

# Estimating intergenerational income mobility in New Zealand using longitudinal census data

Leon Iusitini

[leon.iusitini@aut.ac.nz](mailto:leon.iusitini@aut.ac.nz)



**NEW ZEALAND  
WORK RESEARCH INSTITUTE**



## Disclaimer

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Access to the data used in this study was provided by Stats NZ under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in this study are the work of the author, not Stats NZ or individual data suppliers.

## Aim

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- Question: *How closely related are people's incomes to those of their parents?*
- If strong association, intergenerational mobility is low; if weak association, mobility is high
- Intergenerational mobility is an (imperfect) indicator of equality of opportunity
- Aim: Estimate and explain degree of intergenerational income persistence between parents and their offspring in New Zealand
- The study uses data from the *New Zealand Longitudinal Census* – census microdata linked at the individual level over 1981 to 2013 containing parent-offspring links
- Estimates persistence among father-son and mother-daughter pairs, and by groups
- Constructs a proxy for the 'permanent income' of sons, daughters, fathers, and mothers
- Only two previous New Zealand studies (Andrews & Leigh, 2008; Gibbons, 2010)

## Concepts of intergenerational mobility

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- Structural mobility:
  - *Scalar*: changes in *marginal distributions* of income between parent and offspring generations, ignoring changes in ranks (e.g. income growth or changes in cross-sectional inequality across generations)
  
- Exchange mobility:
  - *Positional*: changes in *ranks* between parent and offspring generations (the copula), ignoring changes in marginal distributions (re-ranking across generations)

## Measurement of intergenerational mobility

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- Standard approach to measuring association between parents' and offspring's incomes is to apply OLS to

$$Y_{ij}^{\text{offspring}} = \alpha + \beta Y_i^{\text{parent}} + \text{Age}^{\text{offspring}} + \text{Age}^2 \text{ offspring} + \text{Age}^{\text{parent}} + \text{Age}^2 \text{ parent} + \varepsilon_i$$

$Y_{ij}^{\text{offspring}}$  = log of lifetime average income of offspring  $j$  in family  $i$

$Y_i^{\text{parent}}$  = log of lifetime average income of parent in family  $i$

$\text{Age}$  = age of offspring and parents

$\varepsilon_i$  = error term capturing factors  $\perp$  to  $Y_i^{\text{parent}}$

- $\beta$  = intergenerational income elasticity (IGE)

## Measurement of intergenerational mobility

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- The IGE:
  - Is a measure of income *persistence*:
    - high IGE = high persistence (low mobility)
    - low IGE = low persistence (high mobility)
  - Empirically, usually lies between zero (no relationship between incomes of parents and offspring) and 1 (offspring incomes are determined by parents' incomes)
  - Captures *total* statistical relationship, not causal, but rather reflects influence on offspring income of all factors correlated with parental income
  - Captures changes in marginal distributions *and* changes in ranks (i.e., doesn't distinguish between structural and exchange mobility)

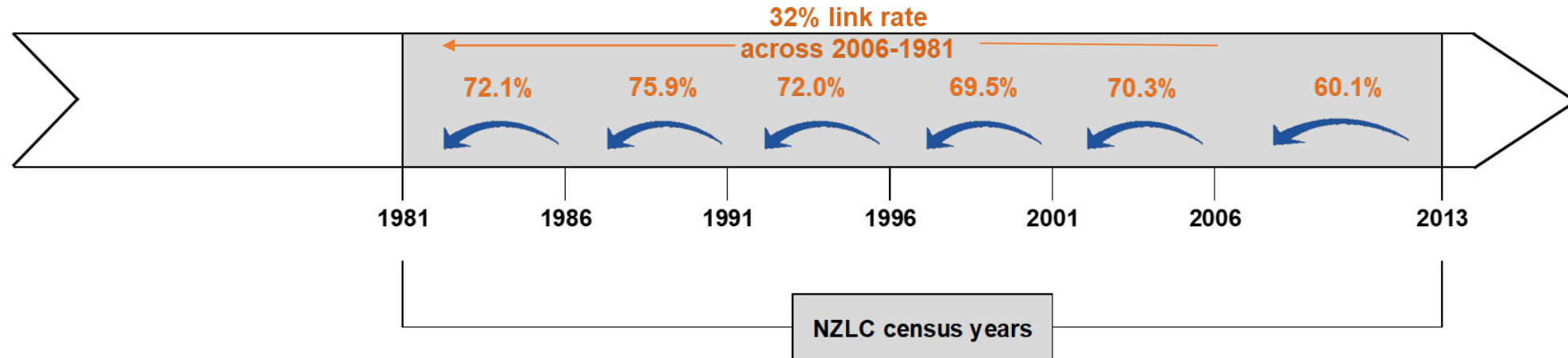
## Measurement error in estimating intergenerational mobility

- Absent lifetime income histories, short-run income must be used to proxy for unobserved lifetime income
- This introduces *measurement error* which can bias estimates of intergenerational persistence

		Parental income	Offspring income	Solution
<b>Measurement error</b>	Income measured over too short a period	Attenuation bias ↓ IGE	No bias (in theory)	Take a multiyear average of income to reduce noise
	Income measured at too young an age	Lifecycle bias ↑ IGE	Lifecycle bias ↓ IGE	Measure income at an age when current income best approximates lifetime average income
	Income measured at too old an age	Lifecycle bias ↓ IGE	Lifecycle bias ↑ IGE	

## New Zealand Longitudinal Census

- NZLC links individuals' census records backwards through pairs of censuses



- Person is linkable if at earlier census they had been born, filled out a census, and resided in New Zealand (those overseas during a census can't be linked over period of their absence)
- Linking was largely deterministic (~67%) based on sex, date of birth, area of usual residence (country of birth, Māori descent) and a further 3% linked probabilistically
- Potential for selection bias from groups less likely to be linked (young adults, males, Māori, Pacific, Asian, those living in higher-deprivation neighbourhoods, the residentially mobile) and those who, by construction, cannot be linked (emigrants)



## New Zealand Longitudinal Census

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- Sample of offspring selected from the earliest (1981) census
- 1981 census defined a family as:

*'...a husband and wife with or without never married children of any age or a lone parent with one or more never married children, living in a private household. **The term 'children' includes step children and adopted children, but not foster children....A family is not necessarily all related people in a household, but only those related by blood, marriage, or adoption, who normally live together as a single family unit and **who are present on census night****'*

