Transmission of Family Influence
ONLINE APPENDIX

September 20, 2024

Contents

A Appendix to Section 2

We construct the policy instrument by combining updates to the following policies in a given year t: tax policy (T), public transfer scheme (S), and interest rate (r). We calculate the combined policy instrument as $\Delta_t = log(Y_t + \Delta_t^T + \Delta_t^S + \Delta_t^r) - log(Y_t)$, where Δ^T, Δ^S, and Δ^r measure the extent to which an individual is better or worse off due to policy changes from year t to year $t+1$, respectively for tax schemes, public transfer incomes, and interest rates. We define each component below and discuss them in detail.

Δ^T: The Danish tax system operates through a progressive tax system with tax rates. The tax system is organized into national-level taxes and local (municipalities and counties) taxes. We use a modified version of the Danish TAXSIM from Jakobsen and Søgaard (2022) to calculate tax payments from individual income components.

From child birth to age 18 (1999 for the 1981 cohort and 2000 for the 1982 cohort), we observe year-by-year changes to the tax scheme, out of which three of them are major tax reforms at the national level (in 1987, 1994, and 1999). In addition to the national level changes, we utilize variation in local income tax rates. Individual municipalities have the discretion to set tax rates to balance their budgets (local tax rates differ by around 2-4 points across municipalities), which vary year-by-year according to the place of residence. The tax policy update for year t is calculated as: $\Delta_t^T = (Y_t|T_{t+j}) - (Y_t|T_t)$ where Y_t denotes disposable income in year t and T_t denotes tax scheme in year t.[1] Next, we give an overview of the three major tax reforms. In our empirical implementation, we use changes in tax schemes in all years.

The 1987 tax reform was adopted in 1986 and came into effect in 1987, major changes in the 1987 reform package included the separate tax scheme for the self-employed, the separation of capital income from labor income for tax purposes (capital income was then taxed at lower rates than labor income), the decrease of the top marginal tax rate by 5% and the decrease of interest expense deduction by up to 23%. The 1994 tax reform introduced the labor market contribution (5% in 1994, increasing by 1% per year to 8% in 1997, and remained at 8% after 1997). The major change in the 1994 tax reform was that social security benefits became taxable, with the gross benefit amount increasing accordingly, and the overall benefit payment remained at the same level. The 1994 tax reform also gradually lowered the tax ceiling to 58%, and the previous concepts

[1] We constructed two versions of innovations, one assuming the independence between tax policy and other policies so that the tax policy innovation term takes the form: $\Delta_t^T = (Y_t|T_{t+j}) - (Y_t|T_t)$ where Y_t denotes disposable income in year t and T_t denotes tax scheme in year t, and one combining the updates in other policies to calculate the tax policy innovation term: $\Delta_t^T = (Y_t|P_{t+1}) - (Y_t|P_t)$, where P_t denotes all tax-relevant policies at time t.

of progressive tax brackets were replaced by the introduction of bottom, middle[2], and top income brackets which have been in use since 1994. Overall, the income tax was reduced from the 1994 tax reform while at the same time, the government expanded the green tax to finance the cut of income taxes. In June 1998, the Danish government adopted the Pentecost package introducing the 1999 tax reform package. The 1999 tax reform further decreased the interest rate expense deduction for tax purposes by a further 14%, another big change in the interest since the 1987 tax reform. The Property Value Tax Act was introduced to replace the previous concept of the rental value of one's own (introduced in 1903). Other components of the 1999 tax reform include lowering wage income tax rates, tax reduction for low incomes, a further expansion of green taxes and an upward shift on the middle income tax bracket threshold.

Δ^S: We observe year-by-year changes in public transfer income rates during our observation period. We specifically focus on the following benefits: social assistance benefits (*kontanthjælp in Danish*, which is applicable for people experiencing social incidences –such as illness, unemployment, and end of cohabitation– and cannot support themselves or their family, and the need for support cannot be met by other benefits like unemployment benefit), child allowances (*børne- og ungeydelse in Danish*, paid until the quarter the child reaches 18), and unemployment benefits (*dagpenge in Danish*, for individuals with unemployment insurrance; based on the 12 months in which one had the highest income within the past 24 months, with a maximum amount based on insurance status). There is also one major adjustment of public transfer income rates in 1994. In 1994, the Danish government greatly increased the nominal rates of most public transfers while making the transfers taxable. Despite the huge nominal increase, only moderate changes were observed in the post-tax public transfer incomes received as most of the nominal increases were netted out by the income tax. While public transfer income became taxable after the 1994 tax reform, the child benefit remained tax-free, with all parents and caretakers of children under 18 years old satisfying certain qualification conditions entitled to the child benefit depending on child age.

We obtain changes to public transfer income rates from the Danish common state legal information system[3]. Like the innovations from interest rate changes and tax schedules, we calculate the counterfactual public transfer incomes an individual would receive under the rates of year $t+j$ by applying the same pro-rata adjustment from public transfer rates of base year t. When $t+j \geq 1994$, we use the modified TASXIM

[2]The middle tax bracket was abolished in the 2009 tax reform. Also, see the Ministry of Taxation (https://skm.dk/media/tegbpqz2/regneprincipper-paa-personskatteomraadet.pdf)

[3]See https://www.retsinformation.dk/ for yearly documentation on public transfer income rates. As an example, we obtained the rates of 1995 from https://www.retsinformation.dk/eli/lta/1994/829

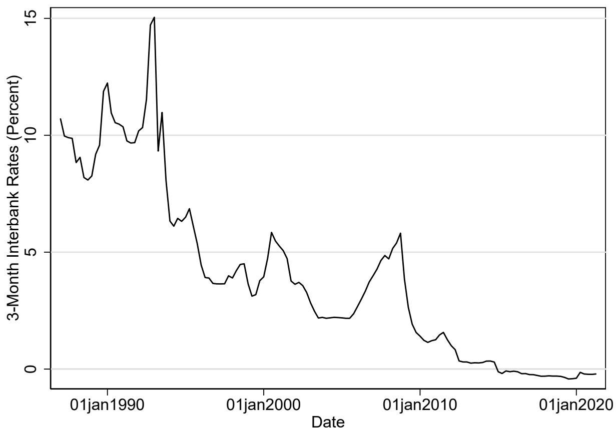
program to calculate the post-tax innovations from the changes to public transfer schemes.

The policy update for public transfer incomes for year t is calculated as: $\Delta_t^S = (Soc_t|S_{t+j}) - (Soc_t|S_t)$ where Soc_t denotes the public transfer incomes received in year t and S_t denotes public transfer income rates in year t.

Δ^r: As shown in Figure A.1, we observe significant volatility of interest rates in Denmark throughout our observation period. To account for the volatility of the financial market, we calculated the yearly real interest rates based on the three-month nominal interbank rates and consumer price index (CPI) in Denmark. We calculate the counterfactual individual equity portfolio by applying pro-rata adjustments to interest income and expense components of year t based on real interest rates of year $t+j$, where j is the forward lag[4] to form the counterfactual innovations. The pro-rata adjustments are applied to every observable component of the individual portfolio in the Danish Administrative Database. We distinguish between taxable and tax-free interest components. Adjustments to the taxable interest incomes and expenses are channeled through the aforementioned Danish TAXSIM program to calculate the overall innovation from the interest rate changes.

The interest rate update for year t is calculated as: $\Delta_t^r = (Int_t|r_{t+j}) - (Int_t|r_t)$ where Int_t denotes net interest income in year t and r_t denotes real interest in year t.

Figure A.1: Three-Month Nominal Interbank Rates for Denmark



Notes: This figure shows real interest rates in Denmark. *Source*: OECD, 3-Month or 90-day Rates and Yields: Interbank Rates for Denmark [IR3TIB01DKQ156N]: https://fred.stlouisfed.org/series/IR3TIB01DKQ156N, October 9, 2021.

[4]In this section we present the results using forward lag $j = 1, 2$ as part of the robustness check.

B Appendix to Section 3

B.1 Introduction to the Register Data

Our data is based on the following register data sets made available by Statistics Denmark:[5] All data sets include unique individual identifiers that allow us to link them across years and content.

- Age, Marital status, and fertility (the BEF register). The register is an annual collapsed form of the daily data from the Civil Registration System (CPR), and serves as a link between public services (e.g., transfer income, education, health care, taxation) across multiple domains.
- Educational attainment (the UDDA register). The register is based on information collected by the Ministry of Higher Education and Research and transferred to Statistics Denmark.
- 9th-grade exam scores in Danish and math (the UDFK register). The register is based on information collected by the Ministry of Education and Children and transferred to Statistics Denmark.
- Income, wealth, assets, transfers, homeownership (the IND register). The data is based on information collected by the Danish Tax authorities and transferred to Statistics Denmark.
- House prices (the IND and EJSA registers). The register is based on information collected by the Danish Tax authorities and transferred to Statistics Denmark.
- Criminal convictions (the KRAF register). The register is based on information from the criminal courts and the police collected by the Ministry of Justice and transferred to Statistics Denmark.

In the paper, we consider the following outcomes besides the different measures of resources:

- Math test scores: Mandatory exam results at grade 9 (age 15-16). Written exam.
- Danish test scores: Mandatory exam results at grade 9 (age 15-16). Written exam.
- Years of schooling: defined total years of schooling it takes to complete the highest education obtained by age 35.
- College degree: having completed a college degree or higher by age 35.
- Crime: an indicator of whether individuals have received a crime conviction by 2019.

[5]See https://www.dst.dk/da/TilSalg/Forskningsservice/Data for information on data and access to data.

- Fertility: whether an individual has become a parent by age 20.

B.2 Imputation of Consumption

Survey Consumption: The Danish Expenditure survey is conducted through a comprehensive interview, where households are asked about purchases of durables within the past twelve months from the interview date. It consists primarily of the following components: food and beverages, clothing, housing, electricity and heating, household services, medical products and services, transport, communications, recreational equipment, entertainment and travel, and other goods and services. The survey is conducted by contacting households at different times of the year so as to have the observations distributed across the calendar year. Furthermore, each household is asked to keep a diary for two weeks, to get a record all expenditures in the household. This is then scaled to get an expression for annual consumption.

Main Consumption Measure: We impute total household expenditures from the relationship between total expenditures, τ, from Danish Expenditure Survey and the components of individuals consumption: household disposable income, assets and liabilities in periods t and $t-1$. We use a random forest estimator with the number of trees selected by 5-fold cross-validation.

$$\hat{\tau}_{rf}(x) = \frac{1}{B}\sum_{b=1}^{B} T_b(x, \{X_i, Y_i\}) \tag{B.1}$$

$$Y_i = \text{Survey Cons}_t$$

$$X_i = A_t, A_{t-1}, L_t, L_{t-1}, I_t, I_{t-1}$$

I_t	Household Disposable income at time t
A_t	Combined Household's Positive Assets at time t
L_t	Combined Household's Liabilities at time t

The random forest estimator proceeds by taking B random bootstrap samples of the size equal to the size of the dataset, predicting the relationship between the predictors, X, and the consumption, Y, through building regression trees, T_b, within each of these random samples, and taking the average of the predictions from the trees. The regression trees predict the relationship between Y and X by recurrently splitting the sample into two daughter nodes and fitting the data via regression on each node until the maximum depth, number of node-splits, is achieved, and then combining the prediction across all the nodes for Y given X.

The split points are chosen to minimize the sum of squared residuals between Y_i and the average of

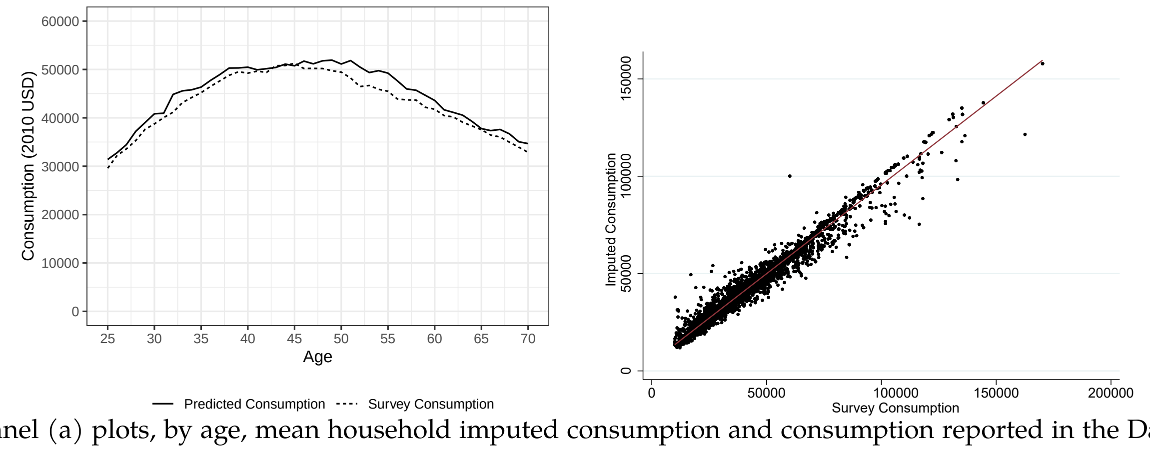
Y_i in each of the daughter nodes. The number of trees, B, and the maximum depth of the trees is chosen through five-fold cross validation, where the data is randomly split into five equally sized sets, wherein one is used as the training-validation sample and the estimation error is evaluated on the fitted model on the remaining four datasets as the number of trees and the depth is increased. The algorithm used is the python package *sklearn*. The cross validation is done for each grid point increasing the number of trees in step sizes of 20 from 40 and 160, and increasing the depth of the trees in step sizes of 10 from 20 to 100, and chosen according to when the change in sum of squared residuals is sufficiently low. The maximum number of sample splits used is 20, and the number of trees used is 120.

We use households' disposable income, I, assets A, and liabilities, L in periods t and $t-1$ to predict the total household consumption as reported in the Danish Expenditure survey. We then use the household disposable income, assets and liabilities in the current and previous periods for the entire population to create a measure of predicted consumption. We then use the equivalence scale adjustment for consumption to adjust for household composition.

Performance and Statistics: We split the data randomly into training (20%) and testing (80%) sample to measure the performance of random forest predictor. Overall, we get a correlation of 0.95 with our imputed measure and the Danish Expenditure Survey data within our testing sample.

Figure B.1: Mean Consumption, Imputed vs. Survey Measure of Consumption

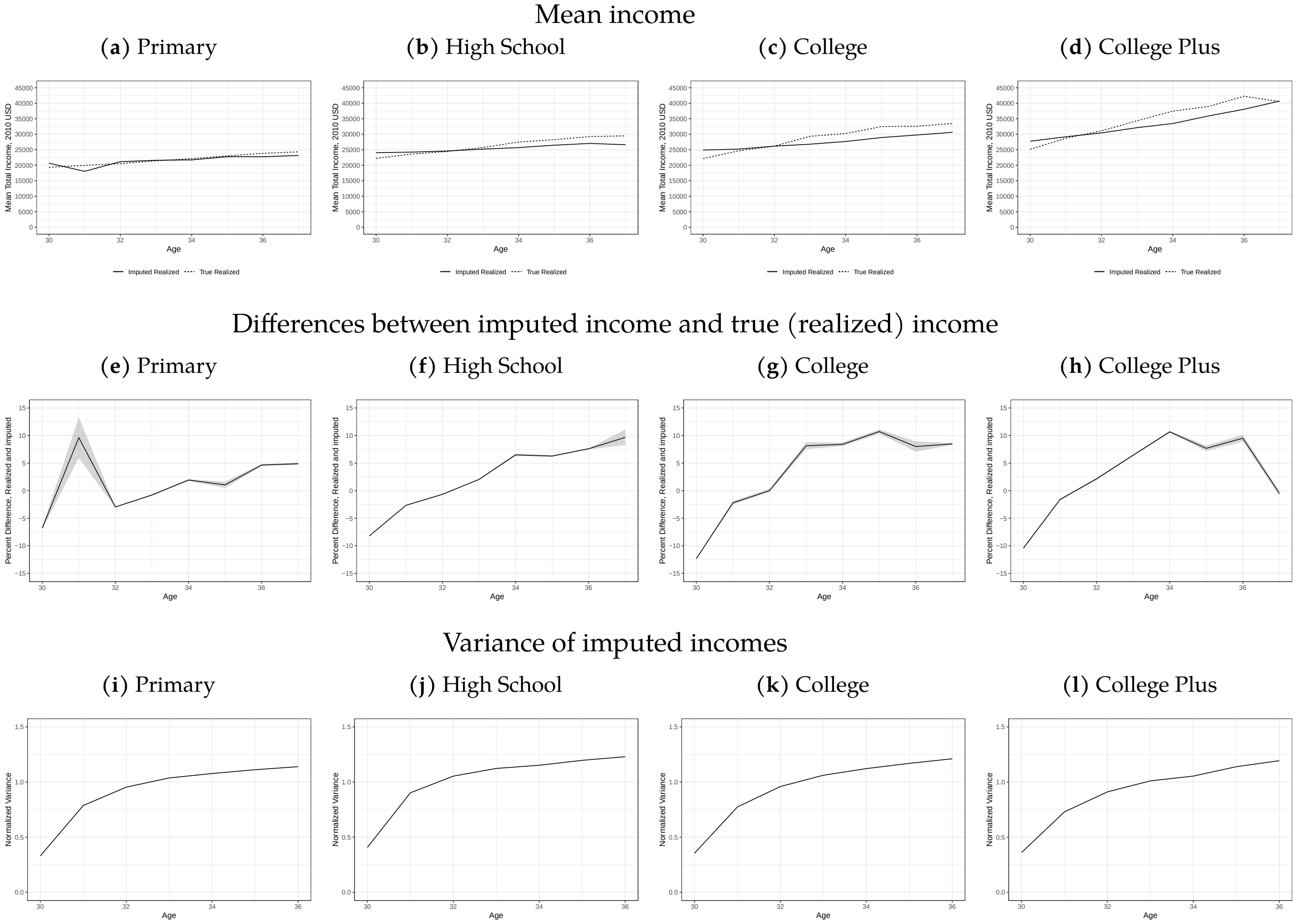
(a) Mean of the Two Measures (b) Scatterplot of the Two Measures



Notes: Panel (a) plots, by age, mean household imputed consumption and consumption reported in the Danish Expenditure Survey. Observations are from the testing sample (a 20% random sample of the individuals observed in the Survey, age 25–70). Panel (b) plots household survey reported consumption against imputed consumption.

