
Supplementary information

**Intergenerational mobility fosters
innovation in Europe**

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authors and unedited

Supplementary Information Guide

Manuscript: “Intergenerational Mobility Fosters Innovation in Europe”

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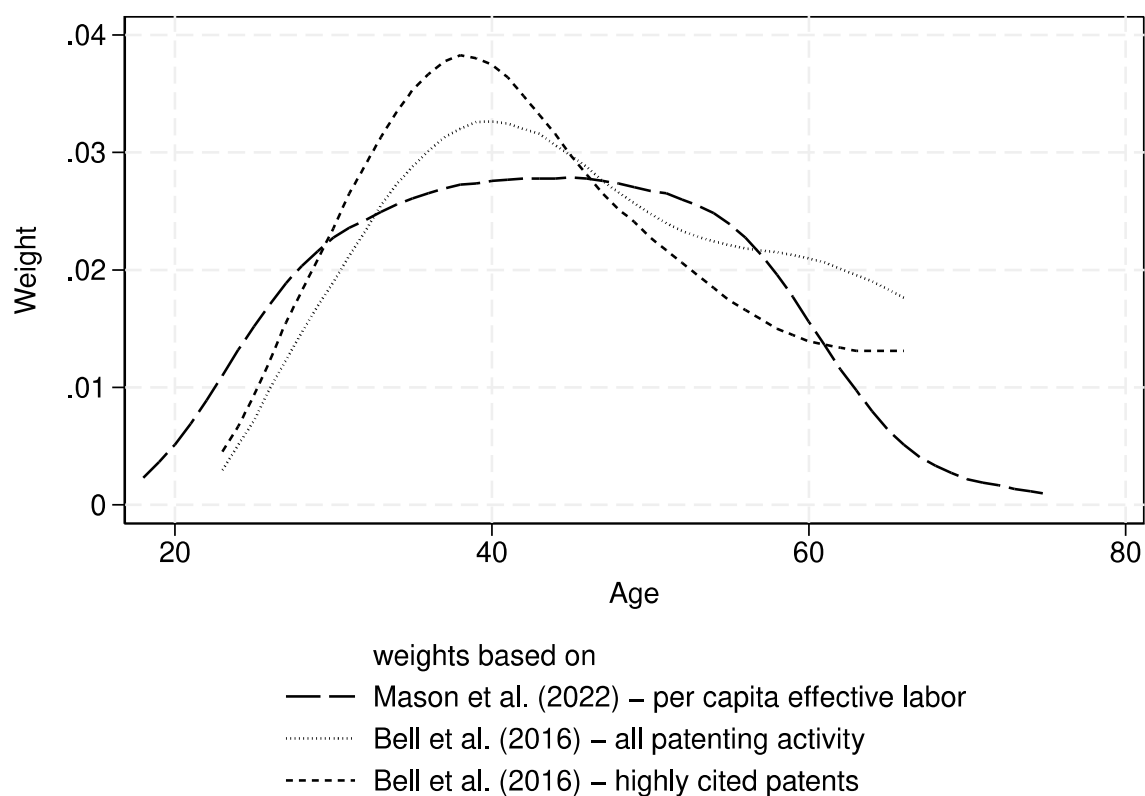
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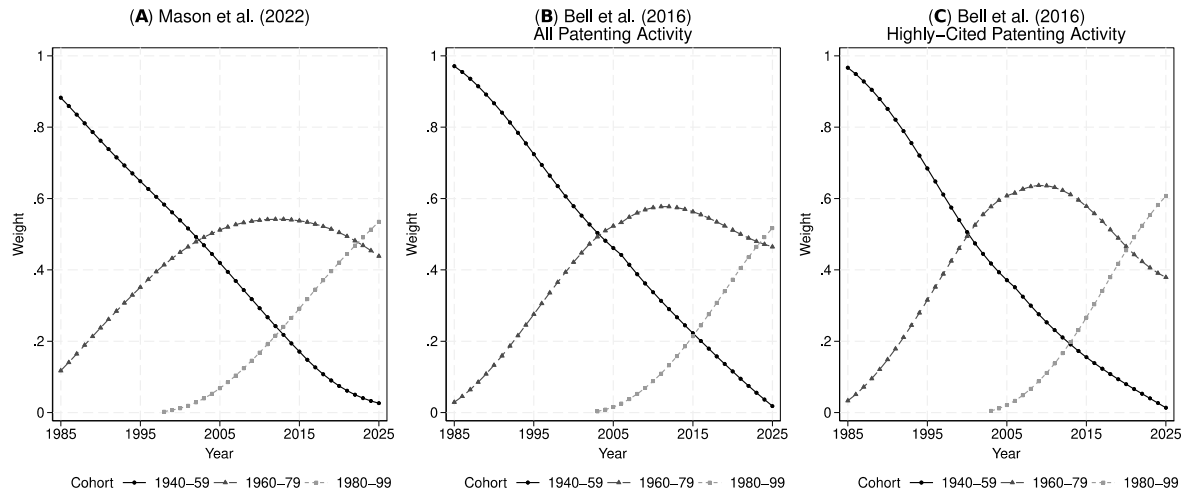
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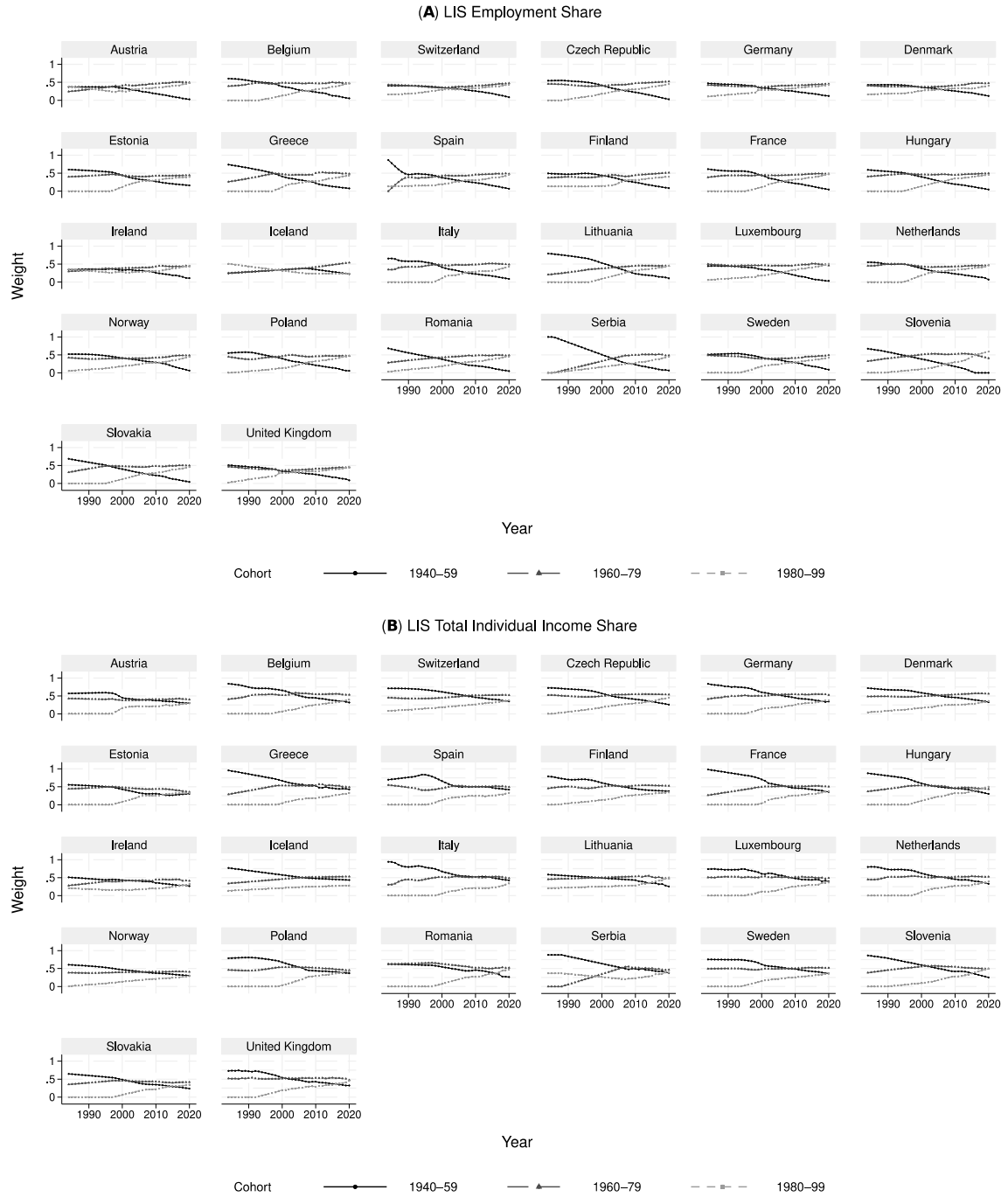
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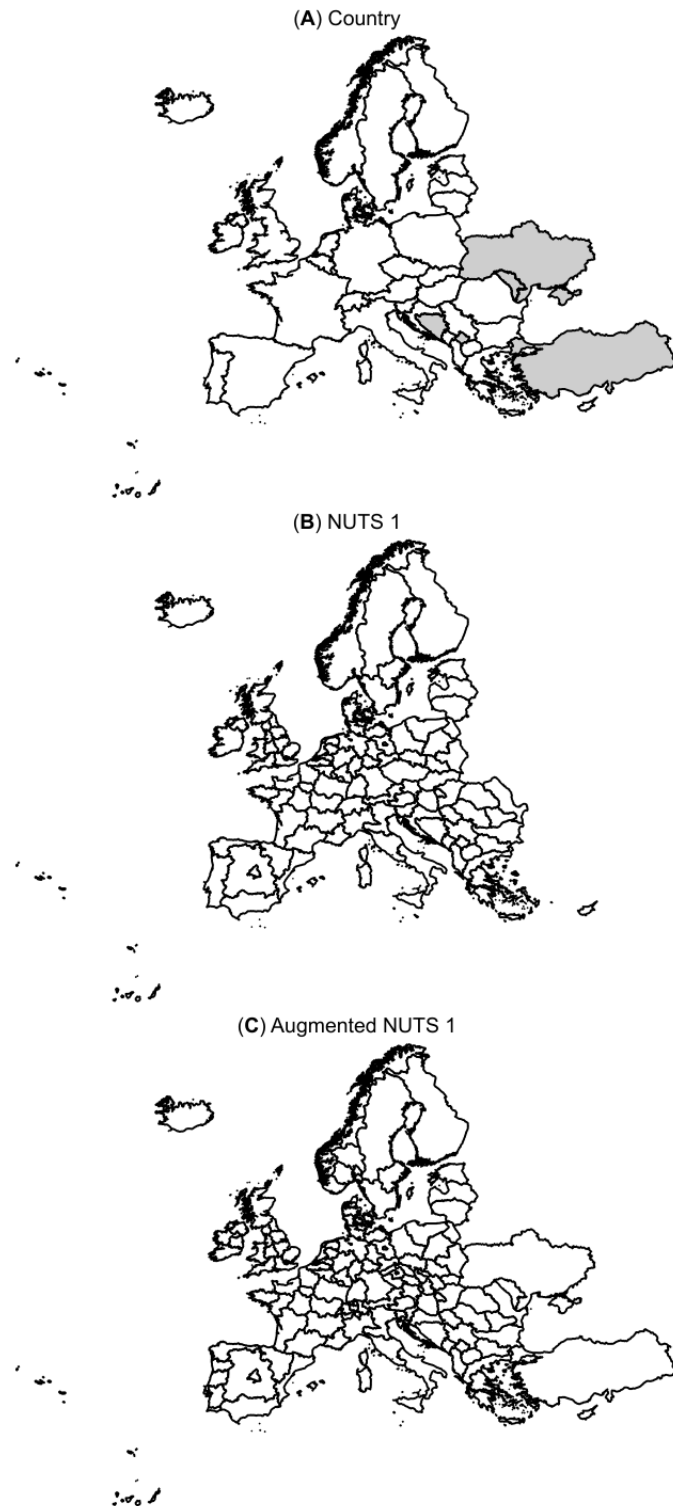
Supplementary Information Figure S1. Lifecycle Participation Profiles Used to Obtain the Cohort Weights. To compute the weights attributed to each cohort for each year, we use the share of each cohort's effective contribution over the total effective contribution in a given year based on per-capita effective participation profiles over the life cycle. The baseline specification of our indices (Profile I weights) relies on measures of per capita effective labor supply over the lifecycle⁶⁵. To permit robustness testing of the results from our application, investigating the relationship between mobility and innovation, we also apply two alternative weighting procedures. We use innovation life-cycle profiles first for all patenting activity (Profile II) and, second, for highly cited patenting activity (Profile III)⁶⁶. Supplementary Information Figure S1 depicts these age-participation profiles.