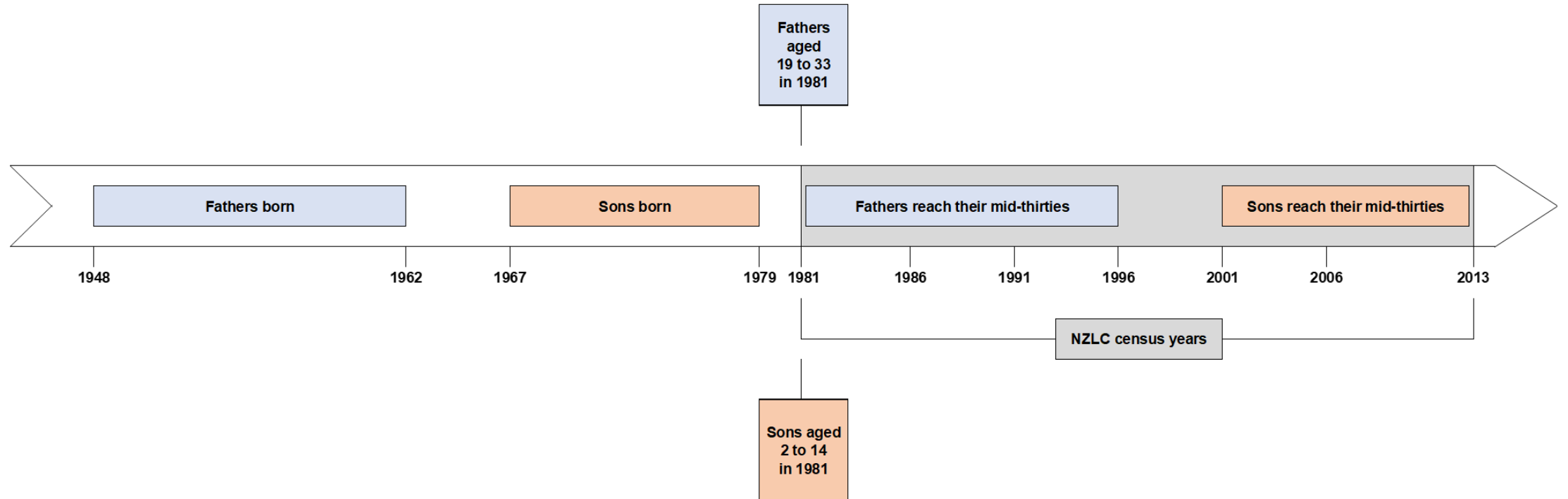
- Fathers and mothers linked to sons and daughters by variables 'Family ID number' and 'Role in family'
- This analysis uses father and mother enumerated in 1981 (disregarding any subsequent changes in father/mother figures)
- Fathers (mothers) may have multiple sons (daughters) in the 1981 census, hence there are brothers (sisters) in the father-son (mother-daughter) samples

## Using census income data to proxy for permanent income

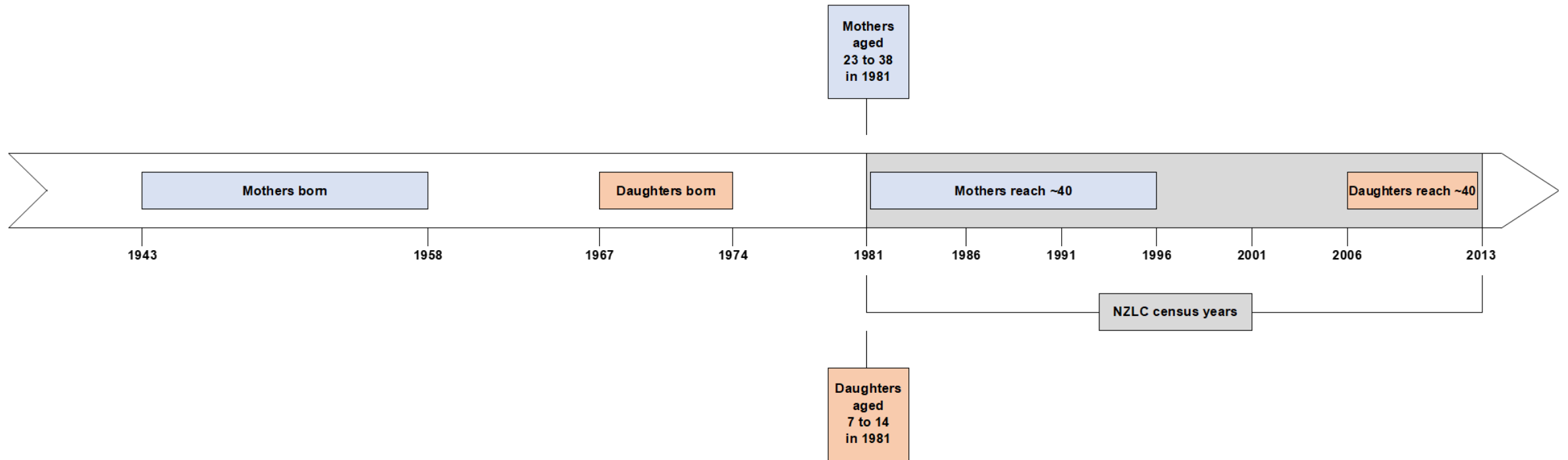
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- Each census collects 'total personal income' = gross annual income from all sources over previous 12 months
- Collected in bands, so parents and offspring assigned *median* of their band (*mid-points* for 1981), deflated to 2012 Q3 dollars
- Permanent income of offspring and parents is proxied with a time-average of total personal income (averaged over 2 to 7 censuses for parents, 1 to 5 censuses for offspring) centred around age 35 for men (fathers and sons) and age 40 for women (mothers and daughters)
- Parents and offspring are eligible for analysis if they are in the right age bracket for construction of such a proxy

