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Evidence on intergenerational income transmission using complete Dutch population data

Fiona Carmichael[a], Christian K. Darko[a], Marco G. Ercolani[b],

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Abstract

We estimate the intergenerational elasticity (IGE) of income for the Netherlands using complete population data for around 177,000 28-year olds. We find that IGEs are much lower when actual individual income data are used rather than proxies or aggregates for income. Though low, daughters' IGEs are higher than sons' indicating lower income mobility for women.

Keywords: intergenerational elasticity, intergenerational mobility, income, equality of opportunity, Great Gatsby curve, Netherlands.

JEL codes: J62, J61, D31

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1 Introduction

Identifying whether all children have equality of opportunity is key to understanding how equitable a society is. Bevis and Barrett (2015, p.233) ask "are all children — perhaps controlling for preferences and ability — equally likely to forge a successful, or unsuccessful, future livelihood? Or are children destined to stand upon the same socio-economic rungs as their parents". The notion of intergenerational elasticity (IGE) explores the relationship between parents' and their children's income levels thus indicating the extent of intergenerational immobility.

The key weakness of existing attempts to calculate IGEs is the lack of comprehensive data on parental income. These data are typically not available or confidential, thus extant research has relied upon fathers' income only, sometimes proxying this using their occupation (OECD, 2018). The result has been mixed estimates of the IGE even for the same country. For example, Statistics Netherlands (CBS, 2011) estimates a parent-son IGE of around 0.30 based on earnings, rather than income, ignoring children who are not earning. This implies that if parents earned 50% more than the average, their child would earn 15% above the average. The OECD (2018) estimates an even higher father-son IGE for the Netherlands of 0.39 by using fathers' occupation to impute their earnings and World Bank (2018) records a similar father-son IGE of 0.30. In addition, for many countries an average value of IGE is estimated without properly distinguishing between individual characteristics including gender.

Our analysis overcomes data limitations due to small samples and lack of data on parental income by using full official tax, welfare and income records for the Netherlands. This mitigates problems associated with self-reporting, proxies and reliance on tax returns, where individuals who do not file tax returns are omitted (as in Chetty et al. 2014).

We estimate the IGE of income by regressing 'adult' son's and daughter's log-income at age 28 on their parents' log-income, when the children were aged 15. Our results point to much lower IGEs for the Netherlands than those found in previous studies. However, although the Netherlands appears to be a country with high income mobility, the results indicate that income mobility is lower for daughters than for sons.

2 Data and Summary Statistics

We link five confidential datasets obtained from the Statistics Netherlands. These cover all residents who are by law required to register with the nearest municipality to access public services. The data comprise a full record of the population of 15 years old children and their parents from 2003 to-date.

Selecting 15 year olds ensures that the children are likely to have completed compulsory education; are living with at least one of their parents (using location-identifiers of mother-father-child), and are not yet active in the labour market beyond probationary employment. These children are aged 28 when we sample the latest available incomes in 2016. Hence data are unavailable to determine how children's age after 28 affects the IGE, though further research will be possible as this cohort ages.

