Economics Letters 189 (2020) 109024

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

The geography of intergenerational mobility — Danish evidence☆

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ARTICLE INFO

Article history:
Received 11 October 2019
Received in revised form 16 January 2020
Accepted 5 February 2020
Available online 8 February 2020

JEL classification:
J1
J62

Keywords:
Intergenerational Mobility
Denmark
Geography

ABSTRACT

We provide within-country intergenerational income rank mobility estimates from Denmark. We find the highest intergenerational income mobility within middle-income rural municipalities and the lowest intergenerational income mobility within urban and poor rural municipalities. Relative mobility within Denmark is similar to relative mobility within Canada and larger than within the United States, while absolute rank mobility at the 25th and 75th parental income percentiles vary more in the United States than in Denmark. Within-country intergenerational mobility is positively correlated with the share of working-age employed and married inhabitants, and negatively with the share of single parents, teen births, non-western immigrants, and inhabitants outside the labor force.

1. Introduction

A new literature, starting with Chetty et al. (2014), estimate intergenerational mobility within countries.[1] Chetty et al. (2014, 2020) provide estimates from US counties and census tracts, and Connolly et al. (2019) for Canadian census tracts.[2] The mobility estimates from these descriptive studies have been used for example by Derenoncourt (2019) and Sharkey and Torrats-Espinosa (2017) to estimate the causal effect of violent crime and the Great Migration on intergenerational mobility in the United States.

We contribute to this literature in three ways. First we estimate within-country intergenerational income rank mobility at the municipality level in Denmark. In line with prior studies, we focus on relative mobility and the expected child family income rank for children from the 25th, 50th, and 75th parental income percentile. We then compare the Danish estimates to Canadian and US estimates by Chetty et al. (2020) and Connolly et al. (2019). Finally, we show correlations between municipal demographics and intergenerational mobility. We provide all estimates in an online data appendix for future research.

2. Data and methods

We use Danish administrative data covering the full population with a social security number from 1980 to 2015. The analytical sample consists of 339,969 matched parents and children where the children were born between 1973 and 1977. Each child is observed in the administrative data at least once from 2010 to 2015 when we measure their income. Matched parent(s) similarly appear at least once from 1980 until child-age 18 when we their income. We stop measuring parents' income at child-age 18 because many Danish children move away from home for tertiary education starting at this age. The 1973–1977 cohorts are 5–10 years younger than children in the US and Canadian studies. We choose this sample to minimize life cycle bias (Nybom and Stuhler, 2016).[3]

We use total pre-tax income to estimate mobility like prior studies (Chetty et al., 2020; Connolly et al., 2019). Total pre-tax income includes wages, capital income, self-employment income,

☆ We thank Sigrid Jessen, participants at the EALE 2019 Conference, and our reviewer for helpful comments. We also thank the IKE research group at Aalborg University for providing access to the administrative data used in the paper.

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[1] This is an extension of the national estimates literature partly initiated by Solon (1992).

[2] A few other studies estimate within-country intergenerational mobility using estimation strategies producing estimates that are not directly comparable to ours and those of Chetty et al. (2014, 2020) and Connolly et al. (2019). These include Heidrich (2017) who estimate Swedish Labor Market Region intergenerational mobility using bayesian hierarchical models, and Güell et al. (2018) using informational content in surnames over individual income as a measure of mobility for Italian regions.

[3] The youngest children in our sample turn 34 in 2010 as we start measuring their income. Landersø and Heckman (2016, Figure A42) show that Danish rank–rank mobility estimates stabilize around age 35.

https://doi.org/10.1016/j.econlet.2020.109024
0165-1765/

Table 1
Descriptive statistics for sample.

