Intergenerational Mobility of Education in Europe: Geographical Patterns and the Innovation Nexus

Sarah McNamara (ZEW) Guido Neidhöfer (ZEW & TAU) Patrick Lehnert (UZH)

WeLaR Webinar

ZEW

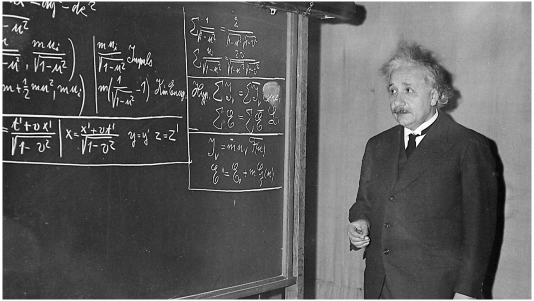
TÜRK-ALMAN ÜNİVERSİTESİ
TÜRKISCH-DEUTSCHE UNIVERSITÄT

Motivation

Intergenerational Mobility *is the degree to which children are able to move beyond their social origins*
–> a dynamic measure of inequality
–> an indicator for inequality of opportunity

- inequality of opportunity leads to inefficient human capital
  ⇒ accumulation (Barro, 1991; Hanushek & Woessmann, 2008)
  ⇒ allocation (Galor & Tsiddon, 1997; Hassler & Mora, 2000)

Inequality of opportunity and low intergenerational mobility lead to...
misallocation of talent (Rodriguez Mora, 2009) and *Lost Einsteins* (Bell et al., 2019)



- more limited: evidence how these inefficiencies translate to economic performance (e.g. Bandiera et al., 2017; Hsieh et al., 2019; Marrero and Rodriguez, 2013; Neidhöfer et al., 2024)

(Im)mobility: How persistent is socioeconomic status?

Neidhöfer/Ciaschi/Serrano/Gasparini (JOEG, 2024) show that intergenerational mobility significantly contributed to long-run growth and development in Latin America.

Here, we test this relationship for innovation in Europe.

Key Contributions of this study

- **EUROPE-IGM-ATLAS** [comparable IGM measures for (up to) 40 countries, 105 mesoregions (NUTS1), and 215 microregions (NUTS2) over time]
- we use cohort-contribution weights (following Neidhöfer et al., 2024) to transform cohort measures into time series indices (1985-2020)
- analyse relationship between intergenerational mobility of education and regional innovation

preview: evidence suggests mobility is **strongly and positively linked** to innovation (abstracting from the accumulation channel)

Data: EUROPE-IGM-ATLAS

- IGM measures - European Social Survey (ESS)
  - indices based on own education, parental education, year born, gender, country, region
  - used to compute aggregate estimates at the regional level
  - individual data (i.e. migration background) allows subsample selection for robustness tests
  - total sample size: 276,379
- Profile Weights
  - effective labour over the lifecycle (Mason, A., Lee, R., & NTA Network, 2022)
  - (highly cited) patents over the lifecycle (Bell, A., Chetty, R., Jaravel, X., Petkova, N., & Van Reenen, J., 2016)

Data: Application

- European Patent Office (EPO)
  - patent count, citation weighted patent count at the NUTS1, NUTS 2 and country level
  - panel data covers 1985-2016
- E-OBS
  - summary statistics obtained from raster by taking within polygon averages
  - cohort-specific initial conditions
- Daytime Satellite Imagery
  - improvement over *nightlights* for proxying economic activity at lower levels of aggregation
  - see Lehnert, Niederberger, Backes-Gellner & Bettinger (2023)
  - coverage 1985-2020 for most European regions at multiple spatial-scales

Empirical set-up

Generating EUROPE-IGM-ATLAS

- **Step 1**: measuring mobility
- **Step 2**: linking cohort measures to time series observations

