BBVA Research

Converging to Convergence: The Role of Human Capital

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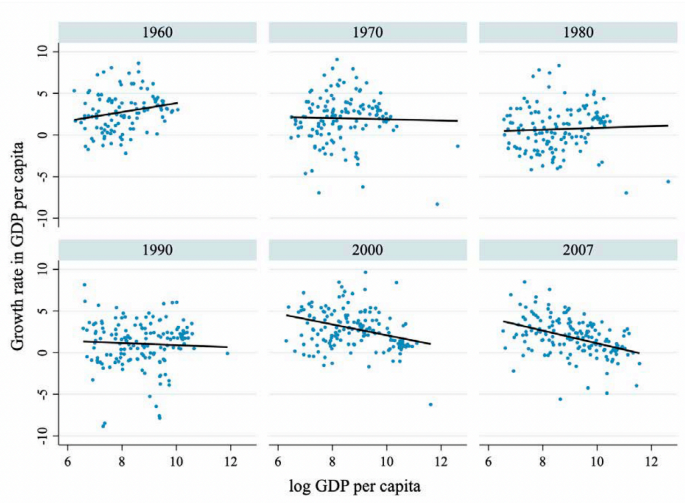
26th APPLIED ECONOMICS MEETING
Santander, June 6, 2024

Creando Oportunidades

Motivation

- Evidence of absolute convergence has not been found in the literature for many decades (Baumol, 1986; De Long, 1988; Barro, 1991; Pritchett, 1997; Rodrick, 2013; Johnson and Papageorgiou, 2020).
- However, new evidence shows signals of unconditional convergence from 2000 onwards (Kremer et al., 2021; Patel et al., 2021).
- In this paper we focus on human capital convergence, and whether it has played any role in the convergence process from 2000.

Motivation



Absolute beta-convergence across decades

Contribution

- We use two measures of human capital, taken from the PWT 10 and Barro and Lee (2013)
- We find that human capital convergence started before income convergence.
  - $\sigma-$ convergence in human capital started around 1977.
  - $\beta-$ convergence in human capital has been statistically significant from the 1980s onwards.
- We corroborate in our sample a lack of income convergence over a long time period and a change in the slope of $\beta-$convergence from the 2000s.
- We use the omitted variable formula to decompose absolute convergence into two parts: the contribution of conditional convergence and the contribution of human capital.

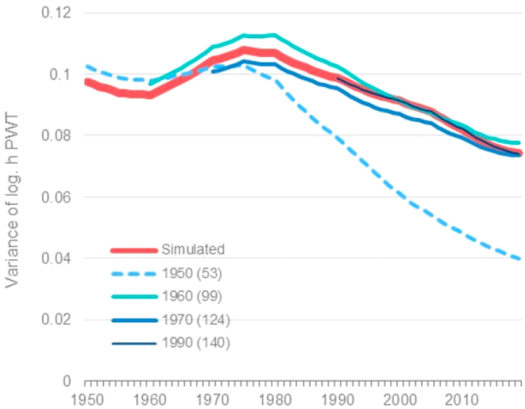
Contribution

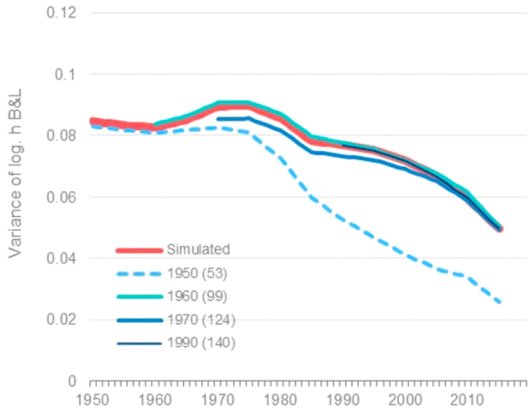
- We find that convergence in per capita income conditional to human capital (β^*) is twice as high as unconditional β convergence.
- We show the results are robust to different sensitivity tests:
  - Alternative measures of GDP
  - Other determinantes of the diferences in the growth rates across countries such as institutions (Acemoglu et al., 2005).
  - Country fixed effects (Acemoglu and Molina, 2021).
  - Causality runs from human capital to GDP per capita (Castelló and Doménech, 2024).