Statistic	N	Mean	St. Dev.	Pctl(25)	Median	Pctl(75)
Child demographics (2010 to 2015)						
Observations in adulthood	339,969	5.92	.52	6	6	6
Female	339,969	.43	.5	0	0	1
Married between 2010–2015	339,969	.62	.48	0	1	1
Child mean income	339,969	60,724	89,008	42,600	54,720	69,110
Family mean income	339,969	95,677	113,142	52,715	86,864	122,009
Parents' demographics (1980 to year of child-age 18)						
Parents' mean income	339,969	93,843	59,063	71,194	86,683	105,848
Mother's mean income	338,874	34,352	17,039	25,684	33,590	41,825
Father's mean income	334,136	61,450	55,220	43,110	53,024	68,316
Mother's age in 1980	338,854	31.57	4.93	28	31	34
Father's age in 1980	333,988	34,37	5.79	31	34	37
Share of observations (1980 to year of child-age 18)						
Moves by age 18	339,969	.47	.92	0	0	1
In assigned municipality	339,969	.93	.15	.93	1	1
Living with both parents	339,969	.75	.38	.54	1	1
Living with mother	339,969	.19	.38	0	0	.2
Living with father	339,969	.03	.14	0	0	0

and public transfers such as unemployment and social benefits. For children, we focus on *family income* for the period 2010 to 2015, taking the time-average of the child's and any registered spouse's summed income. For parents we time-average the sum of registered mother's and father's income from 1980 until the child turns 18. One concern in measuring parents income according to child-age is life-cycle bias. Table 1 shows that most parents are in their early thirties when first observed in 1980. This minimizes parental life-cycle bias. Before taking time-averages we deflate all income using the Danish CPI and then convert from DKK to 2015 USD. We finally rank children's family income and parents' income within cohorts. Ranking within cohorts removes biases from comparing across cohorts. Table 1 also shows summary statistics for income in the sample.

Our within-country spatial aggregation is the 98 Danish municipalities. We focus on municipalities instead of e.g. smaller parishes to increase precision in our estimates. In 2015 the average and median population size of the 98 municipalities were 57,751 and 42,812. To create estimates by municipality, we assign each child to a childhood municipality he or she lived in from 1980 until age 18 according to the administrative data. A small group of children moved from one municipality to another during childhood. We assign these to the municipality they spent most years in. On average children in our sample spent 92.6 percent of their observed childhood in their assigned municipality.

We show four common estimates of intergenerational mobility based on the regression of child family income rank ($R_{i,t}$) on parental income rank ($R_{i,t-1}$) by municipality c,

$$R_{i,t} = \alpha_c + \beta_c R_{i,t-1} + \epsilon_i. \quad (1)$$

The first estimate is the inverse of persistence in relative ranks across generations, β_c, often referred to as relative mobility. The remaining three are the expected income rank of children at the 25th, 50th, and 75th parental income percentiles. They can be calculated by inserting the parental income rank and municipal estimates of α_c and β_c into Eq. (1). We denote these r_{25}, r_{50}, and r_{75}, and refer to r_{25} as absolute upward mobility as it shows expected income rank climbs for children from the bottom half of the income distribution (Chetty et al., 2014).

3. Findings

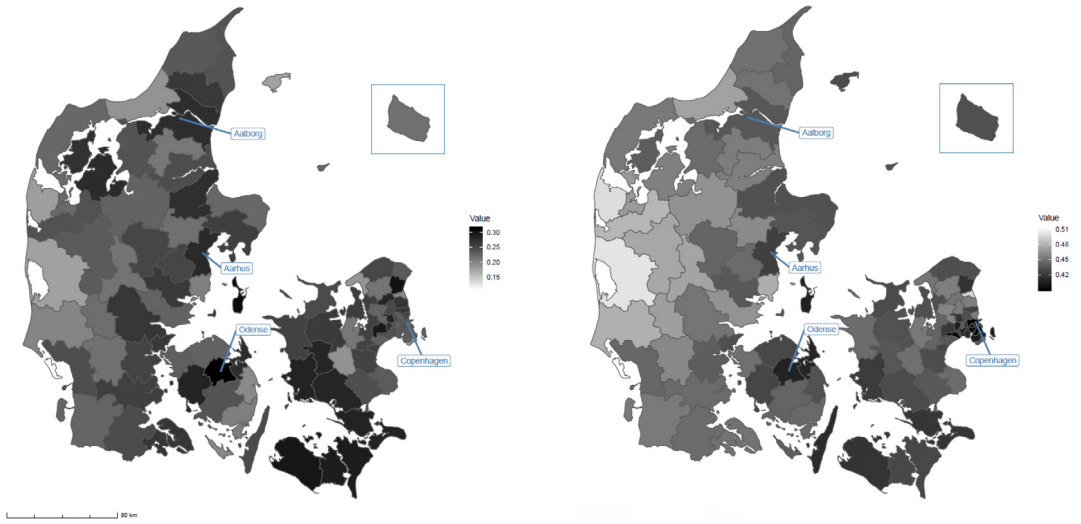
We start by showing the spatial variation of Danish intergenerational mobility in Fig. 1 with maps. On the left we show relative mobility, on the right absolute upward mobility. Darker colors indicate less mobility. The municipalities with the four largest cities have the lowest intergenerational mobility together with poor rural and peripheral municipalities, such as the southeast islands Lolland and Falster.[4] Middle-income rural municipalities in Western Jutland have the highest intergenerational mobility.

