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The geography of intergenerational mobility in Norway: Labor market diversity, career opportunities, and gender

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Abstract

We investigate intergenerational income mobility across labor market regions in Norway, looking at gender differences in response to industrial diversity. Our identification strategy exploits variation in the timing of regional migration, measured over the age spans 6–19 and 13–19 years. We make extensive use of fixed effects so that each region only affects adult outcomes, measured as income rank, through differences in exposure time. Our results reveal significantly larger exposure effects among daughters than among sons. The difference is particularly large when we contrast sons to fathers and daughters to mothers, but it is also apparent when we place sons and daughters, respectively, fathers and mothers, in the same distribution. We further find that industrial diversity, and thus the range of job opportunities, matters most during the teenage years. The patterns are, to some extent, detectible on maps, for example, with better mobility opportunities for men in coastal regions based on maritime and/or marine specialization. We conclude with assessments, a recommendation for regional policy, and some international considerations.

KEYWORDS

career opportunities, gender, intergenerational income mobility, Norway, regions

1 | INTRODUCTION

Numerous recent studies find that intergenerational income mobility varies considerably within countries. The ground-breaking work in this respect is Chetty et al.'s analysis (2014) of intergenerational mobility across commuting zones in the United States, which describes lack of upward mobility as a local problem. Subsequent studies in Sweden (Heidrich, 2017); Denmark (Eriksen & Munk, 2020); Australia (Deutscher, 2020); Canada (Corak, 2020); Italy (Acciari et al., 2022); Brazil (Britto et al., 2022); Mexico (Delajara et al., 2022); the United Kingdom (Rohenkohl, 2023); and France (Kenedi & Sirugue, 2023) corroborate the relevance of a subnational perspective, although patterns in most of these countries pale in comparison to the United States.

Our aim in this paper is to examine the sketched theme, that is, subnational variation in intergenerational income mobility, through a context-sensitive lens. While we pay attention to previous research, we do not follow the beaten path in all respects. More precisely, we take into account significant national and regional features that bear on the case at hand. Three features are specifically salient. First, we study a nation, Norway, that pursues a policy of dispersed regional development. This policy has persisted since the end of World War II and sets Norway apart from the rest of Scandinavia (Lindqvist, 2010). Second, Norway is by any standard a high-mobility country, with substantial upward and downward social movement (Jäntti et al., 2006; Modalsli, 2017). Third, Norway is marked by continuous urbanization and a shifting urban-regional hierarchy. Much of the growth since the millennium shift has taken place in Oslo and other high-order metropolitan areas (Ministry of Local Government and Modernization, 2020). There is thus a contradictory pattern whereby politicians support peripheral labor markets, and, at the same time, people "vote with their feet" and migrate to larger cities. Several recent studies document that such migration, but also opposite flows and flows from city to city, has a profound influence on patterns of intergenerational mobility, particularly for low-income families. Parents who relocate from poorer to better environments improve the prospect of upward mobility for their children, whether it is due to school quality, less poverty, lower income inequality, lower crime rates, better health services, lower commute times, linking social capital, and/or stronger labor markets (Acciari et al., 2022; Borck & Wrede, 2018; Britto et al., 2022; Chetty & Hendren, 2018a, 2018b; Deutscher, 2020). Labor market characteristics are, as indicated above, particularly interesting from a Norwegian perspective. The rapid growth of larger cities must be seen in the context of thinly populated regions, which in turn reflects a topography with mountains, fjords, valleys, and plateaus. Many of these smaller regions may provide well-paid work in male-dominated industries such as fisheries, aquaculture, petroleum activities, and high-tech manufacturing, added by low- or medium-paid work in education, public services, transportation, retail, restaurant services, and low-skilled manufacturing (Ministry of Local Government and Modernization, 2020). This further suggests that smaller regions tend to offer work that are "out of sync" with increasing education and labor force participation among women (Ahrsjö et al., 2023; Dahlström, 1996; Ellingsæter & Rønsen, 1996).

With these features in mind, we seek to answer the following questions: First, is the regional pattern of intergenerational income mobility similar for sons and daughters? Second, is the association between labor market diversity during childhood and income in adulthood similar for sons and daughters?

We examine influences across 133 labor market regions (travel-to-work areas) and reach back to the 1980s and 90s via a longitudinal sample that consists of individuals who were born between 1974 and 1978. For this sample, we trace impacts from the period between ages 6 and 19, added by separate analyses for the teenage period, with outcomes measured between ages 36 and 40. We address the challenge posed by endogenous location choices through a design that exploits variation in the timing of regional migration, assuming that labor market influences unfold over time. The underlying idea is that children in migrating families will adhere more and more to peer influences and role models in the destination region. Our inspiration in this respect comes from Chetty and Hendren's exploration of exposure effects in US commuting zones (2018a, 2018b), but contrary to these and some similar studies (Britto et al., 2022;

Deutscher, 2020), our departure is not mobility gaps as such. What we trace is the plausibly causal impact of industrial structure.

Theory offers several approaches and measurements in the study of intergenerational mobility. The key topic of our research is income rank mobility, allowing upward as well as downward mobility. We start with a simple version of this concept, regressing child income on parent income (the "rank–rank slope"), estimated as a mean at the regional level. We next turn to families who migrated, looking at the duration of exposure to different levels of industrial diversity. We conduct all analyses for each gender, with extensive control for parent rank, family type, and co-varying regional characteristics.

Several concerns lie behind our choice of mobility measure. First, using rank transformation is highly suitable in a comparison of population subgroups (Deutscher & Mazumder, 2023). Second, studying a small country with small labor markets, we cannot choose among all available measures: some measures, for example, those that pinpoint a small section of the population, will likely produce unstable and inaccurate results. To give an example, if we wanted to study upward mobility among children with poor backgrounds, we could hardly maintain the chosen design. With such a procedure, there would not be enough migrating poor families to gain reliable estimates.[1] Third, our thematic focus suggests a broad rather than a narrow approach. We are interested in gender differences whether these emerge at the bottom, the middle, or the top of the income distribution. What is critical, on the other hand, is our ability to neutralize noise that emerges from increasing labor force participation and entrance into more skilled work among women. These secular trends may have affected the intergenerational association in income (Ahrsjö et al., 2023; Deutscher & Mazumder, 2023). We therefore conduct most analyses in two versions—one that contrasts sons and daughters versus parents, and one that contrasts sons versus fathers and daughters versus mothers.