Using the procedure described above, we impute 100 future income streams for ages 38–60. Figure B.2 shows the mean imputed income vs. the mean true (realized) income separately for each education level.

Figure B.2: Mean Imputed vs Mean Realized Income by Education Level



Notes: The figure depicts the mean imputed income (after adjusting for the mean imputation error rate by education level) vs. the mean true (realized) income, the mean difference between the imputed income, and the variance of imputed incomes.

C Appendix to Section 4

C.1 Identification and Estimation

We adapt a nonparametric synthetic cohort strategy from Abbott and Gallipoli (2022). In this paper, we take a conventional parametric position on preferences. We approximate the information set $\mathcal{I}_{i,t}$ by a vector of time-varying and time-invariant individual characteristics, which we denote by $\mathcal{Z}_{i,t}$.

As a first step, let $\mathcal{Z}_{i,t}$ be an empirical approximation of the information set of individual i in period t, $\mathcal{I}_{i,t}$. We assume that individuals form expectations about their future income streams based solely on the information set as proxied by $\mathcal{Z}_{i,t}$. Formally,

$$\text{PDV}(\boldsymbol{z_{i,t}}) = \qquad \mathbb{E}_{i,t}\Bigg[\sum_{\tau=1}^{T-t}\beta^{\tau}y_{i,t+\tau} \mid \boldsymbol{\mathcal{I}}_{i,t}\Bigg] = \mathbb{E}\Bigg[\sum_{\tau=1}^{T-t}\beta^{\tau}y_{i,t+\tau} \mid \boldsymbol{\mathcal{Z}} = \boldsymbol{z}_{i,t}\Bigg], \tag{C.1}$$

where $\mathbb{E}_{i,t}$ denotes the expectation of agent i at time t with characteristics $\boldsymbol{\mathcal{Z}} = \boldsymbol{z}_{i,t}$. These information sets govern agent anticipations. They are also useful as we only have data on limited stretches of life cycles. To address this problem, we invoke a synthetic cohort assumption and estimate the expected PDV and lifetime wealth from information on realized income streams of individuals with the same characteristics (captured by vector $\boldsymbol{z}_{i,t}$) but born in different years. From Equation (C.1), we can write Equation (3) recursively as

$$\text{PDV}(\boldsymbol{\mathcal{Z}}_t) = \mathbb{E}\Big[\beta y_{t+1} \mid \boldsymbol{\mathcal{Z}}_t\Big] + \int \beta\text{PDV}(\boldsymbol{\mathcal{Z}}_{t+1}) \times f_{\boldsymbol{\mathcal{Z}}_{t+1}|\boldsymbol{\mathcal{Z}}_t}(\boldsymbol{\mathcal{Z}}_{t+1} \mid \boldsymbol{\mathcal{Z}}_t)d\boldsymbol{\mathcal{Z}}_{t+1},$$

where $f_{\boldsymbol{\mathcal{Z}}_{t+1}|\boldsymbol{\mathcal{Z}}_t}(\boldsymbol{\mathcal{Z}}_{t+1} \mid \boldsymbol{\mathcal{Z}}_t)$ is the conditional density of $\boldsymbol{\mathcal{Z}}_{t+1}$, where for simplicity we use the fact that the $\boldsymbol{\mathcal{Z}}_{i,t}$ predicts the expected PDV of an agent i to drop the subscript i from our notation. It can be estimated directly from state-transition probabilities observed in the data. Importantly, these transitions are allowed to vary across cohorts to capture cohort differences. $\mathbb{E}\Big[\beta y_{t+1} \mid \boldsymbol{\mathcal{Z}}_t\Big]$ is the expected income flow in the next period for individuals with the same characteristics, which also can be estimated directly from the data once we specify β. We estimate the expected PDV and lifetime wealth nonparametrically by forming the approximation of information set $\boldsymbol{\mathcal{Z}}_{i,t}$, and taking expectations by weighting information across years.[6]

C.2 Specifying the Information Set

Individual choices at early ages reveal agent information sets about future income streams. We can use these choices to separate the impact of predictable heterogeneity from uncertainty in earnings. To fix ideas, suppose that individuals are deciding whether to go to college. If agents possess information about the

[6]See Abbott and Gallipoli (2022); Escanciano et al. (2021). Thus, for example, from the expected PDV beginning at the terminal period, we obtain earlier periods' PDV based on backward recursion. This is slightly different than the method of Abbott and Gallipoli (2022), who construct and invert a large matrix to solve this recursive formula in one step. Our recursive method is more suitable for empirical implementation for unbalanced panel data sets (i.e., not all individuals are observed at all ages). We assume that the expected PDV is zero at age 85 for all individuals ($\text{PDV}(\boldsymbol{\mathcal{Z}}_{85}) = 0$ for all $z \in \boldsymbol{\mathcal{Z}}$), and we then compute the expected PDV at age 84 by computing the expected income flow for each information set group at age 84. We continue this recursion until we have recovered the expected PDV for all ages and all realizations of $\boldsymbol{\mathcal{Z}}$ observed in the data (to age 20). Our procedure for computing the lifetime wealth measure is similar, with the additional step that we compute the SDF for each individual in each period, to which we return below. We use the Nadaraya-Watson estimator to obtain estimates of the expected income flow at the next period: $\mathbb{E}\Big[\beta y_{t+1} \mid \boldsymbol{\mathcal{Z}}_t\Big] = \sum_{j=1}^{N}\beta y_{j,t+1}\gamma_{j,t}(\boldsymbol{\mathcal{Z}}_{j,t})$, where N is the sample size, j denotes individuals in the sample, and $\gamma_{j,t}(\boldsymbol{\mathcal{Z}}_{j,t})$ is a weighting function that accounts for similarity in the observed characteristics of different individuals. Individuals born in cohorts of close proximity, for example, receive greater weight than those born further apart. Thus, the procedure accounts for potentially important cohort effects. Appendix C.1–C.2 present further details on our estimation procedure. Expected income flows are then a sample average of all individuals in the full population. A similar procedure is done to compute the conditional density $f_{\boldsymbol{\mathcal{Z}}_{t+1}|\boldsymbol{\mathcal{Z}}_t}(\boldsymbol{\mathcal{Z}}_{t+1} \mid \boldsymbol{\mathcal{Z}}_t)$. When computing the expected income flow at the next period, we also take into account the possibility of death by allowing transitions from any given $\boldsymbol{\mathcal{Z}}$ to death at the end of the period.

rate of return of going to college (which may be heterogeneous across agents), then they act upon that information when making their educational decisions in the current period. However, they cannot base their decision on the rate of return to higher education that is realized after their decisions are made, which corresponds to the uncertainty about rate of return.

Formally, let y_j denote disposable income at age j, $\boldsymbol{\mathcal{Z}}_j$ the information set of the individual at age j, and c_j the consumption at age j. We test (1) whether agents' decisions today with regard to consumption have predictive power for their future income and (2) whether the information set $\boldsymbol{\mathcal{Z}}_j$ is uncorrelated with *unexpected* component of realized future income (conditional on the defined information set). Thus, let $\boldsymbol{\mathcal{Z}}_{30}$ be the assumed correct information set. Then $y_{50} - \mathbb{E}(y_{50} \mid \boldsymbol{\mathcal{Z}}_{30})$ is uncorrelated with c_{30}.

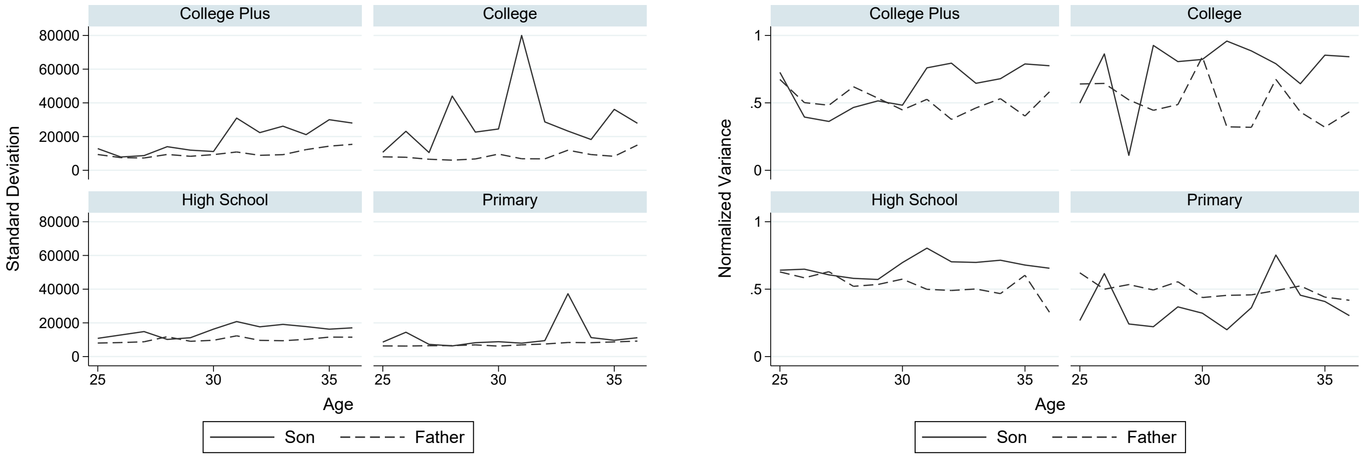
$$\text{Cov}(y_{50} - \mathbb{E}(y_{50} \mid \mathcal{Z}_{30}), c_{30}) = 0. \tag{C.2}$$

A test based on Equation (C.2) examines whether the information set $\boldsymbol{\mathcal{Z}}_{30}$ captures all forward-looking information that individuals use when making current decisions. Fig. C.1(a) shows the standard variation of the unforecastable component of individuals' income by age for the sample of male children and their fathers. Fig. C.1(b) presents the variance of unforecastable component of individuals' income normalized by the total variance of income by age.

Figure C.1: Uncertainty by Education Level

(a) Standard Deviation of Residualized Next-Period Income

(b) Variance of Residualized Next-Period Income Normalized by Total Variance of Income



Notes: The figure shows the uncertainty of next-period income over ages 25–36 for fathers and sons of the 1981–1982 cohorts, separately by education level. Fig. (a) shows the standard deviation of residualized next-period income using the current approximated information set; i.e., $y_{i,j+1} - \mathbb{E}_{i,j}\{y_{i,j+1} \mid \mathcal{Z}_{i,j}\}$, where $y_{i,j+1}$ denotes income of individual i at $j+1$ and $\mathcal{Z}_{i,j}$ is the estimated information set of individual i at age j. Fig. (b) shows the corresponding variance of residualized income normalized relative to the variance of next-period income, $y_{t,j+1}$.

C.3 IV Estimation Procedure

Assume the standard setting and notations of the OLS model, the objective function for the IV-GMM model could be written as:

$$\tilde{Q}(\beta) = \left(\frac{1}{n}\sum_{i=1}^{n}\mathbf{Z}_i'(y_i - \mathbf{X}_i\beta)\right)' W \left(\frac{1}{n}\sum_{i=1}^{n}\mathbf{Z}_i'(y_i - \mathbf{X}_i\beta)\right)$$

In our IGE setting, $\mathbf{X}_i = \log(Y^p_{a_1,a_2})$, $\mathbf{z}_i = [\Delta_{a_1-J}, \Delta_{a_1-J+1}, \Delta_{a_1-J+2}, \ldots, \Delta_{a_1-1}, Y^p_{a_1-1}]'$, $y_i = log(Y^c_{30,35})$ where $Y^p_{a_1-1}$ denotes parental income measure (expected PDV) at child age $a_1 - 1$, $Y^p_{a_1,a_2}$ denotes averaged parental income measure between child age a_1 and a_2, Δ_t denotes the parental policy innovation from equation F.5, J denotes the maximum lag of the policy instrument, $y_i = log(Y^c_{30,35})$ denotes child's lifetime resources (expected PDV) averaged over ages 30 to 35. The optimal weighting matrix ($W = M^{-1}$) uses the inverse of covariance matrix of the moment conditions to produce the most efficient estimator (Hansen, 1982). W is a positive-definite weighting matrix with the same number of rows and columns as the number of columns of z_i. We set W as:

$$W = \left(\frac{1}{n}\sum_{i=1}^{n}\hat{u}_i^2\mathbf{z}_i\mathbf{z}_i'\right)^{-1}$$

We first obtain the residuals $\hat{u}_i$ by estimating the following IV-2SLS Model.

First stage equation:

$$\log(Y^p_{a_1,a_2}) = \alpha + \sum_{i=1}^{J}(\beta_i \Delta_{a_1-i}) + \theta \log(Y^p_{a_1-1}) + \epsilon_i$$

Second stage equation:

$$\log(Y^c_{30,35}) = \alpha + \beta \log(\hat{Y}^p_{a_1,a_2}) + \gamma\hat{\epsilon}_i + u_i$$

Then, using the estimated residuals we construct the weighting matrix **W** to calculate the GMM estimator:

$$\hat{\beta}_{GMM} = \Big(\mathbf{X}'\mathbf{Z}\mathbf{W}\mathbf{Z}'\mathbf{X}\Big)^{-1}\mathbf{X}'\mathbf{Z}\mathbf{W}\mathbf{Z}'\mathbf{y}$$

with the variance of the estimated $\hat{\beta}_{GMM}$:

$$\Sigma_{\hat{\beta}_{GMM}} = n\Big(\mathbf{X}'\mathbf{Z}\mathbf{W}\mathbf{Z}'\mathbf{X}\Big)^{-1}\mathbf{X}'\mathbf{Z}\mathbf{W}\hat{\mathbf{S}}\mathbf{W}\mathbf{Z}'\mathbf{X}\Big(\mathbf{X}'\mathbf{Z}\mathbf{W}\mathbf{Z}'\mathbf{X}\Big)^{-1}$$

We use the optimal GMM variance estimator by setting $\hat{\mathbf{S}} = \mathbf{W}^{-1}$. Then the variance estimator becomes:

$$\Sigma_{\hat{\beta}_{GMM,optimal}} = n\Big(\mathbf{X}'\mathbf{Z}\mathbf{W}\mathbf{Z}'\mathbf{X}\Big)^{-1}.$$

D Appendix to Section 5

D.1 Additional Summary Statistics

Table D.1: Correlations of Measures of Resources at Child Ages 5–9

	Wage Income	Income w/o Transfers	Income w. Transfers	Disposable Income	Household Cons.	Realized PDV
Income w/o Transfers	0.55					
Income w. Transfers	0.50	0.98				
Disposable Income	0.55	0.42	0.42			
Household Cons.	0.45	0.63	0.61	0.38		
Realized PDV	0.37	0.43	0.42	0.37	0.37	
Expected PDV	0.45	0.45	0.42	0.35	0.38	0.39

Notes: The table shows correlations between various measures of resources at ages child ages 5–9 for fathers of the 1981–1982 cohorts.

Table D.2: Correlations of Measures of Resources at Child Ages 10–14

	Wage Income	Income w/o Transfers	Income w. Transfers	Disposable Income	Household Cons.	Realized PDV
Income w/o Transfers	0.55					
Income w. Transfers	0.50	0.98				
Disposable Income	0.55	0.42	0.42			
Household Cons.	0.45	0.63	0.61	0.38		
Realized PDV	0.37	0.43	0.42	0.37	0.37	
Expected PDV	0.45	0.45	0.42	0.35	0.38	0.39

Notes: The table shows correlations between various measures of resources at ages child ages 10–14 for fathers of the 1981–1982 cohorts.

Table D.3: Correlations of Measures of Resources at Ages 30–35 of Fathers

	Wage Income	Income w/o Transfers	Income w. Transfers	Disposable Income	Household Cons.	Realized PDV
Income w/o Transfers	0.55					
Income w. Transfers	0.50	0.98				
Disposable Income	0.55	0.42	0.42			
Household Cons.	0.45	0.63	0.61	0.38		
Realized PDV	0.37	0.43	0.42	0.37	0.37	
Expected PDV	0.45	0.45	0.42	0.35	0.38	0.39

Notes: The table shows correlations between various measures of resources at ages 30–35 for fathers of the 1981–1982 cohorts.

Table D.4: Correlation of Measures of Resources, Family (Mother plus Father)

	Wage Income	Income without Transfers	Income with Transfers	Disposable Income	Household Consumption	Realized PDV
Income without Transfers	0.70					
Income with Transfers	0.62	0.95				
Disposable Income	0.59	0.55	0.60			
Household Consumption	0.54	0.72	0.71	0.49		
Realized PDV	0.45	0.57	0.55	0.43	0.50	
Expected PDV	0.51	0.53	0.50	0.38	0.53	0.50

Notes: The table shows correlations between various measures of resources at ages 30–35 for families of the 1981–1982 cohorts. Family-level measures are computed by adding father's and mother's income measure.

