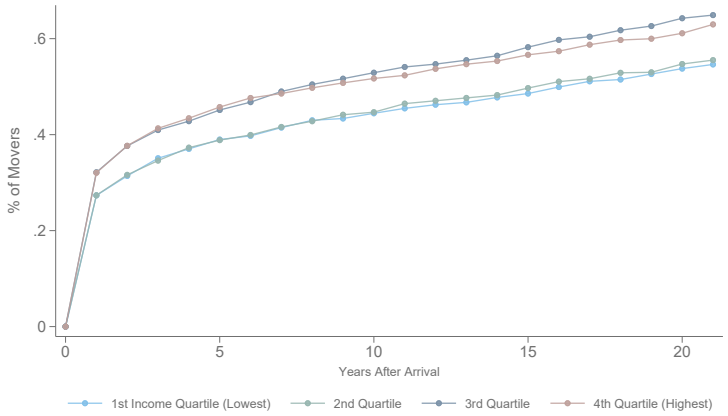
4 Assigned Neighborhood Quality and Adult Outcomes of Children

4.1 Sorting Patterns

We examine the mobility patterns of refugees from their initially assigned neighborhoods over time. Figure 1 shows that even after ten years, more than 50% remain in their original location. This persistence is consistent across different treatment levels, though refugees assigned to higher-quality locations exhibit greater mobility. More importantly, this highlights that the Danish Dispersal Policy operates as a randomized controlled trial with imperfect compliance. As a result, we interpret our coefficients as intention-to-treat (ITT) estimates.

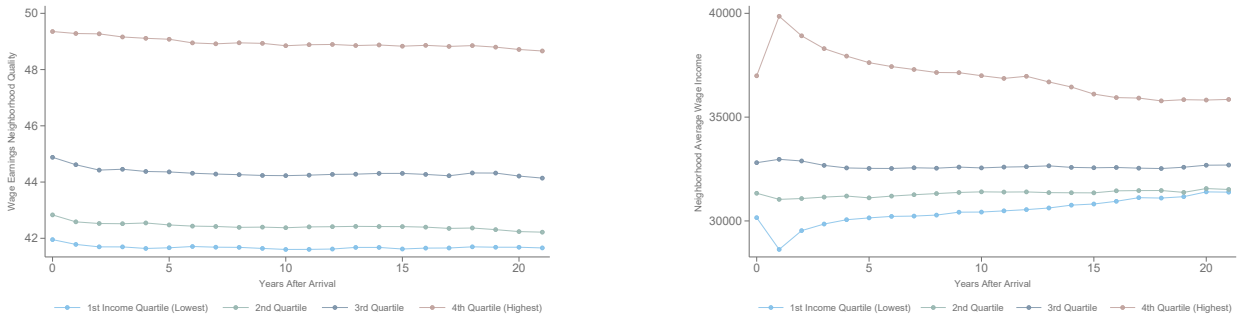
In addition, most studies on neighborhood effects rely on Moving to Opportunity (MTO), which randomly provided voucher subsidies to help disadvantaged families move to better neighborhoods. Nearly half of the families did not use them, leading to noncompliance and selection bias, making it difficult to identify neighborhood effects by simply comparing outcomes across different neighborhoods. Instead, the program measures the causal impact of offering vouchers by evaluating the difference in mean outcomes between families who received a voucher and those who did not (ITT). In contrast, DDP avoids self-selection into treatment, though noncompliance arose over time as individuals left neighborhoods. This allows for the identification of a more relevant policy parameter: the ITT of assigning families to better neighborhoods on later life outcomes

Figure 1: Neighborhood Departure Patterns by Initial Wage Neighborhood Quality of Assignment



Even among movers, dividing the population by treatment levels suggests that individuals, on average, relocate to neighborhoods of similar quality. This pattern holds for neighborhood value-added measures—assumed constant over 30 years—as well as for annually updated metrics like average income and education levels. Figure 2, panels (a) and (b), illustrate these trends.

Figure 2: Sorting of Individuals by Initial Wage Neighborhood Quality of Assignment



(a) Constant

(b) Annually Updated

4.2 Empirical Strategy

In this paper, we relate later life outcomes of children to the assigned neighborhood quality, through the following empirical specification:

$$y_{ikt} = \alpha + \beta w_{ikt-1} + \boldsymbol{\gamma'} \boldsymbol{x}_{it-1} + \varepsilon_{ikt} \tag{3}$$

where the variable y_{ikt} denotes the later life outcomes we presented in Section 3, for individual i, in municipality k in year t. Neighborhood quality is denoted as w_{ikt-1}, measured at the time of assignment, $t-1$. $\boldsymbol{x_{it-1}}$ denotes a vector of variables, known to the council and used at the time of assignment, including the age of the parents, country of origin, household size, and marital status.

Given the quasi-random allocation of refugees into neighborhoods, neighborhood quality at assignment is uncorrelated with ε_{ikt} in Equation (3), conditional on $\boldsymbol{x_{it-1}}$, the set of variables the council observed when assigning individuals. β can therefore be interpreted as an intent-to-treat (ITT) estimate of the effect of assignment to a better quality neighborhood on later life outcomes.