Application

- **Step 3**: relationship between mobility and innovation

How to Measure Mobility

Intergenerational educational mobility is typically estimated via the following:

$$S_i^0 = \alpha + \beta S_i^P + \epsilon_i$$

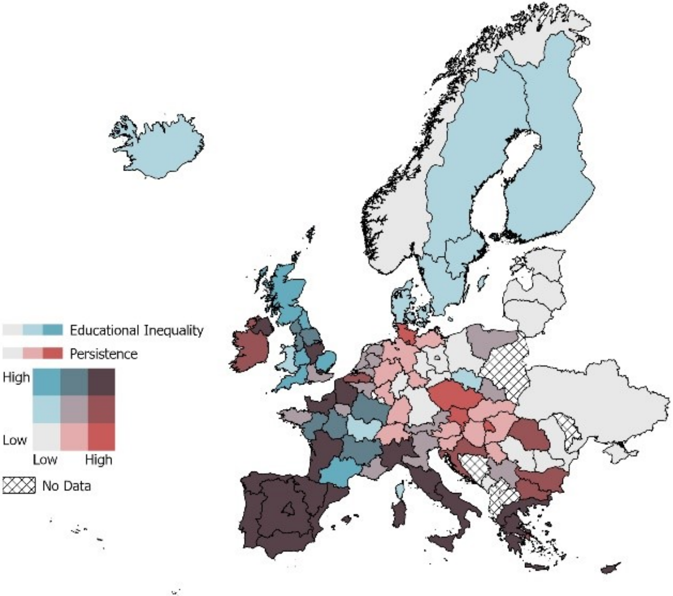
- where S^0 and S^P are the offspring and parents' levels of education, respectively, for family i (Black & Devereux, 2011)
- β measures the degree of intergenerational persistence
- higher β values indicate a **stronger association between parents' and offspring's education**, thus a lower degree of intergenerational mobility
- $\rho = \beta \frac{\sigma^P}{\sigma^O}$ indicates standardized persistence accounting for distributional differences

Results

Intergenerational Mobility of Education in Europe

Summary of results:

- increases in intergenerational mobility –> mostly driven by improvements in educational achievements among individuals from less-educated families
- fewer changes in rank across the educational spectrum
- regression coefficient of educational persistence decreased by 0.108 between oldest and youngest cohorts (on average)
- standardized persistence hardly changed (on average 0.004)
- changes in mobility, however, are not uniformly spatially distributed