Outline

- $\sigma-$convergence in human capital and income
- $\beta-$convergence in human capital
- Human capital and $\beta-$convergence in GDP per capita.
- Robustness analysis
- Conclusions

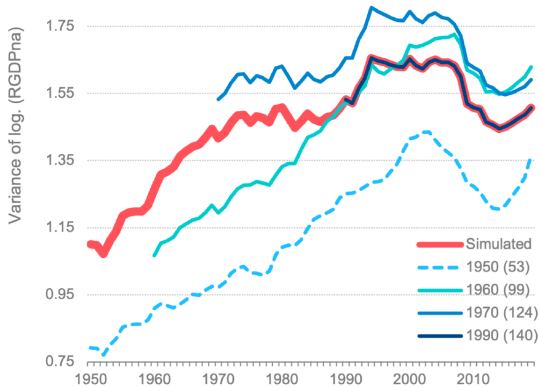
There has been a process of $\sigma-$convergence of human capital since the 1980s





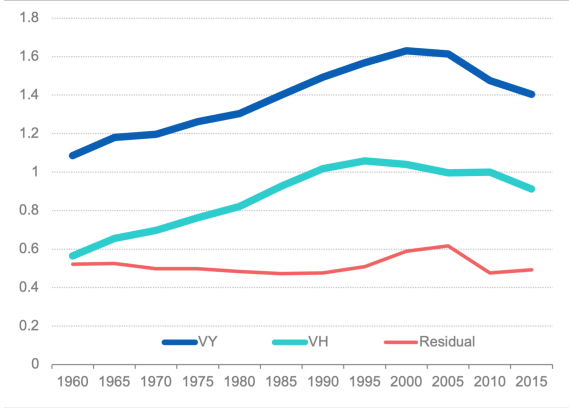
$\sigma-$convergence of GDP per capita is more recent

- Variance of GDP per capita

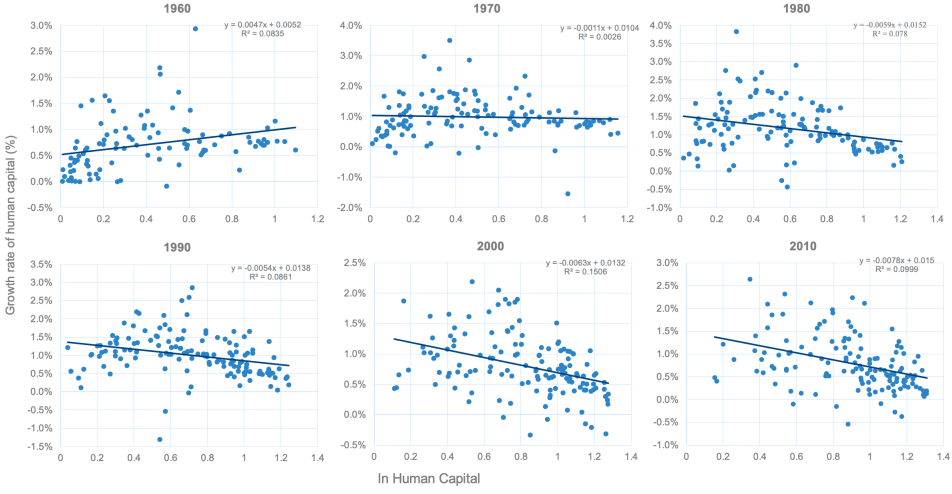


Contribution of human capital to the $\sigma-$convergence of GDP per capita

- Taking into account the increase in the elasticity of output to human capital, the contribution of the variance of human capital (VH) explains most of the variance of GDP per capita across countries, according to Castelló and Doménech, (2024)



$\beta-$convergence in human capital



$\beta-$convergence in human capital

Table 1: $\beta-$ convergence in human capital, 1960-2000

Dep. variable: decadal average human capital growth rate				
	(1)	(2)	(3)	(4)
	hPWT		hBL	
ln$h$	-0.390**		-0.588***	
	(0.062)		(0.081)	
ln$h$*y1960		0.474***		0.124
		(0.123)		(0.191)
ln$h$*y1970		-0.105		-0.356**
		(0.166)		(0.179)
ln$h$*y1980		-0.590***		-0.796***
		(0.165)		(0.187)
ln$h$*y1990		-0.536***		-0.532***
		(0.133)		(0.164)
ln$h$*y2000		-0.628***		-1.090***
		(0.126)		(0.146)
ln$h$*y2010		-0.780***		-2.015***
		(0.202)		(0.416)
Constant	0.689***	0.489***	0.845***	0.614***
	(0.072)	(0.067)	(0.054)	(0.040)
R2	0.122	0.155	0.137	0.208
Obs	821	821	980	980
Year FE	YES	YES	YES	YES