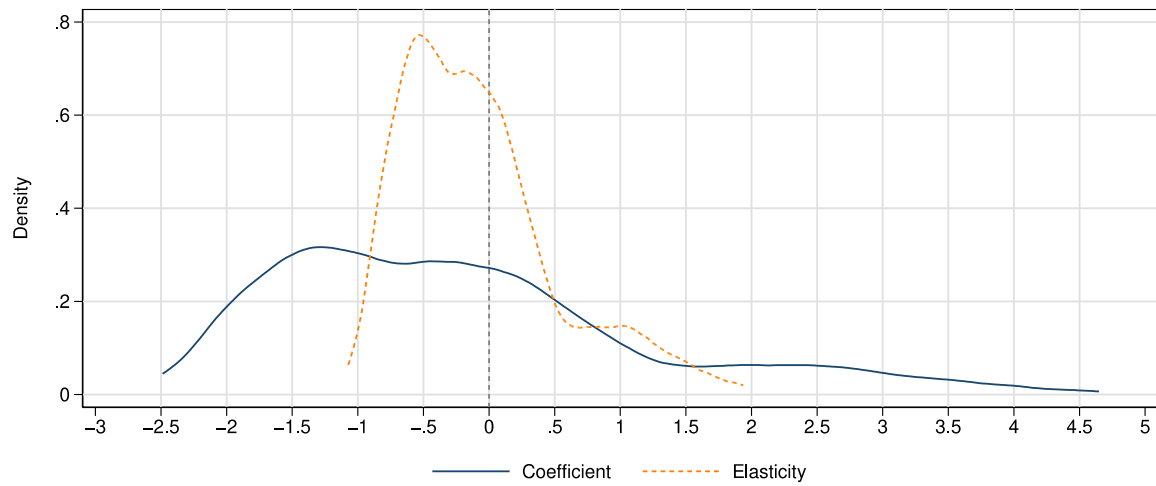
Supplementary Information Figure S2. Annual Cohort Weights. Using the per-capita effective contribution profiles over the life cycle displayed in Supplementary Information Figure S1, we compute the share of a cohort's effective contribution (e.g., labor supply, patenting activity) over the total effective contribution in a given year. To do this, we first compute the relative contribution by age as an integral fraction of the respective participation profile. Then, absolute cohort weights at time t are computed by cohort as a sum of the contribution of the in-range ages in year t (e.g. in $t = 2007$, the oldest members of $c = 1$ are no longer in range). Finally, relative cohort weights are computed as the share of the cohort weight in t over the sum of cohort weights in t yielding w_{ct} . Supplementary Information Figure S2 depicts the respective weights for each cohort in every year used to construct the annualized weighted summations of mobility described in *Methods* (Equation 4), where (A) depicts Profile I weights, (B) depicts Profile II weights, and (C) depicts Profile III weights.



Supplementary Information Figure S3. Annual Cohort Weights with Country Variation. Supplementary Information Figure S3 depicts the share of a cohort's effective contribution to the economy based on representative LIS employment shares in **(A)** and total individual income shares in **(B)** over the total effective contribution in a given year by country and year. To do this, relative cohort weights are computed as the share of the cohort weight in t over the sum of cohort weights in country n at time t yielding w_{nct} . Weights for each cohort in every year in each country are used to construct the annualized weighted summations of intergenerational persistence described in *Methods* (Equation 5) for Type IV and Type V weighting profiles, respectively. *Source:* Luxembourg Income Study Database (LIS), accessed via LISSY; own calculations.



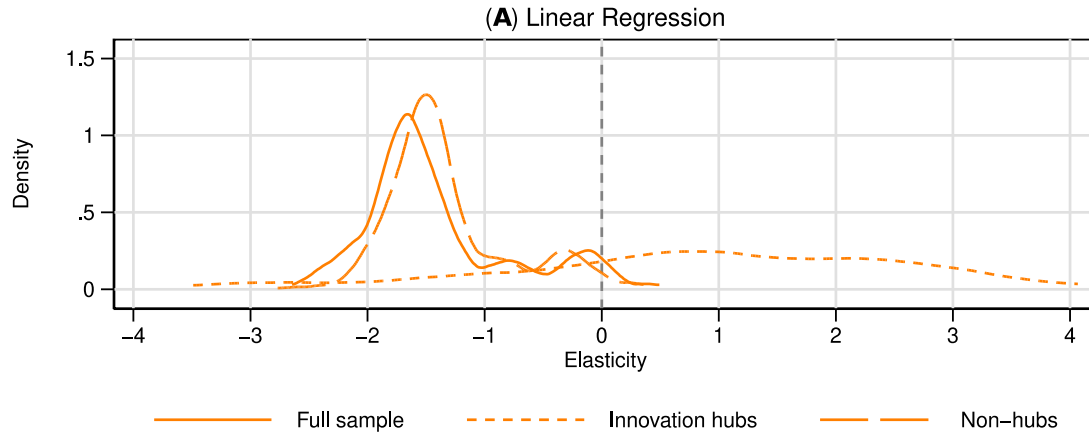
Supplementary Information Figure S4. Modified Shapefiles to Include Non-EUROSTAT Regions. Supplementary Information Figure S4 illustrates how country-level additions were added in (A), based on modifications to the Eurostat/GISCO shapefile “NUTS_RG_01M_2016_4326_LEVL_0.shp”, with administrative boundaries based on the 2016 version of NUTS and an 01M scale. In (B), the addition of Kosovo reshapes the bounds of the Serbian regions, based on modifications to the Eurostat/GISCO shapefile “NUTS_RG_01M_2016_4326_LEVL_1.shp”. Modifications were conducted in ArcGIS Pro 3.02, using the “add join”, “append”, “merge”, and “export features” tools to extract and merge additional regions from the ESRI World Countries Generalized Map. Where boundaries were not perfectly aligned due to differences in scale, hierarchical preferences were assigned to the 01M scale Eurostat/GISCO shapefiles. In (C), we graphically depict the augmented NUTS 1 definition of subnational regions used in the application based on the further inclusion of regions from the Eurostat/GISCO shapefile “NUTS_RG_01M_2016_4326_LEVL_2.shp”, see *Methods* for details. *Source:* European Commission – Eurostat/GISCO and ESRI (data providers ESRI/Garmin International, Inc./U.S. Central Intelligence Agency (The World Factbook)/National Geographic Society).



Number of estimates = 420 | Elasticity statistics: mean = -0.08, SD = 0.592, median = -0.18

Share of negative and significant estimates = 0.52 | Share of positive and significant estimates = 0.24

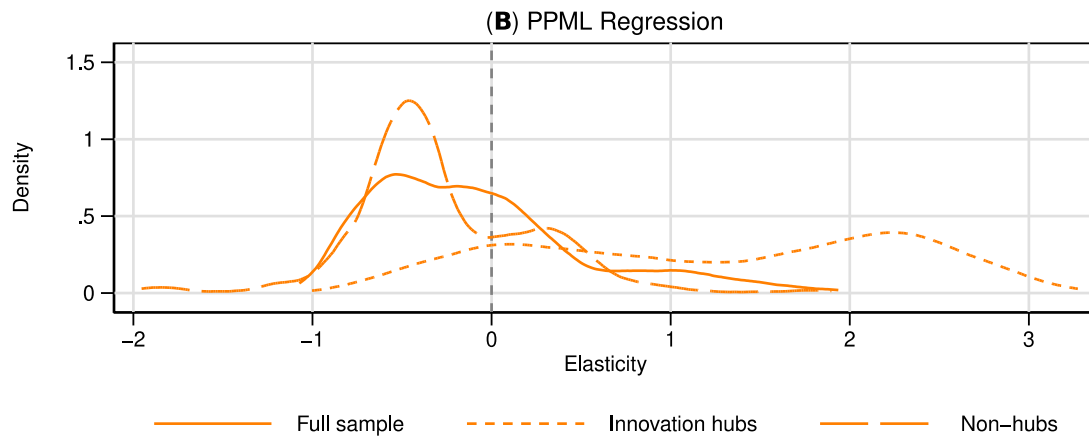
Supplementary Information Figure S5. Application Regression Results Using PPML Estimator. Supplementary Information Figure S5 replicates all $n = 420$ estimations in Panel (A) of Extended Data Figure 3, alternatively using the PPML estimator with untransformed dependent variables. The figure depicts the distribution of all coefficients and elasticities obtained from these additional estimations, based on a convex combination of three different definitions of the dependent variable (patent count, granted patent count, citation weighted patent count), two metrics of intergenerational persistence (persistence and standardized persistence), the iterative inclusion of covariates (described in detail in Supplementary Information Table S3) corresponding to the seven regression specifications with iterative inclusion of controls (see, e.g., Supplementary Information Table S5), five weighting profiles, and using two different samples to construct the cohort-level measures of intergenerational persistence (i.e., i. excluding first-generation migrants only, and ii. additionally excluding individuals with a migration background). The results of this exercise for all regression specifications are presented, including those without controls. Reported shares of significant estimates are based on standard errors obtained by bootstrapping with 100 replications and refer to two-sided Wald tests for each regression coefficient with $P < 0.1$. *Source:* summarized in Supplementary Information Table S3, see *Methods* for details; own calculations.