Table D.5: Correlation of Measures of Resources (Child)

	Wage Income	Disposable Income	Income without Transfers	Income with Transfers	Household Consumption	Realized PDV
Disposable Income	0.53					
Income without Transfers	0.70	0.93				
Income with Transfers	0.60	0.96	0.97			
Household Consumption	0.54	0.43	0.46	0.42		
Realized PDV	0.40	0.22	0.29	0.25	0.37	
Expected PDV	0.57	0.35	0.43	0.36	0.58	0.51

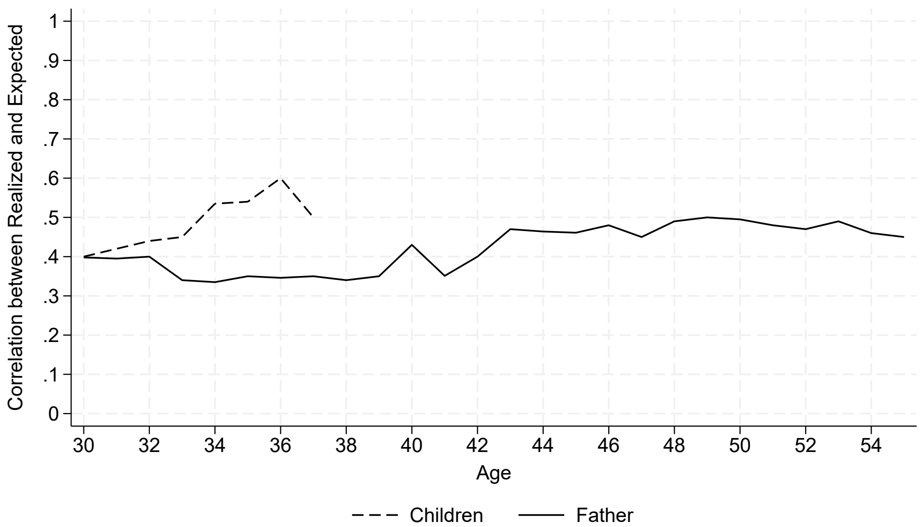
Notes: This table shows the correlation between various measures of resources at ages 30–35 for children of 1981–1982 cohorts. To calculate realized PDV, we impute child income after age 37.

Table D.6: Gini Coefficients

	Male Children	Female Children	Father	Mother
Wage Income	0.338	0.340	0.301	0.356
Disposable Income	0.235	0.183	0.178	0.168
Income without Transfers	0.293	0.293	0.254	0.321
Income with Transfers	0.251	0.198	0.212	0.205
Household Consumption	0.154	0.148	0.086	0.089
Realized PDV	0.251	0.200	0.259	0.190
Expected PDV	0.169	0.135	0.128	0.119

Notes: This figure depicts the Gini coefficient calculated for income measures using the 1981–1982 cohort of children, and their parents. The Gini coefficient is calculated using the mean income over ages 30–35 for each of the income and family types denoted here. The family measures used in this table are the sum of the mother's and father's measures as defined in Appendix B.

Figure D.1: Correlations of Realized PDV with the Expected PDV by Age

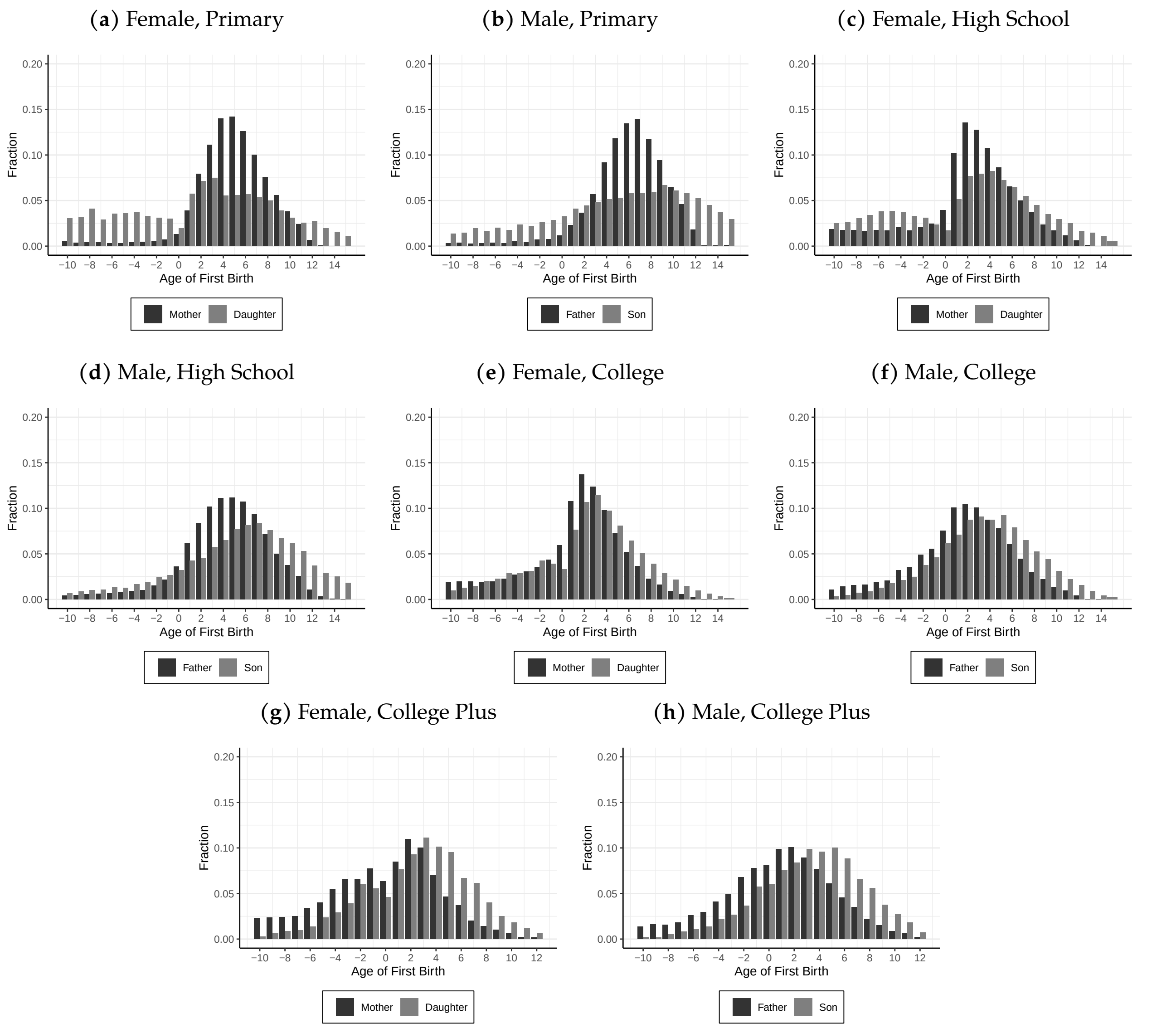


Notes: This figure presents the correlation between the expected and realized PDV over the age range of 30–37 for children and 30-55 for fathers. We use our main sample: the 1981—1982 cohorts of native Danes and their fathers.

D.2 Additional Correlations

Figure D.2 shows the distribution of the age relative to individuals' final graduation at which individuals have their first child for the 1981–1982 birth cohorts (children) compared to that of their parents, for each level of education. Figure D.3 depicts the correlation between child outcomes and different measures of parental resources when we measure resources when children were 0–4, 5–9, and 10–14 years old. Figure D.4 shows the correlation between child outcomes and different parental resource measures evaluated at ages 30–35 of parents.

Figure D.2: Gap in Years between Age of First Birth and Graduation (Age of First Birth minus Age of Graduation)

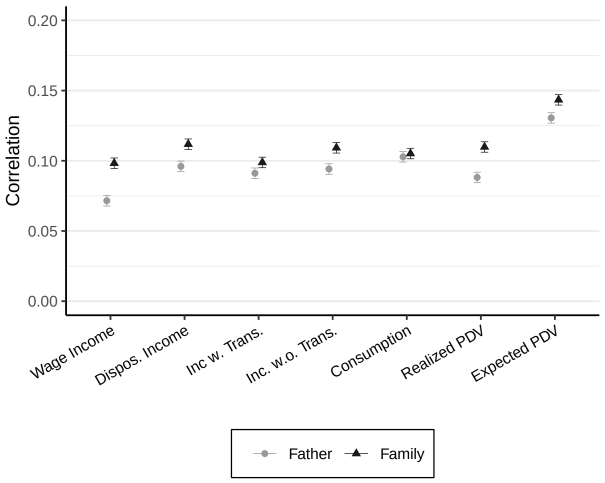


Notes: This figure shows the distribution of the age relative to individuals' final graduation at which individuals have their first child for the 1981–1982 birth cohorts (children) compared to that of their parents, for each level of education. We get the age individuals have their first child and subtract from that the latest age individuals were enrolled in schooling. The vertical axis reports the fraction of individuals who had their first child at a given age relative to their final graduation age.

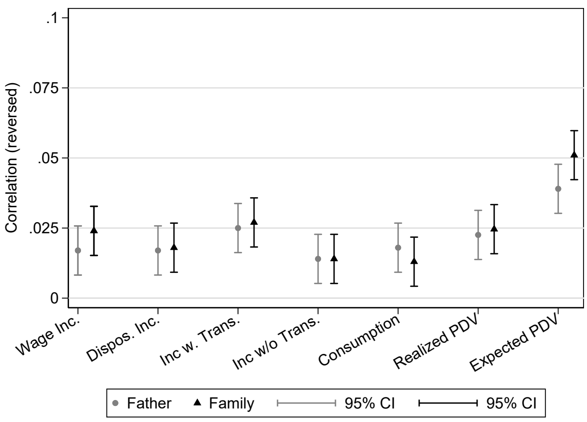
Figure D.3: Parental Resources Measured at Ages 0–4 and Child Outcomes

Ages 0–4

(a) Criminal Behavior (Reversed)

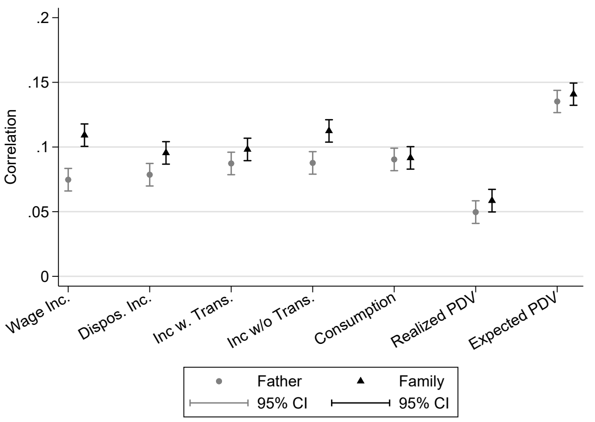


(b) Having a Child by Age 20 (Reversed)

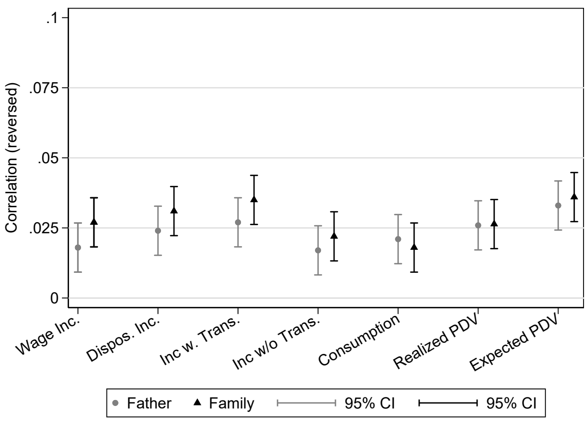


Ages 5–9

(c) Criminal Behavior (Reversed)

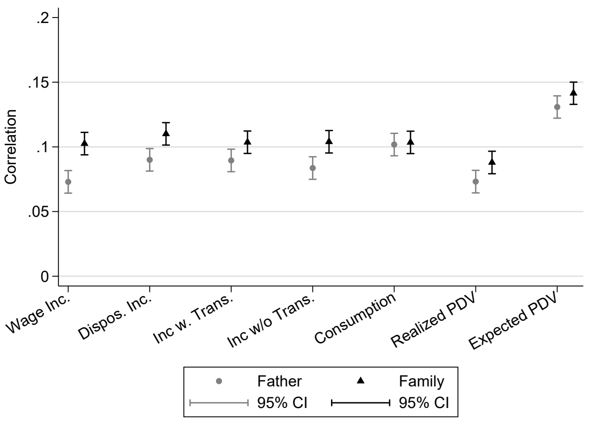


(c) Having a Child by Age 20 (Reversed)

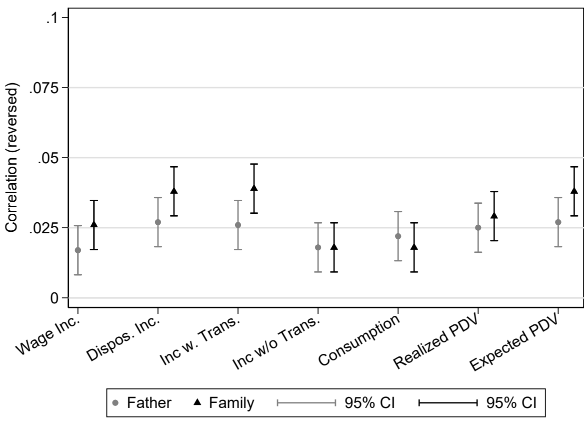


Ages 10–14

(e) Criminal Behavior (Reversed)



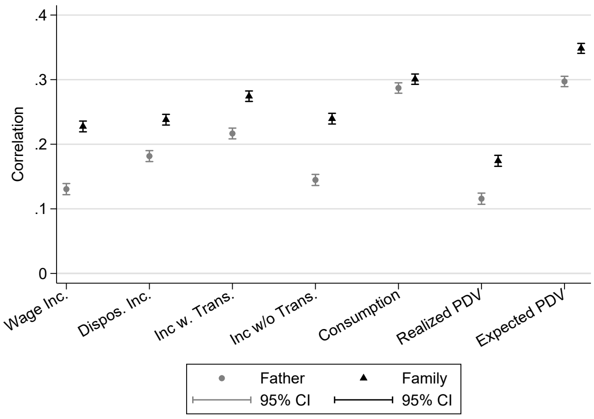
(f) Having a Child by Age 20 (Reversed)



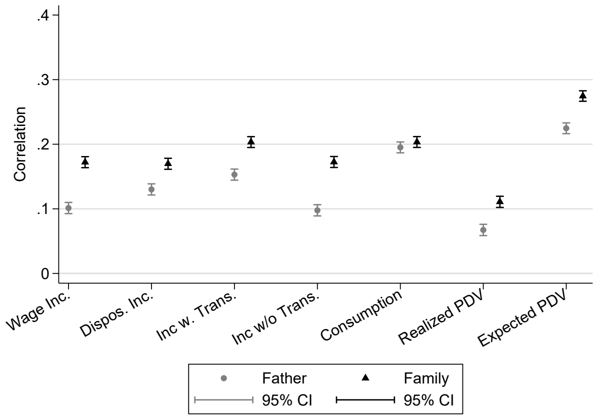
Notes: This figure shows the correlation between child outcomes and different measures of parental resources when we measure resources when children were 0–4, 5–9, and 10–14 years old.

Figure D.4: Parents' Resources and Children's Outcomes

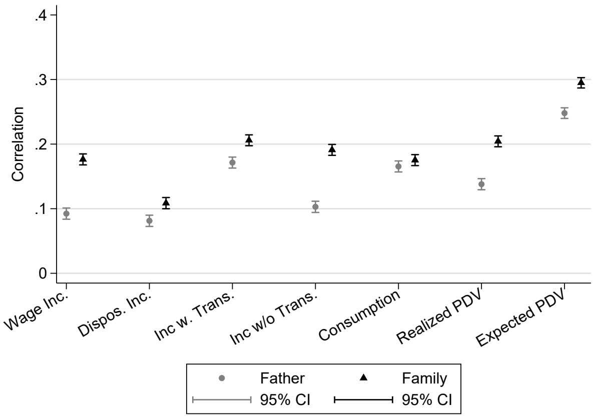
(a) Mathematics Problem Solving



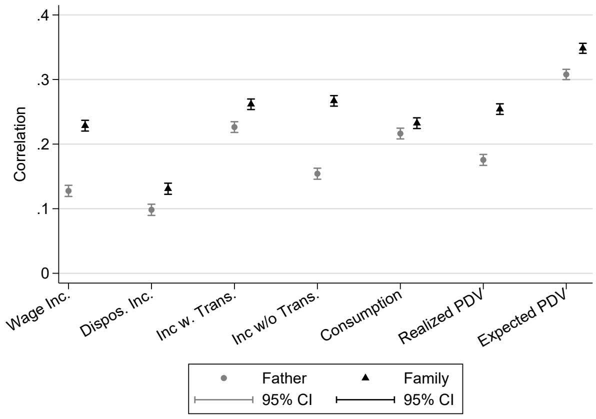
(b) Danish Reading



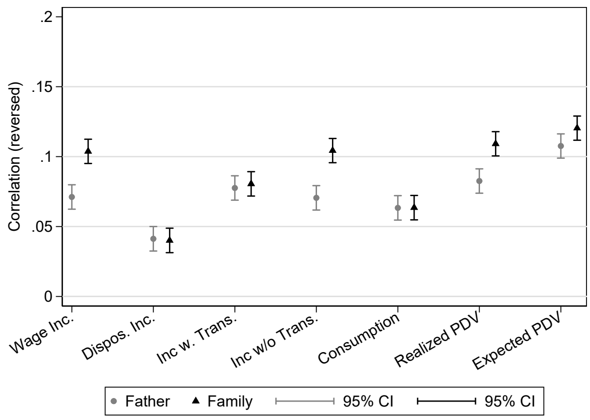
(c) College Attainment



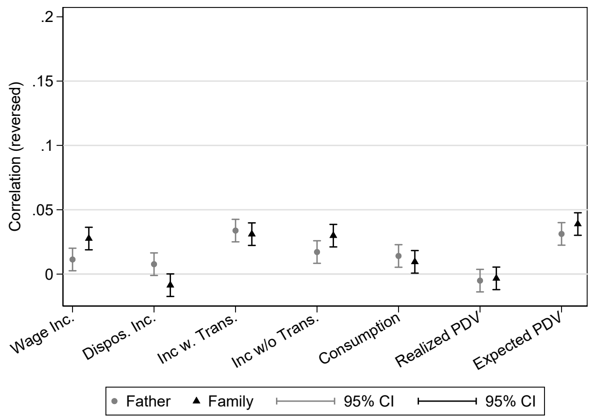
(d) Years of Education



(e) Criminal Behavior (Reversed)



(f) Having a Child by Age 20 (Reversed)

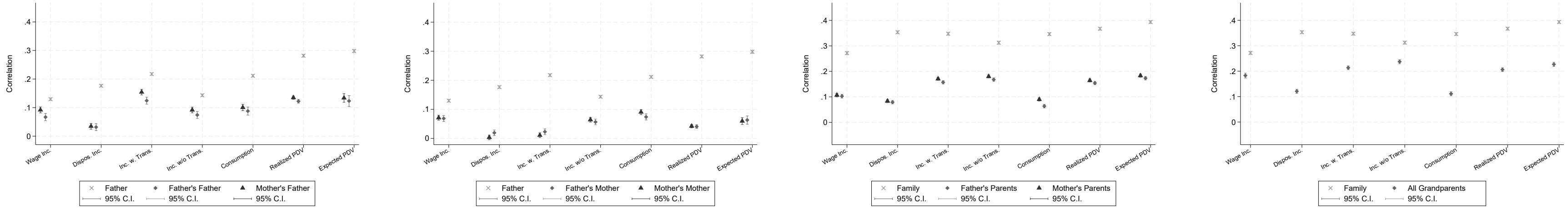


Notes: This figure shows the correlation between child outcomes and different parental resource measures evaluated at ages 30–35 of parents (except realized PDV, which is long run averages discounted to age 30–35). Figs. (a)–(b) show 9th-grade leaving exam scores in mathematics and Danish for the 1995–1997 birth cohorts. Figs. (c)–(f) show educational attainment measured at age 35 (c–d), crime (e), and an indicator of being a parent by age 20 (f) for the 1981–1982 birth cohorts.