# Determining eligibility for analysis

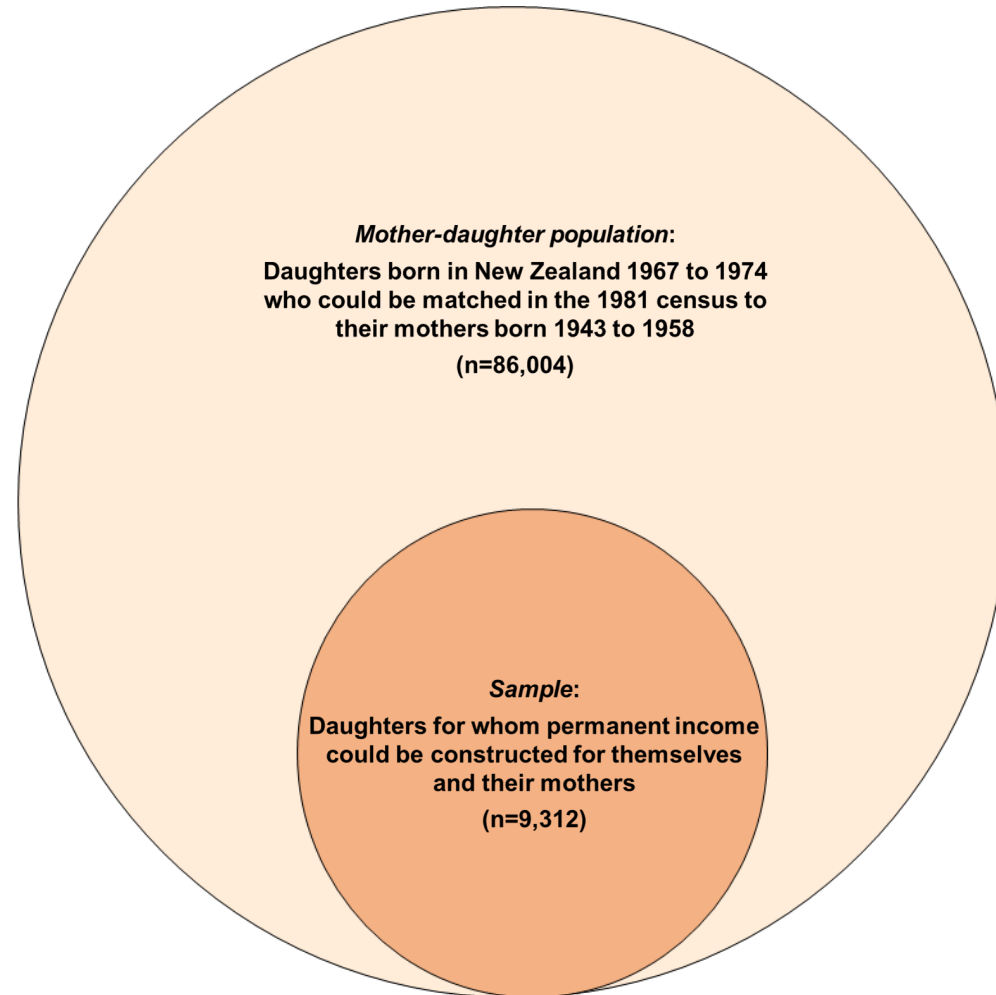
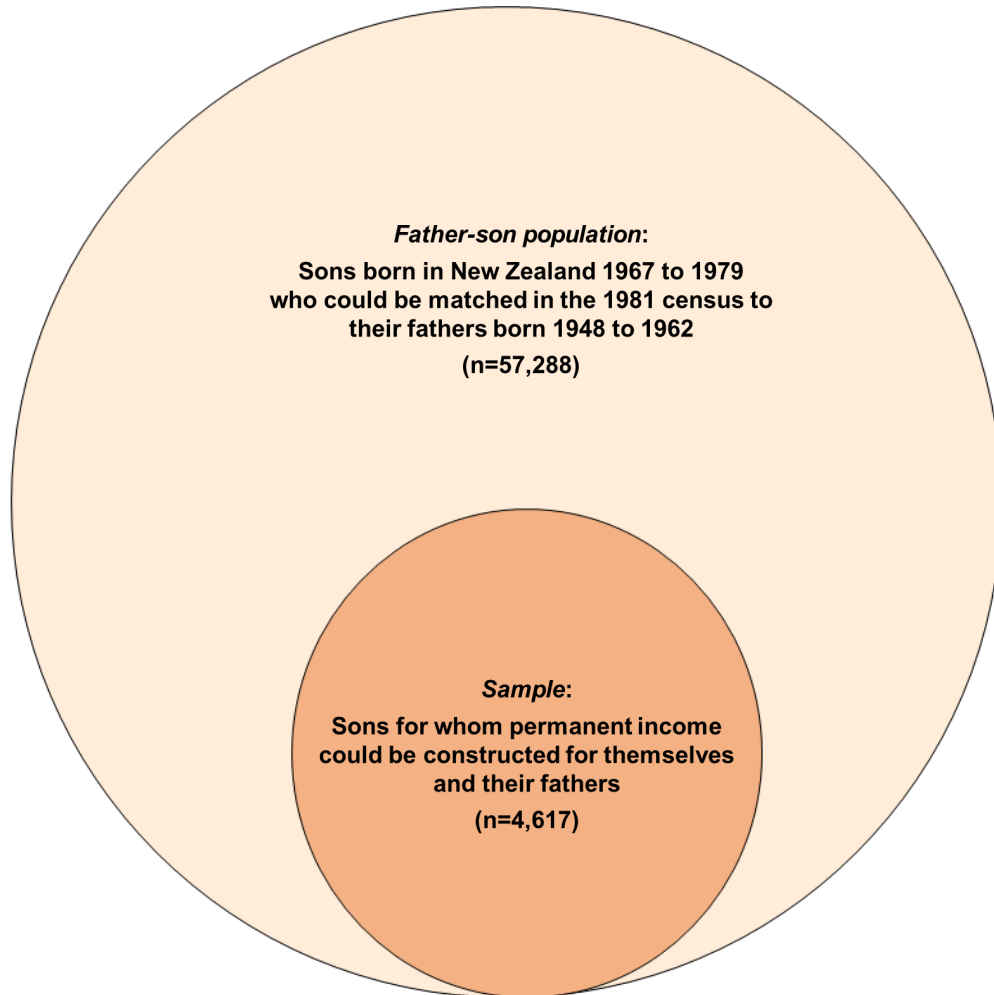