Full sample
 Number of estimates = 420 | Elasticity statistics: mean = -1.41, SD = 0.640, median = -1.59
 Share of negative and significant estimates = 0.89 | Share of positive and significant estimates = 0.00

Innovation hubs
 Number of estimates = 420 | Elasticity statistics: mean = 0.84, SD = 1.691, median = 0.87
 Share of negative and significant estimates = 0.20 | Share of positive and significant estimates = 0.57

Non-hubs
 Number of estimates = 420 | Elasticity statistics: mean = -1.33, SD = 0.537, median = -1.46
 Share of negative and significant estimates = 0.88 | Share of positive and significant estimates = 0.00

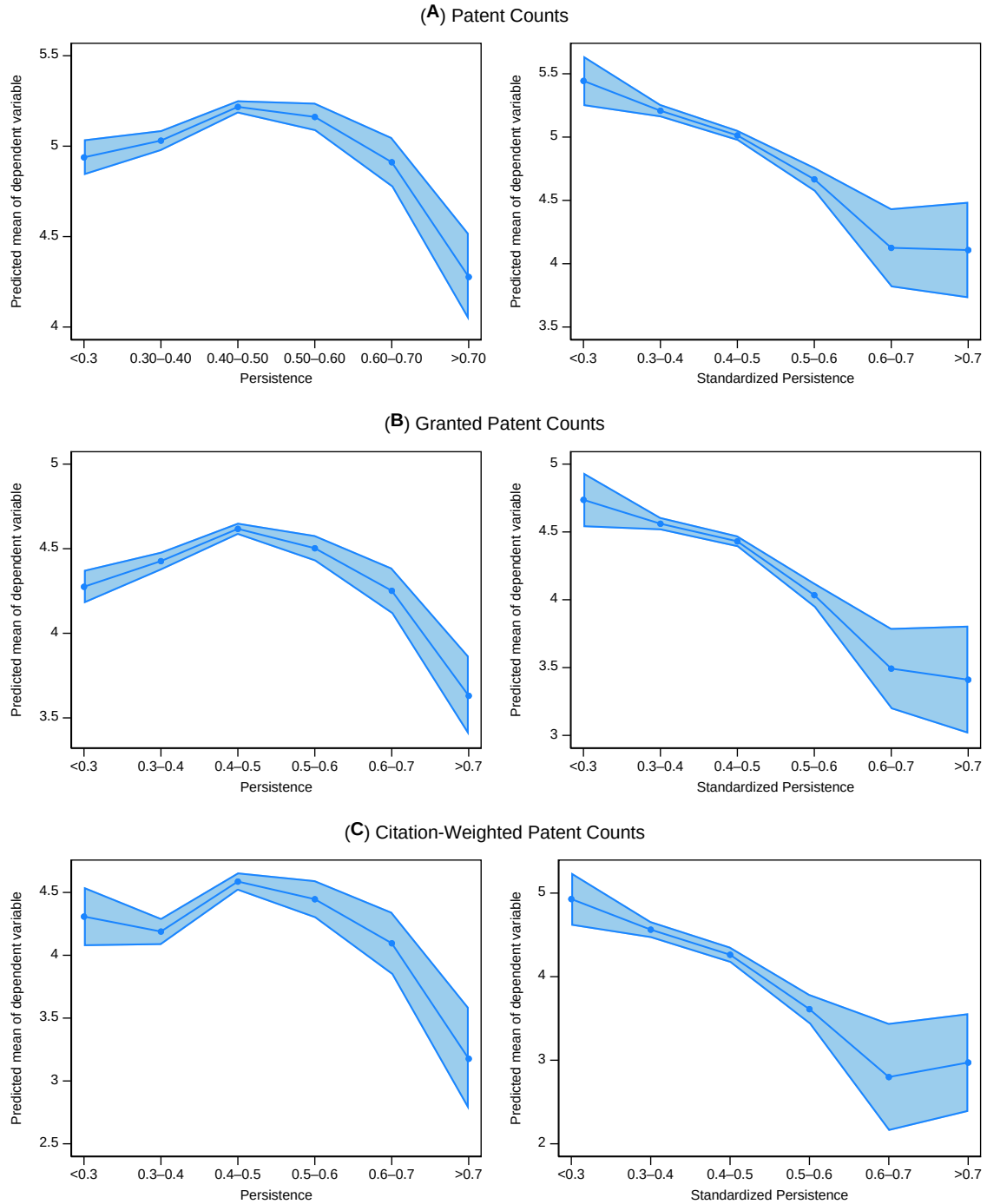


Full sample
 Number of estimates = 420 | Elasticity statistics: mean = -0.08, SD = 0.592, median = -0.18
 Share of negative and significant estimates = 0.52 | Share of positive and significant estimates = 0.24

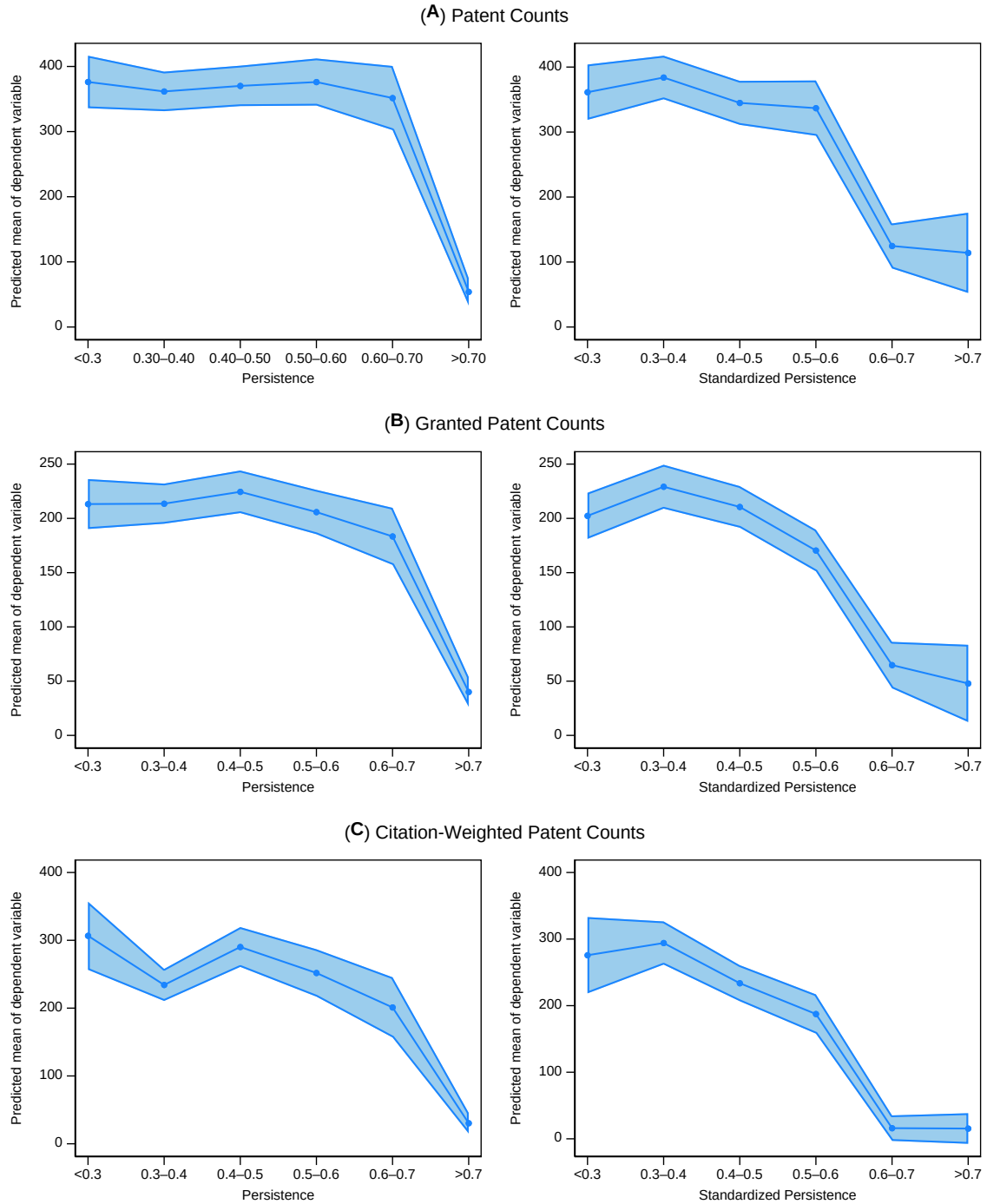
Innovation hubs
 Number of estimates = 420 | Elasticity statistics: mean = 1.24, SD = 1.042, median = 1.30
 Share of negative and significant estimates = 0.06 | Share of positive and significant estimates = 0.71

Non-hubs
 Number of estimates = 420 | Elasticity statistics: mean = -0.27, SD = 0.512, median = -0.40
 Share of negative and significant estimates = 0.66 | Share of positive and significant estimates = 0.14

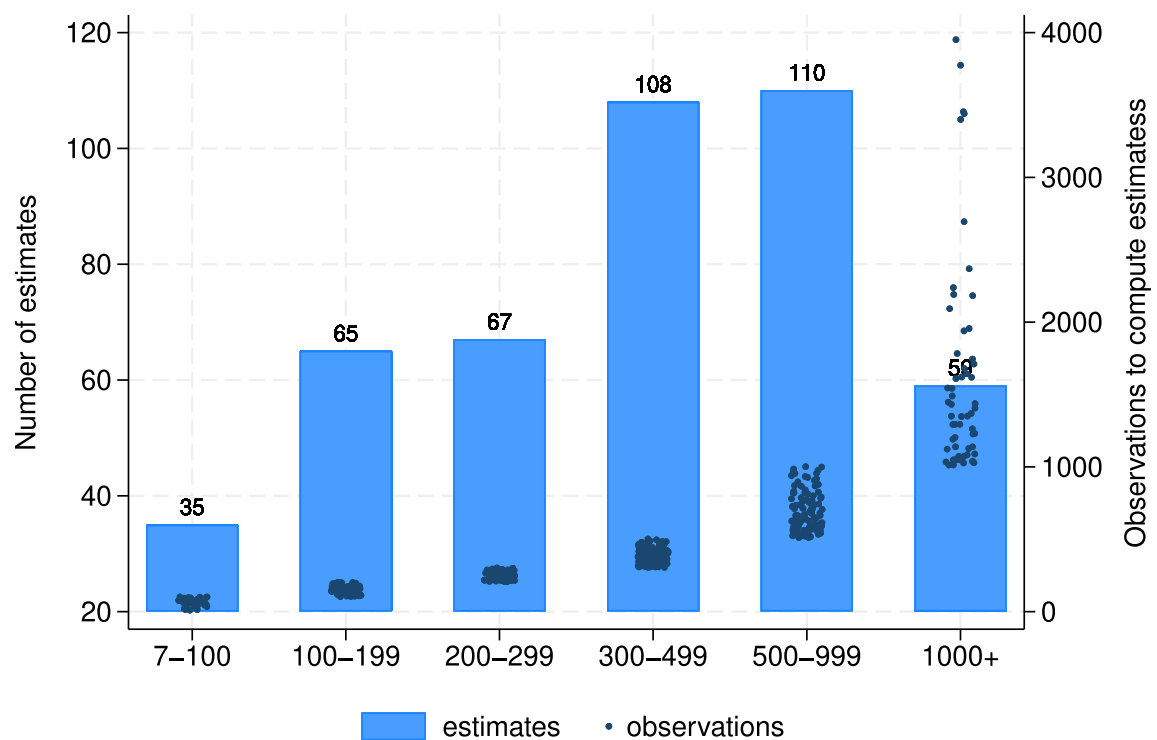
Supplementary Information Figure S6. Comparison of Application Regression Results for Full Sample, Innovation Hubs, and Non-Hubs. Supplementary Information Figure S6 shows the distribution of all $n = 420$ elasticities obtained from replicating all estimations separately for the full sample, for regions identified as innovation hubs, and for the remaining regions (non-hubs). Innovation hubs are regions within the top 10 percent of the distribution of average regional patent counts over the sample period (1985–2020). Panel (A) performs the comparison using linear regression with inverse hyperbolic sine-transformed dependent variables, i.e., it proceeds similarly to Panel (A) of Extended Data Figure 3. Panel (B) performs the comparison using the PPML estimator with untransformed dependent variables, i.e., it proceeds similarly to Supplementary Information Figure S5. Reported shares of significant estimates are based on standard errors obtained by bootstrapping with 100 replications and refer to two-sided Wald tests for each regression coefficient with $P < 0.1$. *Source:* summarized in Supplementary Information Table S3, see *Methods* for details; own calculations.