A second problem is that parents who move may have unobserved characteristics that influence the association between labor market diversity and child rank. It is likely, for instance, that families with high ambitions on behalf of their child will move early rather than later (Chetty & Hendren, 2018a, 2018b). Such bias (differences in unobservables) consists, in our case, of two parts. First, all our estimates, for sons and daughters alike, are likely inflated if migrating residents have higher skills or motivation than non-migrants. Second, our analysis of gender differences is less reliable if parents to boys behave differently than parents to girls. We address these challenges by conducting four tests. The first one assesses adulthood outcomes among children who remained in the same region between ages 6 and 19, assuming that locally and non-locally raised children are subjected to a similar type of socialization and pressure. The second test contrasts counterfactual outcomes among stayers in the origin and destination regions. That is, we estimate how quickly sons and daughters in mover families adapt to the prospects of peers in their new location. The third test controls for observable family characteristics that are associated with both regional migration and intergenerational mobility. A fourth test addresses the risk of bias by looking at migration in early adulthood. Our perspective suggests that exposure effects emerge during childhood, hence we do not expect to find similar patterns among those who move in a post-adolescence stage of life.

In brief, our study adds to the extant literature in two ways. First, we demonstrate gender differences in the impact of industrial diversity on intergenerational mobility. Some other studies have found correlations between industrial structure and upward mobility, measured at the regional level. Yet others have identified gender differences in the impact of specific industries, notably resource extraction. However, to the best of our knowledge, our study is the first one to identify differences in men's and women's responses to the multiplicity of job opportunities. Such insights and the underlying framework hold relevance that stretches beyond the Norwegian context, given the existence of rural gender gaps in many countries. Second, we offer

[1]Even US research faces a problem with unstable estimates in smaller regions. Chetty and Hendren (2018a) therefore restrict the analysis to regions with more than 250,000 inhabitants. Similar restrictions in the Norwegian context would effectively remove all but the largest metropolitan regions.

estimates of intergenerational income dynamics at a lower geographical level than previous Norwegian research.[2] This is a step forward in a country with physically confined labor markets.

We conduct the analysis in four steps. First, we explore geographical patterns of upward mobility for each gender. Next, we consider gender differences in the impact of labor market diversity/specialization. Our third step is to conduct sensitivity tests of the exposure design. Step four includes discussion and consideration of policy implications.

2 | BACKGROUND

From an individual's perspective, living in a larger city will likely provide better opportunities for upward social mobility. Larger cities generate agglomeration economies that reduce operating costs for producers, facilitate learning and innovation, and improve the matching between workers and firms. These advantages for productive life accrue in the end to labor market participants, although with variable effects across different groups (Combes & Gobillon, 2015). Importantly, while much of the extant literature deals with metropolitan areas, there is no reason to assume that beneficial agglomeration economies only occur in these places, or that innovation and economic growth are completely dependent on agglomeration economies (Fitjar & Rodríguez-Pose, 2020). A recent study of 700 commuting zones in the United States argues that labor market policies and opportunities drive regional differences in income transmissions (Rothstein, 2019). Another study comparing intergenerational income mobility in regional subdivisions of the United States and Canada takes the argument a bit further by pointing at labor market differences in the return to skills (Connolly et al., 2019). Still, another study focuses on changes in labor market structures and concludes as follows: "The overall reshuffling of the geography of jobs and incomes in the American economy has generated substantial change in the landscape of intergenerational mobility" (Connor & Storper, 2020, p. 30315). Both the composition of industries, the strength of the local economy, and the quality of jobs changed considerably, sometimes in puzzling ways. Thus, while manufacturing industries experienced a large loss of jobs at the national level, they nevertheless maintained an opportunity-leveraging capacity in several regions (Connor & Storper, 2020, p. 30315). A similar line of argument can be drawn for Norway. The share of manufacturing employment declined by more than 50% between 1970 and 2000, but some regions experienced growth in specialized industrial activities. The discovery of oil and gas in the North Sea led to a fast development of supplier industries, which formed a highly competitive cluster (Reve et al., 2015). Given the time span, there is no extensive research on the social mobility impacts of the changes. One study, however, demonstrates that upward rank mobility differs between regions with variable degrees of oil-related activities. Regions that were strongly affected by the "oil shock" in the early 1970s provided better opportunities for upward mobility both in extraction, construction, and attached industries (Bütikofer et al., 2022).

Common to several studies is the observation that labor market structures interact with parenting practices, family structures, and female labor force participation (Acciari et al., 2022; Connolly et al., 2019; Corak, 2020; Rothstein, 2019). This further implies that traditional studies of father–son links may produce different patterns across space and time than studies that incorporate both genders (for evidence at the national level, see Ahrsjö et al., 2023). Beyond that, one may also need to expand and differentiate the theoretical scope. Given the complexity of family environments, one cannot easily explain intergenerational mobility through a lens that collapses all skills into one entity and all experiences into a single period in a single location (Mogstad & Torsvik, 2023).[3]

[2]Some previous Norwegian studies include a subnational dimension. Two of them (Modalsli, 2017 and Bütikofer et al., 2022) employ clustered geographical categories, whereas one (Bratberg et al, 2017) divides the country into four areas. A fourth study (Hoen et al., 2022) investigates how immigration affects natives' labor-market outcomes in 46 regions.

[3]Both the classic Becker-Thomes model and many of its extensions consider a single child investment good, with no life-cycle variation. This and other assumptions are contradicted by empirical research (Mogstad & Torsvik, 2023).

The new wave of subnational mobility research appears to be moving in the direction that Mogstad and Torsvik (2023) recommend. More and more studies call attention to multiple periods of childhood, multiple skills, and more differentiated forms of parental influence. For our purpose, there is nevertheless limited scholarship to build on. Rothstein (2019) splits income transmissions by gender and observes that regional variation in spousal earnings contributes significantly to differences in upward mobility. His conclusion, in consequence, is that further investigation into the determinants of local intergenerational mobility should scrutinize labor market opportunities and outcomes. Recent Norwegian research has done exactly that. Bütikofer et al. (2022) find, as noted that employment opportunities in petroleum-relevant occupations increased the prospect of upward mobility for labor market entrants in the 1970s. This advantage, however, was seen only for men. Women who spent their childhood in the same regions obtained no mobility gain at all from the emergence of well-paid jobs.