4.3 Results

We begin by presenting the ITT effects of neighborhood assignment on children's life outcomes in Panel A of Table 1. Column (1) reports the effect on pre-tax income of children at around age 30. There is a strong positive and statistically significant gradient of .63. In other words, assignment to a neighborhood where the mean income rank of children of permanent residents is 1 percentile higher (at a given level of parental income) increases child's income rank in adulthood by approximately .63 percentiles. Therefore, children of refugees placed in better quality neighborhoods pick up 63% of the difference in permanent residents' outcomes associated with the assigned neighborhood.

We find similar, albeit slightly more muted effects, on post-tax income of children. The coefficient on neighborhood quality here stands at .54, as shown in column (2) of Table 1. This speaks to the previous literature which stresses the importance of the tax system in

Table 1: Neighborhood Quality on Child Outcomes

	(1) Pre-Tax Income	(2) Post-Tax Income	(3) Employed	(4) Years of Educ.
Neighborhood Quality	0.630***	0.544***	0.006***	0.063***
	(0.095)	(0.100)	(0.001)	(0.009)
R-squared	0.066	0.051	0.048	0.115
N	7040	7040	6962	6467

Notes: This table shows results for our main specification which regresses an outcome, described in the column header, on our measure of neighborhood quality. We include dummies for household size, country of origin, parental age, and marital status, information known by the council at assignment, as well as year of assignment fixed effects. Standard errors corrected for clustering at the municipality-year level are reported in parentheses. The sample includes all individuals whose parents were randomly assigned by the dispersal policy. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Denmark for reducing inequality (see for instance Landersø and Heckman, 2017). Thus, although pre-tax income is increased by better neighborhoods, this effect is reduced through the tax and transfer system.

Finally, in columns (3) and (4), we respectively report the effect on employment and education. Children assigned to better neighborhoods also experience significant returns on the extensive margin of the labor market, with a .6 percentage point increase in employment probability. Not only are the economic outcomes positively impacted, we also find that being assigned to a better neighborhood further increases educational attainment by 0.063 years.

5 Discussion

To delve into the mechanisms behind our results, we run a mediation analysis.

5.1 Framework

We implement a simple mediation analysis for the impact of the initial neighborhood assignment on the long-run income of children of the refugees and whether the effects on children

are mediated through the impacts of neighborhood assignment on the income of parents. Let w denote the neighborhood income and m denote the mediator, i.e., the income of parents. Suppose y^c denotes adult income of children. $\boldsymbol{X}$ denotes a set of baseline covariates.

Then, the total effect of neighborhood quality on adult income is already obtained (and reported in Table 1), as follows:

$$E(y^c|w, \boldsymbol{X}) = \beta_0 + \beta_1 w + \beta_2 \boldsymbol{X}$$

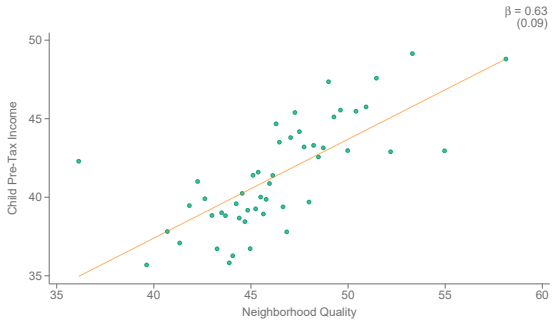
Our second regression includes the mediator as a regressor as follows:

$$E(y^c|w, m, \boldsymbol{X}) = \theta_0 + \theta_1 w + \theta_2 m + \theta_3 \boldsymbol{X}$$

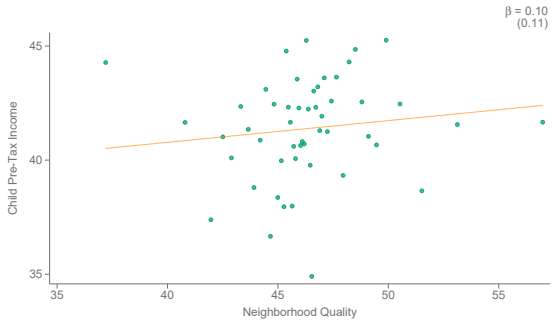
θ_1 shows the direct effect and $(\beta_1 - \theta_1)$ gives us the mediated or indirect effect. The impact of neighborhood assignment on parents is obtained as follows:

$$E(m|w, \boldsymbol{X}) = \gamma_0 + \gamma_1 w + \gamma_3 \boldsymbol{X}$$

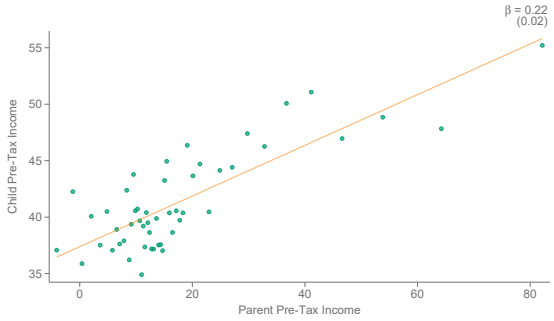
Figure 3: Mediation Analysis



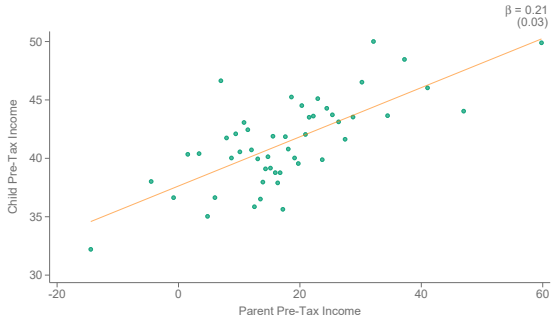
(a) Total Effect (β_1)



(b) Direct Effect (θ_1)



(c) Pre-Tax Income IGE



(d) Pre-Tax Income IGE, Controlling for Neighborhood Quality

Notes: Panel (a) presents the total effect of neighborhood quality on child pre-tax income. Panel (b) presents the direct effect, after controlling for parental income. Panel (c) depicts the intergenerational elasticity (IGE) between parent pre-tax income and child pre-tax income. Finally, panel (d) shows the same relationship, after controlling for assigned neighborhood quality.