# Determining eligibility for analysis

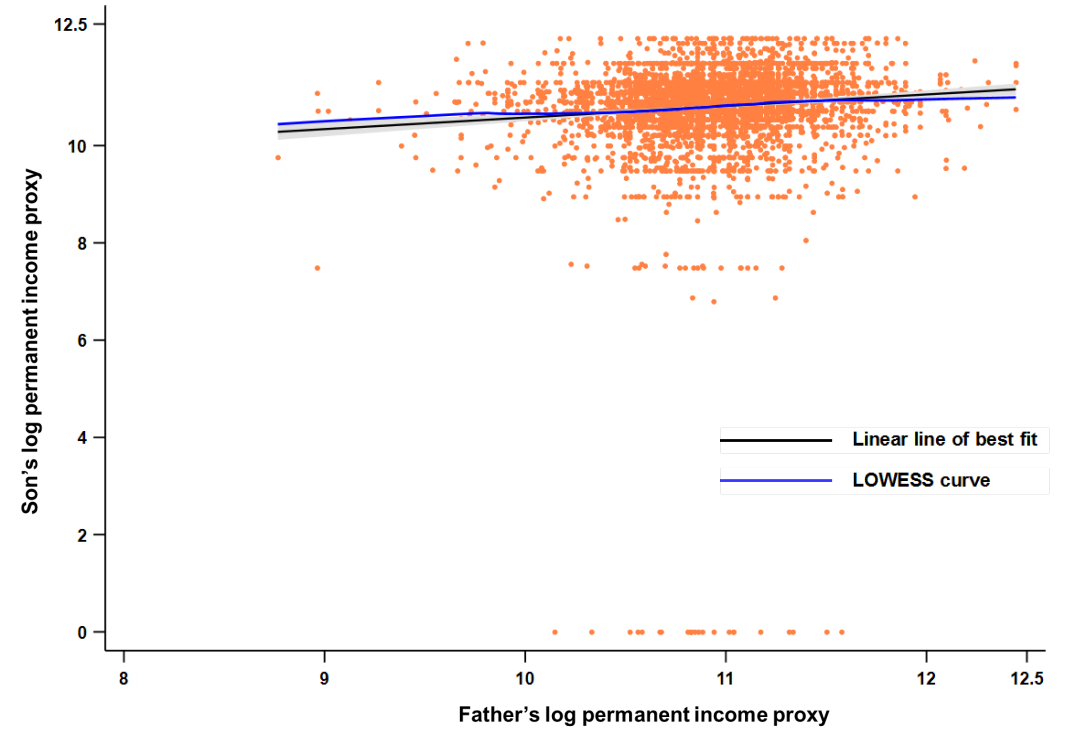
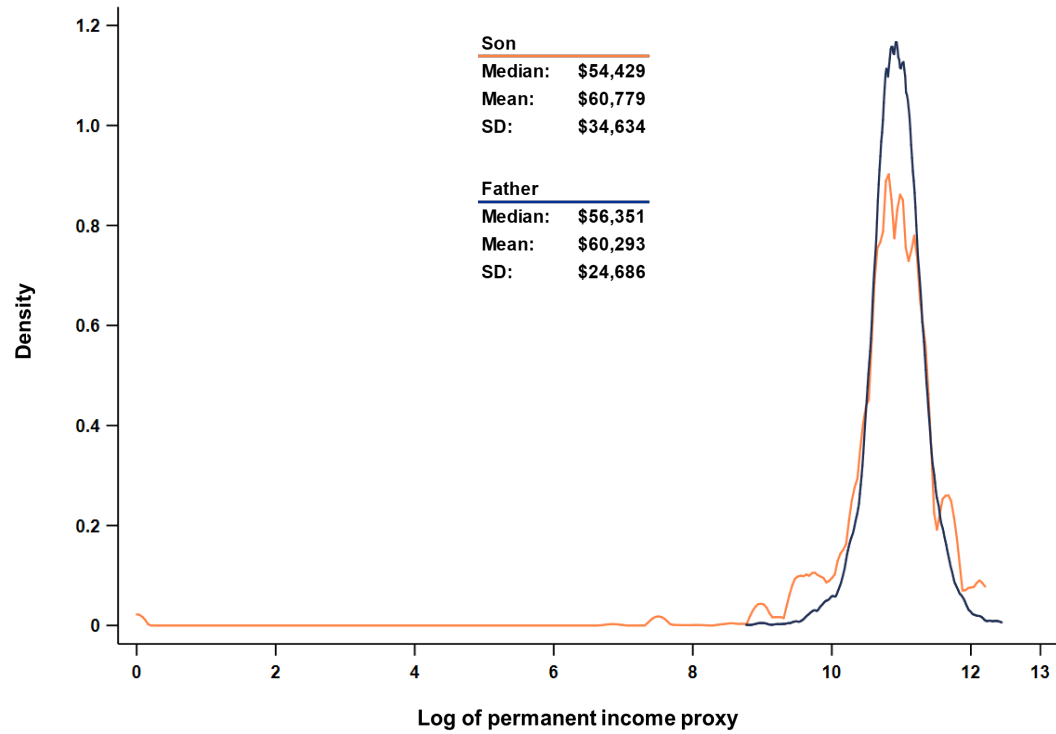


## Sample selection

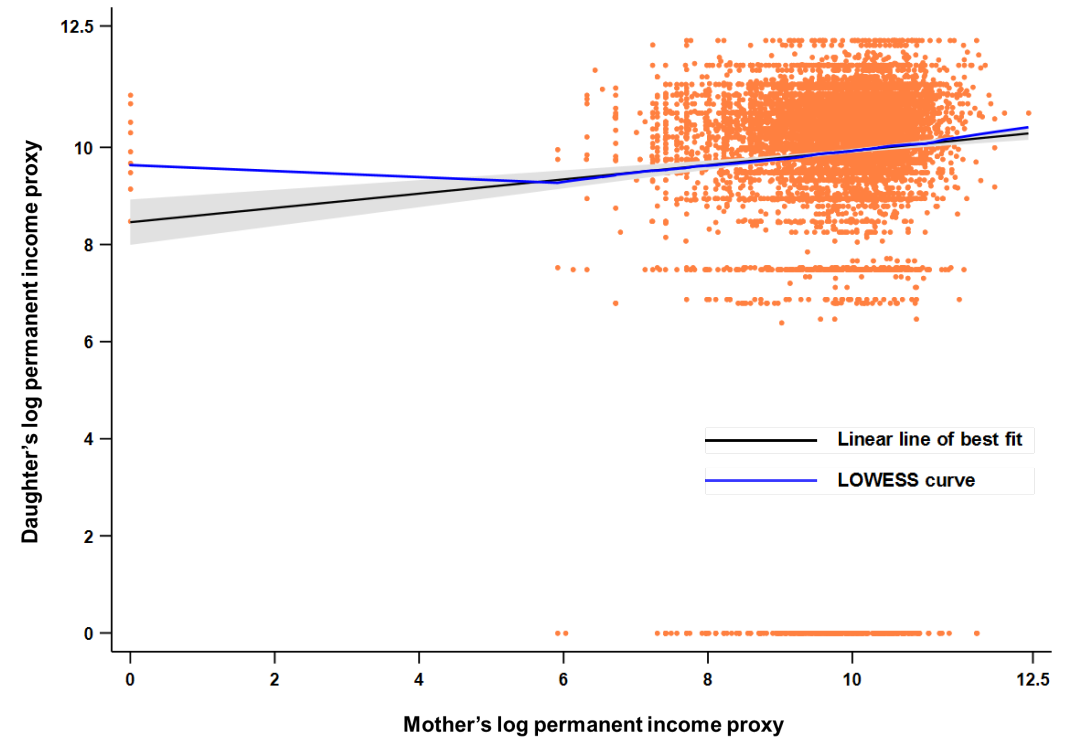
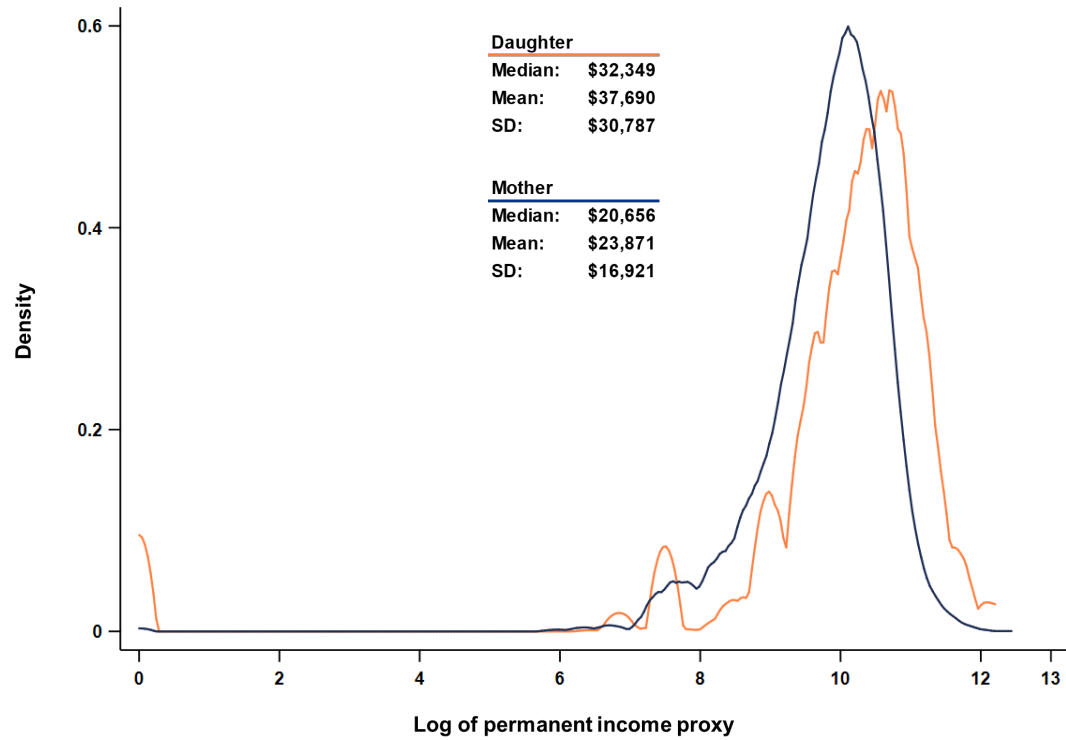
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# Fathers' and sons' permanent incomes