Our perspective in this study is that high-oil regions belong to a broader category of highly specialized regions. At the opposite end of the continuum are regions with a rich blend of industries, technologies, and skills. We further assume that industrial diversity provides a more beneficial context for women than for men. Several studies show that women in highly specialized labor markets face social norms that prevent them for entering the dominant industries (Dahlström, 1996; Fuchs et al., 2021; Hirsch et al., 2013). Women may also gravitate toward industries, occupations, and places because they aspire for "satisfying careers rather than just jobs" (Goldin & Mitchell (2017, p. 181). By implication: women may obtain specific benefits from diverse agglomeration economies, either because these economies privilege skills that are common among women (Bacolod, 2017; Bacolod et al., 2009) or because the density of job opportunities reduces the costs of adjustment after maternal leave or other long-term absences (Fuchs et al., 2021; Phimister, 2005). Men, for their part, may be stuck in industries and environments that provide good pay for manual skills. Returning to the Norwegian case, Bütikofer et al. (2022) show that men in high-oil regions adapted to an unusual demand for vocationally trained workers, which raised the opportunity cost of higher education. Even women were affected by the cost structure but to a far lesser degree. For men in high-oil regions, there was virtually no intergenerational mobility in terms of education (Bütikofer et al., 2022).

An attached argument is that the duration of exposure to specific environments affects individual outcomes. It matters greatly whether children are exposed to low- or high-opportunity areas over a longer or shorter time (Chetty & Hendren, 2018a, 2018b; Deutscher, 2020; Galster, 2011; Wodtke, 2013). We therefore expect to find different longitudinal patterns for sons and daughters. The impact of long-term exposure to high industrial diversity should increase more for daughters. Beyond that, we cannot conjecture much. We have no basis for anticipating specific details, for example, regarding gender differences in the functional form of long-term associations.

Finally, we also assume that expectations and ambitions are conveyed to children through peer influences, social networks, and adult role models. We are unable to separate properly between various transmission channels, but we rely primarily on a developmental perspective. More exactly, we build on the notion that opportunities that people encounter in everyday life impinge on local social interactions. An equivalent if not identical premise underlies several recent studies, particularly Deutscher's examination (2020) of exposure to place in the Australian setting. Deutscher concludes that regional location matters most during adolescence; he also points at peer pressure and peer-group affiliation as dominating mechanisms.

3 | DATA, ANALYTICAL STRATEGY, AND SUMMARY STATISTICS

3.1 | Data and definitions

We employ longitudinal data that are derived from numerous administrative registers, including the Norwegian population register, provided by Statistics Norway. The gross sample consists of 238,860 individuals who fulfill four

criteria: (i) born in Norway between 1974 and 1978, (ii) residing in Norway throughout the age spans from 1–20 to 36–40, (iii) parents born between 1931 and 1968, and (iv) at least one parent residing in Norway throughout the age span 36–40.[4] We assign children to labor market between ages 6 and 19, which corresponds to education entitlements in Norway. Our motivation for this choice is twofold: first, we want to capture school-based peer effects (see Wodtke, 2013); second 20 years, or just below that, is a breaking-point for nest-leaving in Norway (Dommermuth, 2009).[5] Altogether, 87.6% of the gross sample stayed in the same region through all 14 years; 8.2% moved across region boundaries once; and 4.2% shifted region twice or more. We employ the middle subgroup in the baseline analysis and the first one in two validation tests. A larger part of families who moved once, 63%, had teenagers. We conduct separate analyses for this group, given Deutscher's observations from Australia.

The variables in our analysis are parent income, child income, birth cohort/age, gender, parents and children's civil status (coupled family), parent education, labor market location, industrial diversity, and duration of exposure/settlement, organized as an individual-level panel. Income for both generations is defined as individual, pensionable income, which includes pretax wages, pretax self-employment income, sickness benefits, and work assessment allowances, averaged over the age span 36–40.[6] We transform CPI-adjusted monetary values (100 = 2018) into percentile ranks in the national distribution, with separate rankings for parents to children in the same cohort (see Chetty et al., 2014; Deutscher, 2020; Deutscher & Mazumder, 2023; Nybom & Stuhler, 2017). Our definitions are as follows:

Parent income is the sum of income for identified parent(s). For coupled parents, we use the age of the oldest one to identify the age span.

Gender-specific parent income is the sum of income for fathers and mothers, who are placed in separate national distributions.

Gender-neutral child income is the sum of income for children, with sons and daughters in the same national distribution.

Gender-specific child income is the sum of income, with sons and daughters in separate national distributions.

Parent education is the highest attained educational level for one or both parents, measured when the child was 16 years of age. Level 1 is primary school or no education; level 2 is high school; level 3 is a bachelor's degree; and level 4 is a master's degree or PhD. Our measurement is continuous and varies from primary school (1), through high school (2), bachelor's degree (3), and up to master's degree or PhD. (4).

Labor market location consists of 133 geographical areas. The underlying classification (Juvkvam, 2002) relies on commuting flows between municipalities, independent of county boundaries and trade.

To improve estimates, we merge 28 areas in the original classification to its nearest neighbor (Supporting Information S1: Appendix Figure A1).

Industrial diversity is the variety of industries at a three-digit level in the NACE system. We interpolate linearly between population census data from 1980, 1990, and 2001. Our technical tool is Shannon's diversity index,[7] which is a dominant choice in studies of industrial structure.[8]

[4]The total number of Norwegian-born children who were alive at age 41 is 264,260. We lose 17,113 children through the second criterion; 4403 through the third criterion; and 4244 through the fourth criterion. Total attrition is thus 9.7%.

[5]Most recent studies employ or accept just 1 year in the measurement of childhood location (Bratberg et al., 2017; Bütikofer et al., 2022; Chetty et al., 2014, 2022; Connolly et al., 2019; Connor & Storper, 2020; Delajara et al., 2022; Deutscher & Mazumder, 2023; Modalsli, 2017; Rohenkohl, 2023; Rothstein, 2019). Studies that measure a time span set the lower limit at 6 years (Heidrich, 2017); 9 years (Chetty & Hendren, 2018a, 2018b); 13 years (Chetty et al., 2022); and 3–7 years (Eriksen & Munk, 2020). The upper threshold varies between 15 years (Heidrich, 2017); 17 years (Chetty et al., 2022); 18 years (Eriksen & Munk, 2020); and 23 years (Chetty & Hendren, 2018a, 2018b).

[6]Measuring income in the late thirties reduces lifecycle bias that typically turn up in studies of intergenerational mobility (Corak, 2020; Deutscher & Mazumder, 2023; Heidrich, 2017; Nybom & Stuhler, 2017). Our chosen span, 36–40, is, according to Bütikofer et al. (2022), optimal in the Norwegian context. It is also an advantage that we employ 5-year measurements for both generations. This reduces the measurement of error (Deutscher & Mazumder, 2023; Nybom & Stuhler, 2017).

[7]Shannon's index can be written as $H = -\sum_{i=1}^{R} \pi_i \log(\pi_i)$ where R is the number of total activities in the region and π_i the proportion of workers belonging to the ith activity.