Figure 3 reports results from our mediation analysis, where we first consider parental average gross income as a mediator. Panel (a) shows the total effect, which is a visual representation of the slope coefficient reported in Table 1. Panel (b) shows the direct effect. This is the relationship between neighborhood quality and child outcomes, after controlling for parental income. Strikingly, the slope reduces to .10 and becomes insignificant, suggesting that the mediated effect explains fully the effect of neighborhoods on outcomes for children.

Panel (c) of Figure 3 depicts the relationship between parental income and child income. To understand how neighborhoods affects this relationship, we show the same correlation controlling for assigned neighborhood quality, in panel (d). The slope coefficient barely

changes, indicating that the role of parental income on their offspring is unchanged by neighborhood quality.

Table 2: Neighborhood Quality on Parent Outcomes

	(1) Pre-Tax Income	(2) Post-Tax Income	(3) Employed	(4) Years of Educ.
Neighborhood Quality	2.544***	2.067***	0.032***	0.038**
	(0.139)	(0.124)	(0.002)	(0.015)
R-squared	0.463	0.318	0.197	0.050
N	7062	7050	7062	3481

Notes: This table shows results for our main specification, focusing on parental outcomes. Each columns shows estimates from a regression of an outcome, described in the column header, on our measure of neighborhood quality. We include dummies for household size, country of origin, parental age, and marital status, information known by the council at assignment, as well as year of assignment fixed effects. Standard errors corrected for clustering at the municipality-year level are reported in parentheses. The sample includes all individuals whose parents were randomly assigned by the dispersal policy. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Finally, Table 2 shows the effect of neighborhood quality at assignment on the mediator. The effect of neighborhood placement on parental income is of a much larger magnitude than the effect on income of the child. Assignment to a neighborhood where the mean income rank of children of permanent residents is 1 percentile higher (at a given level of parental income) increases parental income rank by approximately 2.5 percentiles. Similarly, the effects on parental employment and education are also stronger than for children, respectively standing at 0.032 and 0.038.

Overall, these findings provide evidence that the first generation of refugees greatly benefits from being placed in higher quality neighborhoods, with positive returns on wages, employment status as well as educational attainment.[5] This then fully explains the impact of assigned neighborhood quality on the next generation, with little remaining variation in the outcomes of children explained by neighborhoods themselves.

[5]Appendix C reports findings from the mediation analysis for post-tax income, employment status and educational attainment.

6 Sensitivity Analysis

As seen above, one natural parameter of interest is the *average direct effect* (ADE) of treatment:

$$ADE(d) \equiv \mathbb{E}[Y_i(M_i(d), 1) - Y_i(M_i(d), 0)]$$

Of separate interest is the effect of variation in the mediator due to treatment but holding the direct contribution of treatment itself fixed. More specifically, one can define the *average indirect effect* (AIE) of treatment as:

$$AIE(d) \equiv \mathbb{E}[Y_i(M_i(1), d) - Y_i(M_i(0), d)]$$

These two types of effects, the ADE and AIE, summarize the role of the direct mechanism as well as the indirect mechanism, a decomposition which may be important in policymaking as well as theory testing. For instance, in the case of complete mediation the ADE is zero and the AIE contains the complete effect, or the ATE. Which is what our previous mediation analysis suggests. Ignoring the presence of mediating variables and alternative mechanisms in the causal path from our treatment to our outcome the typical ATE recovers:

$$ATE = \mathbb{E}[Y_i(M_i(1), 1) - Y_i(M_i(0), 0)]$$

$$= \mathbb{E}[Y_i(M_i(1), 1) - Y_i(M_i(1), 0)] + \mathbb{E}[Y_i(M_i(1), 0) - Y_i(M_i(0), 0)]$$

$$= ADE(1) + AIE(0)$$

By symmetry,

$$ATE = AIE(1) + ADE(0)$$

This shows that the shows that the ATE is a parameter that is a mix of direct and indirect effects. Furthermore, Imai et al. (2010) argue that the ACME or ADE is not identified in

the standard design, where the treatment is randomized or ignorable conditional on pre-treatment covariates, and the mediator/outcome variables are measured. This is to the simple reason that a potential outcome required for the calculation of indirect and direct effects is never observed. Imai et al. (2010) prove that an additional assumption is therefore required for identification: sequential ignorability (SI). This assumption can be written as:

Assumption 1 (Sequential Ignorability) (Imai et al. (2010))

$$Y_i(d', m), M_i(d) \perp D_i \mid X_i = x, \quad Y_i(d', m) \perp M_i(d) \mid D_i = d, X_i = x,$$

where X_i is a vector of the observed pre-treatment confounders, $0 < Pr(D_i = d \mid X_i = x)$, and $0 < p(M_i = m \mid D_i = d, X_i = x)$ for $d = 0, 1$, and all x and m in the support of X_i and M_i, respectively.