# Mothers' and daughters' permanent incomes



# Results

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*Dependent variable: Son's log permanent income*

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Father's log permanent income	0.239 *** (0.038)
Son's age at 1981 census	0.053 ** (0.019)
Son's age squared	-0.003 * (0.001)
Father's age at 1981 census	0.221 (0.116)
Father's age squared	-0.004 (0.002)
Constant	4.826 ** (1.727)

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R-squared	0.0122
Number of observations	4,617

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*Dependent variable: Daughter's log permanent income*

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Mother's log permanent income	0.145 *** (0.026)
Daughter's age at 1981 census	0.340 *** (0.097)
Daughter's age squared	-0.012 ** (0.005)
Mother's age at 1981 census	0.048 (0.143)
Mother's age squared	-0.001 (0.002)
Constant	5.558 * (2.321)

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R-squared	0.015
Number of observations	9,312

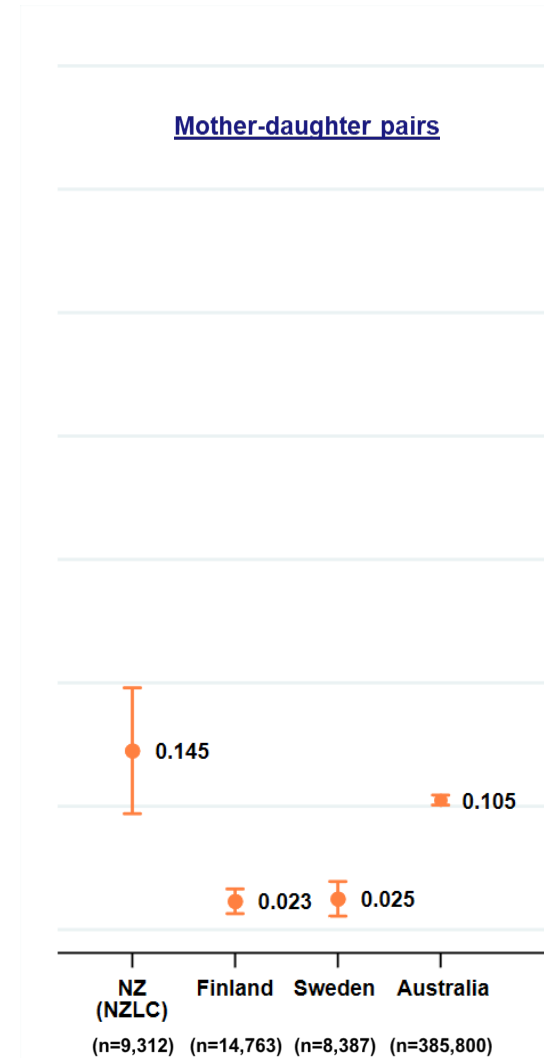
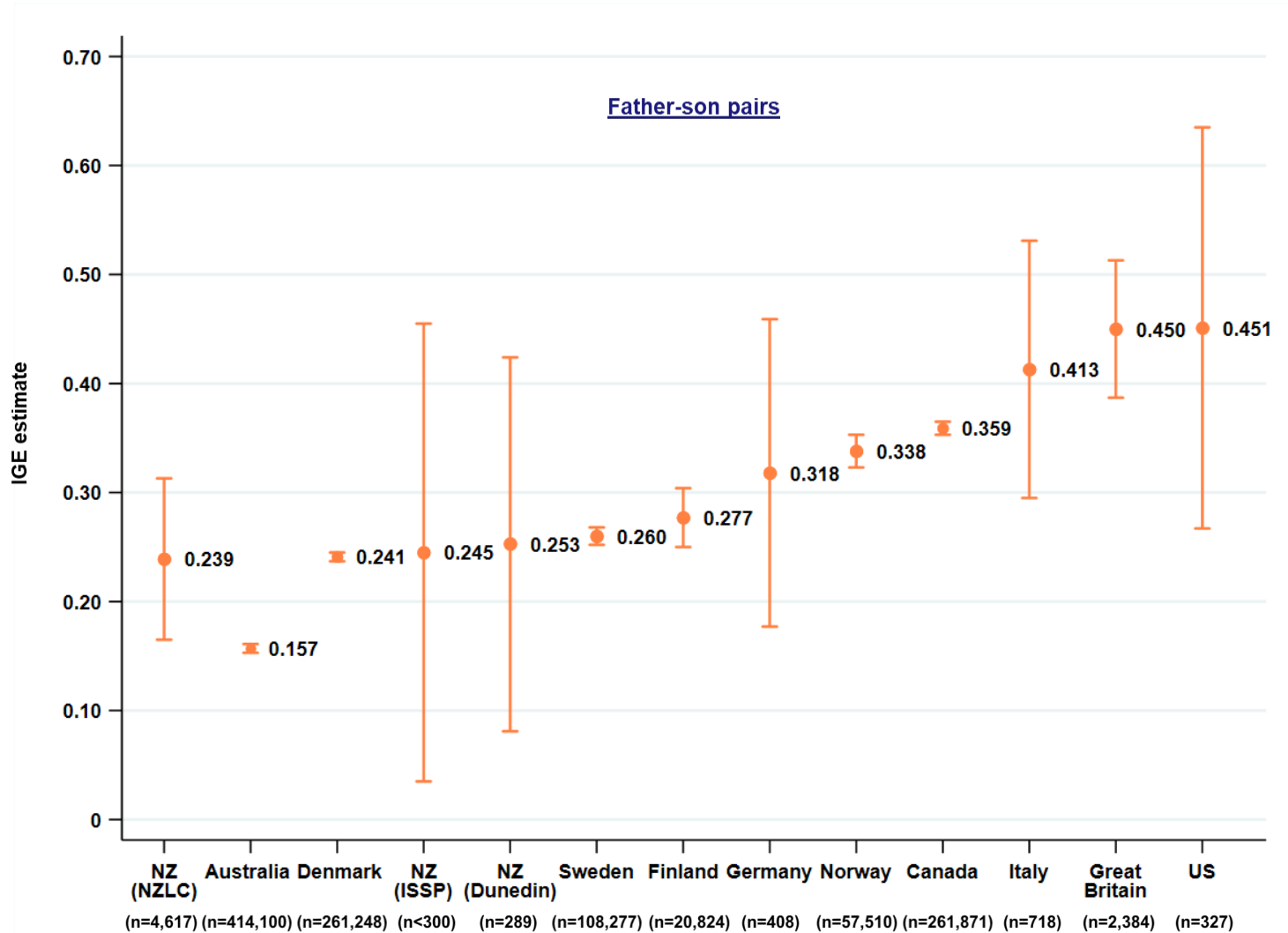
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Robust standard errors in parentheses (adjusted for 4,416 clusters in fathers and 8,892 clusters in mothers)