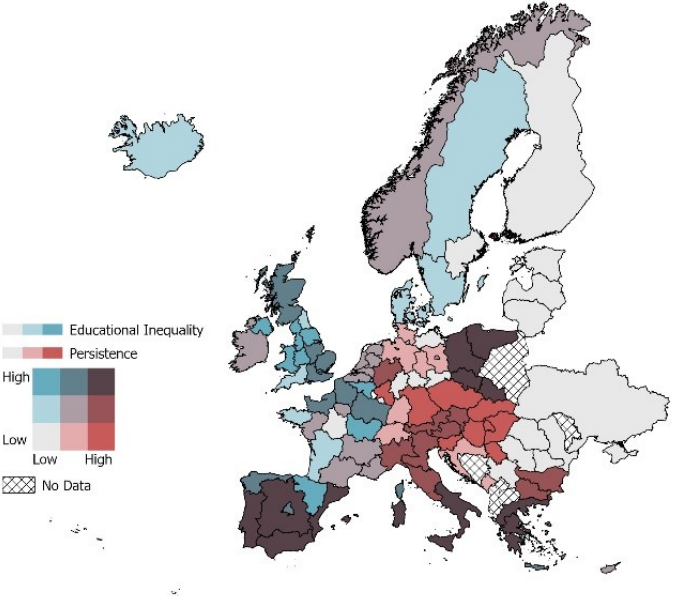


Intergenerational Mobility and Educational Inequality

Persistence (im)mobility
Educational Inequality coefficient of variation

Co. 1: 1940-59 | Co. 2: 1960-79 | Co. 3: 1980-99

**map illustrates terciles*

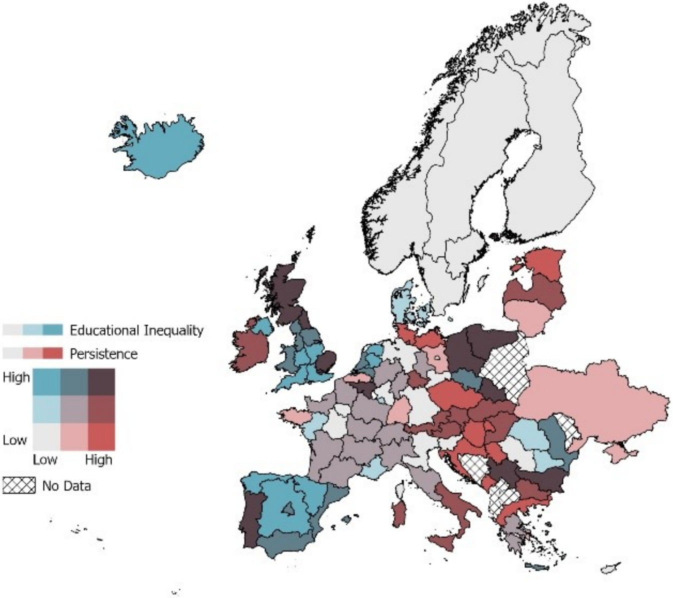


Intergenerational Mobility and Educational Inequality

Persistence (im)mobility
Educational Inequality coefficient of variation

Co. 1: 1940-59 | Co. 2: 1960-79 | Co. 3: 1980-99

**map illustrates terciles*



Intergenerational Mobility and Educational Inequality

Persistence (im)mobility
Educational Inequality coefficient of variation

Co. 1: 1940-59 | Co. 2: 1960-79 | Co. 3: 1980-99

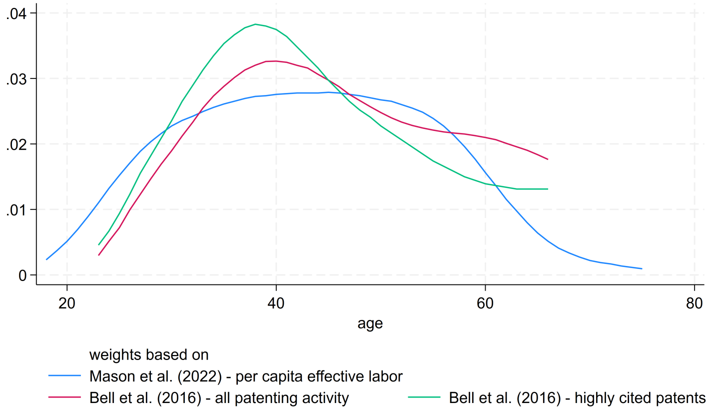
**map illustrates terciles*

Linking Cohort Measures to Current (Time Series) Observations

- to measure mobility *when it matters* we construct a panel (1985-2020)
- we adapt the procedure first proposed in Neidhöfer et al. (2024): for each index, weights are computed based on **relative average contribution to the economy** in a given year by cohort
- by construction, we eliminate risk of reverse causality since we look at the effect of *past* mobility on *contemporary* outcomes

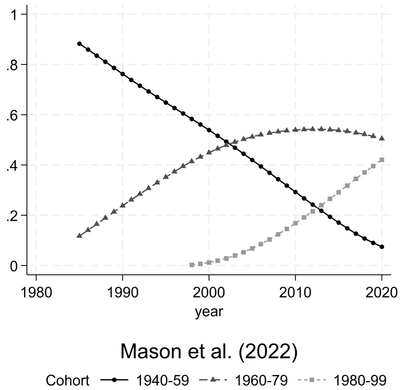
Weighting Profiles

- weights based on age-participation profiles (labor force participation or patenting activity) –> aimed at capturing the economic contribution of a cohort



Weighting Profiles

$$\beta_t = w_1 * \beta_{c=1} + w_2 * \beta_{c=2} + w_3 * \beta_{c=3}$$



Application: Intergenerational Mobility and Economic Performance

We want to test: higher intergenerational mobility $\Rightarrow$ more (regional) innovation

level of regional aggregation: "NUTS 1 plus"
$\Rightarrow$ 148 regions for 1985-2020

Specification

$$Y_{rt} = \alpha + \delta Persistence_{rt} + \theta X_{rt-1} + \Psi I_{rt} + \tau_t + \gamma_r + \epsilon_{rt}$$

