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Economic Catch-Up between Southern and Eastern Mediterranean Countries and Emerging Asian Economies: The Role of Human Capital

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Abstract. This article examines the dynamics of economic convergence between the Southern and Eastern Mediterranean Countries (SEMCs) and the Emerging Asian Economies (EAEs) over the period 2000–2022, with a specific focus on the role of human capital. Using an econometric approach based on the conditional convergence model and panel data, the results reveal the existence of a catch-up process reinforced by investment in human capital. Human capital, measured through a composite index of education and health developed using the Principal Component Analysis (PCA) method, stimulates economic growth and accelerates the reduction of development gaps. These findings highlight the strategic importance of education and health policies in promoting rapid and sustainable catch-up among developing countries. The study also opens avenues for integrating institutional and structural variables in future analyses of economic convergence.

Keywords. Economic catch-up, Human capital, β-Convergence, SEMCs, EAEs, Dynamic panel

Introduction

The dynamics of economic catch-up constitute a fundamental challenge for developing countries, particularly those in the Southern and Eastern Mediterranean region (SEMCs). In a context of global economic transformation, accelerating the convergence process toward the income levels of the Emerging Asian Economies (EAEs) has become a strategic priority.

While economic growth theory (Solow, 1956 ; Barro & Sala-i-Martin, 1992) posits a natural tendency toward convergence under specific conditions, recent studies have emphasized the critical role of structural factors—particularly human capital—in explaining persistent regional disparities.

Human capital, defined as the stock of knowledge, skills, and abilities that contribute to economic productivity (Lucas, 1988 ; Romer, 1990), plays a decisive role in accelerating growth and development. From this perspective, the article investigates whether SEMCs are converging toward the EAEs and evaluates to what extent investment in human capital serves as a significant lever in this process.

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To address this issue, the study applies an econometric analysis using conditional convergence models enriched with human capital indicators. The results shed light on the policy implications for fostering inclusive and sustainable growth in the region.

3. Theoretical Foundations of Economic Catch-Up and Convergence

The analysis of economic catch-up finds its roots in **neoclassical growth models** and later expanded to **endogenous, Schumpeterian, and institutional approaches**. The Solow model (1956) provides the foundational framework: under the assumption of diminishing returns to capital and exogenous technological progress, economies tend toward a steady state, implying **conditional convergence** of income levels when they share similar fundamentals—such as savings rates, population growth, and technology. Within this framework, the speed of convergence depends on the gap from the steady-state level and the underlying structural parameters.

Empirical work by **Barro and Sala-i-Martin (1992)** formalized this intuition through the concepts of **β-convergence** (a negative coefficient on the initial income variable) and **σ-convergence** (a reduction in income dispersion across countries), demonstrating that convergence is generally conditional rather than absolute.

The so-called **« augmented Solow model »** of **Mankiw, Romer, and Weil (1992)** explicitly introduces human capital as a production factor, strengthening the model's empirical validity and explaining persistent income gaps when human capital accumulation differs across countries. Econometrically, Islam (1995) emphasized that panel data estimations with fixed effects significantly alter the measurement of convergence speed, underlining the need to rigorously control for unobserved heterogeneity. Sala-i-Martin (1996) systematized β-convergence tests and proposed broad cross-sectional comparisons, while **Bernard and Durlauf (1996)** criticized naïve interpretations and introduced the notion of **stochastic convergence**, focusing on the joint dynamics of time series.

Beyond the neoclassical framework, the literature highlights the **advantage of backwardness** and **technological diffusion**. Pioneering contributions by **Gerschenkron (1962)** and **Abramovitz (1986)** argue that a « backward » country can grow faster through technological catch-up, provided it possesses sufficient **social capability**, that is, strong institutions, education systems, infrastructure, and governance. In the same spirit, technology diffusion models clarify the mechanisms of catch-up : **Nelson and Phelps (1966)** demonstrate that human capital enhances the ability to adopt advanced technologies, a concept extended by **Comin and Hobijn (2010)** in contemporary diffusion models.