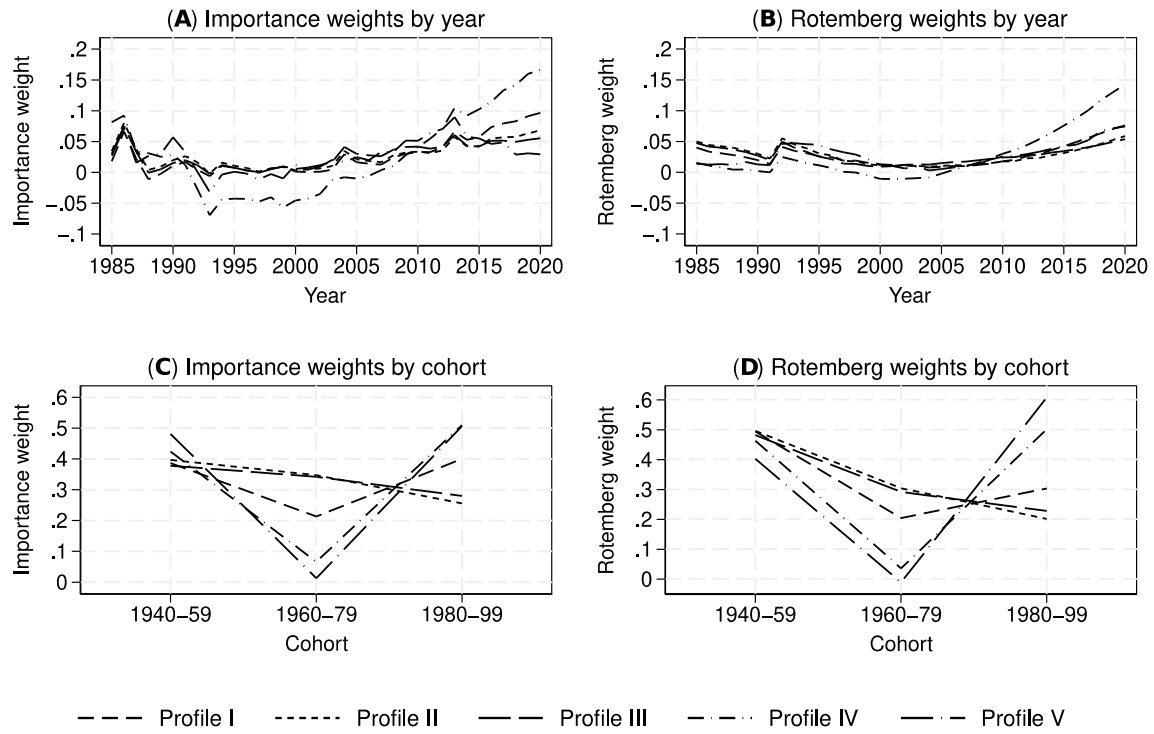
Supplementary Information Figure S7. Linear OLS Regression Results Allowing for Non-Linearities. Supplementary Information Figure S7 shows non-linear regression results applying linear regressions with inverse hyperbolic sine-transformed dependent variables, i.e., patent counts in Panel (A), granted patent counts in Panel (B), and citation-weighted patent counts in Panel (C). The figures display the predicted mean of the dependent variable across flexible bins of the independent variable. In the left-hand panels, the independent variable is *persistence* as measured by the slope coefficient; in the right-hand panels, it is *standardized persistence*. Estimates are based on the preferred specification (corresponding to, e.g., Column 3 of Table 1 in the main text), including the full set of covariates as well as year and region fixed effects. Shaded areas denote 95% confidence intervals constructed based on standard errors obtained by bootstrapping with 100 replications. *Source:* summarized in Supplementary Information Table S3, see *Methods* for details; own calculations.



Supplementary Information Figure S8. PPML Regression Results Allowing for Non-Linearities. Supplementary Information Figure S8 shows non-linear regression results applying PPML regressions with untransformed dependent variables, i.e., patent counts in Panel (A), granted patent counts in Panel (B), and citation-weighted patent counts in Panel (C). The figures display the predicted mean of the dependent variable across flexible bins of the independent variable. In the left-hand panels, the independent variable is *persistence* as measured by the slope coefficient; in the right-hand panels, it is *standardized persistence*. Estimates are based on the preferred specification (corresponding to Column 3 of Table 1 in the main text), including the full set of covariates as well as year and region fixed effects. Shaded areas denote 95% confidence intervals constructed based on standard errors obtained by bootstrapping with 100 replications. *Source:* summarized in Supplementary Information Table S3, see *Methods* for details; own calculations.



Supplementary Information Figure S9. Number of Observations Used to Obtain EUROPE-IGM-ATLAS Cohort-Level Estimates – Augmented NUTS 1 Level. Supplementary Information Figure S9 illustrates the (unweighted) number of observations in the ESS pooled data used to construct the weighted cohort-level estimates of intergenerational educational mobility ($n = 241,377$ individuals). *Source:* ESS 2002-2023. Own calculations.



Supplementary Information Figure S10. Importance Weights and Rotemberg Weights by Year and Cohort. Supplementary Information Figure S10 reports calculations based on the sample of our preferred specification (see Column 3 of Table 1 in the main text), for both importance weights⁶⁷ and Rotemberg weights⁶⁸. Weighting profiles defined as described in *Methods* (Profile I: effective labor contributions over the life-cycle, Profile II: effective patenting activity over the life-cycle, Profile III: effective patenting activity over the life-cycle for highly cited patents, Profile IV: effective labor contributions over the life-cycle based on country-level employment from the Luxembourg Income Study (LIS), and Profile V: effective labor contributions over the life-cycle based on country-level total individual income from the LIS).

Tables

	Cohort 1940–59		Cohort 1960–79		Cohort 1980–99	
	Coeff.	Std. Dev.	Coeff.	Std. Dev.	Coeff.	Std. Dev.
Albania (AL)	.383	.093	.429	.054	.600	.087
Austria (AT)	.539	.025	.557	.027	.558	.031
Belgium (BE)	.506	.016	.362	.014	.398	.017
Bulgaria (BG)	.623	.016	.550	.015	.546	.019
Croatia (HR)	.537	.019	.391	.020	.411	.026
Cyprus (CY)	.608	.036	.419	.022	.269	.032
Czech Republic (CZ)	.519	.019	.492	.016	.382	.019
Denmark (DK)	.380	.021	.337	.019	.234	.026
Estonia (EE)	.265	.014	.272	.013	.403	.019
Finland (FI)	.359	.016	.237	.013	.182	.016
France (FR)	.467	.019	.368	.014	.316	.017
Germany (DE)	.415	.023	.402	.017	.325	.022
Greece (EL)	.670	.034	.403	.016	.355	.023
Hungary (HU)	.499	.017	.587	.017	.620	.019
Iceland (IS)	.250	.029	.268	.030	.207	.033
Ireland (IE)	.558	.016	.400	.011	.399	.018
Italy (IT)	.676	.024	.508	.018	.404	.017
Kosovo (XK)	.619	.118	.395	.043	.283	.088
Latvia (LV)	.257	.044	.254	.026	.355	.042
Lithuania (LT)	.265	.018	.221	.011	.323	.027
Montenegro (ME)	.514	.048	.463	.033	.529	.031
Netherlands (NL)	.435	.015	.392	.014	.299	.020
North Macedonia (MK)	.635	.103	.436	.055	.379	.052
Norway (NO)	.355	.017	.363	.016	.290	.026
Poland (PL)	.459	.018	.577	.017	.430	.016
Portugal (PT)	.798	.034	.678	.025	.399	.022
Romania (RO)	.160	.031	.116	.024	.179	.042
Serbia (RS)	.512	.028	.402	.027	.520	.035
Slovakia (SK)	.522	.025	.531	.024	.529	.035
Slovenia (SI)	.495	.018	.448	.016	.223	.023
Spain (ES)	.699	.024	.486	.014	.352	.014
Sweden (SE)	.333	.015	.289	.016	.245	.022
Switzerland (CH)	.442	.020	.396	.018	.340	.024
Türkiye (TR)	.768	.052	.647	.051	.556	.046
Ukraine (UA)	.308	.019	.292	.022	.361	.046
United Kingdom (UK)	.418	.019	.343	.015	.313	.023

Supplementary Information Table S1. Intergenerational Mobility in Europe: Slope Coefficient (*Persistence*). Supplementary Information Table S1 presents a country-level summary of the index for *persistence* from our database, rounded to 3 d.p., computed cohort-wise by pooling all ESS survey waves and applying design weights. Standard errors are obtained by bootstrapping with 100 replications. *Source:* ESS 2002-2023. Own calculations.

	Cohort 1940–59		Cohort 1960–79		Cohort 1980–99	
	Coeff.	Std. Dev.	Coeff.	Std. Dev.	Coeff.	Std. Dev.
Albania (AL)	.349	.080	.536	.058	.487	.055
Austria (AT)	.510	.024	.462	.025	.520	.030
Belgium (BE)	.510	.014	.450	.016	.495	.020
Bulgaria (BG)	.622	.012	.589	.013	.589	.018
Croatia (HR)	.563	.017	.493	.020	.419	.027
Cyprus (CY)	.366	.025	.470	.025	.342	.037
Czech Republic (CZ)	.464	.017	.464	.014	.408	.019
Denmark (DK)	.413	.021	.407	.022	.278	.031
Estonia (EE)	.344	.019	.334	.015	.404	.019
Finland (FI)	.350	.015	.347	.018	.229	.020
France (FR)	.438	.017	.441	.015	.392	.022
Germany (DE)	.345	.017	.368	.015	.346	.022
Greece (EL)	.420	.021	.403	.014	.464	.023
Hungary (HU)	.560	.017	.591	.016	.605	.018
Iceland (IS)	.269	.030	.265	.029	.219	.033
Ireland (IE)	.480	.012	.475	.012	.479	.019
Italy (IT)	.544	.018	.527	.017	.478	.018
Kosovo (XK)	.410	.076	.439	.045	.319	.095
Latvia (LV)	.339	.028	.330	.032	.372	.043
Lithuania (LT)	.329	.020	.343	.018	.361	.028
Montenegro (ME)	.526	.044	.540	.036	.535	.033
Netherlands (NL)	.417	.014	.419	.015	.335	.021
North Macedonia (MK)	.514	.070	.544	.046	.457	.060
Norway (NO)	.396	.017	.394	.019	.302	.026
Poland (PL)	.437	.016	.508	.016	.434	.015
Portugal (PT)	.446	.021	.454	.016	.414	.022
Romania (RO)	.202	.041	.209	.040	.278	.063
Serbia (RS)	.565	.032	.521	.032	.510	.029
Slovakia (SK)	.510	.022	.506	.021	.510	.033
Slovenia (SI)	.495	.017	.472	.015	.233	.024
Spain (ES)	.471	.019	.449	.012	.411	.017
Sweden (SE)	.376	.015	.400	.021	.305	.027
Switzerland (CH)	.415	.018	.387	.017	.351	.024
Türkiye (TR)	.415	.056	.381	.031	.421	.039
Ukraine (UA)	.412	.023	.395	.029	.333	.041
United Kingdom (UK)	.367	.016	.411	.018	.377	.027

Supplementary Information Table S2. Intergenerational Mobility in Europe: *Standardized Persistence*. Supplementary Information Table S2 presents a country-level summary of the index for *standardized persistence* from our database, rounded to 3 d.p., computed cohort-wise by pooling all ESS survey waves and applying design weights. Standard errors are obtained by bootstrapping with 100 replications. *Source:* ESS 2002-2023. Own calculations.