[8]A Norwegian study (Aarstad & Kvitastein, 2020) concludes that Shannon's measure produces the same picture of specialization/diversification as the Hirschman-Herfindahl measure.

Duration of exposure applies to movers and stretches from 1 to 14 years of settlement in the destination region. We define "exposure" as the difference in industrial diversity between the destination region and the origin region, measured on a yearly basis, that is, we allow industrial diversity to change in both regions. We follow Chetty and Hendren's definition (2018a) of "better neighborhoods" by reducing the variation in difference to a binary variable. "Higher diversity" occurs when diversity in the destination region exceeds diversity in the origin region by 1 decile.

3.2 | Analytical strategy

Our first empirical aim is to compare the geography of intergenerational mobility for men and women. We consider, like many others, the rank–rank slope as a superior measure for such purposes. The rank–rank slope, that is, the relationship between child and parent income rank, has three advantages: (1) It is not sensitive to zero incomes, (2) It is less sensitive to attenuation bias than its main alternative, the intergenerational income elasticity, and (3) It produces relatively consistent estimates across different child ages (see Chetty et al., 2014; Deutscher & Mazumder, 2023; Nybom & Stuhler, 2017). Assuming linearity in the relationship between child and parent income, we estimate the following regression:

$$y_i = \alpha_{ls} + \beta_{ls} p_i + \varepsilon_i \quad (1)$$

where y_i is the child's income rank in adulthood, a is the expected rank of a child born to the lowest-income families, l is a region during childhood, s is the child's birth cohort, and p_i is parent income rank. Supporting Information S1: Figure A2 illustrates the suitability of the specification for the eight largest regions and Norway as a whole. Except for the very bottom and the very top, the relationship is close to linear in all cases. Unsurprisingly, both the slope estimates and the standard errors are quite small. The estimate for the whole country is 0.19, with a standard error of 0.002, implying that a 10 percentile increase in parent income is associated, on average, with a 1.9 percentile increase in child income. Comparing this level to levels in other OECD countries shows a great similarity with Sweden (Heidrich, 2017) and Denmark (Helsø, 2021); a moderate similarity with Germany (Bratberg et al., 2017) and Canada (Corak, 2020); a distinct contrast with Italy (Acciari et al., 2022), France (Kenedi & Sirugue, 2023), and the United Kingdom (Rohenkohl, 2023); and a striking contrast with the United States (Chetty et al., 2014). There is also a similarity within Scandinavia in the sense that daughters have a marginally higher level of upward mobility than sons (in our case: 0.21 and 0.20; for a comparison of countries, see Bratberg et al., 2017).

Our next aim is to identify the contributory influence of location—what Chetty and Hendren (2018a, 2018b) label "causal effects of place." To do that, we need to neutralize bias from unobserved individual characteristics that may jointly affect residence in a particular region and the prospects of income mobility. This is a common problem in studies of neighborhood effects,[9] which we address by exploiting variation in the exposure to regional characteristics that may either facilitate or inhibit upward income mobility, looking at children who move across regions. The design (see Chetty & Hendren, 2018a, 2018b) presupposes that selection effects (δ_m) are unaffected by the child's age at moving (m). The causal effect for a child who spends an additional year in a region with higher industrial diversity can then be identified as $\gamma_m = \beta_m - \beta_{m+1}$, since δ_m cancels out. Following previous research (Chetty & Hendren, 2018a, 2018b; Deutscher, 2020; and Britto et al., 2022), we augment Equation (1) by a term that measures years of exposure to an assumed beneficial context ($\gamma_m.e_{il}$), where e_{il} equals the number of years a child spends in the destination region (d) before the end of childhood, given that industrial diversity (div) in the destination region exceeds industrial diversity in the origin region (o) by 1 decile. We also add a squared term of $\gamma_m.e_{il}$, since exposure effects may vary over

[9]A standard solution in such studies is to compare pre-move and post-move socioeconomic outcomes, using individual fixed effects regression. This alternative is obviously inappropriate in our study, given our interest in regional location during childhood.

different stages in childhood (Deutscher, 2020). We further include an origin by destination fixed effect (ζ_{od}), so that each region only affects outcomes through e_{il} rather than through variation in the migration route (see Chetty & Hendren, 2018b). Our final two controls are parent income fixed effect ($\eta_{ls} p_i$) and coupled family status (θc_{ls}). Living in a couple or not has a huge influence on migration (Feijten & van Ham, 2007) and may affect children's outcomes in adulthood (Chetty & Hendren, 2018a). In sum, the following specification applies:

$$y_i = (\gamma_m . e_{il} | \Delta_{d-o}^{div} \geq 1.1) + (\gamma_m . e_{il} | \Delta_{d-o}^{div} \geq 1.1)^2 + \zeta_{od} + \eta_{ls} p_i + \theta c_{ls} + \varepsilon_i \quad (2)$$

We estimate two versions of the specification in Equation (2). The first one estimates son/daughter income on parent income; the second estimates father–son and mother–daughter pairings. One motivation for this dual strategy is the convergence of labor market participation and outcomes across genders (Deutscher & Mazumder, 2023).

The clustered nature of our data (individuals within regions) is bound to affect the threshold for statistical significance. Like Chetty and Hendren (2018b), we therefore employ bootstrapped standard errors.

3.3 | Summary statistics

Table 1 presents key features of the sample, with movers aged 6–19 in the upper panel and stayers, that is, families who remained in the same region, in the lower panel. The two groups have both similar and dissimilar characteristics. Mean parent income is 571,000 NOK in the mover group and 564,400 in the stayer group. Child income in adulthood is 522,200 and 548,400, respectively, which corresponds to over-representation of women in the mover group (53.3% vs. 48.5%). Industrial diversity is greatest in regions where families remained throughout childhood, followed by destination regions and, somewhat behind, origin regions. The most important difference, however, is education. Parents in mover families have a higher level of education than parents in stayer families. This suggests a potential for selection bias in the mover sample. Looking further at the mover sample, there is a slight tendency that parents to boys have higher income and education than parents to girls. We find no similar difference in the stayer sample, implying that estimates for sons are more likely to be inflated than estimates for daughters.