\*\*\* $p < 0.001$  \*\* $p < 0.01$  \* $p < 0.05$



# Cross-national comparison



## Estimating group-specific IGEs

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- IGE may conceal heterogeneity between groups
- Stratifying sample and estimating IGE separately for each group will produce a misleading comparison of persistence between groups, as Hertz (2008) explains:

*...any long-run difference in group [income] means...is ignored under stratification, and this can lead to the false impression that a persistently disadvantaged group is actually highly mobile. Children of the disadvantaged group may be quite mobile with respect to their parents when measured by their within-group intergenerational elasticity. But if both parents and children in that group are generally confined to the lower end of the income distribution, then the children will typically remain relatively disadvantaged, which is to say, they will display little mobility.*

- Hertz (2008) develops a group-specific IGE statistic which measures “both the degree to which parents and children have similar incomes within a group, as well as the degree to which people in a given group tend to fall above or below the sample mean”

## Estimating group-specific IGEs

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$$\hat{\beta} = \sum_g \hat{\pi}_g \left( \hat{\beta}_g \frac{\hat{\sigma}_{x(g)}^2}{\hat{\sigma}_x^2} + \frac{(\bar{x}_g - \bar{x})(\bar{y}_g - \bar{y})}{\hat{\sigma}_x^2} \right)$$

$g$  = index of groups

$\hat{\pi}_g$  = sample share for group  $g$

$\bar{x}$  ,  $\hat{\sigma}_x^2$  = sample mean and variance of parents' permanent income

$\bar{y}$  ,  $\hat{\sigma}_y^2$  = sample mean and variance of offspring's permanent income

$\bar{x}_g$  ,  $\hat{\sigma}_{x(g)}^2$  = mean and variance of group  $g$ 's parents

$\bar{y}_g$  ,  $\hat{\sigma}_{y(g)}^2$  = mean and variance of group  $g$ 's offspring