Variables	Measure	Source
Dependent variables	- Annual patent count - Annual granted patent count - Citation-weighted annual patent count	Own calculations using PATSTAT
Main independent variables	- Slope coefficient (regression of parents' on children's years of education) - Standardized persistence (slope coefficient multiplied by ratio of standard deviations of parents' and children's years of education)	Own estimations using ESS
Cohort controls	- Average years of education - Coefficient of variation of years of education	Own estimations using ESS
Contemporary controls	Built-up area, crops area, forest area, grass area, no vegetation area, water area (all in log pixel count)	Own estimations using the procedure and data described in original article ³¹
Cohort-specific initial conditions	Daily gridded land-only observational data for Europe, including blended time series measures of precipitation, temperature (max, min, mean), sea level pressure, relative humidity, wind speed, and global radiation associated with the respective cohorts. Computed as a cohort-specific area average. Summarized by factor analysis	Own calculations using E-OBS ⁵⁸

Supplementary Information Table S3. Variable Descriptions. Supplementary Information Table S3 describes the variables used in the estimations for the application, studying the relationship between intergenerational mobility and innovation, as well as the sources of the data.

	years of education (average)	years of education (coefficient of variation)	initial conditions (PCA score)	crops area	forest area	grass area	no vegetation area	water area
years of education (average) (<i>n</i> = 6,068)	-							
years of education (coefficient of variation) (<i>n</i> = 6,068)	-0.7495*** [0.0000]	-						
initial conditions (PCA score) (<i>n</i> = 5,112)	-0.5768*** [0.0000]	0.5283*** [0.0000]	-					
crops area (<i>n</i> = 5,076)	-0.1776*** [0.0000]	0.0326** [0.0203]	0.0440*** [0.0017]	-				
forest (<i>n</i> = 5,076)	-0.0880*** [0.0000]	-0.0450*** [0.0013]	-0.0292* [0.0373]	0.9041*** [0.0000]	-			
grassland (<i>n</i> = 5,076)	-0.1742*** [0.0000]	0.0641*** [0.0000]	0.0154 [0.2740]	0.9610*** [0.0000]	0.9289*** [0.0000]	-		
no vegetation (<i>n</i> = 5,076)	-0.2381*** [0.000]	0.1579*** [0.000]	-0.0343** [0.0147]	0.8019*** [0.0000]	0.8145*** [0.0000]	0.8466*** [0.0000]	-	
water (<i>n</i> = 5,076)	-0.0831*** [0.000]	0.0015 [0.9160]	-0.1956*** [0.0000]	0.8602*** [0.0000]	0.8455*** [0.0000]	0.8731*** [0.0000]	0.8815*** [0.0000]	-
built-up area (<i>n</i> = 5,076)	-0.1745*** [0.0000]	0.1165*** [0.0000]	-0.0803*** [0.0000]	0.7336*** [0.0000]	0.6830*** [0.0000]	0.7269*** [0.0000]	0.7269*** [0.0000]	0.8089*** [0.0000]

Supplementary Information Table S4. Correlations. Supplementary Information Table S4 presents Pearson correlation coefficients for the covariates used to compute the estimates presented in Table 1 of the main text and Supplementary Information Tables S5–10. Cohort controls (average and coefficient of variation of years of education) are from the baseline sample, which excludes first-generation migrants, and both cohort controls and cohort-specific initial conditions, including a summary indicator for historical precipitation, temperature, sea level pressure, relative humidity, wind speed, and global radiation associated with the respective cohorts, are weighted by Profile I effective labor supply weights derived from life-cycle labor contribution profiles⁶⁵ (see *Methods* for details). Contemporary controls, including variables indicative of structural transformation and local development³¹. *P*-values are reported in square brackets, with **P* < .1, ***P* < .05, ****P* < .01. Source: summarized in Supplementary Information Table S3, own calculations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Variable: Patents (arcsinh) / Indep. Variable P: Slope Coefficient (<i>persistence</i>)							
P	-5.273***	-4.090***	-4.206***	-3.476***	-3.267***	-1.997***	-0.928***
	(0.258)	(0.302)	(0.324)	(0.272)	(0.288)	(0.378)	(0.306)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.002]
Observations	4659	4659	4659	4623	4623	4623	4623
Adjusted R-squared	0.102	0.182	0.182	0.269	0.286	0.939	0.968
Elasticity	-2.316	-1.796	-1.847	-1.527	-1.435	-0.877	-0.408
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

Supplementary Information Table S5. Intergenerational Mobility and Innovation – All Specifications. Supplementary Information Table S5 presents the full range of specifications for Table 1 in the main text. The sample consists of $n = 137$ regions in Columns 1–3 or $n = 136$ regions in Columns 4–7 over time ($t = 1992$ to 2020 for regions encompassed by the former Warsaw pact and 1985 to 2020 for all other regions, see *Methods* for details). P is *persistence*, the slope coefficient, weighted using Profile I effective labor supply weights derived from life-cycle labor contribution profiles⁶⁵ (see *Methods* for details). The dependent variable is the inverse hyperbolic sine transformed patent count. Cohort controls are average and coefficient of variation of years of education. Cohort-specific initial conditions include a summary indicator for historical precipitation, temperature, sea level pressure, relative humidity, wind speed, and global radiation associated with the respective cohorts, also weighted by cohort-participation weights. Contemporary controls include variables indicative of structural transformation and local development³¹. The last row shows the elasticity computed based on the regression coefficient³². Standard errors are reported in parentheses and obtained by bootstrapping with 100 replications. P -values from two-sided Wald tests are reported in square brackets, with $*P < .1$, $**P < .05$, $***P < .01$. *Source*: summarized in Supplementary Information Table S3, see *Methods* for details; own calculations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Variable: Granted Patents (arcsinh) / Indep. Variable P: Slope Coefficient (<i>persistence</i>)							
P	-5.021***	-4.094***	-4.041***	-3.308***	-3.253***	-1.910***	-0.453
	(0.260)	(0.304)	(0.328)	(0.284)	(0.285)	(0.392)	(0.459)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.324]
Observations	4659	4659	4659	4623	4623	4623	4623
Adjusted R-squared	0.0890	0.148	0.148	0.227	0.254	0.940	0.943
Elasticity	-2.218	-1.809	-1.785	-1.461	-1.437	-0.844	-0.200
Dep. Variable: Citation Weighted Patents (arcsinh) / Indep. Variable P: Slope Coefficient (<i>persistence</i>)							
P	-4.837***	-4.224***	-4.563***	-3.856***	-3.688***	-2.937***	-1.498***
	(0.312)	(0.337)	(0.355)	(0.339)	(0.352)	(0.617)	(0.561)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.008]
Observations	4659	4659	4659	4623	4623	4623	4623
Adjusted R-squared	0.0580	0.121	0.124	0.202	0.228	0.823	0.864
Elasticity	-2.139	-1.868	-2.018	-1.705	-1.631	-1.299	-0.662
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 Trends							X

Supplementary Information Table S6. Intergenerational Mobility and Innovation - Alternative Specifications I. Supplementary Information Table S6 presents the full range of specifications for two alternative measures of patenting activity, based on the same sample as Table 1 in the main text and Supplementary Information Table S5. Both measures of patenting, granted patent count and citation weighted count, are inverse hyperbolic sine transformed. The sample consists of $n = 137$ regions in Columns 1–3 or $n = 136$ regions in Columns 4–7 over time ($t = 1992$ to 2020 for regions encompassed by the former Warsaw pact and 1985 to 2020 for all other regions, see *Methods* for details). P is *persistence*, the slope coefficient, weighted using Profile I effective labor supply weights derived from life-cycle labor contribution profiles⁶⁵ (see *Methods* for details). Cohort controls are average and coefficient of variation of years of education. Cohort-specific initial conditions include a summary indicator for historical precipitation, temperature, sea level pressure, relative humidity, wind speed, and global radiation associated with the respective cohorts, also weighted by cohort-participation weights. Contemporary controls include variables indicative of structural transformation and local development³¹. The last row shows the elasticity computed based on the regression coefficient³². Standard errors are reported in parentheses and obtained by bootstrapping with 100 replications. P -values from two-sided Wald tests are reported in square brackets, with $*P < .1$, $**P < .05$, $***P < .01$. Source: summarized in Supplementary Information Table S3, see *Methods* for details; own calculations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dep. Variable: Patents (arcsinh) / Indep. Variable P: <i>Standardized Persistence</i>							
P	-4.630*** (0.342) [[0.000]	-4.442*** (0.359) [0.000]	-4.518*** (0.371) [0.000]	-3.973*** (0.320) [0.000]	-3.819*** (0.317) [0.000]	-1.969*** (0.384) [0.000]	-0.544* (0.330) [0.099]
Observations	4659	4659	4659	4623	4623	4623	4623
Adjusted R-squared	0.0399	0.177	0.177	0.271	0.289	0.939	0.968
Elasticity	-1.957	-1.877	-1.910	-1.679	-1.614	-0.832	-0.230
Dep. Variable: Granted Patents (arcsinh) / Indep. Variable P: <i>Standardized Persistence</i>							
P	-4.494*** (0.335) [0.000]	-4.325*** (0.350) [0.000]	-4.222*** (0.368) [0.000]	-3.742*** (0.320) [0.000]	-3.726*** (0.312) [0.000]	-1.665*** (0.402) [0.000]	-0.127 (0.465) [0.784]
Observations	4659	4659	4659	4623	4623	4623	4623
Adjusted R-squared	0.0362	0.142	0.142	0.228	0.256	0.940	0.943
Elasticity	-1.910	-1.838	-1.795	-1.591	-1.584	-0.707	-0.0541
Dep. Variable: Citation Weighted Patents (arcsinh) / Indep. Variable P: <i>Standardized Persistence</i>							
P	-4.477*** (0.415) [0.000]	-4.404*** (0.427) [0.000]	-4.698*** (0.433) [0.000]	-4.179*** (0.404) [0.000]	-4.042*** (0.400) [0.000]	-3.330*** (0.664) [0.000]	-1.280** (0.595) [0.031]
Observations	4659	4659	4659	4623	4623	4623	4623
Adjusted R-squared	0.0252	0.116	0.118	0.201	0.228	0.823	0.864
Elasticity	-1.906	-1.874	-1.999	-1.779	-1.720	-1.417	-0.545
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 Trends							X

Supplementary Information Table S7. Intergenerational Mobility and Innovation - Alternative Specifications II. Supplementary Information Table S7 presents the full range of specifications for an alternative measure of the main independent variable, and for the three alternative measures of patenting activity. All measures of patenting, patent count, granted patent count, and citation weighted count, are inverse hyperbolic sine transformed. *P* is *standardized persistence*, weighted using Profile 1 effective labor supply weights derived from life-cycle labor contribution profiles⁶⁵ (see *Methods* for details). The sample consists of $n = 137$ regions in Columns 1–3 or $n = 136$ regions in Columns 4–7 over time ($t = 1992$ to 2020 for regions encompassed by the former Warsaw pact and 1985 to 2020 for all other regions, see *Methods* for details). Cohort controls are average and coefficient of variation of years of education. Cohort-specific initial conditions include a summary indicator for historical precipitation, temperature, sea level pressure, relative humidity, wind speed, and global radiation associated with the respective cohorts, also weighted by cohort-participation weights. Contemporary controls include variables indicative of structural transformation and local development³¹. The last row shows the elasticity computed based on the regression coefficient³². Standard errors are reported in parentheses and obtained by bootstrapping with 100 replications. *P*-values from two-sided Wald tests are reported in square brackets, with * $P < .1$, ** $P < .05$, *** $P < .01$. *Source*: summarized in Supplementary Information Table S3, see *Methods* for details; own calculations.