4 | RESULTS

4.1 | Geographical patterns

Figure 1 maps the mean of the rank–rank slope at the regional level, counting both movers and stayers. All estimations are relative to each distribution, with light and dark color indicating high respectively low mobility. The upper panel, displaying parent-child rank, shows a crudely similar pattern in sons' and daughters' prospects of intergenerational mobility. There are some differences, however. We note firstly that regions along the Western coast provide better opportunities among men than among women. This area has substantial employment in petroleum extraction, petroleum-supply industries, fisheries, aquaculture, and metal production (Statistics Norway, 2024a), all of which are marked by high wages and low presence of female workers (Statistics Norway, 2024b). Even the Southern coast is more beneficial for men, but the most plausible explanation here is a continuous lag in female labor force participation. To illustrate, whereas the national average in full-time female employment had reached 74.3% in 2014, the average along the Southern coast was just 60.6% (sample data). A third visible difference occurs for regions in the inland of Mid- and Southern Norway. Men who grew up here faced less profitable options than their counterparts along the coast. The inland has marginal employment in the profitable marine and maritime industries, but more so in low- to medium-paid activities such as agriculture, forestry, food production, lumber production, and metal goods production (Statistics Norway, 2024a, 2024b). For women, the picture is less

TABLE 1 Descriptive statistics: Movers and stayers.

	All		Daughters		Sons	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
One-time movers						
Parent income	571.0	257.7	566.9	255.8	575.8	259.7
Father's income	402.6	209.1	399.1	207.2	406.5	211.1
Mother's income	173.9	134.8	172.9	133.8	175.1	136.1
Individual child income	522.2	318.8	442.8	225.8	612.9	379.6
Birth cohort	1975.9	1.4	1975.9	1.4	1975.9	1.4
Daughters	53.32					
Coupled parents (childhood)	76.80		76.54		77.08	
Birth order	1.78	0.99	1.81	1.02	1.74	0.96
Siblings	1.81	1.21	1.82	1.22	1.80	1.20
Parent's education	2.42	0.88	2.37	0.87	2.47	0.88
Exposure time, aged 6–19	6.21	3.76	6.11	3.77	6.31	3.74
Industrial diversity before moving	3.41	0.29	3.41	0.29	3.42	0.29
Industrial diversity after moving	3.50	0.28	3.49	0.29	3.50	0.29
Number of individuals	19,576		10,438		9138	
Number of observations	167,936		82,043		85,893	
Stayers						
Parent income	564.4	233.2	570.7	233.8	580.1	232.6
Father's income	404.8	198.9	404.5	190.9	404.2	188.9
Mother's income	167.1	127.8	167.8	128.0	166.5	127.7
Individual child income	548.4	316.5	455.3	221.9	636.1	363.6
Birth cohort	1975.9	1.42	1975.9	1.42	1975.9	1.42
Daughters	48.50					
Coupled parents (childhood)	87.29		87.18		87.40	
Birth order	1.90	1.01	1.90	1.01	1.90	1.01
Siblings	1.70	1.11	1.70	1.11	1.71	1.11
Parent's education	2.24	0.75	2.24	0.75	2.24	0.75
Industrial diversity	3.56	0.26	3.53	0.26	3.56	0.26
Number of individuals	209,116		101,412		107,704	
Number of observations	2,927,624		1,419,768		1,507,856	

clear-cut. Several inland regions appear to provide decent mobility opportunities for women, possibly because women are over-represented in public services (Statistics Norway, 2024a).

The lower half of Figure 1 shows regional variation in gender-specific mobility rates. Contrasting sons to fathers and daughters to mothers, there are still gender differences along the Western coast and the

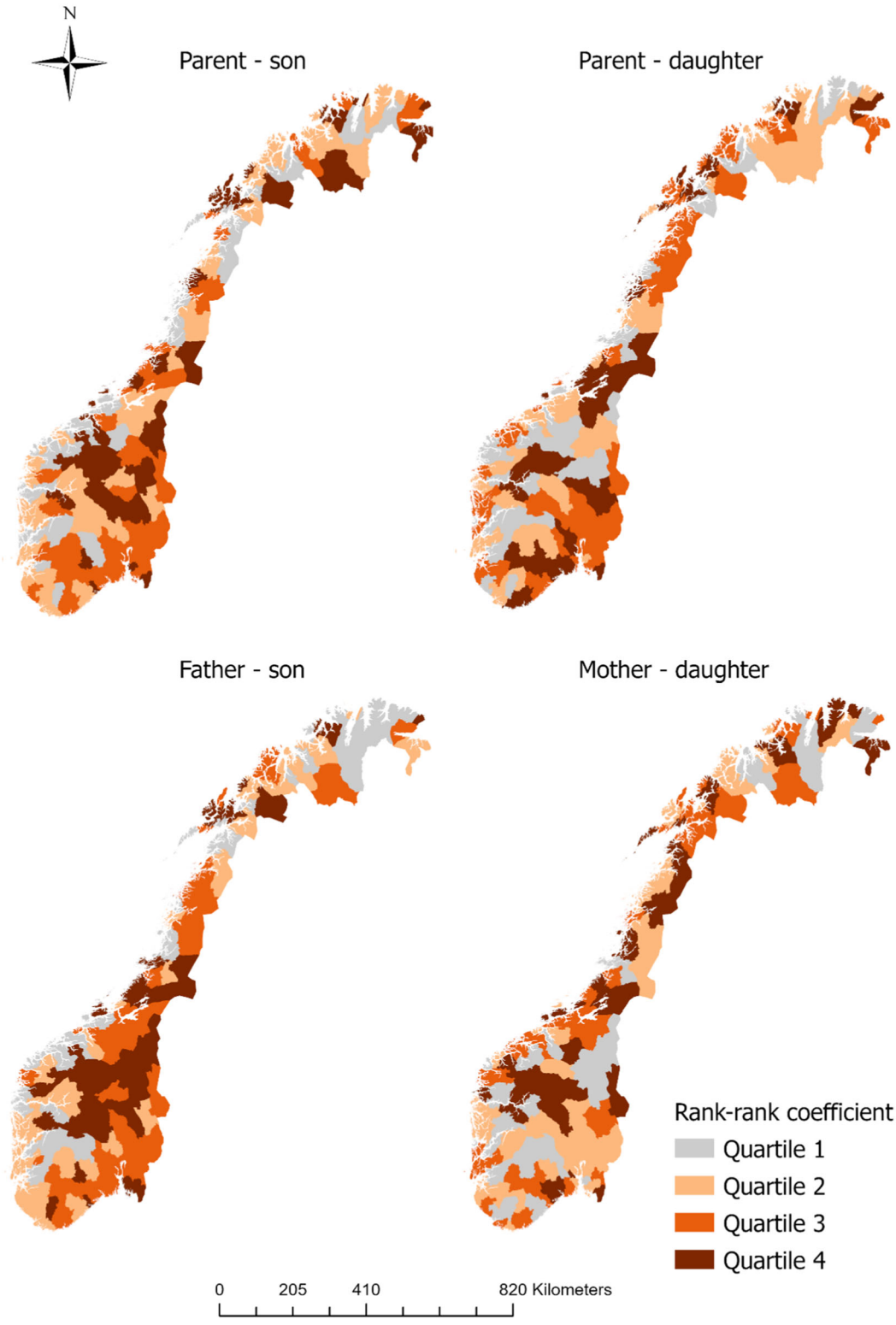

FIGURE 1 Heat maps of intergenerational mobility in Norwegian labor market regions. [Color figure can be viewed at wileyonlinelibrary.com]

Southern inland. For sons, we even see an extension of the dark/low-mobility area in the middle of Southern Norway. This is not very surprising, given the declining profitability in agriculture, forestry, food production, and lumber production (Statistics Norway, 2024c). We should add here that some inland regions in Southern Norway have few residents spread over large areas. Northern Norway has even more such regions, which impedes our ability to interpret the patterns for this part of the country.