$\hat{\beta}_g$  = IGE from regression of  $y$  on  $x$  in group  $g$

## Estimating group-specific IGEs

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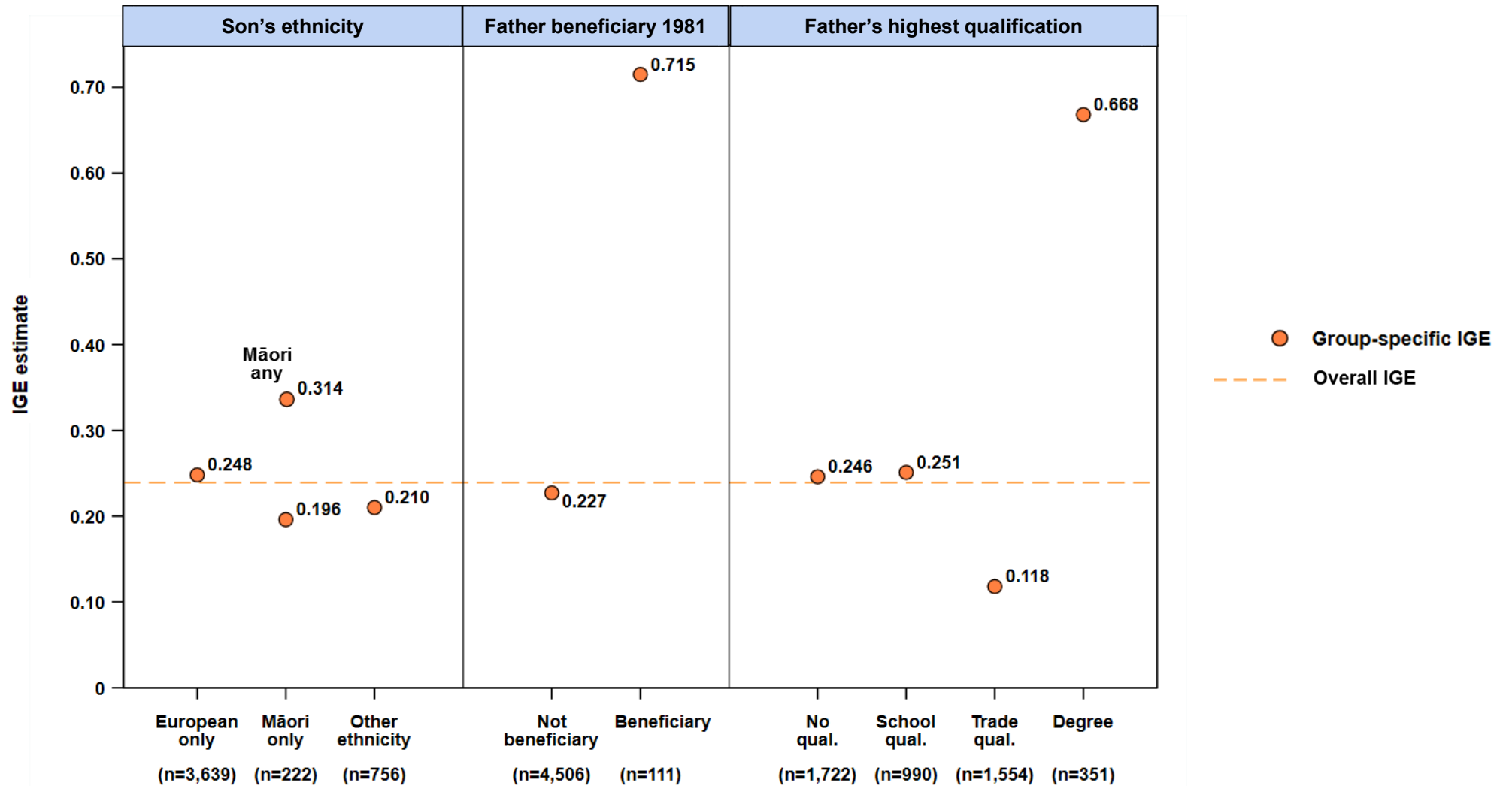
***Within-group component:***

‘degree to which parents and offspring have similar incomes *within a group*’

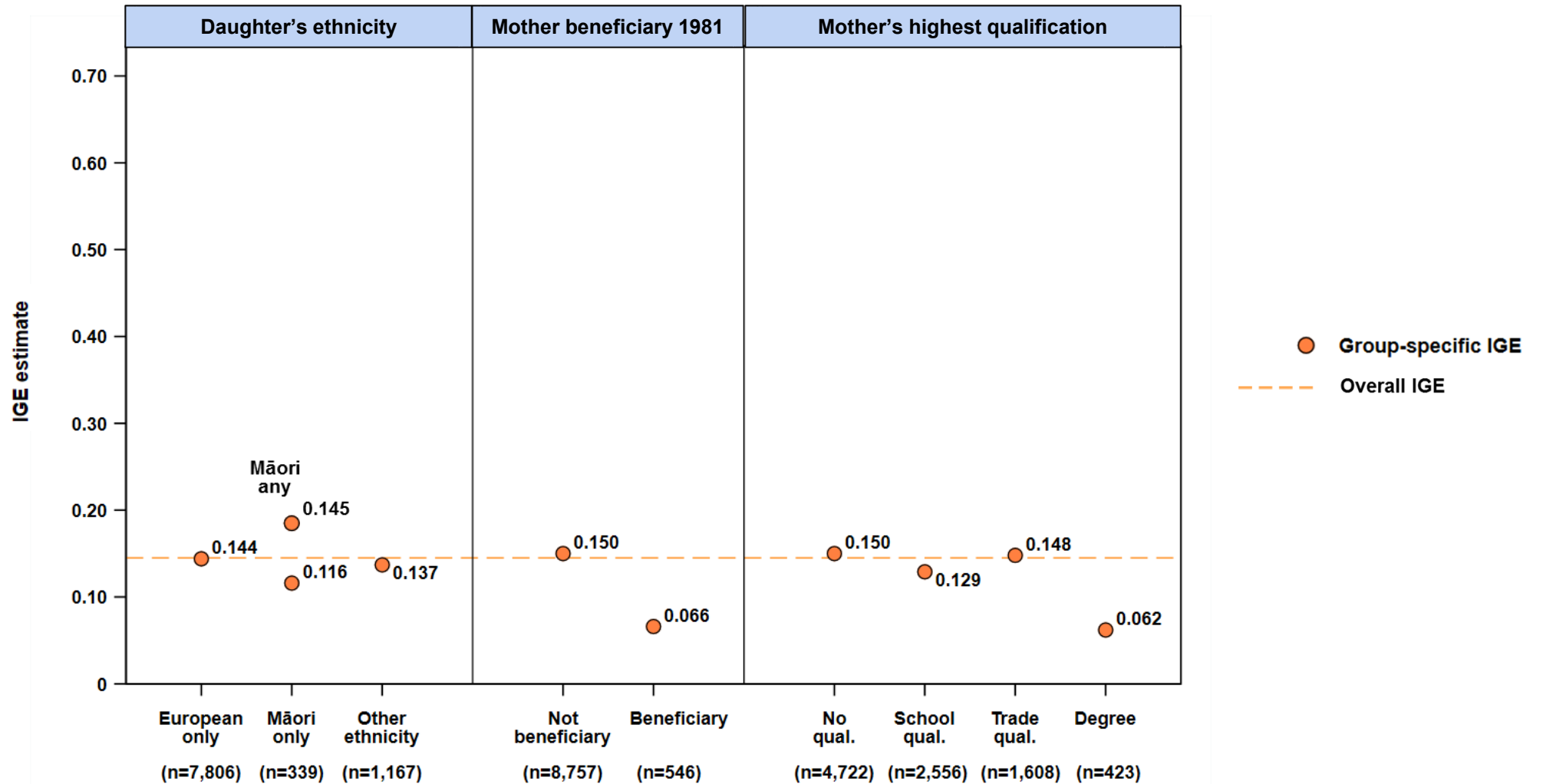
***Between-group component:***

‘degree to which people in a given group tend to fall above or below the population-average income’