Figure D.5: Grandparental Resources and Children's Exam Scores

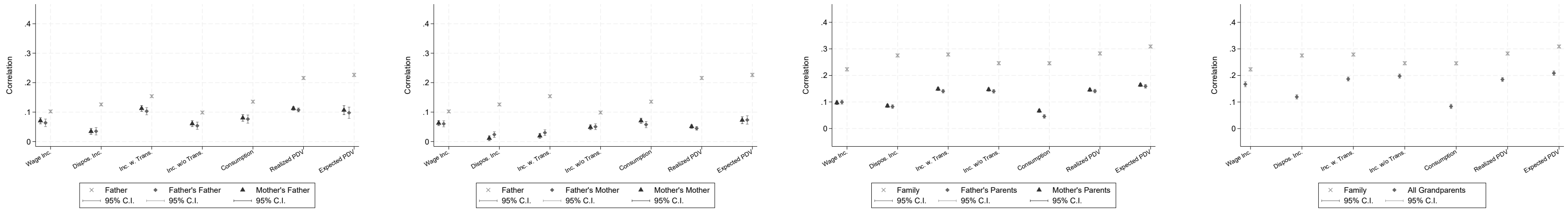
Mathematics Exam Score

(a) Father and Grandfather (b) Mother and Grandmother (c) Family and Grandparents (d) Family and All Grandparents



Danish Exam Score

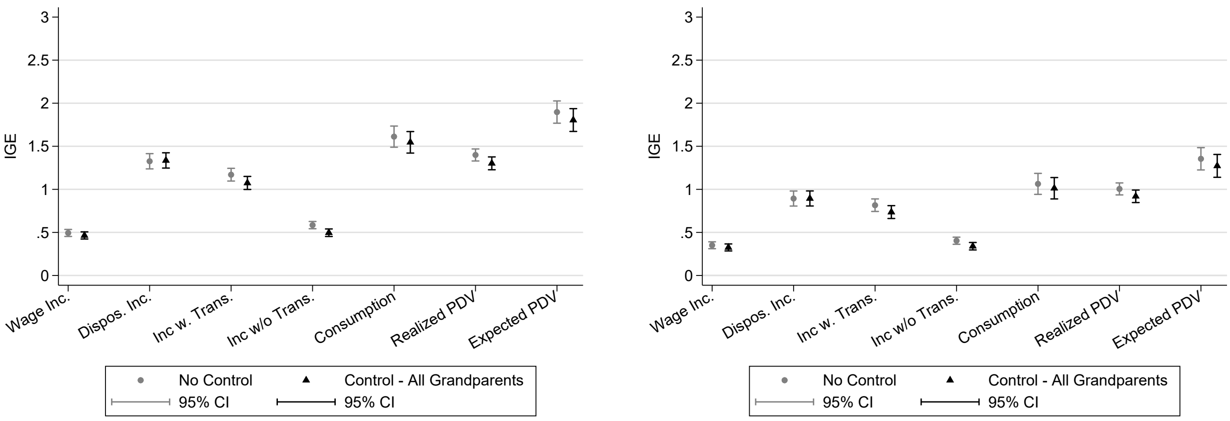
(e) Father and Grandfather (f) Mother and Grandmother (g) Family and Grandparents (h) Family and All Grandparents



Notes: This figure shows the correlation between children's 9th-grade leaving exam scores in mathematics and Danish and measures of resources of grandparents (using the measures specified in Table 2 and Fig. 5 of the main paper), comparing them to the analogous correlation with parental resources. Figs. (a) and (e) show the correlation of test scores with father's resources compared to (paternal) grandfather's resources. Figs. (b) and (f) show the correlation of test scores with family (father plus mother) resources compared to (paternal) grandparents' (grandfather plus grandmother) resources. Figs. (c) and (g) show the correlation of test scores with family (father and mother) resources compared to grandparents' (maternal and paternal grandparents) resources. Figs. (d) and (h) show the correlation of test scores with family (father and mother) resources compared to grandparents' (sum of all four grandparents) resources. We use children of the 1995–1997 cohorts and their grandparents (parents of the 1995–1997 cohorts). We measure parents' and grandparents' resources over ages 40–45.

Figure D.6: Parental Resources' Association with Children's Reading Grades Before and After Controlling for Grandparental Resources

(a) Mathematics (b) Danish Reading

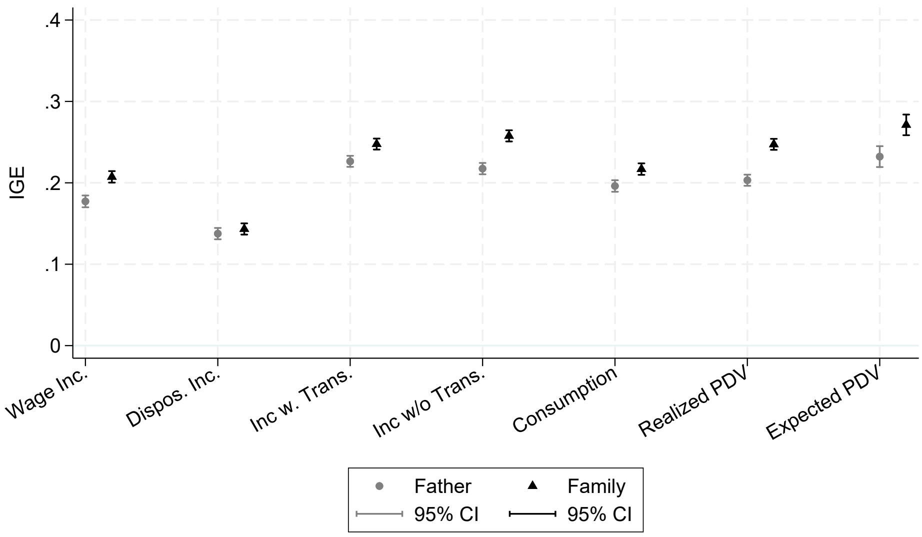


Notes: This figure shows the association between children's 9th-grade leaving exam scores (in Mathematics and Danish reading) and measures of resources of family (using the measures specified in Table 2 and Fig. 5 of the main paper), before and after controlling for resources of (all four) grandparents. Fig. (a) shows the results for children's mathematics scores. Fig. (b) shows the results for children's scores in Danish reading. We use children of the 1995–1997 cohorts and their grandparents (parents of the 1995–1997 cohorts). We measure parents' and grandparents' resources over ages 40–45. Family resources are the sum of father's and mother's resources.

E Appendix to IGEs Estimated by OLS

E.1 Robustness Tests

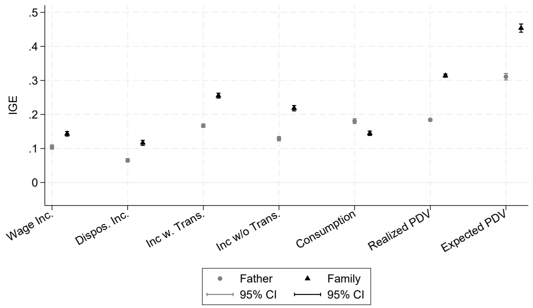
Figure E.1: Rank-Rank Estimates



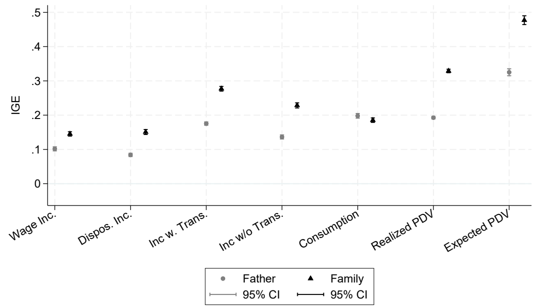
Notes: This figure depicts rank-rank estimates (rank of child measure regressed on rank of father/family measure) for different measures of resources.

Figure E.2: IGE Estimates When Measuring Individuals at a Single Age of Parents and Children

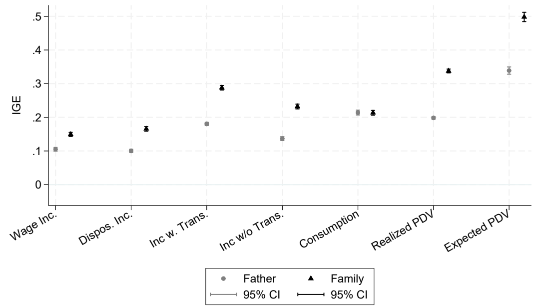
(a) Age 30



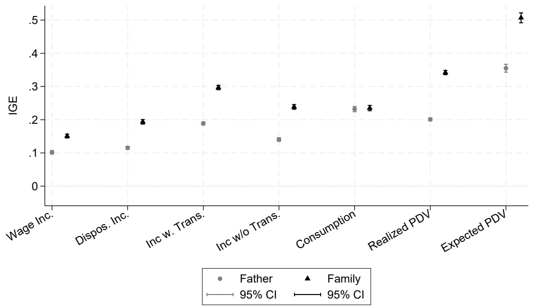
(b) Age 31



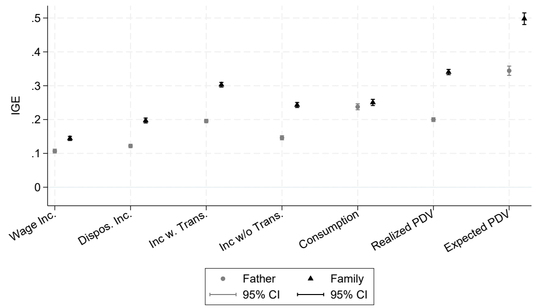
(c) Age 32



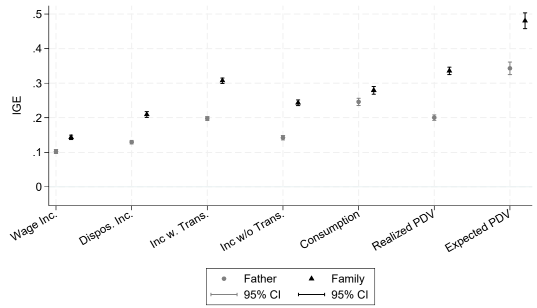
(d) Age 33



(e) Age 34

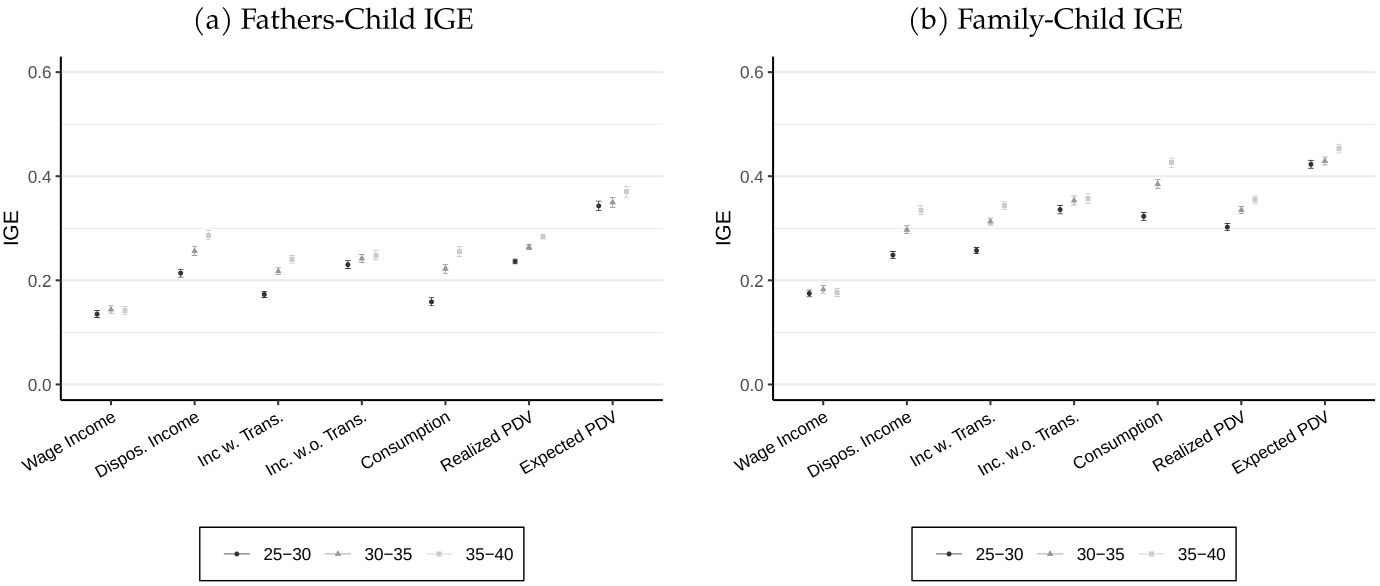


(f) Age 35



Notes: This figure depicts IGE estimates for different measures of resources for the 1981–1982 cohort of native Danes. The IGE is the slope coefficient from the log-log regression of child measure on father (family) measure: $log(y_j^c) = \alpha + \beta * log(y_j^f)$, where y_j^c denotes the child measure at age j, $\bar{y}_j^f$ denotes the father (family) measure at age j, and $j \in \{30, 31, ..., 35\}$.

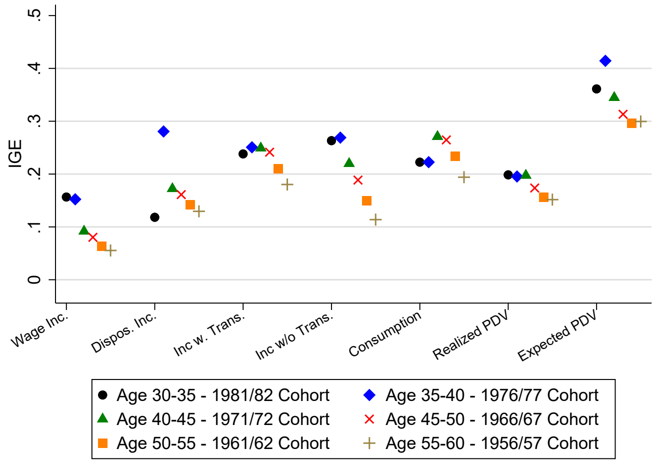
Figure E.3: Log-Log IGE Estimates for Cohorts Born in 1976 and 1977



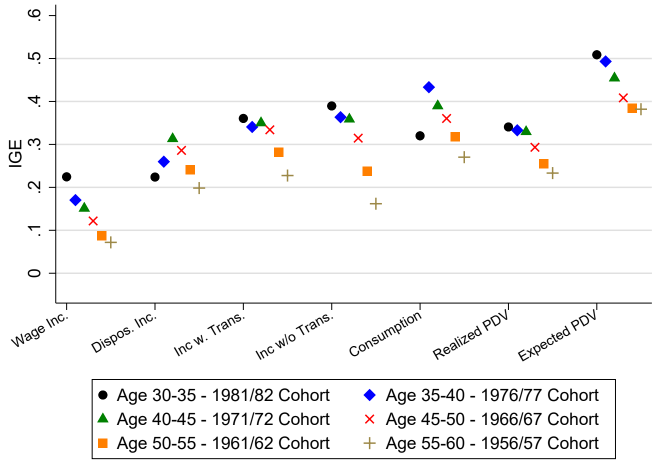
Notes: The figure shows IGE estimates for different measures of resources as in Fig. 6 for the cohort of 1976-1977 averaging the outcomes at different age ranges for the children's cohort. Parents' resources are measured at ages 35–40, while children's resources are measured at age ranges 25–30, 30–35 and 35–40.

Figure E.4: Log-Log IGE Estimates (Different Cohorts)

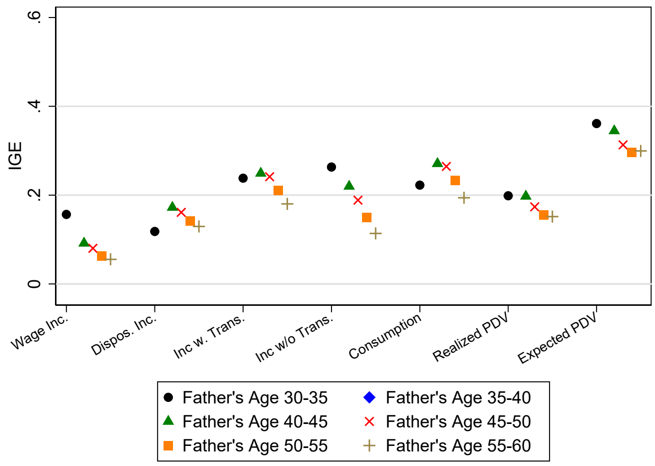
(a) Father-Child IGE (diff. coh.)