4.2 | Results from the baseline model

We now turn to the estimated effects of exposure to industrial diversity, using Equation (2) for parent–child associations. To reduce bias arising from sorting, we only include migrant children who moved to a new region during childhood. We simplify the estimation by dropping families who moved multiple times.

Figure 2 shows outcomes when all children are placed in the same distribution, with two sets of age spans. Panel A covers the entire mover sample, with exposure experiences that stretch from 1 to 14 years. Looking at the curves and the regression results (Supporting Information S1: Table A1), we note several differences between sons and daughters. Sons have much higher incomes than daughters, but they gain nothing or little from increasing diversity. More precisely, it takes 12 years before a positive effect of opportunity-rich environments kicks in. Daughters, by contrast, obtain slowly increasing gain from spells that stretch up to 12 years. Panel B only includes those who moved after the child had reached 13 years of age. With this operation, the picture becomes clearer. Daughters in the teenage group obtain an effect that grows over time, reaching 3.5 percentiles after 7 years, whereas sons with similar experience end up at minus 0.6 percentiles (Supporting Information S1: Table A1).

Figure 3 replicates the analysis in Figure 2 with our alternative specification, contrasting fathers to sons and mothers to daughters. Now, the gender difference in child rank is reversed, with daughters obtaining a consistently higher rank than sons. This is obviously an effect of the convergence in gender roles (Ahrsjö et al., 2023; Ellingsæter & Rønsen, 1996), where new generations of women obtain higher labor force participation and a more even distribution across occupations. More important for us, the pattern along the *y*-axis resembles the pattern in Figure 2, with upward-trending, dwindling curves for daughters and more or less flat curves for men. We also observe larger effects when we remove the smallest children from the analysis. The gender disparity in the teenage subsample reaches a maximum of 5.2 percentiles, corresponding to exposure during the whole period (Supporting Information S1: Table A2).

5 | VALIDATION OF RESULTS

One plausible caveat to our results is that parents may have knowledge of regions that benefit girls more than boys, and vice versa. If they migrate based on such knowledge, we cannot fully trust that Figures 2 and 3 give a correct picture of gender differences. We approach this challenge empirically by looking at suggestive evidence in subpopulations, added by adjusted estimations of the baseline model. We use the same evidence, as far as possible, to assess whether resource-full and less resource-full families move at different stages.

5.1 | Cross-validation test: Outcomes for stayers

Investigation of exposure effects requires some type of treatment, which we lack for stayer families. The patterns we have seen so far nevertheless suggest that sons and daughters in stayer families end up at different levels of income depending on industrial variety in their childhood region. Otherwise, we could hardly uphold our argument

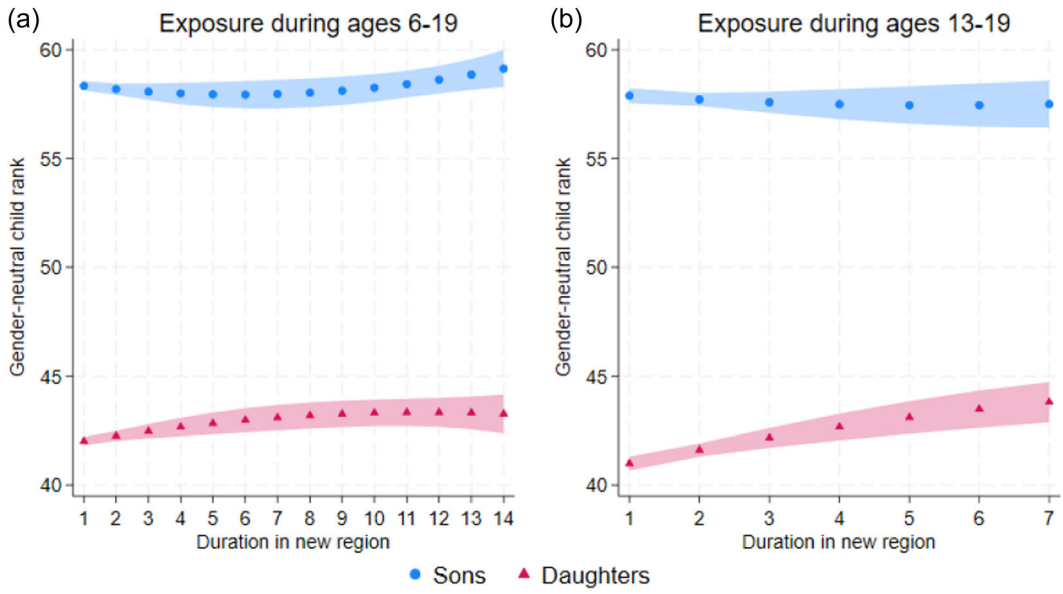

FIGURE 2 Predicted gender-neutral child rank by age, gender, and duration of settlement in a destination region with higher industrial diversity than the origin region. (a) Exposure during the entire period from 6 to 19 years. (b) Exposure during teenage years. Underlying models include origin-by-destination fixed effects and parent income by coupled family fixed effects. Shadowed areas are confidence intervals from bootstrapped standard errors. Children are ranked by birth cohort, with sons and daughters in a common ranking. Parents are ranked relative to other parents of children in the same cohort. See Supporting Information S1: Appendix Table A2 for details. [Color figure can be viewed at wileyonlinelibrary.com]

regarding peer influences that arise from labor market properties. We therefore conduct a cross-validation test based on the following regression:

$$y_i = \iota div_{ls} + \kappa_l^P + \theta c_{ls} + \varepsilon_i \tag{3}$$

where ιdiv_{ls} denotes industrial diversity in the childhood region[10] and κ_l^P a region by parent income fixed effect. We continue to match parents and children based on two sets of ranking.