	Profile I Weights	Profile II Weights	Profile III Weights	Profile IV Weights	Profile V Weights
Dep. Variable: Patents (arcsinh) / Indep. Variable P: Slope Coefficient (<i>persistence</i>)					
P	-1.997*** (0.378) [0.000]	-1.877*** (0.347) [0.000]	-1.770*** (0.327) [0.000]	-2.282*** (0.599) [0.000]	-2.788*** (0.757) [0.000]
Observations	4623	4623	4623	3585	3585
Adjusted R-squared	0.939	0.939	0.939	0.946	0.944
Elasticity	-0.877	-0.836	-0.780	-0.939	-1.182
Dep. Variable: Granted Patents (arcsinh) / Indep. Variable P: Slope Coefficient (<i>persistence</i>)					
P	-1.910*** (0.392) [0.000]	-1.799*** (0.362) [0.000]	-1.730*** (0.335) [0.000]	-1.976*** (0.536) [0.000]	-2.537*** (0.658) [0.000]
Observations	4623	4623	4623	3585	3585
Adjusted R-squared	0.940	0.940	0.940	0.943	0.941
Elasticity	-0.844	-0.806	-0.766	-0.817	-1.081
Dep. Variable: Citation Weighted Patents (arcsinh) / Indep. Variable P: Slope Coefficient (<i>persistence</i>)					
P	-2.937*** (0.617) [0.000]	-2.599*** (0.577) [0.000]	-2.541*** (0.548) [0.000]	-2.940*** (0.767) [0.000]	-4.127*** (0.948) [0.000]
Observations	4623	4623	4623	3585	3585
Adjusted R-squared	0.823	0.822	0.822	0.834	0.832
Elasticity	-1.299	-1.165	-1.127	-1.216	-1.760
Cohort Controls	X	X	X	X	X
Cohort-Specific Initial Conditions	X	X	X	X	X
Contemporary Controls	X	X	X	X	X
Year F.E.	X	X	X	X	X
Reg F.E.	X	X	X	X	X

Supplementary Information Table S8. Intergenerational Mobility and Innovation - Alternative Weighting Profiles I. Supplementary Information Table S8 presents the results of our preferred specification, for the three alternative measures of patenting activity, where cohort controls, our measure of persistence, and cohort-specific initial conditions have been constructed using four alternative weighting profiles. *P* is *persistence*. All measures of patenting, patent count, granted patent count, and citation weighted count, are inverse hyperbolic sine transformed. The sample consists of $n = 136$ regions in Columns 1–3 or $n = 129$ regions in Columns 4 and 5 over time ($t = 1992$ to 2020 for regions encompassed by the former Warsaw pact and 1985 to 2020 for all other regions, see *Methods* for details). For comparative purposes, Column 1 presents results computed using the Profile I effective labor supply weights derived from life-cycle labor contribution profiles⁶⁵ (see *Methods* for details) used thus far. In Columns 2 and 3, weights are based on innovation life-cycle profiles for all patenting activity (Profile II) and highly cited patents (Profile III), respectively⁶⁶. In Columns 4 and 5, weights are based on LIS employment profiles (Profile IV) and total individual income profiles (Profile V), respectively. Cohort controls are average and coefficient of variation of years of education. Cohort-specific initial conditions include a summary indicator for historical precipitation, temperature, sea level pressure, relative humidity, wind speed, and global radiation associated with the respective cohorts, also weighted by cohort-participation weights. Contemporary controls include variables indicative of structural transformation and local development³¹. The last row shows the elasticity computed based on the regression coefficient³². Standard errors are reported in parentheses and obtained by bootstrapping with 100 replications. *P*-values from two-sided Wald tests are reported in square brackets, with * $P < .1$, ** $P < .05$, *** $P < .01$. Source: summarized in Supplementary Information Table S3, see *Methods* for details; own calculations.

	Profile I Weights	Profile II Weights	Profile III Weights	Profile IV Weights	Profile V Weights
Dep. Variable: Patents (arcsinh) / Indep. Variable P: <i>Standardized Persistence</i>					
P	-1.969*** (0.384) [0.000]	-1.963*** (0.360) [0.000]	-1.742*** (0.333) [0.000]	-2.690*** (0.641) [0.000]	-3.482*** (0.795) [0.000]
Observations	4623	4623	4623	3585	3585
Adjusted R-squared	0.939	0.938	0.939	0.946	0.944
Elasticity	-0.832	-0.832	-0.737	-1.109	-1.443
Dep. Variable: Granted Patents (arcsinh) / Indep. Variable P: <i>Standardized Persistence</i>					
P	-1.665*** (0.402) [0.000]	-1.725*** (0.380) [0.000]	-1.534*** (0.348) [0.000]	-1.805*** (0.605) [0.003]	-2.411*** (0.722) [0.001]
Observations	4623	4623	4623	3585	3585
Adjusted R-squared	0.940	0.940	0.940	0.943	0.941
Elasticity	-0.707	-0.736	-0.653	-0.747	-1.004
Dep. Variable: Citation Weighted Patents (arcsinh) / Indep. Variable P: <i>Standardized Persistence</i>					
P	-3.330*** (0.664) [0.000]	-3.056*** (0.628) [0.000]	-2.805*** (0.587) [0.000]	-3.969*** (0.771) [0.000]	-5.987*** (1.009) [0.000]
Observations	4623	4623	4623	3585	3585
Adjusted R-squared	0.823	0.822	0.822	0.834	0.832
Elasticity	-1.417	-1.305	-1.195	-1.645	-2.495
Cohort Controls	X	X	X	X	X
Cohort-Specific Initial Conditions	X	X	X	X	X
Contemporary Controls	X	X	X	X	X
Year F.E.	X	X	X	X	X
Reg F.E.	X	X	X	X	X

Supplementary Information Table S9. Intergenerational Mobility and Innovation - Alternative Weighting Profiles II. Supplementary Information Table S9 presents the results of our preferred specification, for the three alternative measures of patenting activity, where cohort controls, our measure of persistence, and cohort-specific initial conditions have been constructed using four alternative weighting profiles. *P* is *standardized persistence*. All measures of patenting, patent count, granted patent count and citation weighted count, are inverse hyperbolic sine transformed. The sample consists of $n = 136$ regions in Columns 1–3 or $n = 129$ regions in Columns 4 and 5 over time ($t = 1992$ to 2020 for regions encompassed by the former Warsaw pact and 1985 to 2020 for all other regions, see *Methods* for details). For comparative purposes, Column 1 presents the results computed using the Profile I effective labor supply weights derived from life-cycle labor contribution profiles⁶⁵ (see *Methods* for details) used thus far. In Columns 2 and 3, weights are based on innovation life-cycle profiles for all patenting activity (Profile II) and highly cited patents (Profile III), respectively⁶⁶. In Columns 4 and 5, weights are based on LIS employment profiles (Profile IV) and total individual income profiles (Profile V), respectively. Cohort controls are average and coefficient of variation of years of education. Cohort-specific initial conditions include a summary indicator for historical precipitation, temperature, sea level pressure, relative humidity, wind speed, and global radiation associated with the respective cohorts, also weighted by cohort-participation weights. Contemporary controls include variables indicative of structural transformation and local development³¹. The last row shows the elasticity computed based on the regression coefficient³². Standard errors are reported in parentheses and obtained by bootstrapping with 100 replications. *P*-values from two-sided Wald tests are reported in square brackets, with * $P < .1$, ** $P < .05$, *** $P < .01$. Source: summarized in Supplementary Information Table S3, see *Methods* for details; own calculations.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Excluding all individuals with a migration background							
Dep. Variable: Patents (arcsinh) / Indep. Variable P: Slope Coefficient (<i>persistence</i>)							
P	-5.168*** (0.261) [0.000]	-3.992*** (0.303) [0.000]	-4.096*** (0.327) [0.000]	-3.355*** (0.275) [0.000]	-3.141*** (0.292) [0.000]	-2.351*** (0.369) [0.000]	-0.881*** (0.293) [0.003]
Observations	4659	4659	4659	4623	4623	4623	4623
Adjusted R-squared	0.0968	0.179	0.179	0.268	0.285	0.939	0.968
Elasticity	-2.276	-1.758	-1.804	-1.477	-1.383	-1.035	-0.388
(B) Including all individuals with and without a migration background							
Dep. Variable: Patents (arcsinh) / Indep. Variable P: Slope Coefficient (<i>persistence</i>)							
P	-4.028*** (0.268) [0.000]	-2.442*** (0.255) [0.000]	-2.333*** (0.272) [0.000]	-1.405*** (0.266) [0.000]	-1.054*** (0.270) [0.000]	-3.707*** (0.349) [0.000]	-0.518* (0.307) [0.092]
Observations	4659	4659	4659	4623	4623	4623	4623
Adjusted R-squared	0.0515	0.154	0.154	0.261	0.281	0.939	0.967
Elasticity	-1.802	-1.092	-1.043	-0.628	-0.471	-1.658	-0.232
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 Trends							X

Supplementary Information Table S10. Intergenerational Mobility and Innovation - Alternative Sample Selection. Supplementary Information Table S10 presents the full range of specifications, as in Supplementary Information Table S5, for two alternative versions of our database. **(A)** presents results for the version where mobility indices were obtained based on a sample that excludes all individuals with a migration background (i.e., additionally excluding second-generation migrants, or those who have not naturalized). **(B)** presents results for the version where mobility indices were obtained based on a sample that includes all individuals with and without a migration background. *P* is *persistence*, weighted using Profile I effective labor supply weights derived from life-cycle labor contribution profiles⁶⁵ (see *Methods* for details). The dependent variable is the inverse hyperbolic sine transformed patent count. The sample consists of $n = 137$ regions in Columns 1–3 or $n = 136$ regions in Columns 4–7 over time ($t = 1992$ to 2020 for regions encompassed by the former Warsaw pact and 1985 to 2020 for all other regions, see *Methods* for details). Cohort controls are average and coefficient of variation of years of education. Cohort-specific initial conditions include a summary indicator for historical precipitation, temperature, sea level pressure, relative humidity, wind speed, and global radiation associated with the respective cohorts, also weighted by cohort-participation weights. Contemporary controls include variables indicative of structural transformation and local development³¹. The last row shows the elasticity computed based on the regression coefficient³². Standard errors are reported in parentheses and obtained by bootstrapping with 100 replications. *P*-values from two-sided Wald tests are reported in square brackets, with * $P < .1$, ** $P < .05$, *** $P < .01$. *Source:* summarized in Supplementary Information Table S3, see *Methods* for details; own calculations.