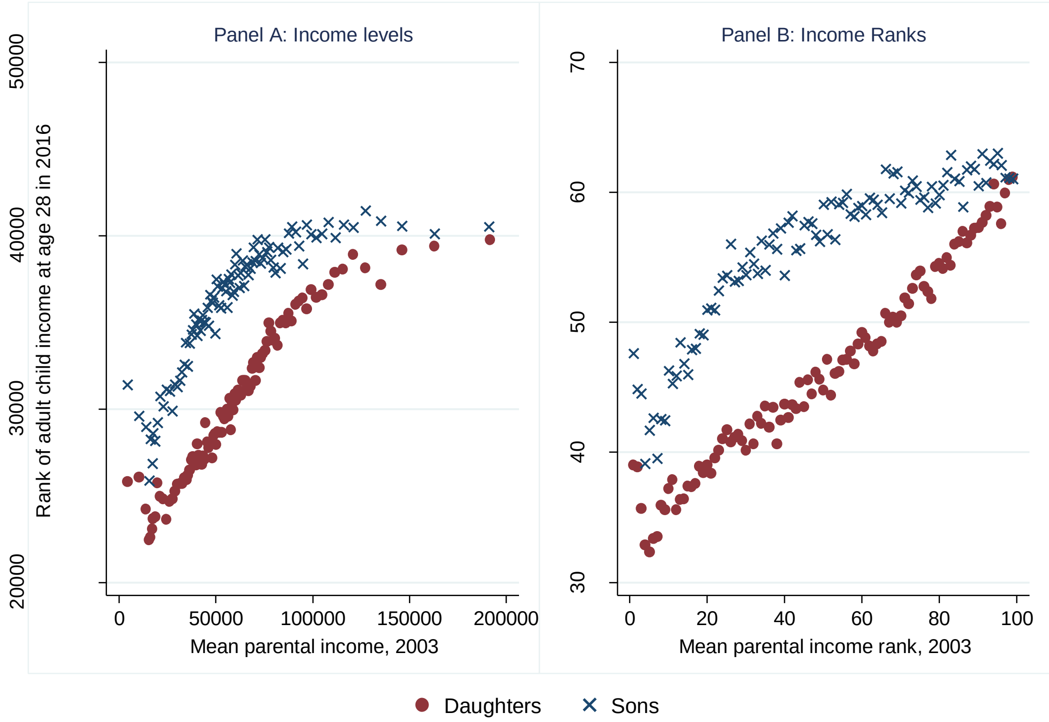
Table 1 illustrates the cross-generational quintile income transition matrix for the Netherlands, suggesting high transition rates. There is a 12 percent probability that a child whose parents were in the bottom fifth of the 2003 income distribution is in the top fifth of the 2016 child income distribution. The comparable transition probability is 7.5 percent in the US (Chetty et al., 2014), 11.7 percent in Denmark (Boserup et al., 2013) and 13.4 percent in Canada (Corak and Heisz, 1999). Thus, the chance of a child from a relatively poor family background achieving economic success are similar for the Netherlands, Canada and Denmark, and much higher than in the US. Nevertheless, in the Netherlands, as in other countries, the most frequent transitions are still those where a child remains in the same income quintile as their parents (i.e. non-transitions) and this is particularly notable at the top and bottom of the income distribution.

Table 1. Cross-generation income quintile transition matrix

	Quintile for 2003 parental income				
Quintile for child 2016 income	1	2	3	4	5
1	0.29	0.20	0.16	0.14	0.14
2	0.25	0.22	0.20	0.17	0.14
3	0.19	0.22	0.23	0.21	0.17
4	0.15	0.21	0.22	0.24	0.23
5	0.12	0.15	0.19	0.24	0.33
Total	1.00	1.00	1.00	1.00	1.00

Before estimating the IGE, we show in Figure 1 the relation between child income and parental income. Panel A illustrates income levels and Panel B percentile income ranks (which are less sensitive to zero incomes). This figure shows a clear, positive relationship between parental and child income and also highlights the gender income gap. The concavity of the relationship for sons additionally suggests more intergenerational mobility for most sons (with parental income rank 35 and over) compared to the linear relationship for daughters.

Figure 1. Daughters' and sons' income and parental income



3 Econometric Model and Results

Children's income at age 28 in 2016 are modelled as a log-log function of their parents' incomes when the children were aged 15 in 2003 and other socio-economic characteristics:

$$\ln Inc_i^{2016} = \alpha_0 + \alpha_1 \ln ParentsInc_i^{2003} + \textstyle\sum_{j=2}^{K} \alpha_j x_j + \varepsilon_i \quad (1)$$

where $\ln Inc_i^{2016}$ is the natural logarithm of the child's total gross pre-tax income from all sources (so there are no zeros) and $\ln ParentsInc_i^{2003}$ is the natural logarithm of total parental income, also from all sources. α_1 is the estimated IGE of income. The remaining explanatory variables (x_j) control for demographic characteristics, including gender and the nationality of parents and children. Supplementary Table S1 provides summary statistics for all variables. For 28 year olds in 2016, 51 percent were male and average non-zero annual income was €34,405.95.