The fitted models from Equation (3), with up to 13,500 fixed effects, support our assumption: The association between industrial diversity during childhood and adulthood income differs between sons and daughters in stayer families. The discrepancy is particularly striking when we rank sons and daughters together, but the tendency is also apparent in same-gender pairings (Supporting Information S1: Table A3). Using gender-neutral ranking, a one standard deviation increase in diversity is associated with a 0.668 standard deviation increase in future income rank for daughters, compared to a statistically nonsignificant estimate for sons. The difference (0.618) is statistically significant with $p < 0.001$.

5.2 | Benchmark test: Movers versus stayers

To further avoid failed identification, we also employ outcomes among stayers in a two-step estimation. Following Chetty and Hendren (2018a, 2018b), we first estimate predicted child rank for stayers in each destination region ($\hat{y}_{dps}$), together

[10]Shannon's diversity index is far from intuitive. We therefore present standardized regression coefficients in this estimation.

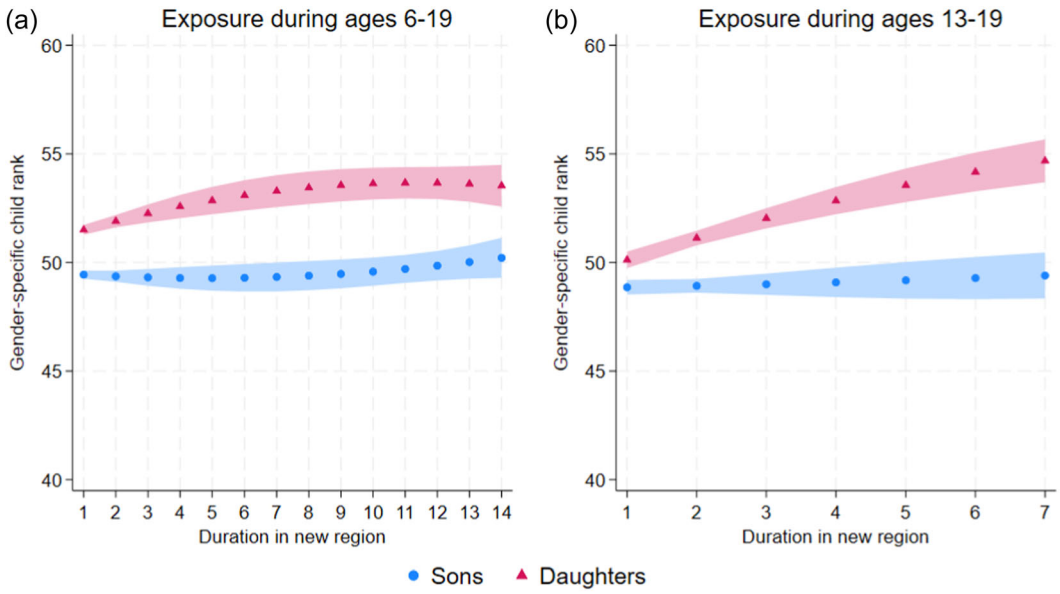

FIGURE 3 Predicted gender-specific child rank by age, gender, and duration of settlement in a destination region with higher industrial diversity than the origin region. (a) Exposure during the entire period from 6 to 19 years. (b) Exposure during teenage years. Underlying models include origin-by-destination fixed effects and parent income by coupled family fixed effects. Shadowed areas are confidence intervals from bootstrapped standard errors. Children are ranked by birth cohort and gender. Parents are ranked relative to other parents of children in the same cohort, with separate rankings for fathers and mothers. See Supporting Information S1: Appendix Table A2 for details. [Color figure can be viewed at wileyonlinelibrary.com]

with predicted rank for movers in a counterfactual scenario where they remained in the origin region ($\hat{y}_{ops}$). We next subtract the latter from the former ($\Delta_{odps} = \hat{y}_{dps} - \hat{y}_{ops}$),[11] and insert this outcome into a regression that includes one-time movers:

$$y_i = (\Delta_{odps}.e_{il}|\Delta^{div}_{d-o} \geq 1.1) + \zeta_{od} + \eta_{ls}p_i + \theta c_{ls} + \varepsilon_i \quad (4)$$

The results, shown in Supporting Information S1: Tables A4 and A5, are consistent with previous outcomes, although with some nuances. Daughters pick up substantially more of the difference in predicted income than sons do, but even sons gain from moving to higher-opportunity regions when they are measured against parent income. A corresponding lever effect for sons does not appear in gender-specific measurements, which seems puzzling. A speculative explanation might be that gender-neutral measurements reflect a difference in female labor force participation between origin regions and destination regions. It is also plausible that analytical aspects play a role. The model described in Equation (4) presupposes that movers relocate in a higher-opportunity region, but contrary to the baseline model, it does not consider that destination regions vary in industrial diversity. This sheds some light on outcomes for sons. To be more exact: It suggests that sons face additional challenges in the largest and most diverse labor market regions.

[11]We facilitate comparison with international research by skipping a squared duration term.

5.3 | Test of extended model: Family-related factors

A valuable test of selection bias would be to compare outcomes across siblings who relocate in different regions (see Chetty & Hendren, 2018b), but this approach is impossible to implement with the current size of the sample. An alternative, which we employ, is to control for family-related factors that may increase the probability of early migration and/or responses to child gender. Two of the three factors we include, parents' education and the number of siblings, have proved important in previous exposure studies (Acciari et al., 2022; Britto et al., 2022; Chetty & Hendren, 2018a). The third factor, birth-parity, is known to affect regional migration (Kulu & Milewski, 2007). We increase the efficiency of this factor by interacting it with the number of siblings.

Supporting Information S1: Tables A6 and A7 show mobility outcomes from these reinforced models, using both age spans. As expected, some estimates become attenuated, but the gender difference remains statistically significant in all four estimations. We also continue to find notably larger effects of teenage exposure.

5.4 | Posttreatment test: Adult children

Children who have passed the teenage stage provide an appropriate test group because resistance to peer influences increases substantially in emerging adults (Steinberg & Monahan, 2007).[12] We conduct this test by estimating a slightly modified version of the baseline model on a subsample of y who relocated in a new region during ages 24–30. The model is given by:

$$y_i = (\gamma_m.e_{il}|\Delta^{div}_{d-o} \geq 1.1) + (\gamma_m.e_{il}|\Delta^{div}_{d-o} \geq 1.1)^2 + \zeta_{od} + \lambda c_{ds} + \mu r_i + \varepsilon_i \quad (5)$$

where λc_{ds} is a control for coupled family status during the measurement of $\gamma_m.\ e_{il}$ and μr_i is regional relocation during childhood.

Compared with the baseline results, we now see a completely different picture (Supporting Information S1: Table A8). Men, and not women, obtain a statistically significant effect from industrial diversity when the movement occurs in early adulthood. The difference between the genders is small and statistically nonsignificant, but it is nevertheless a sharp contrast to the baseline results.