- Y_{rt} represents patents in region r in year t (asymptotic sine transformation)
- $Persistence_{rt}$ is weighted measure(s) of intergenerational mobility (β_{rt})
- X is vector of contemporary controls for region characteristics $t-1$ (daytime satellite imagery)
- I vector of controls for cohort-specific characteristics: average years of education, coefficient of variation, cohort-specific initial conditions (E-OBS)
- fixed effects for year (τ) and region (γ) [in one specification: country-specific time trends]

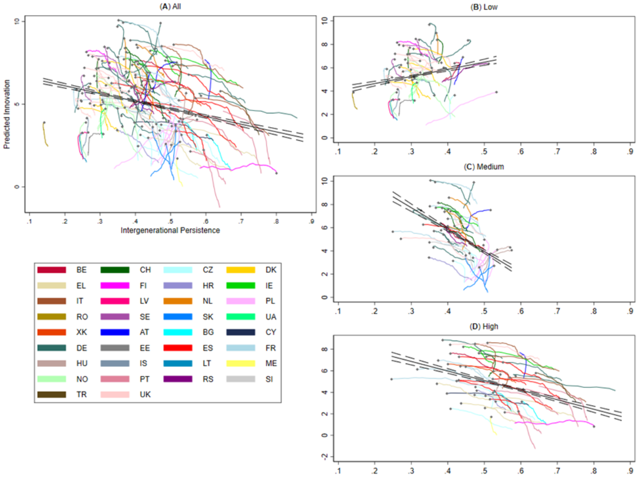
Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
P *(Slope Coefficient)*	-4.193***	-2.629***	-2.887***	-2.725***	-2.574***	-1.443***	-1.061**
	(0.294)	(0.315)	(0.346)	(0.319)	(0.315)	(0.399)	(0.414)
Cohort Controls		X	X	X	X	X	X
Cohort-Specific Initial Conditions			X	X	X	X	X
Contemporary Controls				X	X	X	X
Year F.E.					X	X	
Reg F.E.						X	X
Country-Specific Time Trend							X
Observations	3859	3859	3859	3747	3747	3747	3747
Adjusted R-squared	0.0638	0.154	0.155	0.166	0.180	0.942	0.962
Elasticity	-1.870	-1.173	-1.288	-1.216	-1.148	-0.644	-0.473

What do the results mean?

- consistently negative and significant coefficient of P implies: lower levels of intergenerational persistence –> more innovation
- last row shows the elasticity: decrease of the slope coefficient by 0.1 (close to average change from the oldest to the youngest cohort), is associated with a positive change in the number of patents 4.7%-19%

Results


(A) All
Predicted Innovation
Intergenerational Persistence
(B) Low
(C) Medium
(D) High
BE
CH
CZ
DK
EL
FI
HR
IE
IT
LV
NL
PL
RO
SE
SK
UA
XK
AT
BG
CY
DE
EE
ES
FR
HU
IS
LT
ME
NO
PT
RS
SI
TR
UK

Conclusions

- New database of indices for intergenerational mobility in Europe
- Suggestive evidence that mobility can be a driver economic growth through innovation

---

Policy Implications

- no equity-efficiency trade-off
- interventions increasing equality of opportunity may lead to long-term efficiencies
  $\Rightarrow$ even if policies have short-run inefficiencies
- regional structural transformation (in terms of innovation structure) may partly be driven by localized opportunities

Intergenerational Mobility of Education in Europe: Geographical Patterns and the Innovation Nexus

Sarah McNamara (ZEW) Guido Neidhöfer (ZEW & TAU) Patrick Lehnert (UZH)

Thank you for your attention
Comments and questions are welcome!

Iterative Controls

- **Cohort controls**: average and coefficient of variation of years of education
- **Cohort-specific initial conditions**: summary indicator for historical precipitation, temperature, sea level pressure, relative humidity, wind speed, and global radiation associated with the respective cohorts
- **Contemporary controls**: include variables indicative of structural transformation and local development (Lehnert et al., 2023)