We next compare our Danish municipal estimates with US county and Canadian Census District estimates from Chetty et al. (2014, 2020) and Connolly et al. (2019). US counties and Canadian Census Districts reasonably match our Danish municipalities in population size. For example, using 2010 decennial census data and excluding the 30 largest counties, average US county population size was 75,609 inhabitants, 1.5 times the Danish municipal population, while the corresponding 2011 census Canadian number is 69,694, excluding the largest 10 Census Districts. The average relative mobility estimates within Canada and Denmark are nearly equal at .242, while the number is higher for US counties at .33. From the US data we have also calculated county level means and standard deviations for r_{25}, r_{50}, and r_{75}. These are .427 (.065), .51 (.059), and .591 (.062). Corresponding Danish numbers are .441 (.023), .502 (.019), and .562 (.019). The standard deviation of the US percentile rank estimates are about three times those found for Denmark, suggesting larger variation of absolute mobility in the United States than in Denmark. The range from average r_{25} to average r_{75} is also larger in the United States at 16.4 percentile ranks compared to 12.1 percentile ranks in Denmark. This is close to the difference (Connolly et al., 2019) find when comparing similar US and Canadian averages. These findings are consistent with prior studies finding slightly higher national mobility in both Denmark and Canada compared to the United States.

Finally, we show correlations between the mobility estimates and municipal demographic characteristics in Fig. 2. Unless otherwise noted in the figure, we construct all variables from Danish administrative data as the municipality time-average over 1980–1995 for the working-age population (18–65).[5] Correlations with β_c have the opposite sign from other intergenerational mobility estimates as this is the inverse of relative mobility.

[4] We refer to urban, intermediate, rural, and peripheral municipalities according to the rural development classification by the Danish Ministry of Food Agriculture and Fisheries (2011). Urban municipalities have more and better educated inhabitants, more jobs, and higher income levels than rural and peripheral municipalities.

[5] We focus on education levels and not years of education in the figure to capture variation of types of education with approximately similar length in Denmark.



(a) Relative mobility *(b) Absolute upward mobility*

Fig. 1. Relative and absolute upward mobility estimates by Danish municipalities based on author's estimates from Danish administrative data. Text boxes indicate center-points of the four largest cities, and the island Bornholm has been framed in blue and moved north-west of its true position.