Human capital growth rates by geographical regions

Table 2: Decadal Average Human Capital Growth Rate by Geographical Region

				Growth Rate						
	Countries	HC1960		1960s		1970s	1980s	1990s	2000s	2010s	
Whole sample	140	1.642		1.031		1.222	1.072	0.875	0.832	0.779	
Advanced Economies	24	2.226	(1)	0.923	(5)	1.021	0.681	0.651	0.635	0.258	(7)
East Asia and the Pacific	17	1.509	(4)	1.387	(1)	1.423	1.008	0.967	1.129	0.621	(5)
Europe and Central Asia	20	2.078	(2)	1.191	(2)	1.330	0.809	0.765	0.450	0.305	(6)
Latin America and the Caribbean	24	1.629	(3)	1.036	(4)	1.179	1.139	0.928	0.763	0.670	(4)
Middle East and North Africa	17	1.370	(5)	1.179	(3)	1.544	1.612	1.184	0.951	1.341	(2)
South Asia	6	1.309	(6)	0.910	(6)	0.821	1.176	1.199	1.232	1.463	(1)
Sub-Saharan Africa	32	1.217	(7)	0.764	(7)	1.134	1.206	0.798	0.975	1.203	(3)

Econometric Model

- Unconditional $\beta-$convergence ($\beta < 0$)

$$\ln(y_{i,t+\Delta t}) - \ln(y_{i,t}) = \alpha + \beta_t \ln(y_{i,t}) + \mu_t + \epsilon_{i,t} \tag{1}$$

- $\beta-$convergence conditional to human capital ($\beta^* < 0$)

$$\ln(y_{i,t+\Delta t}) - \ln(y_{i,t}) = \alpha + \beta_t^* \ln(y_{i,t}) + \lambda_t \ln h_{i,t} + \mu_t + \varepsilon_{i,t} \tag{2}$$

Econometric Model

- An omitted variable bias exists if h is a determinant of economic growth and if it is correlated with ln$y$.
- If h and y are correlated as follows:

$$\ln h_{i,t} = \phi + \delta_t \ln(y_{it}) + \mu_t + v_{i,t} \tag{3}$$

we can substitute (3) into (2) and decompose absolute convergence into two componenets,

$$\beta_t = \beta_t^* + \lambda_t \times \delta_t \tag{4}$$

skip

No role of h: $\lambda_t \times \delta_t = 0$ and $\beta_t = \beta_t^*$
Role of h: $\beta_t - \beta_t^* = \lambda_t \times \delta_t > 0$

Main Results

Table 3: Conditional and Unconditional $\beta - convergence$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		HC PWT			HC BL		
	β	β^*	λ	δ	β^*	λ	δ
1960s	0.336^c	-0.653^a	4.283^a	0.231^a	-0.580^c	4.392^a	0.208^a
1970s	0.236	-0.215	2.717^a	0.171^a	-0.281	3.427^a	0.155^a
1980s	-0.252	-1.232^a	5.841^a	0.173^a	-1.201^a	6.489^a	0.151^a
1990s	0.014	-0.012	0.134	0.195^a	0.063	-0.293	0.171^a
2000s	-0.575^a	-1.359^a	4.203^a	0.174^a	-1.190^a	4.013^a	0.153^a
2010s	-0.440^a	-0.904^a	2.454^a	0.183^a	-0.965^a	3.275^a	0.155^a
Constant	2.366a	2.366a	2.366a	0.513a	2.366a	2.366a	0.504a
R2	0.313	0.403	0.403	0.621	0.397	0.397	0.643
Obs	821	821	821	821	821	821	821

Main Results

Table 4: Decomposition of β – *convergence*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		HC PWT			*HC BL*		
	β	β^*	$(\beta - \beta^*)$	$(\lambda \times \delta)$	β^*	$(\beta - \beta^*)$	$(\lambda \times \delta)$
2000s	-0.575	-1.359	0.784	0.731	-1.190	0.615	0.614
2010s	-0.440	-0.904	0.464	0.449	-0.965	0.525	0.508

Robustness: Different Measures of GDP

Table 5: GDP from World Development Indicators (WDI)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		HC PWT			*HC BL*		
	β	β^*	$(\beta - \beta^*)$	$(\lambda \times \delta)$	β^*	$(\beta - \beta^*)$	$(\lambda \times \delta)$
2000s	-0.424	-1.219	0.795	0.763	-1.188	0.764	0.732
2010s	-0.308	-0.942	0.634	0.569	-0.927	0.619	0.555

Robustness: Institutions

Table 6: Conditioning on institutions (DemocracyANRR)