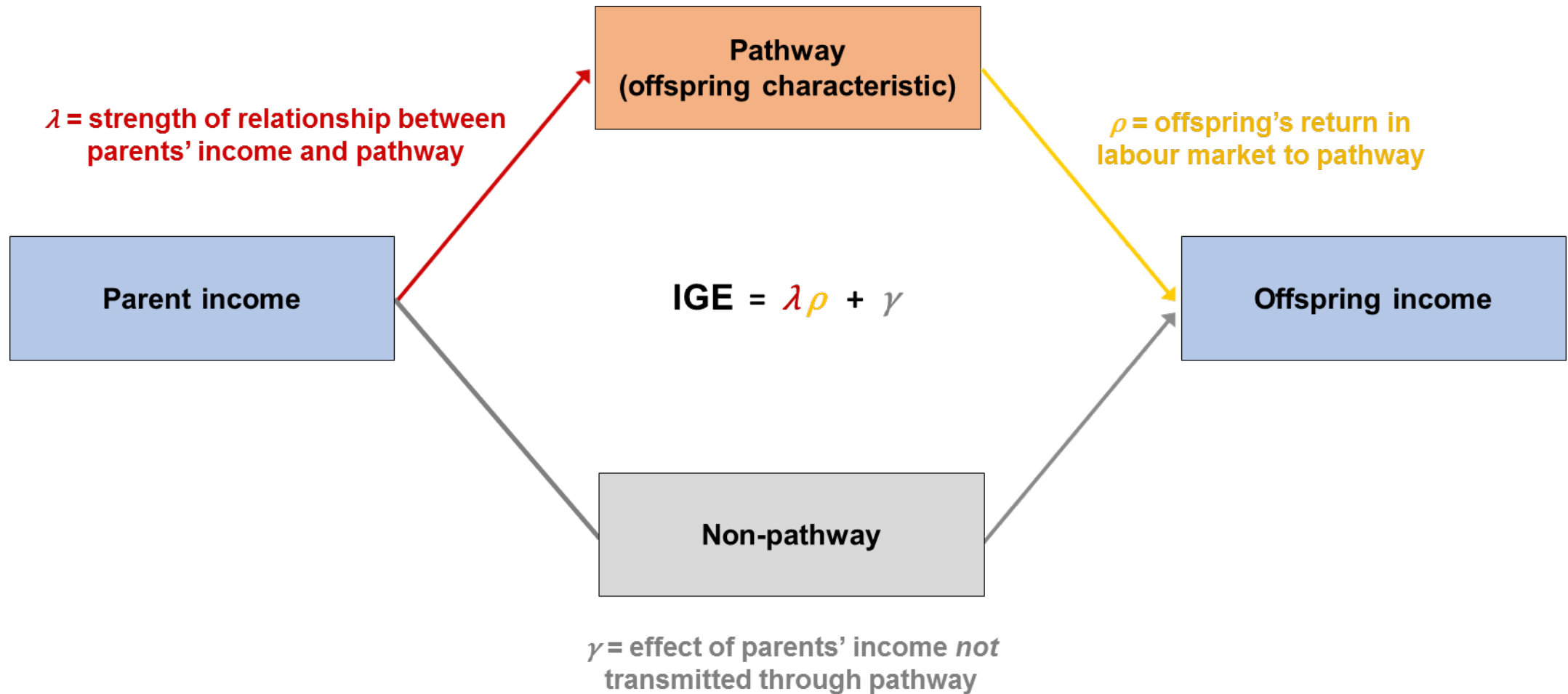
# Estimating group-specific IGEs



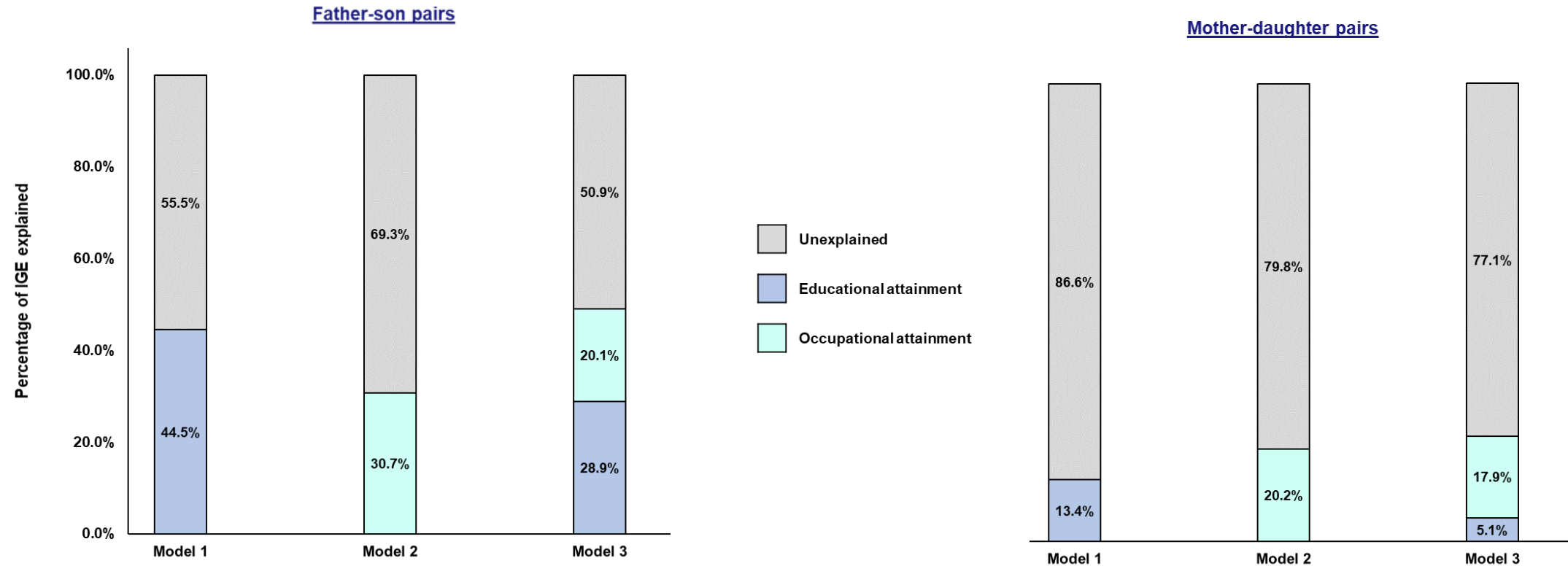
# Estimating group-specific IGEs



## Pathways mediating the intergenerational association



# Pathways mediating the intergenerational association





## Conclusions

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- NZLC data has considerable limitations for a study of intergenerational mobility (income is self-reported and banded, panel attrition, excludes emigrants, etc.)
- Income persistence from fathers to sons in New Zealand is comparatively low (mobility high), *among the particular cohorts studied*
- Persistence from mothers to daughters in New Zealand is comparatively high (mobility low), *among the particular cohorts studied*
- There is heterogeneity in intergenerational persistence among subgroups in the population, notably by parental education level
- Offspring's educational and occupational attainment play key roles in intergenerational persistence
- In future research it will be useful to:
  - Distinguish structural and exchange mobility (estimate rank mobility)
  - Explore a richer set of mechanisms
  - Estimate intergenerational mobility with administrative data