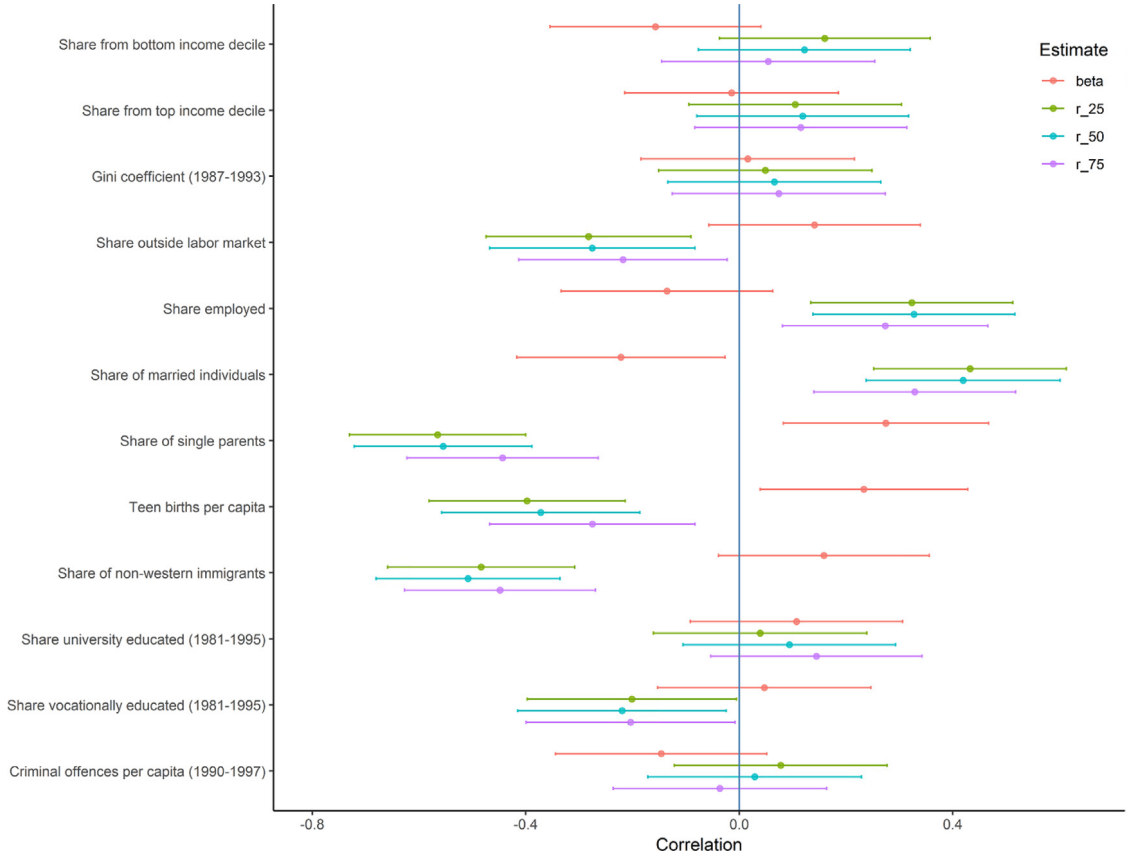


Fig. 2. Correlations between municipal characteristics and intergenerational mobility estimates. All variables and estimates are based on Danish administrative data except within-municipality gini coefficient which we obtain from Statistics Denmark (2017). The shares of bottom and top income decile earners are calculated for the population aged 25 and older, and students are excluded from labor market numbers. 95 percent confidence intervals are based on OLS standard errors.

Within-country intergenerational mobility is *positively* correlated with the share of employed working-age inhabitants and married inhabitants. This is driven by Western Jutland high intergenerational mobility municipalities with high employment and marriage rates, and urban municipalities with low employment and marriage rates and intergenerational mobility. Correlations are *negative* with the share of single parents, first- and second-generation non-western immigrants, teen births per capita, and working-age inhabitants outside the labor force. Single parents and non-western immigrants are more prevalent in the low mobility urban municipalities while the rate of teen births and share of inhabitants outside the labor force are higher in low mobility

rural and peripheral municipalities, including Lolland and Falster in the south-east of Denmark.

In future work our estimates can be used to analyze causal drivers of intergenerational mobility. Sharkey and Torrats-Espinosa (2017) and Derenoncourt (2019) provide recent examples of how this can be done with US estimates. We make our estimates available in an online data appendix for related future research.[6]

4. Conclusion

We make three main contributions to the literature on within-country intergenerational income rank mobility. First, we provide estimates of intergenerational mobility at the municipal level in Denmark. Middle-income rural municipalities in Western Jutland have the highest intergenerational mobility, while urban and poor rural municipalities have the lowest. Second, we compare our Danish estimates with Canadian Census Districts and US county mobility estimates. Relative mobility within Denmark and Canada is similar, and less than in the United States. There is higher variation of outcomes for children at the 25th and 75th parental income percentiles within the United States than in Denmark with average differences of 16.4 and 12.1 percentile points. Finally, we show that mobility within Denmark correlates positively with shares of employed and married inhabitants, and negatively with the number of single parents, teen births, first and second-generation non-western immigrants, and inhabitants outside the labor force.

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[6] The online dataset does not include any confidential administrative data used to produce the estimates. For restrictions on use of Danish administrative data for research see Statistics Denmark's website (https://www.dst.dk/da/TilSalg/Forskningsservice/Dataadgang). In addition to estimates presented in this paper, the online dataset contains (1) intergenerational elasticity estimates, (2) estimates by pre-2007-reform municipalities, and (3) estimates computed using children's, mother's and father's individual incomes.