Measure Type	Time Period	Weight Type	Sample Selection
Cohort-linked measures	1940–1959, 1960–1979, 1980–1999	Survey weights	Including all migrants
			Excluding 1 st gen migrants
			Excluding 2 nd gen migrants
Weighted time series measures	1985–2025	Profile I (effective labor)	Including all migrants ^a
			Excluding 1 st gen migrants ^a
			Excluding 2 nd gen migrants ^f
	1985–2025	Profile II (patents)	Including all migrants
			Excluding 1 st gen migrants ^b
			Excluding 2 nd gen migrants
	1985–2025	Profile III (highly cited patents)	Including all migrants
			Excluding 1 st gen migrants ^c
			Excluding 2 nd gen migrants
	1985–2023	Profile IV (LIS employment share)	Including all migrants
			Excluding 1 st gen migrants ^d
			Excluding 2 nd gen migrants
	1985–2023	Profile V (LIS total income share)	Including all migrants
			Excluding 1 st gen migrants ^e
			Excluding 2 nd gen migrants

Supplementary Information Table S11. EUROPE-IGM-ATLAS Database Versioning and Available Indices. Supplementary Information Table S11 summarizes the available versions of the database described in this article. In all cases, the available indices are a) *persistence* (slope coefficient from a regression of parents' on children's years of education), b) *standardized persistence* (slope coefficient multiplied by the ratio of standard deviations of parents' and children's years of education), c) average years of education for both parents and children, and d) educational inequality (coefficient of variation of years of education) for both parents and children, as well as the corresponding standard errors computed via bootstrap with 100 replications. Further, we include geographical information (e.g., NUTS region, NUTS level, country, etc.) and information about the index's construction (e.g., number of observations used to compute the estimate — both weighted and unweighted). ^a Indicates the baseline version, used for the main analyses in this paper in the main text and in Supplementary Information Tables S5–S7. ^b, ^c, ^d and ^e indicate the annualized versions constructed using alternative weighting profiles, used for the robustness tests in Supplementary Information Tables S8 and S9. ^f and ^g indicate the versions used for the robustness tests in Supplementary Information Table S10, constructed using Profile I effective labor supply weights, for samples additionally excluding those with a migration background, e.g., second generation migrants or later generations who have not naturalized (**A**) and including all migrants (**B**), respectively.

	Dep. var.: <i>ln</i> (GDP) (1)	Dep. var.: <i>ln</i> (Population) (2)
<i>ln</i> (<i>builtup</i> + 1)	1.265*** (0.052) [0.000]	1.184*** (0.040) [0.000]
<i>ln</i> (<i>grass</i> + 1)	-0.177*** (0.047) [0.000]	-0.069* (0.037) [0.062]
<i>ln</i> (<i>crops</i> + 1)	-0.233*** (0.041) [0.000]	-0.213*** (0.033) [0.000]
<i>ln</i> (<i>forest</i> + 1)	0.099*** (0.029) [0.001]	0.161*** (0.022) [0.000]
<i>ln</i> (<i>noveg</i> + 1)	-0.409*** (0.029) [0.000]	-0.402*** (0.024) [0.000]
<i>ln</i> (<i>water</i> + 1)	-0.005 (0.042) [0.903]	-0.022 (0.033) [0.513]
Year fixed effects	X	X
Country fixed effects	X	X
Observations	2,138	2,067
Adjusted R-squared	0.795	0.841

Supplementary Information Table S12. Regressions of Population and GDP on Surface Groups. Supplementary Information Table S12 reports the results of regressions specified analogously to those conducted in the original article describing the *surface groups* data set³¹ for a sample of regions ($n = 115$) over time ($t = 2000$ to 2020, unbalanced), i.e., the augmented NUTS1 regions included in Column 3 of Table 1, and for which data were available from both Eurostat and the surface groups data³¹. GDP indicates annual gross domestic products in million euros. Population is inferred by dividing annual GDP (in Euros) by annual GDP per inhabitant (in Euros). Robust standard errors are reported in parentheses. P -values from two-sided t -tests are reported in square brackets, with * $P < .1$, ** $P < .05$, *** $P < .01$. *Source:* Surface groups data were retrieved as described in *Methods*. Dependent variables based on Eurostat data were downloaded (on June 23, 2022) from: <https://ec.europa.eu/eurostat/databrowser/explore/all/economy?lang=en&subtheme=na10&display=list&sort=category>.

ESS Definition	ESS-ISCED I less than lower secondary	ESS-ISCED II lower secondary	ESS-ISCED IIIb lower tier upper secondary	ESS-ISCED IIIa upper tier upper secondary
Bulgaria <i>edlvbg</i>	Not completed primary; Primary (I-IV grade); Primary (I-IV grade)	Lower secondary (V-VIII grade)		Upper secondary (IX-XIII grade)
Cyprus <i>edlvcy</i>	Not completed primary; Primary or 1st stage of basic	Lower secondary or 2nd stage of basic		Upper secondary
<i>edlvacy</i>	Not completed primary; Primary or 1st stage of basic	Lower secondary or 2nd stage of basic		Upper secondary
<i>edlvfcy</i>	Not completed primary; Primary or 1st stage of basic	Lower secondary or 2nd stage of basic		Upper secondary
<i>edlvmcy</i>	Not completed primary; Primary or 1st stage of basic	Lower secondary or 2nd stage of basic		Upper secondary
Estonia <i>edlvbee</i>	Illiterate; Without education; Basic without professional qual; Primary without prof qual or uncomplete	Vocational education: < 3 years; >= 3 years; basic education	Vocational with secondary; Vocational-secondary after basic; Vocational secondary/ technical after basic	Secondary without professional qual; Vocational-secondary after secondary; Vocational secondary/technical after secondary
<i>edlvfee</i>	Not completed primary; Primary	Basic		Secondary
<i>edlvmee</i>	Not completed primary; Primary	Basic		Secondary
France <i>edlvfr</i>	Sans diplôme; Certificat d'études primaires; Non diplômés du CAP/BEP filière professionnelle;	Non diplômés jusqu'à la fin 3ème, 2nde, 1ère filière general; CAP, examen de fin d'apprentissage artisanal; Brevet: élémentaire, d'étude du premier cycle, brevet	BEP, BP, BEA, BEC, BEI, BES; Brevet de technicien; baccalauréat de technicien, baccalauré	Baccalauréat général, brevet supérieur
UK <i>edlvagb</i>	No qualifications	CSE Grade 2-5/GCSE Grades D-G; CSE Grade 1/O-Level; GCSE Grades A-C		A-Level, As-Level or Equiv
<i>edlvgb</i>	No qualifications	GCSE/O-level/CSE/ NVQ1/NVQ2 or equiv		A-level/NVQ3 or equiv
<i>edlvfgb</i>	No qualifications	GCSE/O-level/CSE/ NVQ1/NVQ2 or equiv		A-level/NVQ3 or equiv
<i>edlvmgb</i>	No qualifications	GCSE/O-level/CSE/ NVQ1/NVQ2 or equiv		A-level/NVQ3 or equiv
Greece <i>edlvgr</i>	Illiterate/not completed primary; Primary	Partial secondary		Full secondary
<i>edlvagr</i>	Analphabetic; Primary education	Lower secondary		Upper secondary
<i>edlvfgr</i>	Analphabetic; Primary education	Lower secondary		Upper secondary
<i>edlvmgr</i>	Analphabetic; Primary education	Lower secondary		Upper secondary
Ireland <i>edlvie</i>	None/primary not completed; Primary or equivalent	Intermediate/junior/ group cert or equiv		Leaving cert or equiv
<i>edlviae</i>	None/primary not completed; Primary or equivalent	Intermediate/junior/ group cert or equiv		Leaving cert or equiv
<i>edlvbie</i>	None/primary not completed; Primary or equivalent	Intermediate/junior/ group cert or equiv		Leaving cert or equiv
<i>edlvfie</i>	None/primary not completed; Primary or equivalent	Intermediate/junior/ group cert or equiv		Leaving cert or equiv
<i>edlvmie</i>	None/primary not completed; Primary or equivalent	Intermediate/junior/ group cert or equiv		Leaving cert or equiv
Italy <i>edlvit</i>	Senza titolo; Licenza elementare	Licenza media; avviamento professional		Diploma scuola media superiore
Portugal <i>edlvpt</i>	Nenhum; 1 ciclo; 2 ciclo	3 ciclo		Secundario

	Nenhum; 1 ciclo; 2 ciclo	3 ciclo	Secundario	
Sweden				
<i>edlvse</i>	Not finished elementary; Elementary, old; Elementary	Lower secondary elementary; Vocational school 1963-1970; 2 year high school	Vocational high school after 1992	3-4 year high school prior to 1995; Theoretical high school after 1992; entered University, no exam
<i>edlvase</i>	Ej avslutad folkskola/ grundskola; Folkskola;	Realskola/Flickskola; Fackskola (1963-1970); 2-årig gymnasielinje, 2-årig yrkesskola	Yrkesinriktat gymnasium (efter 1992)	3- eller 4 årig gymnasium (före 1995); Teoretiskt gymnasium (efter 1992); Universitet/högskola utan examen
<i>edlvfse</i>	Ej avslutad folkskola/ grundskola; Folkskola;	Realskola/Flickskola; Fackskola (1963-1970); 2-årig gymnasielinje, 2-årig yrkesskola	Yrkesinriktat gymnasium (efter 1992)	3- eller 4 årig gymnasium (före 1995); Teoretiskt gymnasium (efter 1992); Universitet/högskola utan examen
<i>edlvmse</i>	Ej avslutad folkskola/ grundskola; Folkskola;	Realskola/Flickskola; Fackskola (1963-1970); 2-årig gymnasielinje, 2-årig yrkesskola	Yrkesinriktat gymnasium (efter 1992)	3- eller 4 årig gymnasium (före 1995); Teoretiskt gymnasium (efter 1992); Universitet/högskola utan examen
Turkey				
<i>edulvla</i>	Less than lower secondary	Lower secondary completed		Upper secondary completed
<i>edulvfa</i>	Less than lower secondary	Lower secondary completed		Upper secondary completed
<i>edulvma</i>	Less than lower secondary	Lower secondary completed		Upper secondary completed
<i>edlvtr</i>	Okuma-yazma bilmiyor; Okuma-yazma biliyor ama okul bitirmemis/ diplomasiz; İlkokul mezunu (5 yıl); İlköğretim mezunu (8 yıl)	Genel ortaokul mezunu;	Mesleki lise mezunu	Genel lise mezunu
<i>edlvftr</i>	Okuma-yazma bilmiyor; Okuma-yazma biliyor ama okul bitirmemis/ diplomasiz; İlkokul mezunu (5 yıl); İlköğretim mezunu (8 yıl)	Genel ortaokul mezunu;	Mesleki lise mezunu	Genel lise mezunu
<i>edlvmttr</i>	Okuma-yazma bilmiyor; Okuma-yazma biliyor ama okul bitirmemis/ diplomasiz; İlkokul mezunu (5 yıl); İlköğretim mezunu (8 yıl)	Genel ortaokul mezunu;	Mesleki lise mezunu	Genel lise mezunu
Ukraine				
<i>edlvua</i>	Not completed primary; Primary (4-7 years of secondary)	Not completed secondary (8-9 years)		Completed secondary (10-11 years)

Supplementary Information Table S13. Modified ISCED I-IIIa Harmonization of ESS Education Measures from Waves 1-4 Excluded from ESS-ISCED. Supplementary Information Table S13 illustrates how the country-specific variables included in the ESS for parents and their offspring's levels of education have been recoded to expand the data basis of this analysis, for those with education below the tertiary level.