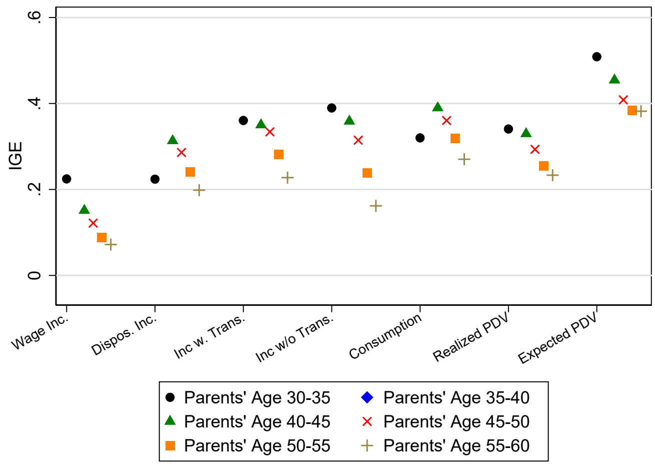
(b) Family-Child IGE (diff. coh.)



(a) Father-Child IGE (same coh.)



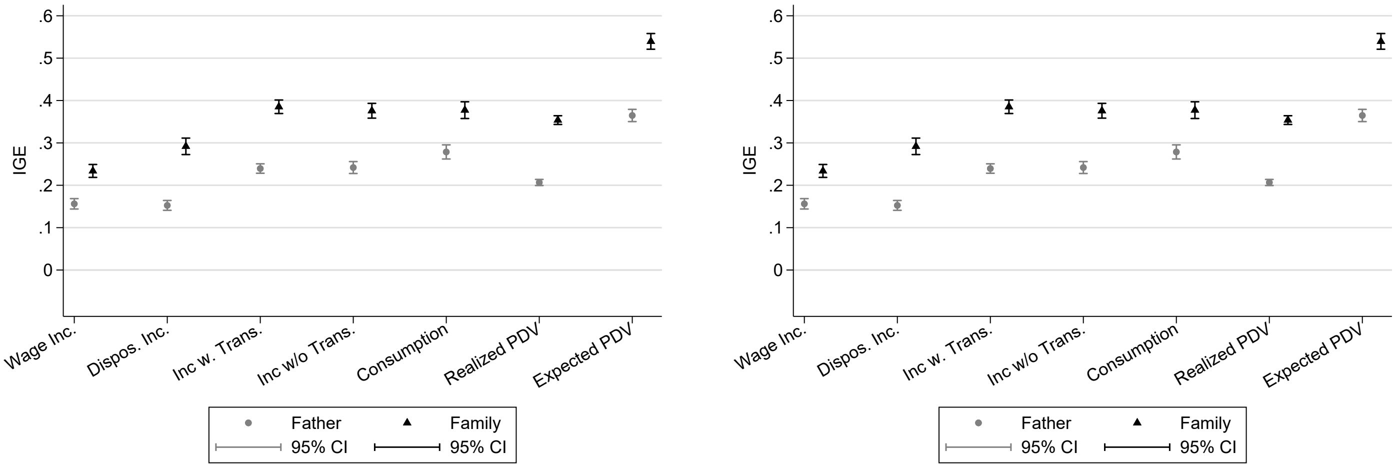
(b) Family-Child IGE (same coh.)



Notes: This figure depicts the IGE estimates for different cohorts and ages at measurement. Selected child birth cohorts are spaced every six years from 1956–1957 to 1981–1982 so that outcomes are measured every six-year interval from ages 55–60 (for the 1956–1957 birth cohort) to ages 30–35 (for the 1981–1982 birth cohort). Panel (a) compares the father-child IGE estimates, and Panel (b) compares the family-child IGE estimates across cohorts and measures of resources. Panels (c) and (d) show estimates using different ages at measurement for the parents, while keeping the child information fixed at 30–35.

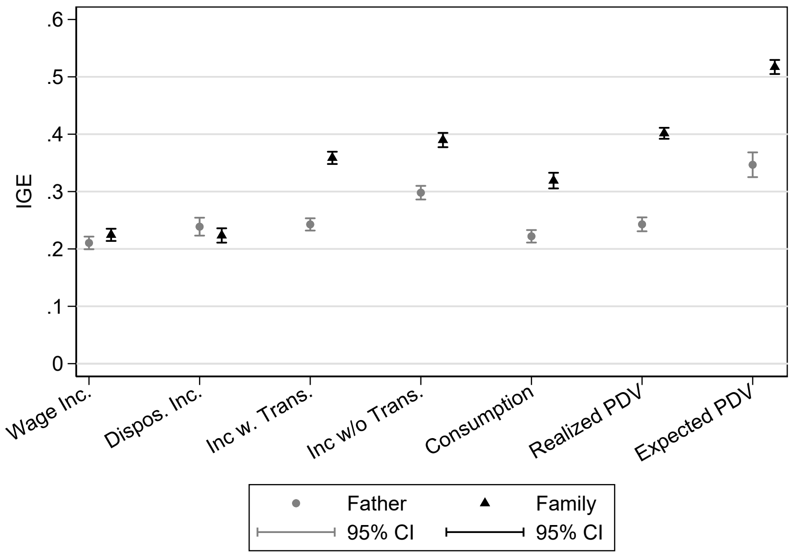
Figure E.5: Log-log IGE Estimates, First and Second Children

(**a**) IGEs First Child (**b**) IGEs Second Child



Notes: This figure depicts the IGE estimates by order of child's birth for children of two child families. Fig. (a) shows IGE estimates for the different measures for the first child for fathers and households. Fig. (b) shows a similar exercise for the second child.

Figure E.6: Log-Log IGE Estimates, Child's Household



Notes: This figure depicts the IGE estimates when using child's household resources in place of individual measures. The parental measure used is father's individual or household, defined as the sum of the resources of the child's father and mother. The sample of children is restricted to the 1981–1982 cohort of native Danes. The child's household resources are the sum of the child and her partner's resources at the child's ages 30–35.

Table E.1: IGE Estimates (Parents' Resources Measured at Ages 5–9 of Children)

	Father-Child IGE $\hat{\beta} = \rho_{\textbf{child,father}} \frac{sd(\textbf{child})}{sd(\textbf{father})}$	**Family-Child IGE** $\hat{\beta} = \rho_{\textbf{child,family}} \frac{sd(\textbf{child})}{sd(\textbf{family})}$
Traditional Measures		
Wage Income	0.087*** = $0.088\frac{1.128}{1.137}$	0.154*** = $0.126\frac{1.140}{0.937}$
Disposable Income	0.099*** = $0.103\frac{0.457}{0.478}$	0.224*** = $0.145\frac{0.459}{0.298}$
Income with Transfers	0.162*** = $0.165\frac{0.512}{0.520}$	0.293*** = $0.206\frac{0.515}{0.362}$
Income without Transfers	0.065*** = $0.113\frac{1.079}{1.890}$	0.151*** = $0.161\frac{1.094}{1.171}$
Household Consumption	0.238*** = $0.172\frac{0.306}{0.221}$	0.260*** = $0.186\frac{0.307}{0.220}$
Lifetime Measures		
Realized PDV	0.147*** = $0.226\frac{0.281}{0.432}$	0.280*** = $0.295\frac{0.281}{0.296}$
Expected PDV	0.396*** = $0.298\frac{0.286}{0.215}$	0.531*** = $0.326\frac{0.279}{0.171}$
Expected PDV IV	0.342*** = $0.218\frac{0.257}{0.164}$	0.397*** = $0.215\frac{0.236}{0.128}$

Notes: This table decomposes estimates from Fig. 6(b) and Table 4 into its components. We obtain decompositions of Expected PDV IV using the first-stage predicted values from our IV approach.
* $p < .1$, ** $p < .05$, *** $p < .01$.

Table E.2: IGE Estimates (Parents' Resources Measured at Ages 10–14 of Children)

	Father-Child IGE $\hat{\beta} = \rho_{\textbf{child,father}} \frac{sd(\textbf{child})}{sd(\textbf{father})}$	**Family-Child IGE** $\hat{\beta} = \rho_{\textbf{child,family}} \frac{sd(\textbf{child})}{sd(\textbf{family})}$
Traditional Measures		
Wage Income	0.083*** = $0.093\frac{1.123}{1.251}$	0.163*** = $0.144\frac{1.141}{1.004}$
Disposable Income	0.129*** = $0.143\frac{0.458}{0.508}$	0.284*** = $0.195\frac{0.461}{0.318}$
Income with Transfers	0.148*** = $0.167\frac{0.512}{0.577}$	0.285*** = $0.214\frac{0.516}{0.387}$
Income without Transfers	0.039*** = $0.101\frac{1.092}{2.813}$	0.088*** = $0.142\frac{1.119}{1.803}$
Household Consumption	0.216*** = $0.181\frac{0.307}{0.257}$	0.230*** = $0.199\frac{0.308}{0.266}$
Lifetime Measures		
Realized PDV	0.162*** = $0.239\frac{0.281}{0.415}$	0.298*** = $0.302\frac{0.281}{0.285}$
Expected PDV	0.356*** = $0.310\frac{0.286}{0.249}$	0.481*** = $0.335\frac{0.280}{0.195}$
Expected PDV IV	0.325*** = $0.251\frac{0.276}{0.213}$	0.380*** = $0.240\frac{0.260}{0.164}$

Notes: This table decomposes estimates from Fig. 6(c) and Table 4 into its components. We obtain decompositions of Expected PDV IV using the first-stage predicted values from our IV approach.
* $p < .1$, ** $p < .05$, *** $p < .01$.

Table E.3: IGE Estimates (Parents' Resources Measured at Parents' Ages 30–35)

	Father-Child IGE $\hat{\beta} = \rho_{\textbf{child,father}} \frac{sd(\textbf{child})}{sd(\textbf{father})}$	Parents-Child IGE $\hat{\beta} = \rho_{\textbf{child,family}} \frac{sd(\textbf{child})}{sd(\textbf{family})}$
Traditional Measures, OLS		
Wage Income	$0.125^{***} = 0.107 \frac{0.930}{0.798}$	$0.287^{***} = 0.148 \frac{0.913}{0.471}$
Disposable Income	$0.085^{***} = 0.078 \frac{0.438}{0.402}$	$0.239^{***} = 0.118 \frac{0.434}{0.215}$
Income with Transfers	$0.209^{***} = 0.170 \frac{0.477}{0.387}$	$0.346^{***} = 0.193 \frac{0.475}{0.264}$
Income without Transfers	$0.232^{***} = 0.162 \frac{0.894}{0.623}$	$0.405^{***} = 0.194 \frac{0.879}{0.420}$
Household Consumption	$0.341^{***} = 0.188 \frac{0.279}{0.154}$	$0.426^{***} = 0.210 \frac{0.279}{0.138}$
Lifetime Measures, OLS		
Realized PDV	$0.292^{***} = 0.214 \frac{0.384}{0.281}$	$0.386^{***} = 0.271 \frac{0.392}{0.275}$
Expected PDV	$0.371^{***} = 0.310 \frac{0.279}{0.233}$	$0.522^{***} = 0.341 \frac{0.277}{0.181}$

Notes: The table decomposes estimates from Fig. 6(d) into its components.
* $p < .1$, ** $p < .05$, *** $p < .01$.

E.2 Decomposing the IGE

To understand the mechanisms generating the large IGEs for expected PDV, we decompose our estimated IGEs into interpretable components. We explore the impact of variations in the factors that shape individual income levels and trajectories. As shown in Section 5.2, life-cycle dynamics have changed dramatically across cohorts. Recent cohorts acquire more education and graduate later, they are older when they form families (marriages and stable cohabitation) and as a group, face significantly steeper income profiles when they enter the labor market associated with their rising educational level.

We conduct a simple decomposition exercise using linear approximations to explain income dynamics. Let $y^p_{i,t}$ and $y^c_{i,t}$ denote log income of the parents and children, where i indexes family, and t the age when income is measured, in the following regression specification:

$$y^k_{i,t} = \lambda^k + (\boldsymbol{\beta}^k)'\boldsymbol{X}^k_{i,t} + \mu^k_i + \epsilon^k_{i,t}, \tag{E.1}$$

where $k \in \{p, c\}$ represents the family member, λ^k denotes an aggregate generation-specific effect, and $\boldsymbol{\beta}^k$ is a vector of parameters associated with the vector of observables $\boldsymbol{X}_{i,t}$. The additive shock term consists of an individual permanent component μ^k_i and serially uncorrelated shocks $\epsilon^k_{i,t}$.

The average of log-income for ages 30 to 35 is given by:

$$\overline{y}^k_i = \lambda^k + (\boldsymbol{\beta}^k)'\overline{\boldsymbol{X}}^k_i + \mu^k_i + \overline{\epsilon}^k_i,$$

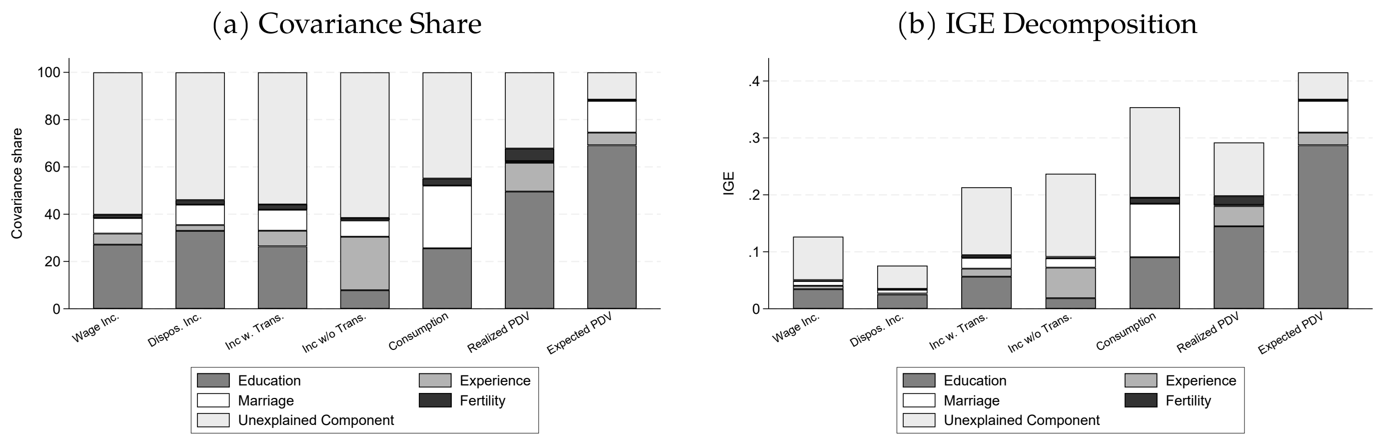
where $\overline{y}_i$ refers to the log-income averaged over ages 30–35. To assess the role of persistence due to observable characteristics, $\boldsymbol{X}^k_{i,t}$ (e.g., persistence in college attainment) and persistence in permanent components μ^k_i (which include a variety of unexplained factors such as the transmission of genetic potential), we decompose the intergenerational covariance of log-income into components:

$$\text{Cov}(\overline{y}^c_i, \overline{y}^p_i) = \text{Cov}\left((\boldsymbol{\beta}^c)'\overline{\boldsymbol{X}}^c_i, \overline{y}^p_i\right) + \text{Cov}(\mu^c_i, \overline{y}^p_i), \tag{E.2}$$

where arising covariances from serial shocks are not distinguished to simplify the exposition. We decompose $\overline{\boldsymbol{X}}^c_i$ into components: education (high school, college, and university dummies), experience (years of experience linear and squared), marriage and cohabitation (marriage and cohabitation dummies, and age of first marriage and cohabitation), and fertility (number of children and age at birth of first child). To avoid gender effects, we focus on comparisons between fathers and their sons. Also, note that differences in fertility are partially driven by the sample selection where we focus on fathers (who, of course, all have children) and their children who may not be a parent.

Fig. E.7 shows how expected PDV better capture important intergenerational differences in educational attainment and income trajectories.[7] The figure presents the key results from the simple linear decomposition exercise of Equation (E.2), with Fig. E.7(a) showing the share of the covariance between fathers and their sons' resources that can be explained by each of the child's four observable factors as well as by the unexplained components, and Fig. E.7(b) showing the corresponding estimates by IGE levels. There are large differences in the relative importance of the different factors for traditional and lifetime measures. Around 60% of the father-son covariance for the traditional measures of resources is unexplained. Even when we consider the parents' realized PDV, around 40% of the father-son covariance is unexplained. In comparison, the unexplained share is only 10%–20% for the expected PDV. Intergenerational persistence in education and income trajectories explain the majority of the father–son covariance in expected PDV, but only smaller fraction for the other estimates.

Figure E.7: Decomposition of IGEs and Covariances



Notes: The figure depicts the covariance decomposition. Panel (a) plots the share of the intergenerational covariance that can be explained by each of the child's observables $\text{Cov}((\beta_t^c)'\overline{\boldsymbol{X}}_i^c, \overline{y}_{i,t}^p)$ and the child's unexplained component $\text{Cov}(\mu_{i,t}^c, \overline{y}_{i,t}^p)$. Panel (b) decomposes the estimated father-son IGEs into each of the components depicted in Panel (a).

[7] Eshaghnia et al. (2023) show that parental characteristics like education correlate with child outcomes above and beyond the impacts through parental expected lifetime resources, which emphasizes that the higher predictive power of parents' expected lifetime resources are not simply a mechanical result of incorporating independent effects of parental characteristics on child outcomes.