The first step of the sequence of assumptions, is the well known exogeneity condition in econometrics. In the Danish Dispersal policy, the assumption is expected to hold since treatment is randomized. The second step assumes that, given the actual treatment status and pre-treatment confounders, the observed mediator is ignorable.

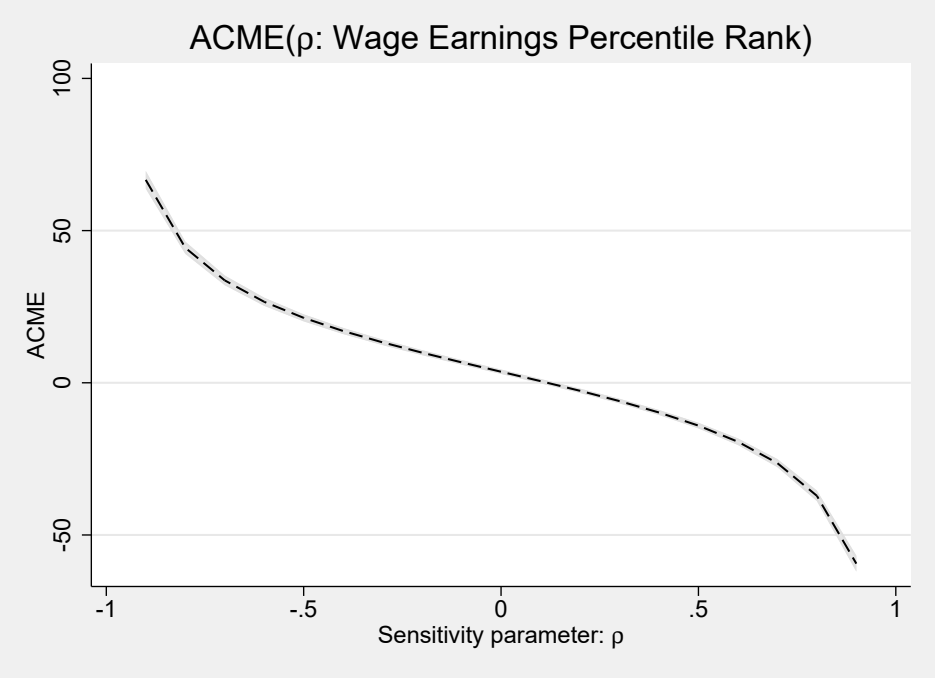
Imai, Keele, and Yamamoto (2010) result have vast implications for the Linear Structural Equation model. For instance, they show that the Baron and Kenny's (Baron and Kenny, 1986) interpretation is valid if the sequential ignorability holds. It is important to remember that Figure 3 is nothing more than a representation of Baron and Kenny. Hence, the arguments follow through if this assumption holds in practice. Sadly, this assumption cannot be tested directly.

6.1 Simulation

The Sequential Ignorability assumption cannot be tested with the data; therefore, a sensitivity analysis is necessary to assess the robustness of the results to violations of this assumption.

We implement the parametric algorithm described in Imai et al. (2010). For this, we categorize the treatment into a binary variable, classifying refugees into either low added-value neighborhoods or high added-value neighborhoods. The sensitivity analysis indicates that the results are highly sensitive to even small violations of the assumption (see Figure 4).

Figure 4: Sensitivity Analysis Simulation



Notes: The treatment has been dummy-coded into high and low-income quality. ρ represents the correlation between ε_{i1} and ε_{i2} in equations 4 and 5.

Following Hicks and Tingley (2011) the mediation analysis in section 5 can be described with the following two equations,

$$M_i = \beta_0 + \beta_1 D_i + \xi_1^\top X_i + \varepsilon_{i1}, \tag{4}$$

$$Y_i = \theta_0 + \theta_1 D_i + \theta_2 M_i + \xi_2^\top X_i + \varepsilon_{i2}. \tag{5}$$

A violation of the Sequential Ignorability (SI) assumption leads to a correlation between ε_{i1} and ε_{i2}, which is denote by ρ in Figure 4. Under SI, ρ should be equal to zero. Using this

theory, Figure 4 show that for the point estimate of the ADE to be 0 the correlation between ε_{i1} and ε_{i2} must be approximately 0.10. If this is true, the mediation effect will then be given by $\beta_1\theta_2$. Or, similarly, θ_1 shows the direct effect while $\beta_1 - \theta_1$ gives us the mediated or indirect effect.

7 Testing for Mechanisms: A simple case

Much of the literature on mediation analysis identifies the effect of M on Y (conditional on D) by assuming conditional unconfoundedness for M as discussed in the previous section. Alternative strategies include using an instrument for M (Frölich and Huber, 2017), a Difference-in-Differences (DiD) approach (Deuchert et al., 2019), and, when feasible, double randomization techniques such as paired and cross-over designs in experimental settings.

Now, we follow Kwon and Roth (2024), which provides a methodology to explore mechanisms without imposing strong assumptions to identify the effect of M on Y (conditional on D), unlike previous methods that require stringent assumptions. In part, they can use less assumptions because they try to answer an easier question: is the effect of D on Y fully explained through its effect on M? Kwon and Roth (2024) define this as the sharp null of full mediation, which will be our object of interest moving forward.