Estimates for the whole sample, pooling men and women, suggest IGEs of 0.1957 and 0.1204 with covariates. Table 2 provides further evidence of the extent to which both sons' and daughters' 2016 income is determined by their parents' 2003 income. Parents-Daughter and Parents-Son IGEs are 0.2312 and 0.1649 respectively, while Father-Daughter and Father-Son IGEs are slightly lower at 0.1942 and 0.1539. Table 3 presents model estimates including covariates, which reduces the IGEs for both daughters and sons. Tables 4 and 5 show that parent-child IGEs of earnings are comparable although somewhat smaller. Thus, the parental income effect is predominantly due to parental earnings rather than the other unearned components of wealth in the Netherlands. These IGE ranges indicate that, contrary to Chadwick and Solon's (2002) results for the US, the economic advantage of parents passed on to daughters is greater than that passed onto sons, meaning that intergenerational mobility of sons appears greater than that of daughters in the Netherlands.

Table 2. Bivariate regressions for parent-child IGE of income

	ln Inc^{2016} (Log of child income)			
	Daughters		Sons	
	(1)	(2)	(3)	(4)
ln$ParentsInc^{2003}$	0.2312***		0.1649***	
	(0.0050)		(0.0045)	
ln$FatherInc^{2003}$		0.1942***		0.1539***
		(0.0050)		(0.0046)
Constant	7.6038***	8.0659***	8.5269***	8.7008***
	(0.0545)	(0.0532)	(0.0492)	(0.0495)
Observations	86,031	79,527	90,184	83,562
R-squared	0.034	0.027	0.018	0.018

Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

Table 3. Multivariate regressions for parent-child IGE of income

	ln Inc^{2016} (Log of child income)			
	Daughters		Sons	
Regressors†	(1)	(2)	(3)	(4)
ln$ParentsInc^{2003}$	0.1544***		0.0872***	
	(0.0056)		(0.0051)	
ln$FatherInc^{2003}$		0.1256***		0.0913***
		(0.0051)		(0.0049)
Constant	3.6460***	3.7337***	7.6600***	7.7005***
	(0.2293)	(0.2393)	(0.1992)	(0.2070)
Observations	81,331	77,019	85,215	80,801
R-squared	0.057	0.054	0.043	0.043

Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1
†Including controls for province, Foreign-born child, Foreign-born parents, Mother's&Father's age, Mother's&Father's age squared, birth order, single-parent families and number of brothers and sisters.

The supplementary models in Tables S2 and S3 use the natural logarithm of parental income and earnings averaged across 2003-2006 to account for idiosyncratic temporal variation (Lee and Solon, 2009; Mazumder, 2005; Haider and Solon, 2006). These results are similar to those in Tables 3 and 5. Supplementary Tables S4 and S5 present similar models to those in Tables 3 and S2 but with child earnings instead of income as the dependent variable to explore the influence of parental income on earnings. The IGE estimates for sons remain largely unchanged while for daughters they increase.

Table 4. Bivariate regressions for parent-child IGE of earnings

	ln $Earn^{2016}$ (Log of child earnings)			
	Daughters		Sons	
	(1)	(2)	(3)	(4)
ln*ParentsEarn*^{2003}	0.1780***		0.1170***	
	(0.0052)		(0.0046)	
ln*FatherEarn*^{2003}		0.1535***		0.1043***
		(0.0055)		(0.0050)
Constant	8.1692***	8.4779***	9.0640***	9.2403***
	(0.0573)	(0.0596)	(0.0507)	(0.0540)
Observations	74,078	67,987	78,936	72,564
R-squared	0.023	0.015	0.011	0.008

Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1

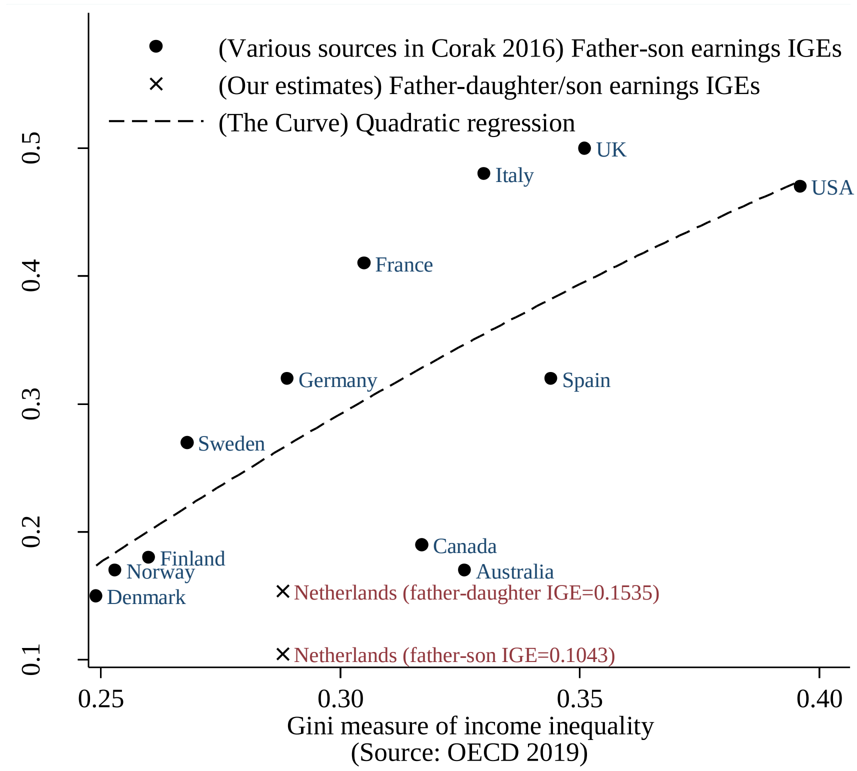
Table 5. Multivariate regressions for parent-child IGE of earnings

	Ln $Earn^{2016}$ (Log of child earnings)			
	Daughters		Sons	
Regressors†	(1)	(2)	(3)	(4)
ln*ParentsEarn*^{2003}	0.1162***		0.0726***	
	(0.0054)		(0.0050)	
ln*FatherEarn*^{2003}		0.1017***		0.0673***
		(0.0056)		(0.0052)
Constant	2.3344***	2.1896***	7.5388***	7.6042***
	(0.3320)	(0.3599)	(0.2793)	(0.2976)
Observations	70,687	65,823	75,294	70,183
R-squared	0.048	0.045	0.031	0.029

Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1
†Including all controls as in Table 3.

The results imply approximately 20 percent of the income advantage of parents in the Netherlands is passed on to their children in adulthood. This IGE is lower compared with most previous estimates, although in line with Jerrim's (2017) finding that the Netherlands has a relatively low income gap between sons of more and less educated parents. The results enable us to position the Netherlands on Krueger's (2012) "Great Gatsby Curve" which traces a positive relationship between inequality and the IGE of earnings. The curve suggests that countries with high income inequality also have intergenerational income persistence. Figure 2 illustrates the Great Gatsby Curve based on Corak's (2016) compilation of other's estimates for father-son IGEs of earnings. Our comparable earnings IGEs for the Netherlands, for both daughters and sons, lie below the Great Gatsby Curve.

Figure 2. Great Gatsby Curve for selected OECD countries



5 Conclusion

We report intergenerational elasticity (IGE) of income estimates for the full population of 28 year olds in the Netherlands in 2016. These IGEs are relative to their parents' income in 2003 when they were aged 15. An important contribution of this paper is to show that when actual individual-level income is used, instead of proxies or aggregate data, estimated IGEs for the Netherlands' are comparatively low, approximately half those found for the US and UK. The father-son earnings IGE of 0.1043 is comparable with father-son estimates for Denmark (Corak, 2016) where income inequality is also relatively low (OECD, 2019). IGEs for daughters are larger than those for sons, irrespective of whether we include regression covariates. Thus, despite overall high income mobility in the Netherlands, there are notable gender differences in that daughters are more likely than sons to remain at the same income level as their parents, a result which requires further research.

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Supplementary file: Summary statistics and auxiliary regressions