F Appendix to IGEs Estimated by IV

In what follows, we present a conceptual framework to estimate the causal impact of parental resources on child outcomes in the context of IGE estimates. To identify the causal IGE estimate, we exploit innovations to parental resources caused by various policy reforms that took place in Denmark over the past few decades as described in Section A. We first discuss how we use variations in public transfer incomes as another source of shock to individuals' resources. We then present additional results exploiting year-to-year changes in interest rates, which provide us with an additional source of exogenous variations in individuals' resources.

We outline two estimation strategies, an IV-GMM approach and a two-step estimation procedure (Heckman (1976); Heckman and Robb (1985)) to identify the causal intergenerational persistence in lifetime resources. Next, we explain the policy reforms and estimation strategies that we exploit in more detail.

F.1 Robustness to Higher Order Lags

Regarding the instruments based on policy changes (Δ terms), there might be a concern that individuals' incomes in year $t+1$ might be partly impacted by behavioral responses to the policy changes in t. This might be the case if there was a lag between the announcement of the policy and its implementation or due to the ongoing debates in the parliament for example. To mitigate this concern, we can use a higher order lag when we compute our instrument by comparing policies in t vs $t+2$ (as opposed to t vs $t+1$). In this section, we present the results of robustness checks where we compute instruments using a 2-year lag.

We construct the policy instrument by combining updates to the following policies in year t: tax policy (T), interest rate (r), public transfer incomes (S). In this section, we extend the policy update by one year and compute the policy updates based on year $t+2$. For tax policy, the policy update for year t is calculated as: $\tilde{\Delta}_t^T = (Y_t|T_{t+2}) - (Y_t|T_t)$ where Y_t denotes disposable income in year t and T_t denotes tax scheme in year t. Likewise, for interest rate update, we calculate the update as: $\tilde{\Delta}_t^r = (Int_t|r_{t+2}) - (Int_t|r_t)$ where Int_t denotes net interest income in year t and r_t denotes real interest in year t. Policy update for public transfer incomes (cash assistance benefits, unemployment benefits and child assistance) is calculated as: $\tilde{\Delta}_t^S = (Soc_t|S_{t+2}) - (Soc_t|S_t)$ where Soc_t denotes the public transfer incomes received in year t and S_t denotes public transfer rates in year t.

After calculating each component at time t, we calculate the combined policy delta instrument as:

$$\tilde{\Delta}_t = log(Y_t + \tilde{\Delta}_t^T + \tilde{\Delta}_t^r + \tilde{\Delta}_t^S) - log(Y_t). \tag{F.1}$$

Table F.1 presents the estimates from the IV-GMM approach to obtain the causal estimates of parental expected PDV on children's expected PDV. It also presents the estimates from the IV-GMM approach to obtain the causal estimates of parental expected PDV on children's educational attainment in adulthood (measured as total months of schooling by age 35). The results are not substantially different from the benchmark estimates presented in Table 4.

Table F.1: OLS and IV-GMM IGE Estimates, Expected PDV, multiple innovations

	Outcome: E(PDV)				Outcome: log(months of completed school.)			
	Father		Household		Father		Household	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	IV-GMM	OLS	IV-GMM	OLS	IV-GMM	OLS	IV-GMM	OLS
Parental resources at ages 0-4 of child $(E(PDV^p_{0,4}))$	0.352***	0.378***	0.449***	0.512***	0.229***	0.263***	0.293***	0.358***
	(0.00656)	(0.00506)	(0.00863)	(0.00662)	(0.00388)	(0.00309)	(0.00508)	(0.00400)
IV: innovations, child age 0 to 4								
Parental resources at ages 5-9 of child $(E(PDV^p_{5,9}))$	0.361***	0.396***	0.438***	0.531***	0.230***	0.269***	0.278***	0.365***
	(0.00667)	(0.00467)	(0.00864)	(0.00612)	(0.00402)	(0.00285)	(0.00514)	(0.00372)
IV: innovations, child age 0 to 4								
Parental resources at ages 10-14 of child $(E(PDV^p_{10,14}))$	0.334***	0.356***	0.407***	0.481***	0.214***	0.237***	0.260***	0.324***
	(0.00520)	(0.00407)	(0.00683)	(0.00541)	(0.00308)	(0.00249)	(0.00400)	(0.00329)
IV: innovations, child age 5 to 9								
Parental resources at ages 15-19 of child $(E(PDV^p_{15,19}))$	0.259***	0.305***	0.350***	0.431***	0.157***	0.201***	0.208***	0.286***
	(0.00452)	(0.00353)	(0.00628)	(0.00481)	(0.00275)	(0.00217)	(0.00380)	(0.00294)
IV: innovations, child age 10 to 14								

*** p<0.01, ** p<0.05, * p<0.1

Notes: The OLS estimates are obtained from the regression $\log(E(PDV^c_{30,35})) = \alpha + \beta \log(E(PDV^p_{a_1,a_2})) + \epsilon$ in columns (1) to (4) and $\log(Educ^c_{35}) = \alpha + \beta \log(E(PDV^p_{a_1,a_2})) + \epsilon$ in columns (5) to (8). $E(PDV^c_{30,35})$ is children's expected PDV measured over ages 30–35, $Educ^c_{35}$ denotes child total months of education by age 35, and $PDV^p_{a_1,a_2}$ are parental expected PDV measured over child age $a_1 - a_2$. For the IV-GMM results, we first estimated the IV-2SLS model with first stage: $\log(Y^p_{a_1,a_2}) = \alpha + \sum_{i=1}^{J}(\beta_i \tilde{\Delta}_{a_1-i}) + \theta \log(Y^p_{a_1-1}) + \epsilon_i$ and second stage: $log(Y^c_{30,35}) = \alpha + \beta \log(\hat{Y}^p_{a_1,a_2}) + \gamma \hat{\epsilon}_i + u_i$, where Y denotes expected PDV. We form the weighting matrix ($\mathbf{W}$) of the IV-GMM model using the residuals ($\hat{u}_i$) from the IV-2SLS model above: $\mathbf{W} = (\frac{1}{n}\sum_{i=1}^{n} \hat{u}_i^2 \mathbf{z}_i \mathbf{z}_i')^{-1}$ to calculate the IV-GMM estimator: $\hat{\beta}_{GMM} = (\mathbf{X'ZWZ'X})^{-1}\mathbf{X'ZWZ'y}$. Columns (1), (2), (5), and (6) show the results at father's level, and columns (3), (4), (7), and (8) show the corresponding results at household level (using household's innovation as instruments for household resources).

F.2 IV Estimates Using Multiple Instruments and Combined Policy

In the main specification in Section 6.2, we estimate $\Delta_t = log(Y_t + \Delta_t^T + \Delta_t^r + \Delta_t^S) - log(Y_t)$, which ignores any interdependence of the income shocks due to different policy innovations that taking place simultaneously.

This subsection relaxes the independence assumption. We do this by imbedding the transfer and interest changes into the TAXSIM program (Jakobsen and Søgaard, 2022) such that updates to the tax policy component $\Delta_t^T = (Y_t|P_{t+1}) - (Y_t|P_t)$, with P_t denoting all relevant policies at time t, capture all policy-induced variation jointly.

Assume the standard setting and notations of the OLS model, the objective function for the IV-GMM model could be written as:

$$\tilde{Q}(\beta) = \left(\frac{1}{n}\sum_{i=1}^{n}\mathbf{Z}_i'(y_i - \mathbf{X}_i\beta)\right)' W \left(\frac{1}{n}\sum_{i=1}^{n}\mathbf{Z}_i'(y_i - \mathbf{X}_i\beta)\right)$$

In our IGE setting, $\mathbf{X}_i = \log(Y^p_{a_1,a_2})$, $\mathbf{z}_i = [\Delta_{a_1-J}, \Delta_{a_1-J+1}, \Delta_{a_1-J+2}, \ldots, \Delta_{a_1-1}, Y^p_{a_1-1}]'$, $y_i = log(Y^c_{30,35})$ where $Y^p_{a_1-1}$ denotes parental income measure (expected PDV) at child age $a_1 - 1$, $Y^p_{a_1,a_2}$ denotes averaged parental income measure between child age a_1 and a_2, Δ_t denotes the parental policy innovation from equation F.5, J denotes the maximum lag of the policy instrument, $y_i = log(Y^c_{30,35})$ denotes child 30 to 35 averaged income measure. W is a positive-definite weighting matrix with the same number of rows and columns as the number of columns of z_i. We set W as:

$$\mathbf{W} = \left(\frac{1}{n}\sum_{i=1}^{n}\hat{u}_i^2\mathbf{z}_i\mathbf{z}_i'\right)^{-1}$$

We first obtain the residuals $\hat{u}_i$ by estimating the following IV-2SLS Model.

First stage equation:

$$\log(Y^p_{a_1,a_2}) = \alpha + \sum_{i=1}^{J}(\beta_i\Delta_{a_1-i}) + \theta\log(Y^p_{a_1-1}) + \epsilon_i$$

Second stage equation:

$$\log(Y^c_{30,35}) = \alpha + \beta\log(\hat{Y}^p_{a_1,a_2}) + \gamma\hat{\epsilon}_i + u_i$$

Then, using the estimated residuals we construct the weighting matrix **W** to calculate the GMM estimator:

$$\hat{\beta}_{GMM} = \left(\mathbf{X}'\mathbf{Z}\mathbf{W}\mathbf{Z}'\mathbf{X}\right)^{-1}\mathbf{X}'\mathbf{Z}\mathbf{W}\mathbf{Z}'\mathbf{y}$$

with the variance of the estimated $\hat{\beta}_{GMM}$:

$$\Sigma_{\hat{\beta}_{GMM}} = n\Big(\mathbf{X}'\mathbf{Z}\mathbf{W}\mathbf{Z}'\mathbf{X}\Big)^{-1}\mathbf{X}'\mathbf{Z}\mathbf{W}\hat{\mathbf{S}}\mathbf{W}\mathbf{Z}'\mathbf{X}\Big(\mathbf{X}'\mathbf{Z}\mathbf{W}\mathbf{Z}'\mathbf{X}\Big)^{-1}$$

In the documented results we use the optimal GMM variance estimator by setting $\hat{\mathbf{S}} = \mathbf{W}^{-1}$ Then the variance estimator becomes:

$$\Sigma_{\hat{\beta}_{GMM,optimal}} = n\Big(\mathbf{X}'\mathbf{Z}\mathbf{W}\mathbf{Z}'\mathbf{X}\Big)^{-1}$$

Table F.2 present the results.

Table F.2: OLS and IV-GMM IGE Estimates, Expected PDV, multiple innovations

	Outcome: E(PDV)				Outcome: log(months of completed school.)			
	Father		Household		Father		Household	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	IV-GMM	OLS	IV-GMM	OLS	IV-GMM	OLS	IV-GMM	OLS
Parental resources at ages 0-4 of child ($\text{PDV}^p_{0,4}$)	0.353***	0.378***	0.455***	0.512***	0.229***	0.263***	0.297***	0.358***
	(0.00654)	(0.00506)	(0.00856)	(0.00662)	(0.00388)	(0.00309)	(0.00503)	(0.00400)
IV: innovations, child age 0 to 4								
Parental resources at ages 5-9 of child ($\text{PDV}^p_{5,9}$)	0.370***	0.396***	0.457***	0.531***	0.235***	0.269***	0.291***	0.365***
	(0.00677)	(0.00467)	(0.00855)	(0.00612)	(0.00408)	(0.00285)	(0.00509)	(0.00372)
IV: innovations, child age 0 to 4								
Parental resources at ages 10-14 of child ($\text{PDV}^p_{10,14}$)	0.326***	0.356***	0.399***	0.481***	0.210***	0.237***	0.255***	0.324***
	(0.00506)	(0.00407)	(0.00682)	(0.00541)	(0.00300)	(0.00249)	(0.00399)	(0.00329)
IV: innovations, child age 5 to 9								
Parental resources at ages 15-19 of child ($\text{PDV}^p_{15,19}$)	0.258***	0.305***	0.348***	0.431***	0.156***	0.201***	0.208***	0.286***
	(0.00456)	(0.00353)	(0.00637)	(0.00481)	(0.00277)	(0.00217)	(0.00386)	(0.00294)
IV: innovations, child age 10 to 14								

*** p<0.01, ** p<0.05, * p<0.1

Notes: The OLS estimates are obtained from the regression $\log(E(PDV^c_{30,35})) = \alpha + \beta \log(E(PDV^p_{a_1,a_2})) + \epsilon$ in columns (1) to (4) and $\log(Educ^c_{35}) = \alpha + \beta \log(E(PDV^p_{a_1,a_2})) + \epsilon$ in columns (5) to (8). $E(PDV^c_{30,35})$ is children's expected PDV measured over ages 30–35, $Educ^c_{35}$ denotes child total months of education by age 35, and $PDV^p_{a_1,a_2}$ are parental expected PDV measured over child age $a_1 - a_2$. For the IV-GMM results, we first estimated the IV-2SLS model with first stage: $\log(Y^p_{a_1,a_2}) = \alpha + \sum_{i=1}^{J}(\beta_i \tilde{\Delta}_{a_1-i}) + \theta \log(Y^p_{a_1-1}) + \epsilon_i$ and second stage: $log(Y^c_{30,35}) = \alpha + \beta \log(\hat{Y}^p_{a_1,a_2}) + \gamma \hat{\epsilon}_i + u_i$, where Y denotes expected PDV. We form the weighting matrix (**W**) of the IV-GMM model using the residuals ($\hat{u}_i$) from the IV-2SLS model above: $\mathbf{W} = (\frac{1}{n}\sum_{i=1}^{n} \hat{u}_i^2 \mathbf{z}_i \mathbf{z}_i')^{-1}$ to calculate the IV-GMM estimator: $\hat{\beta}_{GMM} = (\mathbf{X'ZWZ'X})^{-1}\mathbf{X'ZWZ'y}$. Columns (1), (2), (5), and (6) show the results at father's level, and columns (3), (4), (7), and (8) show the corresponding results at household level (using household's innovation as instruments for household resources).

F.3 2SLS Approach

To implement the IV-strategy, we ues GMM in the main text. An alternative approach is to use Two Stage Least Squares (2SLS). We build on the previous literature (Heckman (1976); Heckman and Robb (1985)) and use a two-stage procedure, which exploits the exogenous changes to parental resources due to unanticipated tax changes. In the first stage, we isolate the exogenous changes in parental income from the endogenous changes. By using appropriate control function, estimated in the first stage, the endogenous explanatory variable becomes appropriately exogenous in a second-stage estimating equation. In what follows, we discuss both stages in detail.

First Stage

Note that the log parental income in 1987 (right after the tax reform), $log(Y_{1987})$, is partly attributable to the different tax schemes in 1986 and 1987. In the first stage, we decompose the post-reform parental income to two components, a component that is exogenously induced by the tax changes and a residual component. To capture the exogenous changes due to the tax reform, we form a ratio as $\Delta_{Y_{86}}^{T_{87}} = log(\frac{Y_{1986}|T_{1987}}{Y_{1986}|T_{1986}})$, where $Y_t|T_{t'}$ is the counterfactual disposable income at time t if the tax scheme of the year t' was in place.[8] Let $\mathcal{Y}$ denote pre-tax total income and $T_t(.)$ denotes the tax scheme that was in place in year t, so $Y_t = \mathcal{Y}_t - T_t(\mathcal{Y}_t)$ and $Y_t|T_{t'} = \mathcal{Y}_t - T'_t(\mathcal{Y}_t)$. Note that the term $\Delta_{Y_{86}}^{T_{87}}$ is arguably exogenous conditional on the pre-reform income if the tax change was unanticipated.

With this notation, we define our first-stage regression as follows:

$$log(Y_{1987}) = c + \gamma \Delta_{Y_{86}}^{T_{87}} + \eta_1 log(Y_{1986}^p) + \epsilon \tag{F.2}$$

where, as defined above, Y denotes disposable income, $\Delta_{Y_{86}}^{T_{87}} = log(\frac{Y_{1986}|T_{1987}}{Y_{1986}|T_{1986}})$ and $Y_{1986}|T_{1987}$ is obtained from the TAXSIM. The constant c captures average income growth across the years. The term η_j captures aspects of post-reform income that vary across the income profile (including differential responses to the tax reform by pre-reform income) that could be correlated with Δ. Finally, ϵ is the residual income that cannot be explained by the tax changes or by pre-reform income and it captures, for example, idiosyncratic income shocks.

We assume that conditional on the controls in the regression (i.e., initial income), $E[\Delta\epsilon] = 0$ and that

[8] We calculate these counterfactual disposable incomes using the TAXSIM.

$E[\Delta u] = 0$. We assume that conditional on the pre-tax income, $\Delta^{T_{87}}_{Y_{86}}$ is uncorrelated with the error term in the child outcome equation u. From estimating Equation F.2, the predicted value for the endogenous variable, $\hat{log}(Y_{1987})$, and the predicted value for the residual, $\hat{\epsilon}$ can be obtained:

$$log(Y_{1987}) = \hat{log}(Y_{1987}) + \hat{\epsilon}, \tag{F.3}$$

where the first term on the right side is the predicted income based on our instrument (Δ) and controls for pre-reform income, and the second term, $\hat{\epsilon}$ is the predicted idiosyncratic income.

One concern here is that maybe individuals' incomes in 1986 were partly impacted by behavioral responses to the tax change in 1987. This might be the case if there was a lag between the announcement of the policy and its implementation or due to the ongoing debates in the parliament for example. To address this concern, we use the year 1985 as our benchmark.

Second Stage

In the second stage, we replace our endogenous variable in the IGE Equation with its two components that are orthogonal to each other. The second stage equation will be:

$$y^c = \alpha + \beta \hat{log}(Y_{1987}) + \beta\hat{\epsilon} + u, \tag{F.4}$$

where $\hat{log}(Y_{1987})$ and $\hat{\epsilon}$ are obtained from the first stage.

We assume that $\hat{log}(Y_{1987}) \perp u$, conditional on $\hat{\epsilon}$, and $\hat{log}(Y_{1987})$ is uncorrelated with the other regressors in Equation F.4. To identify the causal impact of parental income on children's outcomes, our parameter of interest is the coefficient on $\hat{log}(Y_{1987})$.