To study mechanisms, suppose we observe $(Y, M, D) = (Y(D, M(D)), M(D), D)$ where D is the binary treatment of interest (assigned to a high-income neighborhood) and M is a potential mediator (Parental Employment Status). For simplicity, we assume that D and M is binary. The analysis in Kwon and Roth (2024) requires:

- Conditional Random assignment : $D|X \perp Y(\cdot,\cdot), M(\cdot)$ and $0 < \mathbb{P}(D = 1) < 1$
- Monotonicity in D: $M(1) \geq M(0)$ almost surely

Random assignment is achieved by construction through the Danish Dispersal Policy. Mono-

tonicity implies that being assigned to a high-income neighborhood increases the likelihood of parents being employed.

One of the object of study is the sharp null of full mediation [6,7] which is satisfied if and only if, $Y(d,m) = Y(m)(\text{ a.s. })\forall d, m$. Using the fact that under the sharp null of full mediation $Y(1,1) = Y(0,1)$ one can show that the following identifiable densities have to hold:

$$\mathbb{P}(y \in Y, M = \text{Unemployed}|D = \text{Low Income}) \geq \mathbb{P}(y \in Y, M = \text{Unemployed}|D = \text{High Income}) \quad (6)$$

$$\mathbb{P}(y \in Y, M = \text{Employed}|D = \text{High Income}) \geq \mathbb{P}(y \in Y, M = \text{Employed}|D = \text{Low Income}) \quad (7)$$

The results in Kitagawa (2015) imply that these testable implications are sharp[8] but due to imperfect compliance in the Dispersal Policy, it is uncertain whether the property will hold. Nonetheless, the methodology in Kwon and Roth (2024) follows through by setting $D = Z$, based on the assumption that if Z is a valid instrument for the effect of D on Y, and if the sharp null hypothesis holds, then Z affects Y only through M. Robustness checks can also explore relaxing the monotonicity assumption. Kwon and Roth (2024) provide a framework for this.

Accordingly, in this standard setting, following Kitagawa (2015), I utilize a variance-weighted Kolmogorov-Smirnov (KS) statistic and derive a p-value of 0.91. Hence, there is no evidence to reject the sharp null of full mediation. This provides additional support for the conclusion that the mediated effect fully explains the impact of neighborhoods on children's outcomes. One concern is that the Kitagawa test has been criticized for being underpowered, and in this setting, we cannot guarantee sharpness, although Kwon and Roth (2024) conjecture that it will remain sharp.

[6]Can the effect of D on Y be explained fully by a candidate mechanism (or set of mechanisms) M? Has the usual interpretations of a null hypothesis test. If the sharp null is satisfied, then M is the only mechanism that matters. If we reject the sharp null, then there is evidence that mechanisms other than M are having an effect.

[7]If the sharp null of full mediation is satisfied, then D is a valid instrument for the LATE of M on Y. Then, the instrument only affects Y through M. In case the null is not satisfied, there would be a direct effect from D to Y, invalidating the instrument.

[8]Equivalent to testing for the exclusion restriction for the validity of an instrumental variable.

8 Conclusion

We exploit quasi-random variation in the assigned neighborhood income among the refugee population in Denmark who were subject to the Danish dispersal policy. We find that a higher neighborhood quality is significantly associated with higher income for both parents and children (in their adulthood) and with children's long-run educational attainment. Children of refugees placed in better neighborhoods pick up about 63% of the difference in permanent residents' outcomes associated with the assigned neighborhood. We find that the impact of assigned neighborhood quality is significantly larger for parents' market income compared to children's market income. Strikingly, our findings show that the effect of neighborhoods on the later life outcomes of children is fully mediated by their parental income. We argue that these findings are sensitive to violations of the sequential ignorability assumption. To address this, we introduce a novel approach in the intergenerational mobility literature for testing indirect effects, leveraging the state-of-the-art methodology of Kwon and Roth (2024). Specifically, we test the sharp null of full mediation using a variance-weighted Kolmogorov-Smirnov (KS) statistic and obtain a p-value of 0.91. This result suggests that the indirect effect of the neighborhood—operating through the parent to the child—is the sole mechanism driving the ITT estimates.

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A Summary Statistics

Table A1: Summary Statistics: Child Characteristics

	Mean	Median	SD	N
College Completion	0.330	0.000	(0.470)	7,514
Years of Education	12.465	12.000	(2.730)	6,882
Wage earnings	41.176	32.000	(28.929)	7,376
Disposable Income	41.261	35.000	(30.398)	7,376
Total Gross income	40.863	33.000	(30.482)	7,376
Disposable (net of tax) income	41.264	34.000	(30.599)	7,376
Gross income excl. transfers	39.970	32.000	(30.212)	7,376
Employment Status	0.629	1.000	(0.436)	7,400
Year of birth	1,988.649	1,989.000	(1.704)	7,514
Age at arrival	4.928	5.000	(3.245)	2,782
Household Size	5.154	5.000	(2.052)	2,782