Table 3 including all covariates

Table 3. Multivariate regressions for parent-child IGE of income

	ln Inc^{2016} (Log of child income)			
	Daughters		Sons	
	(1)	(2)	(3)	(4)
ln$ParentsInc^{2003}$	0.1544***		0.0872***	
	(0.0056)		(0.0051)	
ln$FatherInc^{2003}$		0.1256***		0.0913***
		(0.0051)		(0.0049)
Foreign-born child	-0.0326*	-0.0465**	-0.0445***	-0.0552**
	(0.0175)	(0.0189)	(0.0165)	(0.0179)
Foreign-born parents	-0.1579***	-0.1508***	-0.3751***	-0.3638***
	(0.0131)	(0.0140)	(0.0120)	(0.0127)
Mother's age	0.1318***	0.1376***	0.0688***	0.0651***
	(0.0110)	(0.0114)	(0.0097)	(0.0102)
Mother's age squared	-0.0014***	-0.0014***	-0.0008***	-0.0008***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Father's age	0.0699***	0.0747***	0.0128*	0.0140*
	(0.0077)	(0.0083)	(0.0067)	(0.0074)
Father's age squared	-0.0007***	-0.0007***	-0.0002***	-0.0002**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Additional regressors†				
Constant	3.6460***	3.7337***	7.6600***	7.7005***
	(0.2293)	(0.2393)	(0.1992)	(0.2070)
Observations	81,331	77,019	85,215	80,801
R-squared	0.057	0.054	0.043	0.043

Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1
†Including controls for province, birth order, single-parent families and number of brothers and sisters.

Table 5 including all covariates

Table 5. Multivariate regressions for parent-child IGE of earnings

	ln $Earn^{2016}$ (Log of child earnings)			
	Daughters		Sons	
	(1)	(2)	(3)	(4)
ln$ParentsEarn^{2003}$	0.1162***		0.0726***	
	(0.0054)		(0.0050)	
ln$FatherEarn^{2003}$		0.1017***		0.0673***
		(0.0056)		(0.0052)
Foreign-born child	-0.0357	-0.0608**	-0.0866***	-0.1084***
	(0.0254)	(0.0276)	(0.0238)	(0.0258)
Foreign-born parents	-0.1951***	-0.1892***	-0.3692***	-0.3710***
	(0.0190)	(0.0206)	(0.0164)	(0.0175)
Mother's age	0.1861***	0.1856***	0.0667***	0.0596***
	(0.0158)	(0.0172)	(0.0133)	(0.0144)
Mother's age squared	-0.0019***	-0.0019***	-0.0008***	-0.0007***
	(0.0002)	(0.0002)	(0.0001)	(0.0002)
Father's age	0.0867***	0.1013***	0.0269**	0.0345***
	(0.0118)	(0.0146)	(0.0106)	(0.0125)
Father's age squared	-0.0008***	-0.0010***	-0.0003***	-0.0004***
	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Additional regressors†				
Constant	2.3344***	2.1896***	7.5388***	7.6042***
	(0.3320)	(0.3599)	(0.2793)	(0.2976)
Observations	70,687	65,823	75,294	70,183
R-squared	0.048	0.045	0.031	0.029

Robust standard errors in parentheses. Significance: *** p<0.01, ** p<0.05, * p<0.1
†Including controls for province, birth order, single-parent families and number of brothers and sisters.

Table S1: Summary statistics

Definition	Obs.	Mean	s.d.
Child total income at the age of 28 (euros in 2016)	176215	34405.95	24393.03
Child earnings[a] at the age of 28 (euros in 2016)	176215	32332.13	25974.53
Parental total income [b] (euros in 2003)	176215	63991.87	43831.21
Parental total income (euros; 2003-2006 average)	176215	67470.49	43988.36
Parental earnings (euros in 2003)	176215	59453.90	45843.28
Parental earnings (euros; 2003-2006 average)	176215	62324.05	46343.72
Mother's total income (euros in 2003)	173561	16170.52	17913.67
Mother's total income (euros; 2003-2006 average)	173936	17512.18	17122.85
Father's total income (euros in 2003)	165600	51145.87	38638.99
Father's total income (euros; 2003-2006 average)	166280	53183.28	39075.82
Father's earnings (euros in 2003)	165600	48531.57	40283.21
Father's earnings (euros; 2003-2006 average)	166280	50133.94	40923.41
ln(Child total income at the age of 28 (euros in 2016))	176215	10.22	0.82
ln(Child earnings[a] at the age of 28 (euros in 2016))	162341	10.20	0.96
ln(Parental total income [b] (euros in 2003))	176215	10.88	0.66
ln(Parental total income (euros; 2003-2006 average))	176034	10.95	0.62
ln(Parental earnings (euros in 2003))	164126	10.83	0.84
ln(Parental earnings (euros; 2003-2006 average))	167128	10.82	0.96
ln(Mother's total income (euros in 2003))	142714	9.55	0.96
ln(Mother's total income (euros; 2003-2006 average))	152144	9.48	1.27
ln(Father's total income (euros in 2003))	163089	10.66	0.69
ln(Father's total income (euros; 2003-2006 average))	164995	10.68	0.70
Birth order of the child with the same couple_id	176215	1.86	1.10
1=second child; 0=otherwise	176215	0.35	0.48
Number of siblings per couple_id	175001	1.68	1.31
Number of brothers per couple_id (male)	175001	0.86	0.93
Number of sisters per couple_id (female)	175001	0.82	0.93
1=if single parent; 0=otherwise	176215	0.04	0.19
1=if child was born abroad; 0=otherwise	176215	0.06	0.23
1=if at least one parent was born abroad; 0=otherwise	176215	0.20	0.40
1=if both parents were born abroad; 0=otherwise	176215	0.13	0.33
1=if both parents were born in the Netherlands; 0=otherwise	176215	0.80	0.40
Age of the mother (years)	176034	43.73	4.55
Age of the father (years)	172031	46.57	5.24
Gender (1=if male; 0=otherwise)	176215	0.51	0.50