	β	β^*	λ	δ
	(1)	(2)	(3)	(4)
1960s	0.332	0.165	0.651	0.256^a
1970s	0.393^b	0.556^a	-0.773	0.188^a
1980s	-0.200	-0.516^b	2.431^a	0.135^a
1990s	0.017	-0.146	1.141^a	0.144^a
2000s	-0.629^a	-0.686^a	0.599	0.095^a
2010s	-0.436^a	-0.497^a	0.799^c	0.086^b
Constant	0.358	1.456	1.456	-1.686
R2	0.341	0.392	0.392	0.193
Obs	724	724	724	724

Robustness: Institutions

Table 7: Decomposition of $\beta - convergence$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	β	β^*	$(\beta - \beta^*)$	$(\lambda \times \delta)$	β	β^*	$(\beta - \beta^*)$	$(\lambda \times \delta)$
	Controlling for Human Capital							
	HC PWT				HC BL			
2000s	-0.575	-1.359	0.784	0.731	-0.575	-1.190	0.615	0.614
2010s	-0.440	-0.904	0.464	0.449	-0.440	-0.965	0.525	0.508
	Controlling for Institutions							
	Democracy				Political Rights Index			
2000s	-0.629	-0.686	0.057	0.057	-0.570	-0.661	0.091	0.092
2010s	-0.436	-0.497	0.061	0.069	-0.416	-0.559	0.143	0.142

Robustness: Fixed Effects

Table 8: Conditional and Unconditional β – *convergence*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		HC PWT			HC BL		
	β	β^*	λ	δ	β^*	λ	δ
1960s	-1.314^a	-1.297^a	0.722	0.009	-1.078^a	-0.775	0.005
1970s	-1.376^a	-1.470^a	0.914	0.003	-1.403	0.191	-0.002
1980s	-1.748^a	-2.347^a	3.899^a	0.012	-2.220^a	3.251^a	-0.001
1990s	-1.697^a	-1.595^a	0.130	0.014^c	-1.397^a	-1.503	-0.003
2000s	-2.288^a	-3.090^a	4.891^a	0.007	-2.882^a	3.780^a	-0.006
2010s	-2.328^a	-2.994^a	4.208^a	0.001	-2.859^a	3.591^a	-0.018^b
Constant	1.540^a	1.665^a	1.665^a	0.391^a	1.573^a	1.573^a	0.403^a
R2	0.436	0.469	0.469	0.851	0.466	0.466	0.872
Obs	821	821	821	821	821	821	821
Countries	140	140	140	140	140	140	140

Robustness: Fixed Effects

Table 9: Decomposition of β – *convergence*

	(1)	(2)	(3)	(4)	(5)
	Controlling for Human Capital (HC PWT)				
	β^{OLS}	β^{FE}	β^{FE}_{H}	$(\beta^{OLS}-\beta^{FE})$	$(\beta^{FE}-\beta^{FE}_{H})$
2000s	-0.575	-2.288	-3.090	1.713	0.802
2010s	-0.440	–2.328	-2.994	1.888	0.667
	Controlling for Institutions (Democracy)				
	β^{OLS}	β^{FE}	β^{FE}_{IN}	$(\beta^{OLS}-\beta^{FE})$	$(\beta^{FE}-\beta^{FE}_{IN})$
2000s	-0.629	-3.013	-2.997	2.384	-0.016
2010s	-0.436	-3.024	-3.019	2.588	-0.005

Robustness: Regional dummies

Table 10: Decomposition of $\beta - convergence$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	β	β^*	$(\beta - \beta^*)$	$(\lambda \times \delta)$	β	β^*	$(\beta - \beta^*)$	$(\lambda \times \delta)$
	Controlling for Human Capital							
	HC PWT				HC BL			
2000s	-1.071	-1.477	0.406	0.327	-1.071	-1.465	0.394	0.331
2010s	-1.019	-1.202	0.183	0.199	-1.019	-1.249	0.230	0.221
	Controlling for Institutions							
	Democracy				Political Rights Index			
2000s	-1.089	-1.038	-0.051	-0.010	-1.069	-1.048	-0.021	0.065
2010s	-0.978	-0.927	-0.051	-0.023	-0.989	-1.036	0.047	0.102

Conclusions

- This paper shows evidence of $\sigma-$convergence and $\beta-$convergence in human capital starting around the end of the 1970s.
- Convergence in human capital started well before the new process of unconditional convergence in income levels initiated around 2000s.
- The coefficient of $\beta-$convergence in per capita income conditional to human capital is twice as high as the coefficient of unconditional $\beta-$convergence.
- Our results are robust to alternative measures of per capita income, are not driven by the role of institutions and hold when we control for fixed effects and regional dummies.