Table A2: Summary Statistics: Parent Characteristics

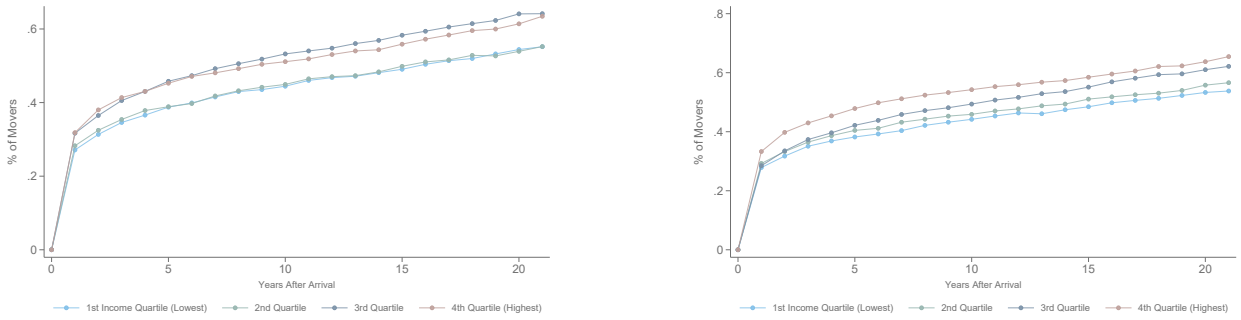
	Mean	Median	SD	N
Years of Education of Mother	11.270	12.000	(3.165)	3,570
Years of Education of Father	12.213	13.000	(3.186)	3,147
Parent Wage earnings	7,953.149	21.500	(13,912.935)	7,355
Parent Disposable Income	19,391.517	18,245.336	(6,978.566)	7,355
Parent Total Gross income	25,892.120	23,991.871	(10,438.040)	7,355
Parent Disposable (net of tax) income	20,298.133	19,020.207	(7,805.311)	7,343
Parent Gross income excl. transfers	9,836.042	3,100.581	(14,943.365)	7,343
Employment Status of Mother	0.219	0.000	(0.413)	7,514
Employment Status of Father	0.261	0.000	(0.439)	7,514

Table A3: Summary Statistics: Neighborhood Characteristics

	Mean	Median	SD	N
Employment Rate	77.503	77.992	(5.705)	5,240
Avg. Gross Income Excl. Transfers	37,507.243	36,099.781	(7,802.759)	5,240
Average Gross Income	47,219.834	46,251.223	(7,159.073)	5,240
Average Wage Income	30,943.943	29,961.603	(6,749.667)	5,240
Average Net Income	33,580.938	33,065.475	(4,998.698)	5,240
Avg. Years of Schooling	11.550	11.477	(0.546)	5,240
Proportion of Married HH	0.576	0.580	(0.045)	5,240
Proportion of Non-Westerners	0.017	0.011	(0.022)	5,240
Proportion of Immigrants	0.029	0.023	(0.020)	5,240
Proportion of Foreigners	0.034	0.026	(0.028)	5,240
Average Age	38.322	38.293	(2.229)	5,240
Porportion of Cohabitating HH	0.523	0.525	(0.025)	5,240
Proportion of Iraquis	0.001	0.000	(0.002)	5,240
Proportion of Iranians	0.001	0.000	(0.001)	5,240
Proportion of Vietnamese	0.001	0.000	(0.002)	5,240
Proportion of Sri Lankans	0.001	0.000	(0.002)	5,240
Proportion of Lebanese	0.001	0.000	(0.002)	5,240
Proportion of Ethiopians	0.000	0.000	(0.000)	5,240
Proportion of Afghans	0.000	0.000	(0.001)	5,240
Proportion of Somalis	0.001	0.000	(0.001)	5,240

B Sorting Patterns

Figure B1: Neighborhood Departure Patterns by Initial Neighborhood Quality of Assignment