Notes:
[a] Earnings correspond to annualised wage income before tax; in other words the wage received as a result of actively working in a job. Income includes all forms of income.
[b] Parental income/earnings equals to the sum of mother's and father's income/earnings.

Table S2. IGE of income conditional on average 2003-2006 parental income

	Log of child income ($\ln I^{2016}$)			
	Daughters		Sons	
	(1)	(2)	(3)	(4)
$\ln ParentsInc^{2003\text{-}2006}$	0.2417***	0.1685***	0.1768***	0.0999***
	(0.0055)	(0.0058)	(0.0047)	(0.0055)
Constant	7.4769***	3.6010***	8.3876***	7.6078***
	(0.0605)	(0.2274)	(0.0516)	(0.1985)
Covariates†	No	Yes	No	Yes
Observations	86,031	82,017	90,184	85,904
R-squared	0.034	0.058	0.018	0.044

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
† Covariates are the same as in Table 3.

Table S3. IGE of earnings conditional on average 2003-2006 parental earnings

	Log of child earnings ($\ln E^{2016}$)			
	Daughters		Sons	
	(1)	(2)	(3)	(4)
$\ln ParentsEarn^{2003\text{-}2006}$	0.1717***	0.1160***	0.1217***	0.0777***
	(0.0048)	(0.0050)	(0.0043)	(0.0047)
Constant	8.2310***	2.5643***	9.0067***	7.6655***
	(0.0528)	(0.3232)	(0.0467)	(0.2744)
Covariates†	No	Yes	No	Yes
Observations	75,873	72,256	80,898	77,013
R-squared	0.028	0.051	0.016	0.035

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
† Covariates are the same as in Table 3.

Table S4. IGE of earnings conditional on 2003 parental income

	Log of child earnings ($\ln E^{2016}$)			
	Daughters		Sons	
	(1)	(2)	(3)	(4)
$\ln ParentsInc^{2003}$	0.2703***	0.1741***	0.1684***	0.0865***
	(0.0066)	(0.0070)	(0.0055)	(0.0060)
Constant	7.1265***	2.1417***	8.4720***	7.3633***
	(0.0723)	(0.3099)	(0.0600)	(0.2643)
Covariates†	No	Yes	No	Yes
Observations	78,416	74,421	83,932	79,590
R-squared	0.032	0.054	0.014	0.037

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
†Covariates are the same as in Table 3.

Table S5. IGE of earnings conditional on average 2003-2006 parental earnings

	Log of child earnings ($\ln E^{2016}$)			
	Daughters		Sons	
	(1)	(2)	(3)	(4)
ln*ParentsInc*$^{2003\text{-}2006}$	0.2875***	0.1942***	0.1797***	0.0957***
	(0.0072)	(0.0073)	(0.0057)	(0.0064)
Constant	6.9223***	2.0598***	8.3395***	7.3503***
	(0.0796)	(0.3073)	(0.0630)	(0.2631)
Covariates†	No	Yes	No	Yes
Observations	79,126	75,037	84,670	80,231
R-squared	0.036	0.056	0.016	0.038

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
†Covariates are the same as in Table 3.