ESS Definition	ESS-ISCED IV advanced vocational	ESS-ISCED V1 lower tertiary education	ESS-ISCED V2 higher tertiary education
Bulgaria			
<i>edlvbg</i>	Post secondary, non-tertiary (vocational)	Tertiary education	
Cyprus			
<i>edlvcy</i>	Diploma	Bachelor/Master/PhD	
<i>edlvacy</i>	Diploma	1st stage of tertiary Bachelor/Ptych	2nd stage of tertiary, Master; PhD
<i>edlvfcy</i>	Diploma	1st stage of tertiary Bachelor/Ptych	2nd stage of tertiary, Master; PhD
<i>edlvmcy</i>	Diploma	1st stage of tertiary Bachelor/Ptych	2nd stage of tertiary, Master; PhD
Estonia			
<i>edlvbee</i>	Vocational higher education; Applied higher education	Bachelor, 3 years; Bachelor > 3 years;	2 year Master studies; Scientific degree of Master; Phd, doctor, other scientific degrees above Master
<i>edlvfee</i>	Vocational education after secondary ed	1st stage of tertiary	2nd stage of tertiary
<i>edlvmee</i>	Vocational education after secondary ed	1st stage of tertiary	2nd stage of tertiary
France			
<i>edlvfr</i>		Diplôme universitaire du premier cycle (DEUG)	Diplôme universitaire des deuxième et troisième cycles
UK			
<i>edlvagb</i>		Degree/Postgraduate Qual	
<i>edlvgb</i>	NVQ4/NVQ5 or equiv	Degree/HNC/teacher training/nursing	PhD/DPhil or equiv
<i>edlvfgb</i>	NVQ4/NVQ5 or equiv	Degree/HNC/teacher training/nursing	PhD/DPhil or equiv
<i>edlvmgb</i>	NVQ4/NVQ5 or equiv	Degree/HNC/teacher training/nursing	PhD/DPhil or equiv
Greece			
<i>edlvgr</i>	Post secondary/ polytechnic	University degree	Post-graduate degree
<i>edlvagr</i>	Post-compulsory Secondary	Higher Education: University Diploma	MA Degree/PhD Degree
<i>edlvfgr</i>	Post-compulsory Secondary	Higher Education: University Diploma	MA Degree/PhD Degree
<i>edlvmgr</i>	Post-compulsory Secondary	Higher Education: University Diploma	MA Degree/PhD Degree
Ireland			
<i>edlvie</i>	Diploma/certificate	Primary degree	Postgraduate/higher degree
<i>edlviae</i>	Diploma/certificate	Primary degree	Postgraduate/higher degree
<i>edlvbie</i>	Diploma/certificate	Primary degree	Postgraduate Higher Diploma/Masters; PhD
<i>edlvfie</i>	Diploma/certificate	Primary degree	Postgraduate Higher Diploma/Masters; PhD
<i>edlvmie</i>	Diploma/certificate	Primary degree	Postgraduate Higher Diploma/Masters; PhD
Italy			
<i>edlvit</i>		Diploma universitario	Laurea; Specializzazione post-laurea
Portugal			
<i>edlvpt</i>	Superior Politecnico	Superior Universitario	Mestrado/Doutoramento
<i>edlvapt</i>	Superior Politecnico	Superior Universitario	Pós-graduação; Mestrado; Doutoramento
Sweden			
<i>edlvse</i>	University, exam < 3 years	University, exam > 3 years	
<i>edlvase</i>	Universitet/högskola kortare än 3 år	Universitet/högskola 3 år eller längre	Forskarutbildning

<i>edlvfse</i>	Universitet/högskola kortare än 3 år	Universitet/högskola 3 år eller längre	Forskarutbildning
<i>edlvmse</i>	Universitet/högskola kortare än 3 år	Universitet/högskola 3 år eller längre	Forskarutbildning
Turkey			
<i>edulvla</i>		Tertiary education completed	
<i>edulvfa</i>		Tertiary education completed	
<i>edulvma</i>		Tertiary education completed	
<i>edlvtr</i>		Universite veya yüksekokul mezunu	Master derecesi sahibi
<i>edlvftr</i>		Universite veya yüksekokul mezunu	Master derecesi sahibi
<i>edlvmttr</i>		Universite veya yüksekokul mezunu	Master derecesi sahibi
Ukraine			
<i>edlvua</i>	Secondary technical education (college, more than secondary, but not high)	1st stage of high education (bachelor)	Completed high education (specialist, master, postgraduate, scientific degree)

Supplementary Information Table S14. Modified ISCED IV-V2 Harmonization of ESS Education Measures from Waves 1-4 Excluded from ESS-ISCED. Supplementary Information Table S14 illustrates how the country-specific variables included in the ESS for parents and their offspring's *levels* of education have been recoded to expand the data basis of this analysis, for those with tertiary sector education.

Modified ISCED Definition		Standardized Years of Schooling Assigned
ESS-ISCED I	less than lower secondary	6
ESS-ISCED II	lower secondary	9
ESS-ISCED IIIb	lower tier upper secondary	11
ESS-ISCED IIIa	upper tier upper secondary	12
ESS-ISCED IV	advanced vocational	13
ESS-ISCED V1	lower tertiary education	15
ESS-ISCED V2	higher tertiary education	17

Supplementary Information Table S15. Standardized Years of Schooling by Modified-ISCED Educational Rank. Supplementary Information Table S15 shows the ordinal rank assigned to specific ISCED levels of educational attainment, which are used to construct the harmonized *years* of schooling for both parents and their offspring.

	N	Mean	SD	25 th Percentile	50 th Percentile	75 th Percentile
<i>Dep. Vars</i>						
Patent Count	4,659	361.49	732.44	18.17	101.59	362.23
Granted Patent Count	4,659	213.66	460.18	8.20	53.53	206.23
Citation Weighted Patent Count	4,659	252.65	522.47	7.61	64.42	256.24
<i>Cohort Controls</i>						
Years of Education (Average)	4,659	11.65	1.08	11.20	11.88	12.32
Years of Education (Coefficient of Variation)	4,659	0.24	0.06	0.19	0.23	0.28
<i>Cohort-Specific Initial Conditions</i>						
PCA Score*	4,659	-0.02	1.02	-0.48	-0.193	0.46
Averaged Relative Humidity	4,659	78.20	5.84	76.59	79.46	81.57
Average Sea Level Pressure	4,659	1004.07	81.54	1013.69	1015.60	1016.74
Mean Global Radiation	4,659	131.07	29.41	112.82	122.46	144.92
Precipitation	4,659	2.13	0.72	1.57	2.00	2.50
Mean Temperature	4,659	8.91	3.44	7.54	8.80	10.22
Minimum Temperature	4,659	4.83	3.17	3.28	4.99	6.08
Maximum Temperature	4,659	13.16	3.76	11.61	12.97	14.82
<i>Contemporary Controls</i>						
Crops Area	4,623	15.70	2.13	15.19	16.08	16.87
Forest Area	4,623	15.60	2.26	14.76	15.93	16.98
Grass Area	4,623	15.51	2.13	15.01	15.86	16.65
No Vegetation Area	4,623	14.18	2.16	13.28	14.29	15.32
Water Area	4,623	13.99	2.06	13.19	14.11	14.96
Built-up Area	4,623	15.38	1.61	14.63	15.47	16.22

Supplementary Information Table S16. Summary Statistics. Supplementary Information Table S16 presents summary statistics for the covariates used to compute the estimates presented in Table 1 of the main text and Supplementary Information Tables S5–S7 (i.e., for $n = 137$ Augmented NUTS 1 regions for the years $t = 1992$ to 2020 for regions encompassed by the former Warsaw pact and 1985 to 2020 for all other regions, see *Methods* for details). Cohort controls (average and coefficient of variation of years of education) are from version of the EUROPE-IGM-ATLAS computed based on the baseline sample of $n = 233,057$ observations, which excludes first-generation migrants. Cohort-specific initial conditions include a summary indicator for historical precipitation, temperature, sea level pressure, relative humidity, wind speed, and global radiation⁵⁸. Both cohort controls and cohort-specific initial conditions associated with the respective cohorts are weighted using Profile I effective labor supply weights derived from life-cycle labor contribution profiles⁶⁵ (see *Methods* for details). Contemporary controls are in log pixel count form and include variables indicative of structural transformation and local development³¹. *Only the PCA Score is included in the analyses conducted as part of our empirical application as a control for cohort-specific initial conditions; the components upon which the score is computed are included here only for informational purposes.

	Low Persistence (%)	Medium Persistence (%)	High Persistence (%)
Albania (AL)	100.00	0.00	0.00
Austria (AT)	0.00	33.33	66.67
Belgium (BE)	0.00	66.67	33.33
Bulgaria (BG)	0.00	0.00	100.00
Croatia (HR)	0.00	50.00	50.00
Cyprus (CY)	0.00	0.00	100.00
Czech Republic (CZ)	0.00	50.00	50.00
Denmark (DK)	80.00	20.00	0.00
Estonia (EE)	100.00	0.00	0.00
Finland (FI)	50.00	50.00	0.00
France (FR)	30.77	53.85	15.38
Germany (DE)	56.25	31.25	12.50
Greece (EL)	0.00	0.00	100.00
Hungary (HU)	0.00	66.67	33.33
Iceland (IS)	100.00	0.00	0.00
Ireland (IE)	0.00	33.33	66.67
Italy (IT)	0.00	0.00	100.00
Kosovo (XK)	0.00	0.00	100.00
Latvia (LV)	100.00	0.00	0.00
Lithuania (LT)	100.00	0.00	0.00
Montenegro (ME)	0.00	0.00	100.00
Netherlands (NL)	25.00	75.00	0.00
Norway (NO)	71.43	28.57	0.00
Poland (PL)	16.67	66.67	16.67
Portugal (PT)	0.00	0.00	100.00
Romania (RO)	75.00	0.00	25.00
Serbia (RS)	0.00	100.00	0.00
Slovakia (SK)	0.00	25.00	75.00
Slovenia (SI)	0.00	100.00	0.00
Spain (ES)	0.00	0.00	100.00
Sweden (SE)	100.00	0.00	0.00
Switzerland (CH)	28.57	71.43	0.00
Türkiye (TR)	0.00	0.00	100.00
Ukraine (UA)	100.00	0.00	0.00
United Kingdom (UK)	75.00	16.67	8.33

Supplementary Information Table S17. Share of Regions in Initial Tercile of Persistence by Country. In the main text, Figure 3 plots predicted innovation, based on regression specification (3) in Table 1, where innovation is captured by the inverse hyperbolic sine transformation of the number of patents, against *persistence* (the slope coefficient) after applying cohort-participation weights (Profile I weights). Panels (B-D) of Figure 2 illustrate, respectively, those regions in the low, medium, and high terciles of *persistence* in the baseline period in 1985. Supplementary Information Table S17 reports the share of regions in each tercile by country.

Weighting profile	N	$\text{Var}(P_{rt})$ (total variance)	$\text{Var}_r[\text{E}_t(P_{rt})]$ (cohort-driven variance component)	$\text{E}_r[\text{Var}_t(P_{rt})]$ (contribution weight-driven variance component)
Profile I	4,623	0.01572	0.01391 (88.5% of total variance)	0.00186 (11.8% of total variance)
Profile II	4,623	0.01635	0.01444 (88.3% of total variance)	0.00197 (12.0% of total variance)
Profile III	4,623	0.01642	0.01416 (86.2% of total variance)	0.00233 (14.2% of total variance)
Profile IV	3,585	0.01285	0.01198 (93.2% of total variance)	0.00090 (7.0% of total variance)
Profile V	3,585	0.01254	0.01205 (96.1% of total variance)	0.00050 (4.0% of total variance)

Supplementary Information Table S18. Variance Decomposition of Intergenerational Educational Persistence by Cohort-Participation Weighting Profile. Supplementary Information Table S18 shows a variance decomposition of our annualized measure of intergenerational educational *persistence* (the slope coefficient) according to the law of total variance. Weighting profiles are defined as described in *Methods* (Profile I: effective labor contributions over the life-cycle, Profile II: effective patenting activity over the life-cycle, Profile III: effective patenting activity over the life-cycle for highly cited patents, Profile IV: effective labor contributions over the life-cycle based on country-level employment from the Luxembourg Income Study (LIS), and Profile V: effective labor contributions over the life-cycle based on country-level total individual income from the LIS). Residual differences in the variance decomposition may arise from finite-sample numerical imprecision.