(a) Gross Income Exc. Transfers

(b) Dis. Net of Tax Income

Figure B2: Sorting of Individuals by Initial Neighborhood Quality of Assignment

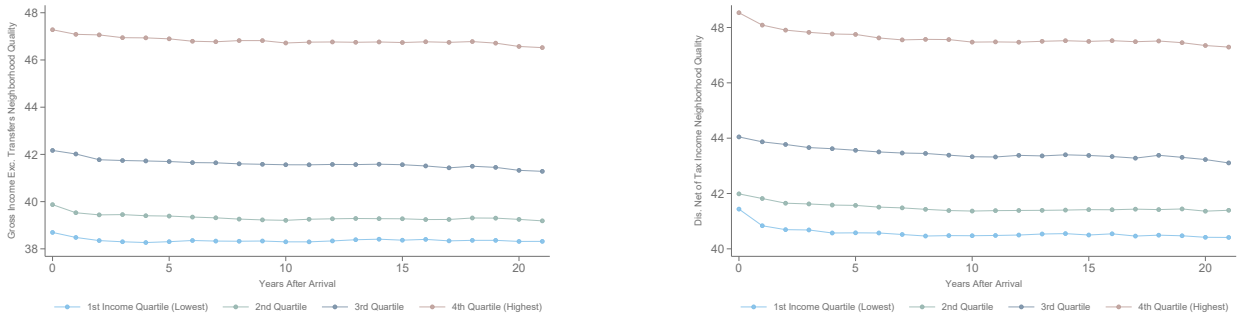
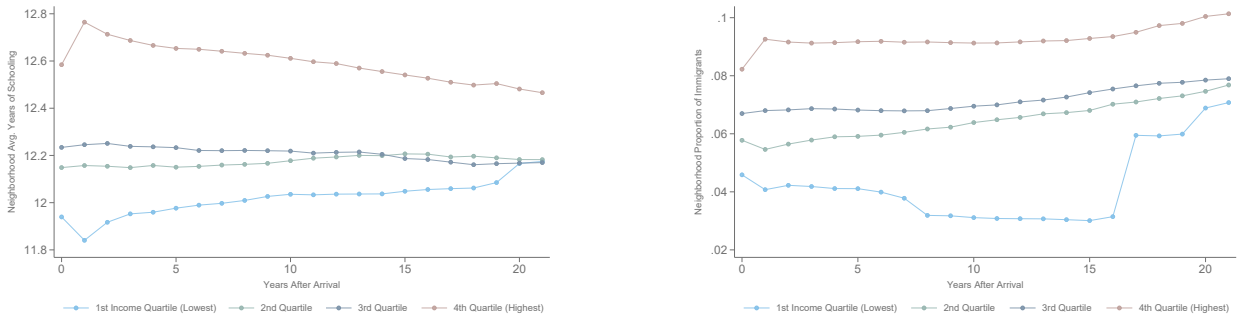
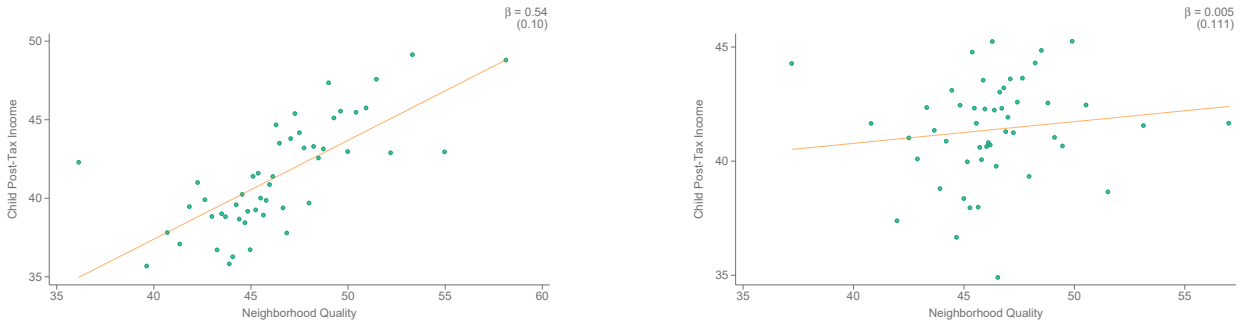


Figure B3: Sorting of Individuals by Initial Non-Monetary Measures of Neighborhood Quality of Assignment



C Mediation Analysis: Post-Tax Income, Employment and Educational Attainment

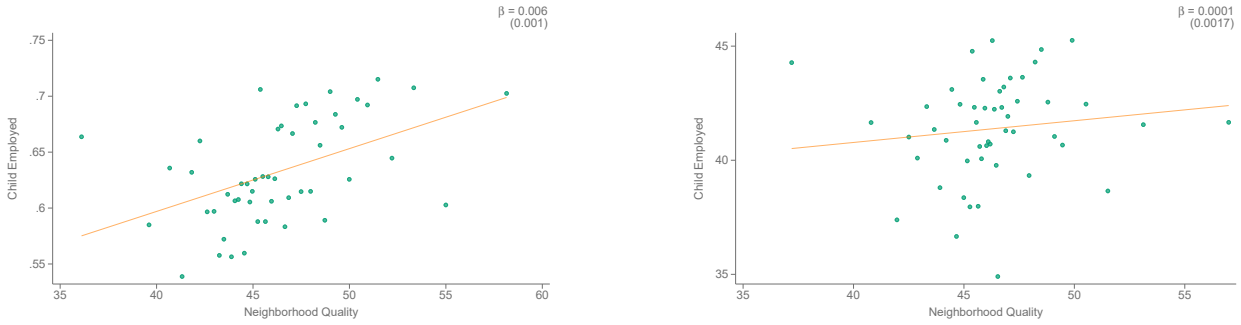
Figure B4: Mediation Analysis: Post-Tax Income



(a) Total Effect (β_1) (b) Direct Effect (θ_1)

Notes: Panel (a) presents the total effect of neighborhood quality on child post-tax income. Panel (b) presents the direct effect, after controlling for parental income.

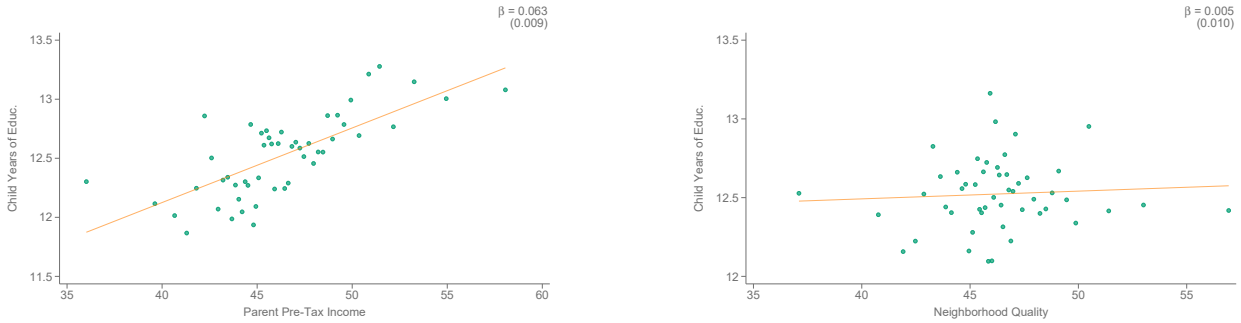
Figure B5: Mediation Analysis: Employment Status



(a) Total Effect (β_1) (b) Direct Effect (θ_1)

Notes: Panel (a) presents the total effect of neighborhood quality on child employment status. Panel (b) presents the direct effect, after controlling for parental income.