Next, we lay out our procedure for identifying the impact of parental lifetime resources PDV on child outcomes.

Extension to Other Years and Policy Variations

In our empirical setting, we extend this approach and compute instrument for all years and other policy changes. We construct the policy instrument by combining updates to the following policies in year t: tax policy (T), interest rate (r), public transfer scheme (S). For tax policy, the policy update for year t is calculated as: $\Delta_t^T = (Y_t|T_{t+1}) - (Y_t|T_t)$ where Y_t denotes disposable income in year t and T_t denotes tax scheme in year t. Likewise, for interest rate update, we calculate the update as: $\Delta_t^r = (Int_t|r_{t+1}) - (Int_t|r_t)$ where Int_t denotes net interest income in year t and r_t denotes real interest in year t. Policy update for public transfer incomes (cash assistance benefits, unemployment benefits and child assistance) is calculated as: $\Delta_t^S = (Soc_t|S_{t+1}) - (Soc_t|S_t)$ where Soc_t denotes the public transfer incomes in year t and S_t denotes public transfer income rates in year t.

After calculating each component at time t, we calculate the combined policy instrument as:[9]

$$\Delta_t = log(Y_t + \Delta_t^T + \Delta_t^r + \Delta_t^S) - log(Y_t) \tag{F.5}$$

Table F.3 presents the first stage results. Table F.4 presents the reduced form results for the policy innovations on children's expected PDV, and Table F.5 presents the corresponding reduced form results for children's total months of schooling, separately for different child's age ranges. Table F.6 presents the estimation results, respectively for the expected PDV and the impact of parental expected PDV on child's schooling.

[9]As a robustness check, we also relax the independence assumption and update the tax policy component with $\Delta_t^T = (Y_t|P_{t+1}) - (Y_t|P_t)$, where P_t denotes all tax-relevant policies at time t. This is because changes in interest income or interest expense and benefits (taxable after 1994 reform) are part of the TAXSIM program. The TAXSIM program we use is a modified version of Jakobsen and Søgaard (2022). Appendix Section F.2 presents the results, which manifest similar patterns to the estimates shown here.

Table F.3: OLS and 2SLS IGE Estimates, Expected PDV, First Stage

Endogenous Variable Variables	PDV^f_{0-4} (1)	PDV^h_{0-4} (2)	PDV^f_{5-9} (3)	PDV^h_{5-9} (4)	PDV^f_{10-14} (5)	PDV^h_{10-14} (6)	PDV^f_{15-19} (7)	PDV^h_{15-19} (8)
$\log(\text{PDV}^p_{t+4})$	1.523***	1.424***	1.363***	1.289***	1.084***	1.071***	0.883***	0.872***
	(0.00596)	(0.00602)	(0.00645)	(0.00642)	(0.00257)	(0.00285)	(0.00277)	(0.00321)
Δ_t	-0.00734***	-0.00104	-0.00709***	-0.00790***	0.0550***	0.0534***	0.0276***	0.223***
	(0.00148)	(0.00153)	(0.00174)	(0.00176)	(0.00828)	(0.00931)	(0.00626)	(0.0132)
Δ_{t+1}	0.204***	0.170***	0.313***	0.347***	0.0119**	0.0330***	-0.0846***	-0.334***
	(0.0225)	(0.0262)	(0.0270)	(0.0302)	(0.00613)	(0.00993)	(0.0108)	(0.0199)
Δ_{t+2}	-0.512***	-0.845***	-1.095***	-1.721***	-0.00749***	-0.0114***	-0.0830***	-0.209***
	(0.0567)	(0.0680)	(0.0655)	(0.0781)	(0.00244)	(0.00345)	(0.0129)	(0.0215)
Δ_{t+3}	-1.573***	-2.348***	-0.971***	-1.716***	-0.0250***	-0.0164***	0.170***	0.432***
	(0.0926)	(0.111)	(0.109)	(0.128)	(0.00212)	(0.00327)	(0.0136)	(0.0249)
Δ_{t+4}	-0.0327***	-0.0814***	-0.0525***	0.0320	-0.0949***	-0.114***	0.277***	0.696***
	(0.0128)	(0.0181)	(0.0159)	(0.0209)	(0.00712)	(0.0140)	(0.0153)	(0.0267)
F-Stat	106	164	226	302	241	91	1115	1036
Child Age t	$t=0$	$t=0$	$t=0$	$t=0$	$t=5$	$t=5$	$t=10$	$t=10$

*** p<0.01, ** p<0.05, * p<0.1

Notes: The first stage is $log(\text{PDV}^p_{a_1,a_2}) = \alpha + \sum_{j=1}^{J} \beta_j \Delta_{a_1-j} + \phi \log(\text{PDV}^p_{a_1-1}) + \epsilon$ where $\text{PDV}^p_{a_1,a_2}$ is parental expected PDV averaged over the years between child ages y_1 and y_2 years old and Δ_t is the combined innovation from tax, interest and public transfer policies. We show the results when $J = 5$ in the table above. Columns (1), (3), (5), (7) show the first stage results at father's level while columns (2), (4), (6), (8) show the first stage the corresponding first stage results at household level (using household's innovation as instruments for household resources). All PDV terms are calculated up to age 64 (65 is the official retirement age in Denmark for our sample) based on the discount factor of 0.96.

Table F.4: Expected PDV, Reduced Form

Outcome Variable Variables	$\text{PDV}^c_{30,35}$ (1)	$\text{PDV}^c_{30,35}$ (2)	$\text{PDV}^c_{30,35}$ (3)	$\text{PDV}^c_{30,35}$ (4)	$\text{PDV}^c_{30,35}$ (5)	$\text{PDV}^c_{30,35}$ (6)	$\text{PDV}^c_{30,35}$ (7)	$\text{PDV}^c_{30,35}$ (8)
$\log(\text{PDV}^p_{t+4})$	0.507***	0.573***	0.428***	0.475***	0.345***	0.405***	0.220***	0.253***
	(0.0152)	(0.0184)	(0.0138)	(0.0169)	(0.00692)	(0.00926)	(0.00522)	(0.00737)
Δ_t	-0.0129***	0.00327	-0.0114***	0.000937	0.123***	0.162***	0.0158	0.172***
	(0.00377)	(0.00467)	(0.00372)	(0.00462)	(0.0224)	(0.0303)	(0.0119)	(0.0303)
Δ_{t+1}	0.693***	0.850***	0.664***	0.914***	0.0137	-0.00920	-0.0272	-0.194***
	(0.0574)	(0.0800)	(0.0577)	(0.0793)	(0.0166)	(0.0324)	(0.0204)	(0.0458)
Δ_{t+2}	-0.764***	-1.189***	-0.731***	-1.491***	-0.0194***	-0.0423***	-0.0499**	-0.174***
	(0.144)	(0.207)	(0.140)	(0.205)	(0.00660)	(0.0113)	(0.0244)	(0.0494)
Δ_{t+3}	-0.757***	-1.985***	-0.313	-1.810***	-0.0313***	-0.0564***	0.122***	0.318***
	(0.236)	(0.339)	(0.234)	(0.338)	(0.00572)	(0.0107)	(0.0258)	(0.0573)
Δ_{t+4}	0.162***	-0.233***	0.168***	0.324***	-0.0123	0.0165	0.276***	0.711***
	(0.0328)	(0.0553)	(0.0340)	(0.0550)	(0.0192)	(0.0455)	(0.0289)	(0.0614)
Endogenous Variable	PDV^f_{0-4}	PDV^h_{0-4}	PDV^f_{5-9}	PDV^h_{5-9}	PDV^f_{10-14}	PDV^h_{10-14}	PDV^f_{15-19}	PDV^h_{15-19}
Child Age t	$t=0$	$t=0$	$t=0$	$t=0$	$t=5$	$t=5$	$t=10$	$t=10$

*** p<0.01, ** p<0.05, * p<0.1

Notes: The 2SLS estimates are obtained as follows. The first stage is $log(\text{PDV}^p_{a_1,a_2}) = \alpha + \sum_{j=1}^{J} \beta_j \Delta_{a_1-j} + \phi \log(\text{PDV}^p_{a_1-1}) + \epsilon$ where lifetime resources of children ($\text{PDV}^c_{30,35}$) are measured over ages 30–35, $\text{PDV}^p_{a_1,a_2}$ is parental expected PDV averaged over the years between child ages y_1 and y_2 years old and Δ_t is the combined innovation from tax, interest and public transfer policies. We show the results when $J = 5$ in the table above. The second stage is as follows $\log(\text{PDV}^c_{30,35}) = \alpha + \beta \log(P\hat{D}V^p_{a_1,a_2}) + \gamma\hat{\epsilon} + \phi$. Columns (1), (3), (5), (7) show the reduced form results at father's level while columns (2), (4), (6), (8) show the corresponding reduced form results at household level (using household's innovation as instruments for household resources). All PDV terms are calculated up to age 64 (65 is the official retirement age in Denmark for our sample) based on the discount factor of 0.96.

Table F.5: Log Total Months of Education, Reduced Form

Outcome Variable	$\log(Educ^c_{35})$	$\log(Educ^c_{35})$	$\log(Educ^c_{35})$	$\log(Educ^c_{35})$	$\log(Educ^c_{35})$	$\log(Educ^c_{35})$	$\log(Educ^c_{35})$	$\log(Educ^c_{35})$
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\log(\text{PDV}^p_{t+4})$	0.329***	0.372***	0.270***	0.299***	0.222***	0.257***	0.131***	0.144***
	(0.00925)	(0.0110)	(0.00842)	(0.0102)	(0.00419)	(0.00556)	(0.00318)	(0.00444)
Δ_t	-0.00654***	0.00185	-0.00568***	0.00100	0.0624***	0.104***	0.0109	0.109***
	(0.00231)	(0.00281)	(0.00228)	(0.00280)	(0.0136)	(0.0182	(0.00727)	(0.0183)
Δ_{t+1}	0.470***	0.536***	0.446***	0.596***	0.0150	-0.0123	-0.0296**	-0.194***
	(0.0350)	(0.0480)	(0.0352)	(0.0479)	(0.0101)	(0.0195)	(0.0124)	(0.0276)
Δ_{t+2}	-0.555***	-0.787***	-0.530***	-0.988***	-0.00988***	-0.0147**	-0.0202	-0.125***
	(0.0885)	(0.125)	(0.0860)	(0.124)	(0.00401)	(0.00666)	(0.0149)	(0.0298)
Δ_{t+3}	-0.643***	-1.284***	-0.352***	-1.178***	-0.0152***	-0.0340***	0.0948***	0.286***
	(0.144)	(0.204)	(0.143)	(0.204)	(0.00347)	(0.00640)	(0.0157)	(0.0345)
Δ_{t+4}	0.120***	0.166***	0.119***	0.223***	-0.0212*	-0.00329	0.154***	0.461***
	(0.0201)	(0.0331)	(0.0209)	(0.0332)	(0.0117)	(0.0272)	(0.0176)	(0.0370)
Endogenous Variable	PDV^f_{0-4}	PDV^h_{0-4}	PDV^f_{5-9}	PDV^h_{5-9}	PDV^f_{10-14}	PDV^h_{10-14}	PDV^f_{15-19}	PDV^h_{15-19}
Child Age t	$t=0$	$t=0$	$t=0$	$t=0$	$t=5$	$t=5$	$t=10$	$t=10$

*** p<0.01, ** p<0.05, * p<0.1

Notes: The 2SLS estimates are obtained as follows. The first stage is $log(\text{PDV}^p_{a_1,a_2}) = \alpha + \sum_{j=1}^{J} \beta_j \Delta_{a_1-j} + \phi \log(\text{PDV}^p_{a_1-1}) + \epsilon$ where $\text{PDV}^p_{a_1,a_2}$ is parental expected PDV averaged over the years between child ages y_1 and y_2 years old and Δ_t is the combined innovation from tax, interest and public transfer policies. We show the results when $J = 5$ in the table above. The second stage is as follows $\log(Educ^c_{35}) = \alpha + \beta \log(P\hat{D}V^p_{a_1,a_2}) + \gamma\hat{\epsilon} + \phi$, where $Educ^c_{35}$ denotes child total months of education by age 35. We show the reduced form results when $J = 1$ in the table above. Columns (1), (3), (5), (7) show the reduced form results at father's level while columns (2), (4), (6), (8) show the corresponding reduced form results at household level (using household's innovation as instruments for household resources). All PDV terms are calculated up to age 64 (65 is the official retirement age in Denmark for our sample) based on the discount factor of 0.96.

Table F.6: OLS and 2SLS IGE Estimates, Expected PDV, Multiple Instruments

	Outcome: E(PDV)				Outcome: log(months of completed school.)			
	Father		Household		Father		Household	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS
Parental resources at ages 0-4 of child ($\text{PDV}^p_{0,4}$)	0.329***	0.378***	0.416***	0.512***	0.211***	0.263***	0.271***	0.358***
	(0.00815)	(0.00507)	(0.0125)	(0.00662)	(0.00476)	(0.00309)	(0.00744)	(0.00400)
IV: innovations, child age 0 to 4								
Parental resources at ages 5-9 of child ($\text{PDV}^p_{5,9}$)	0.341***	0.396***	0.396***	0.531***	0.217***	0.268***	0.251***	0.365***
	(0.00965)	(0.00467)	(0.0125)	(0.00612)	(0.00586)	(0.00285)	(0.00746)	(0.00372)
IV: innovations, child age 0 to 4								
Parental resources at ages 10-14 of child ($\text{PDV}^p_{10,14}$)	0.326***	0.356***	0.382***	0.481***	0.208***	0.237***	0.242***	0.324***
	(0.00625)	(0.00407)	(0.00847)	(0.00541)	(0.00376)	(0.00249)	(0.00505)	(0.00329)
IV: innovations, child age 5 to 9								
Parental resources at ages 15-19 of child ($\text{PDV}^p_{15,19}$)	0.260***	0.305***	0.313***	0.431***	0.155***	0.201***	0.183***	0.286***
	(0.00574)	(0.00353)	(0.00803)	(0.00481)	(0.00347)	(0.00217)	(0.00481)	(0.00294)
IV: innovations, child age 10 to 14								

*** p<0.01, ** p<0.05, * p<0.1

Notes: The OLS estimates are obtained from the regression $\log(E(PDV^c_{30,35})) = \alpha + \beta \log(E(PDV^p_{a_1,a_2})) + \epsilon$ in columns (1) to (4) and $\log(Educ^c_{35}) = \alpha + \beta \log(E(PDV^p_{a_1,a_2})) + \epsilon$ in columns (5) to (8). $E(PDV^c_{30,35})$ is children's expected PDV measured over ages 30–35, $Educ^c_{35}$ denotes child total months of education by age 35, and $PDV^p_{a_1,a_2}$ are parental expected PDV measured over child age $a_1 - a_2$. The 2SLS estimates are obtained as follows. The first stage is $log(\text{PDV}^p_{a_1,a_2}) = \alpha + \sum_{j=1}^{J} \beta_j \Delta_{a_1-j} + \phi \log(\text{PDV}^p_{a_1-1}) + \epsilon$. The second stage is $\log(\text{PDV}^c_{30,35}) = \alpha + \beta \log(P\hat{D}V^p_{a_1,a_2}) + \gamma\hat{\epsilon} + \phi$ in columns (1) to (4) and $\log(Educ^c_{35}) = \alpha + \beta \log(P\hat{D}V^p_{a_1,a_2}) + \gamma\hat{\epsilon} + \phi$ in columns (5) to (8). Columns (1), (2), (5), and (6) show the results at father's level, and columns (3), (4), (7), and (8) show the corresponding results at household level (using household's innovation as instruments for household resources).

G Extension: Alternative Identification Strategy of the IGE Using Income Innovations from Hause Model

In this section, we follow an alternative estimation strategy to identify the causal effect of parental expected PDV on child's outcomes where we use a simple income dynamic model and construct instruments for parental expected lifetime resources based on idiosyncratic income shocks to parental income. We compute the updates to the expected PDV in each period after the realization of the shocks (i.e., the difference in expected PDV between two consecutive periods, $E_{j-2}(PDV_j) - E_{j-1}(PDV_j) = \nu_j$ and use it as our instrument for the expected PDV.

We should note that the analysis in this section departs from the previous analysis in the main text in an important way. Unlike the analysis in the main text, here we follow an instrumental variable approach where our instruments are innovations, ν computed using a parametric specification for individual income trajectories. We describe the estimation approach next. Our measure of resources for children (the dependent variable of the IGE equation) is also expected lifetime resources measured at age 30–35 computed using the parametric approach to obviate the problems of different life cycle trajectories across generations.

The key identifying assumption for estimating the causal impact of parental expected resources on children's outcome is that the innovations to parental expected income are uncorrelated with nonpecuniary factors that could directly affect the child outcome of interest. Otherwise, the exclusion restriction could be violated. For example, if shocks to parents' labor market status are the driving forces of the innovations to parental income, our identifying assumption requires that these shocks do not directly affect children's outcomes; they impact children only through the changes to parental resources.

G.1 Estimation

We focus on parental resources in early childhood, middle childhood, and late childhood (as also done in the main text). Consider the following equation:

$$\log(\text{PDV}^c) = \alpha + \beta \log(\text{PDV}^p_{a_1,a_2}) + \epsilon \tag{G.1}$$

where PDV^c denotes the child's expected PDV measured over the ages 30–35 and $\text{PDV}^p_{a_1,a_2}$ denotes the averaged expected PDV of future income of parents when the child was between a_1 and a_2 years old in our sample.