6 | DISCUSSION AND CONCLUSION

This article demonstrates geographical variations in intergenerational mobility in Norway. We show that men and women have crudely similar prospects in different labor-market regions, although with some differences at a larger scale. Sons are better off if they spent their childhood on the Western coast, and worse off if they grew up in the Southern inland. We find, not surprisingly, distinctly different industrial structures in these two areas, with profitable maritime and marine industries along the coast and less profitable, more traditional activities in the Southern inland. It is more difficult to detect macro patterns for daughters, possibly because families with daughters have a higher rate of regional migration. One evident feature, however, is that daughters on the Southern coast are disadvantaged compared to daughters elsewhere in Norway. We believe this inferior position reflects a lower level of labor force participation, which in turn reflects a more traditional attitude toward "career and family."

Having observed these patterns, we next turn to a potential pathway through which sons and daughters obtain different predicted outcomes in different regions. We narrow our attention to industrial diversity since this feature

[12]Chetty and Hendren (2018b) argue that neighborhood exposure effects size to exist in adulthood.

corresponds closely to the range of local job opportunities. The idea is that potential career paths affect social interaction and social networks, with distinctively different influences among boys and girls. Previous Norwegian research has shown that boys, but not girls, respond positively to specialization in oil-based activities (Bütikofer et al., 2022). We expand this focus to embrace all types of jobs, intimating that girls have greater sensitivity to option demand. We investigate the proposition through a study of children who moved to a region with more or less/similar industrial diversity. Looking at exposure over time in the new region, we find that daughters benefit significantly and systematically from higher diversity. Predicted outcomes for sons are more adverse, specifically in the first years after arrival. The difference increases when we switch from a common ranking of sons and daughters to a gender-specific ranking, contrasting sons with fathers and daughters with mothers. It is easier for daughters to gain a high position versus their mothers than versus both parents, obviously because female labor force participation and valuation of female skills have increased over time (Ahrsjö et al., 2023). It also matters whether we observe sons and daughters from 6 or 13 years onwards. The favorable association with industrial diversity for daughters becomes especially clear in the latter measurement.

Our baseline results could theoretically emerge from selective migration. But this threat to internal validity seems highly unlikely. Migrating parents have a higher level of education than parents in stayer families, but there are no signs that migrating parents to daughters have better skills and higher earnings potential than parents to sons. Nor is there any indication that families who move at a later stage are positively selected. They have, if anything, less resources than early movers. Various robustness checks strengthen our observation of larger exposure effects among daughters. A similar difference appears for children in stayer families; it also appears when we estimate how migrating children reduce the expected advantage of children in stayer families; it remains present when we extend the baseline model with potential confounders (parents' education, number of siblings, and birth order); and it receives counterfactual support through a posttreatment test. At a more detailed level, we also find that exposure effects matter most during the teenage years, particularly among daughters. We do not reject the possibility that all migrants may have unobserved characteristics that differ from stayers. However, like Chetty and Hendren (2018a, 2018b), Deutscher (2020), Britto et al. (2022), and Bütikofer et al. (2022), we do not believe omitted variables could produce similarly systematic differences in adult age.

Our findings are consistent with Norwegian migration research showing that women who migrate to metropolitan areas before labor-market entry have larger long-term earnings than men who make the same transition (Wessel & Magnusson Turner, 2021). There is also consistency between the posttreatment test and the observation of larger urban premiums for men after labor-market entry (Galster & Osland, 2024; Wessel & Magnusson Turner, 2021). Of course, we do not address the impact of rural–urban location, but the urban dimension looms large in our account. Industrial diversity and population size correlate highly throughout the period we study, for example, with Pearson's $r = 0.83$ for 2014 (logged variables).

This further implies that our policy recommendations differ from the school- and welfare-oriented recommendations that Chetty and Hendren (2018a, 2018b) and Chetty et al. (2014) offer for the United States. Low industrial diversity in the Norwegian context should not be confounded with poverty, criminality, poor school quality, or unhealthy environments. We may even add unemployment to this list since most low-diversity regions have jobs in public services and specialized industrial activities. The major challenge, as we see it, is that low-diversity, peripheral regions struggle with declining populations, massive aging, and dispersed settlements, all of which are related to extensive female outflux (Ministry of Local Government and Modernization, 2020). Current data show a quotient of 113 men to 100 women at the lowest level of centrality—a situation that would have been worse without immigration (Ministry of Local Government and Modernization, 2020).[13] We, therefore, believe the key solution is to strengthen local centra since this strategy might lay the foundation for both labor market developments and institutional "thickness." A helpful example here is the region Alta in Northern Norway. Alta is

[13]A recent study (Hoen et al., 2022) argues that immigrants are attracted to urban and rural labor markets with favorable demand conditions. This suggests that immigration cannot reduce depopulation in all peripheral regions.

located in an area (Finnmark) with a scattered population and extremely long distances. It is not a very populous region, and its industrial diversity (3.5 on the Shannon's index in 1990) places it in the lower half of the scale. These conditions are nevertheless sufficient to yield a mobility rate that lies 29% above the average for women and 18% for men.

Going forward, there are several research gaps to be filled. One task is to explore causal mechanisms in greater detail. Our observation of larger exposure effects during adolescence has several interpretations. It may indicate that peer influences intensify at this stage of life, along with common wisdom and insights from psychological research (Steinberg & Monahan, 2007). However, as Deutscher (2020) points out, it is also likely that peer influences are specifically strong at a higher geographical scale in late childhood. One may even suspect that younger children care less about occupational choices and career opportunities. Hence, future research in this area should try to link friending practices and pro-social behavior during different stages of childhood to later-life outcomes. Another task, which is specifically important for Norway, is to scrutinize the linkages between industrial diversity and other attributes of the local labor market. We know that industrial diversity correlates with female employment and education, but we cannot nail down whether specific industries or combinations of industries generate greater gender equality in mobility opportunities. Similarly, we also see some limitations with our opportunity lens. Obvious alternatives are to trace links between mobility outcomes and occupational preferences and/or labor market norms.

Such research, whether it targets opportunities, preferences, or norms, seems specifically relevant for states and territories with large or increasing surpluses of men in rural areas. This includes a large part of Europe, with Central-Eastern European countries, the Baltics, Spain, Greece, Finland, and Sweden as the most obvious cases (Leibert, 2016). Rural women in these countries appear to search for "women-friendly" labor markets, which they tend to find in larger cities (Leibert, 2016). It is highly likely that corresponding beliefs and desires are transmitted to teenage girls.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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