Figure B6: Mediation Analysis: Educational Attainment

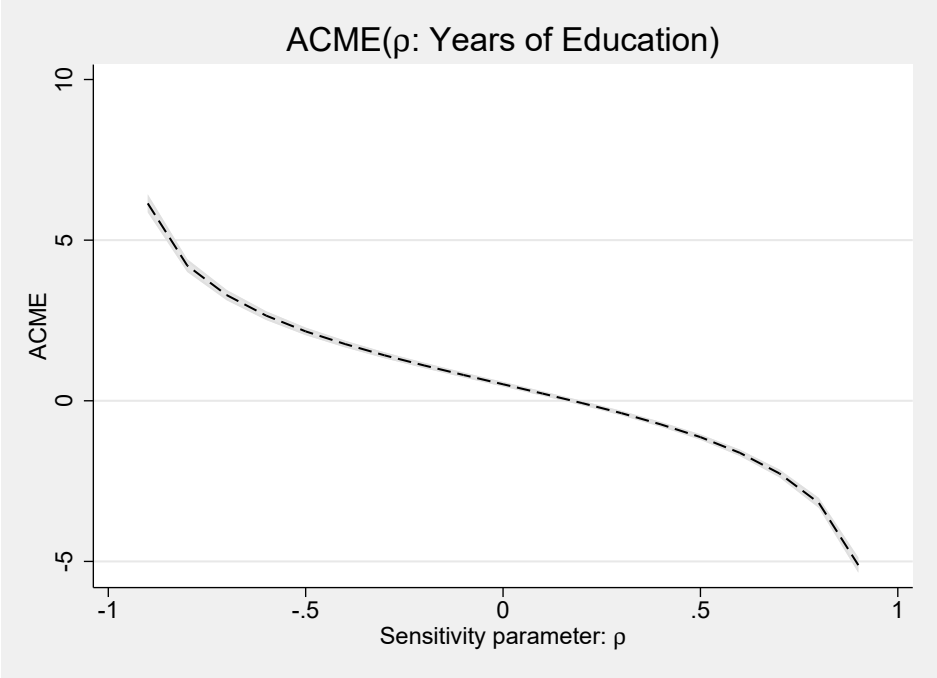


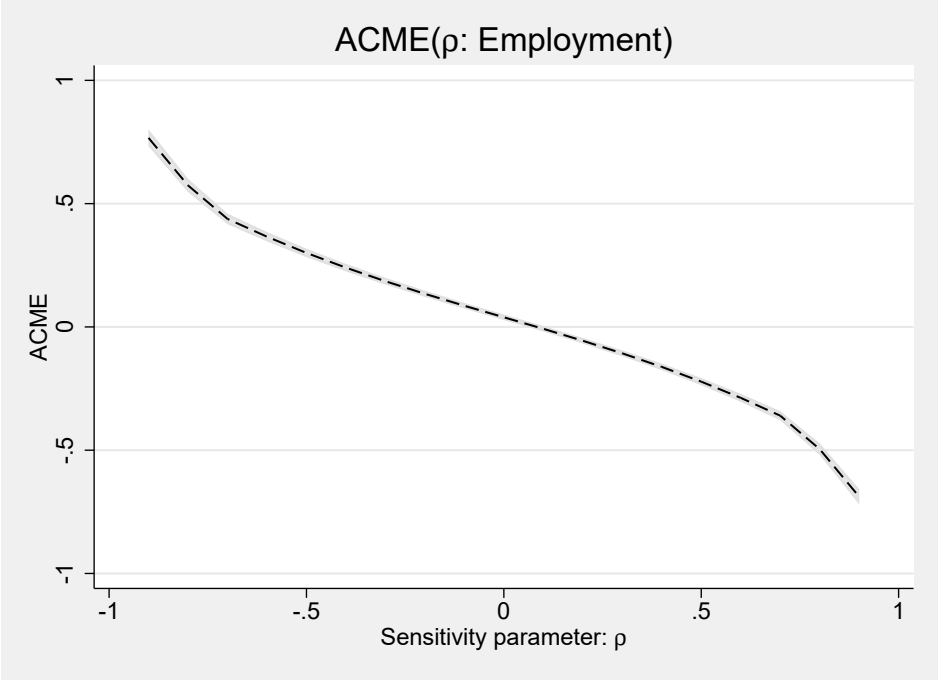
(a) Total Effect (β_1)

(b) Direct Effect (θ_1)

Notes: Panel (a) presents the total effect of neighborhood quality on child educational attainment. Panel (b) presents the direct effect, after controlling for parental income.

D Sensitivity Analysis




ACME(ρ: Employment)
ACME
1
.5
0
-.5
-1
-1
-.5
0
.5
1
Sensitivity parameter: ρ