The main challenge in estimating the causal IGE is the endogeneity of parental resources. To overcome this challenge, we use an Instrumental Variable (IV) approach. To gain intuition about our approach, consider individual i with a given income profile (with certain intercept and slope). However, in each period, they are exposed to income shocks (innovations ν_j), which makes their expected resources differ from their expected resources in the previous period as they update their expectation after they are hit by income shocks in each period. We exploit these innovations to parental income to instrument for parental expected PDV of income. The key idea here is that exogenous shocks to parental income are correlated with parental expected PDV but they are uncorrelated with confounding factors which are correlated with parental income.

We use a simple income dynamic model to identify innovations to individual income in spirit of Lillard and Willis (1978), Hause (1980), and Lochner and Park (2022), which captures heterogeneity of intercept and slope across individuals. An important feature of these models is that it allows the intercept and slope of income profiles to vary from one individual to another. We specify disposable income (which enters our measures of lifetime resources) dynamics as follows:

$$Y_{it} = \alpha_i + \beta_i t + \varepsilon_t \tag{G.2}$$

where α is individual i's intercept, β_i is individual i's slope, and

$$\varepsilon_t = \rho\varepsilon_{t-1} + \nu_t + \theta\nu_{t-1}. \tag{G.3}$$

where t denotes work experience. We allow for serial correlations in the residuals from the fitted income profile (ε), which is captured by the parameter ρ. The second term in this equation (ν_t) is regarded as the income innovation that could not be predicted at time $t-1$, which forms our instrument for parental resources. We also include a moving average component introducing the third term (ν_{t-1}) in the residual process. We use this random growth rate model to fit the individual-specific income trajectories.

After estimating the model parameters separately for each individual in our sample, we decompose the expected income to the predicted component in the previous period and unpredicted component (ν_t), which is the update to expected PDV after the realization of the shocks in the previous period. The unpredicted component is then used to instrument for parental realized PDV. We obtain one instrument per year of analysis $(\nu_{t-1}, \nu_{t-2}, \nu_{t-3}, ...)$.[10]

In our empirical setting, we construct parental innovations from the difference between parental expected PDV across two consecutive periods where we compute parental expected PDV based on the income dynamics estimated based on individual disposable income profile observed over all years between 1980 and 2019.

To align our analysis with the IGE estimates presented in the previous sections, we measure parental resources averaged over the following age ranges of children: 0–4, 5–9, 10–14, and 15–19. We run the following first stage equation

$$\log(\text{PDV}^p_{a_1,a_2}) = \alpha + \sum_{i=0}^{J} (\beta_i \Delta_{a_1-i}) + \epsilon. \tag{G.4}$$

where $\Delta_t = \log(E_{t-1}(PDV^p_t)) - \log E_{t-2}(PDV^p_t)$ and $PDV^p_{a_1,a_2}$ is the average of parental realized PDV of all future income when the child was between a_1 and a_2 years old. J denotes the maximum lagged instruments (i.e., innovations to parental income), which we set it up to 5. The second stage is as follows

$$\log(\text{PDV}^c)) = \alpha + \beta \log(\hat{\text{PDV}}^p_{a_1,a_2}) + \gamma\hat{\epsilon} + \phi. \tag{G.5}$$

where $\log(\hat{\text{PDV}}^p_{a_1,a_2})$ and $\hat{\epsilon}$ are the predicted values for $\log(\text{PDV}^p_t)$ and ϵ, respectively, which are obtained from the first stage.

Δ_t is our instrument for parental expected PDV.

G.2 IGE Estimates

Table G.1 presents the first stage results of the 2SLS estimates. Table G.2 presents the reduced form results of the 2SLS estimates. Similarly, Table G.3 presents the reduce form results of the 2SLS estimates for educational attainment of children.

Table G.4 reports both the OLS and 2SLS estimates of intergenerational elasticities of PDV of disposable income with the empirical 95% confidence interval in the square brackets. The first row of Table G.4 presents both OLS and 2SLS IGE estimates when parental resources are measured over ages 0–4 of children. The OLS estimate is around 0.45 at the household level and around .27 at the father level. This is consistent with the findings previously presented in this paper (see Figure 6) where household resources exhibit much stronger

[10] As a robustness check, we change the number of instruments we include in our analysis and present the corresponding results in Appendix Table G.4.

correlations with child outcomes compared to when we proxy parental resources by paternal resources.

Comparing our OLS estimates of IGEs to those obtained from the 2SLS approach suggests that up to 50% of the observed relationship between parental and child PDV can be attributed to the causal impact of parental resources on children's lifetime resources. At the father level, our IGE estimate decreases from around 0.27 to about 0.19 when we move from the OLS to the 2SLS. At the household level, implementing the 2SLS approach reduces our IGE estimate to around 0.36 from the OLS estimate of 0.45.

The second row of Table G.4 shows both OLS and 2SLS IGE estimates when parental resources are measured over ages 5–9 of children. The patterns are similar to the estimates for child ages 0–4 in the first row. However, the estimates are, in general, slightly lower for both OLS and 2SLS approaches. The third and fourth rows of Table G.4 present the IGE estimates when parental resources are measured over ages 10–14 and 15–19 of children, respectively. The IGE estimates continue to decrease as we increase the child's ages over which parental resources are measured. For child's ages 15–19, the OLS estimate is around 0.30 at the household level and around .20 at the father level, respectively at the father and household level, which are close to the 2SLS estimates of 0.30 and 0.18, respectively at the father and household level.

We also conduct a similar analysis to assess the causal role of parental resources in shaping educational attainment (i.e., completed months of schooling by age 35) of children. Table G.4 presents the results. The table presents the same overall patterns as for the corresponding IGE estimates. The OLS estimates are around twice the magnitude of their 2SLS counterparts, and both associations and causal estimates are largest for parental resources in early childhood.

Table G.1: Expected PDV, First Stage

Endogenous Variable Variables	PDV^f_{0-4} (1)	PDV^h_{0-4} (2)	PDV^f_{5-9} (3)	PDV^h_{5-9} (4)	PDV^f_{10-14} (5)	PDV^h_{10-14} (6)	PDV^f_{15-19} (7)	PDV^h_{15-19} (8)
Δ^f_t	-1.111	-1.718***	-5.033***	-3.857***	-4.606***	-3.399***	-4.937***	-3.000***
	[-2.131,0.705]	[-2.531,-1.010]	[-6.322,-3.839]	[-4.720,-3.115]	[-5.539,-3.676]	[-4.240,-2.589]	[-6.120,-3.745]	[-3.993,-2.202]
Δ^f_{t+1}	4.039***	3.439***	4.931***	3.670***	4.521***	3.397***	5.543***	3.417***
	[1.394,6.179]	[1.738,5.058]	[2.343,7.418]	[1.829,5.791]	[1.713,7.454]	[1.115,5.991]	[2.962,8.078]	[1.436,5.606]
Δ^f_{t+2}	0.440	0.914	5.081***	3.787***	5.144***	3.324***	4.632***	2.708***
	[-1.991,3.368]	[-0.619,2.889]	[2.429,8.210]	[1.993,6.147]	[1.757,7.917]	[1.295,5.341]	[2.389,6.979]	[0.630,4.967]
Δ^f_{t+3}	-4.374***	-3.345***	-0.582	-0.556	-0.479	-0.541	-0.798	-0.518
	[-6.076,-2.637]	[4.441,-2.196]	[-3.855,3.004]	[-2.255,1.374]	[-3.319,2.356]	[-2.496,1.053]	[-3.294,2.654]	[-2.416,1.386]
Δ^f_{t+4}	1.334***	0.875***	-6.0119***	-4.388***	-6.384***	-3.915***	-6.182***	-3.650***
	[0.889,1.761]	[0.616,1.141]	[-7.845,-3.792]	[-5.445,-3.271]	[-8.114,-4.369]	[-5.154,-2.244]	[-8.496,-4.216]	[-4.898,-2.440]
Δ^f_{t+5}			1.883***	1.482***	2.066***	1.252***	1.980***	1.185***
			[1.384,2.353]	[1.204,1.780]	[1.549,2.465]	[0.851,1.600]	[1.517,2.625]	[0.861,1.552]
F-Stat	1454	543	679	274	675	268	635	237
Child Age t	$t = 0$	$t = 0$	$t = 0$	$t = 0$	$t = 5$	$t = 5$	$t = 10$	$t = 10$

*** p<0.01, ** p<0.05, * p<0.1

Notes: The first stage is $log(\text{PDV}^p_{a_1,a_2}) = \alpha + \sum_{j=1}^{J} \beta_j \Delta_{a_1-6+j} + \epsilon$ where $\text{PDV}^p_{a_1,a_2}$ is parental expected PDV averaged over the years between child ages y_1 and y_2 years old and $\Delta_t = \log E_{t-1}(PDV^p_t) - \log E_{t-2}(PDV^p_t)$. We show the first stage results when $J = 6$ in the table above. The second stage is as follows $\log(\text{PDV}^c) = \alpha + \beta \log(P\hat{D}V^p_{a_1,a_2}) + \gamma\hat{\epsilon} + \phi$, where lifetime resources of children (PDV^c) are measured over ages 30–35. Columns (1), (3), (5), (7) show the first results at father's level while columns (2), (4), (6), (8) show the first show the corresponding results at household level (using father's innovation as instruments for household resources). All PDV terms are calculated up to age 64 (65 is the official retirement age in Denmark for our sample) based on the discount factor of 0.96. We show the empirical 95% confidence interval in the square brackets.

Table G.2: Reduced Form Estimates, Expected PDV, Six Instruments

Outcome Variable Variables	$\text{PDV}^c_{30,35}$ (1)	$\text{PDV}^c_{30,35}$ (2)	$\text{PDV}^c_{30,35}$ (3)	$\text{PDV}^c_{30,35}$ (4)
Instrument: innovations from child age t to t+5				
Δ^f_t	-1.489***	-1.649***	-0.776***	-1.319***
	[-2.212,-0.625]	[-2.560,-0.649]	[-1.602,-0.144]	[-2.258,-0.542]
Δ^f_{t+1}	2.265**	1.468	0.703	1.504
	[0.101,3.797]	-0.969,3.327]	[-1.130,2.479]	[-0.346,3.468]
Δ^f_{t+2}	0.915	1.644*	1.351	1.407
	[-0.742,2.772]	[-0.0357,3.543]	[-0.890,3.209]	[-0.646,3.118]
Δ^f_{t+3}	-2.156***	0.0719	0.358	-0.587
	[-3.238,-1.063]	[-1.730,1.577]	[-2.343,2.311]	[-2.250,1.404]
Δ^f_{t+4}	0.521***	-2.209***	-1.508***	-1.619***
	[0.220,0.821]	[-3.607,-0.985]	[-3.275,-0.142]	[-2.985,-0.397]
Δ^f_{t+5}		0.730***	0.536***	0.653***
		[0.445,1.058]	[0.143,0.949]	[0.371,0.994]
Endogenous Variable	PDV^p_{0-4}	PDV^p_{5-9}	PDV^p_{10-14}	PDV^p_{15-19}
Child Age t	$t = 0$	$t = 0$	$t = 5$	$t = 10$

*** p<0.01, ** p<0.05, * p<0.1

Notes: The first stage is $log(\text{PDV}^p_{a_1,a_2}) = \alpha + \sum_{j=1}^{J} \beta_j \Delta_{a_1-6+j} + \epsilon$ where $\text{PDV}^p_{a_1,a_2}$ is parental expected PDV averaged over the years between child ages y_1 and y_2 years old and $\Delta_t = \log E_{t-1}(PDV^p_t) - \log E_{t-2}(PDV^p_t)$. The second stage is as follows $\log(\text{PDV}^c) = \alpha + \beta \log(P\hat{D}V^p_{a_1,a_2}) + \gamma\hat{\epsilon} + \phi$, where lifetime resources of children (PDV^c) are measured over ages 30–35. We show the reduced form results when $J = 6$ in the table above. Columns 1 to 4 show results using the instrument sets of 0-4, 5-9, 10-14, 15-19 averaged expected PDV. All PDV terms are calculated up to age 64 (65 is the official retirement age in Denmark for our sample) based on the discount factor of 0.96. We show the empirical 95% confidence interval in the square brackets.

Table G.3: Reduced Form Estimates, Log Total Months of Schooling, Six Instruments

Outcome Variable Variables	$\log(Educ^c_{35})$ (1)	$\log(Educ^c_{35})$ (2)	$\log(Educ^c_{35})$ (3)	$\log(Educ^c_{35})$ (4)
Instrument: innovations from child age t to t+5				
Δ^f_t	-0.704***	-0.782***	-0.584***	-0.429***
	[-1.050,-0.391]	[-1.184,-0.433]	[-0.897,-0.320]	[-0.824,-0.0561]
Δ^f_{t+1}	1.101***	0.721	0.583	0.493
	[0.319,1.986]	[-0.169,1.639]	[-0.239,1.478]	[-0.529,1.322]
Δ^f_{t+2}	0.452	0.786	0.726	0.494
	[-0.481,1.251]	[-0.149,1.606]	[-0.123,1.774]	[-0.379,1.276]
Δ^f_{t+3}	-1.109***	0.00112	-0.0674	-0.149
	[-1.667,-0.558]	[-1.021,0.970]	[-0.896,0.946]	[-1.011,0.680]
Δ^f_{t+4}	0.284***	-1.065***	-1.022***	-0.542*
	[0.155,0.423]	[-1.595,-0.353]	[-1.750,-0.417]	[-1.141,0.00613]
Δ^f_{t+5}		0.361***	0.387***	0.165*
		[0.188,0.497]	[0.208,0.569]	[-0.0105,0.364]
Endogenous Variable	PDV^p_{0-4}	PDV^p_{5-9}	PDV^p_{10-14}	PDV^p_{15-19}
Child Age t	$t = 0$	$t = 0$	$t = 5$	$t = 10$

*** p<0.01, ** p<0.05, * p<0.1

Notes: The first stage is $log(\text{PDV}^p_{a_1,a_2}) = \alpha + \sum_{j=1}^{J} \beta_j \Delta_{a_1-6+j} + \epsilon$ where $\text{PDV}^p_{a_1,a_2}$ is parental expected PDV averaged over the years between child ages y_1 and y_2 years old and $\Delta_t = \log E_{t-1}(PDV^p_t) - \log E_{t-2}(PDV^p_t)$. The second stage is as follows $\log(Educ^c_{35}) = \alpha + \beta \log(P\hat{D}V^p_{a_1,a_2}) + \gamma\hat{\epsilon} + \phi$, where $Educ^c_{35}$ denotes child total months of education by age 35. We show the reduced form results when $J = 6$ in the table above. Columns 1 to 4 show results using the instrument sets of 0-4, 5-9, 10-14, 15-19 averaged expected PDV. All PDV terms are calculated up to age 64 (65 is the official retirement age in Denmark for our sample) based on the discount factor of 0.96. We show the empirical 95% confidence interval in the square brackets.

Table G.4: OLS and 2SLS PDV IGE Estimates, Expected PDV- Using Multiple Instruments

	Outcome: E(PDV)				Outcome: log(months of completed school.)			
	Father		Household		Father		Household	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS
Parental resources at ages 0-4 of child (PDV^p_{0-4})	0.187***	0.273***	0.363***	0.451***	0.0825***	0.141***	0.164***	0.238***
	[0.184,0.190]	[0.273,0.274]	[0.357,0.368]	[0.451,0.452]	[0.0809,0.0837]	[0.140,0.141]	[0.162,0.166]	[0.237,0.238]
IV: innovations, child age 0 to age 2								
Parental resources at ages 5-9 of child (PDV^p_{5-9})	0.200***	0.249***	0.352***	0.403***	0.0875***	0.130***	0.160***	0.216***
	[0.195,0.206]	[0.249,0.250]	[0.339,0.375]	[0.403,0.404]	[0.0850,0.0900]	[0.130,0.130]	[0.154,0.166]	[0.216,0.216]
IV: innovations, child age 0 to age 5								
Parental resources at ages 10-14 of child (PDV^p_{10-14})	0.180***	0.227***	0.325***	0.358***	0.0833***	0.118***	0.153***	0.191***
	[0.175,0.185]	[0.226,0.227]	[0.312,0.335]	[0.358,0.359]	[0.0814,0.0855]	[0.118,0.118]	[0.148,0.158]	[0.191,0.191]
IV: innovations, child age 5 to age 10								
Parental resources at ages 15-19 of child (PDV^p_{15-19})	0.178***	0.200***	0.307***	0.305***	0.0833***	0.105***	0.142***	0.164***
	[0.173,0.183]	[0.199,0.200]	[0.297,0.319]	[0.305,0.306]	[0.0807,0.0854]	[0.104,0.105]	[0.137,0.147]	[0.164,0.164]
IV: innovations, child age 10 to age 15								

*** p<0.01, ** p<0.05, * p<0.1

Notes: The OLS estimates are obtained from the regression $\log(E(PDV^c_{30,35})) = \alpha + \beta \log(E(PDV^p_{a_1,a_2})) + \epsilon$ in columns (1) to (4) and $\log(Educ^c_{35}) = \alpha + \beta \log(E(PDV^p_{a_1,a_2})) + \epsilon$ in columns (5) to (8). $E(PDV^c_{30,35})$ is children's expected PDV measured over ages 30–35, $Educ^c_{35}$ denotes child total months of education by age 35, and $PDV^p_{a_1,a_2}$ are parental expected PDV measured over child age $a_1 - a_2$. The 2SLS estimates are obtained as follows. The first stage is $log(\text{PDV}^p_{a_1,a_2}) = \alpha + \sum_{j=0}^{J} \beta_j \Delta_{a_1-j} + \epsilon$. The second stage is $\log(\text{PDV}^c_{30,35}) = \alpha + \beta \log(P\hat{D}V^p_{a_1,a_2}) + \gamma\hat{\epsilon} + \phi$ in columns (1) to (4) and $\log(Educ^c_{35}) = \alpha + \beta \log(P\hat{D}V^p_{a_1,a_2}) + \gamma\hat{\epsilon} + \phi$ in columns (5) to (8). Columns (1), (2), (5), and (6) show the results at father's level, and columns (3), (4), (7), and (8) show the corresponding results at household level (using household's innovation as instruments for household resources).

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