Endogenous growth theories shifted the focus toward internal determinants of technological progress. In **Lucas (1988)**, human capital accumulation generates externalities that sustain self-reinforcing growth ; in **Romer (1990)**, knowledge and innovation (in the form of ideas and variety) are at the heart of a cumulative process. The **Schumpeterian perspective** of **Aghion and Howitt (1992)** emphasizes creative destruction and innovation incentives ; applied to catch-up, it suggests that proximity to the technological frontier changes the nature of effective policies (general education versus advanced skills, competition policy, innovation finance).

At the global level, observed convergence dynamics have been far from uniform. **Baumol (1986)** initially found convergence among industrialized countries, but **Pritchett (1997)** described « *divergence, big time* » among large groups of developing nations. **Quah (1996)** documented bimodal income distributions ("twin peaks"), suggesting the existence of

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convergence clubs rather than a single global convergence path. Methodologically, **Phillips and Sul (2007)** proposed a non-parametric aggregation approach capable of endogenously identifying convergence clubs and testing whether subgroups of countries follow specific trajectories.

The magnitude and sustainability of catch-up are also conditioned by **institutions and social infrastructure. Hall and Jones (1999)** linked productivity differences to institutions and policy environments; **Acemoglu, Johnson, and Robinson (2001, 2002)** isolated the role of **inclusive institutions** in shaping long-term development trajectories; and **Rodrik, Subramanian, and Trebbi (2004)** ranked institutions above geography and trade integration, concluding that institutions are the primary determinant of prosperity. These findings connect the neoclassical framework of conditional convergence with deep structural heterogeneity : without conducive institutions, technological adoption and human capital accumulation remain constrained, weakening the catch-up process.

Evolutionary and techno-gap approaches emphasize the cumulative nature of productive capabilities. **Fagerberg (1994)** and **Verspagen (1991)** show that the technology gap, absorptive capacity, and national innovation systems determine relative growth rates. Within this framework, trade openness and integration into global value chains can accelerate technological diffusion **(Frankel and Romer, 1999)**, though their effects remain mediated by human capital and institutional quality.

For regions such as the SEMCs, the literature suggests that successful catch-up relative to the EAEs depends simultaneously on :

Sustained accumulation of human capital (secondary and higher education, health),

Pro-market and pro-innovation institutions, and

An absorptive capacity that enables full exploitation of technological diffusion.

Human capital thus emerges as a **central determinant of growth and catch-up**, through its direct productivity effects, externalities, and complementarities with innovation and institutions.

At the microeconomic level, **Schultz (1961), Becker (1964)**, and **Mincer (1974)** conceptualized investment in education as a cost-benefit decision, linking years of schooling to earnings through the wage function. At the macroeconomic level, human capital increases factor productivity and allocative efficiency, as confirmed by the **augmented Solow model** (Mankiw, Romer & Weil, 1992).

Endogenous models demonstrate how education and skill accumulation sustain self-perpetuating growth : **Lucas (1988)** highlights learning externalities (*learning-by-doing*, *learning-by-schooling*), while **Romer (1990)** links knowledge, a non-rival factor, to variety expansion and R&D-driven innovation. In the technological adoption perspective, **Nelson and Phelps (1966)** and later **Benhabib and Spiegel (1994)** formalized the role of education in enhancing absorptive capacity, a key factor in catching up with the technological frontier.

Empirically, extensive macroeconomic evidence supports a positive correlation between education and long-term growth. **Barro (1991, 1997)** found that higher secondary and tertiary education levels significantly boost growth when controlling for fundamentals (investment, demography, macroeconomic stability). **Cohen and Soto (2007)** improved the robustness of estimates by refining measures of educational attainment. However, debates persist: **Bils and Klenow (2000)** questioned causality, suggesting that growth may drive education; **Krueger and Lindahl (2001)** confirmed positive but specification-sensitive effects; and **Pritchett (2001)** noted that weak institutions and unproductive labor markets can nullify education's macroeconomic impact. At the micro level, **Psacharopoulos and Patrinos (2004)**

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summarized substantial private returns to schooling, supporting the notion that under sound institutions, these returns translate into aggregate gains.

A key turning point lies in the **quality of human capital. Hanushek and Woessmann (2008, 2012)** showed that **cognitive skills**, rather than years of schooling alone, explain long-term growth. Mere "quantity" of schooling without learning quality does not guarantee macroeconomic gains. This reconciles the divergent findings of micro and macro studies: education fosters growth when it builds market-relevant and innovation-oriented competencies.

Human capital also encompasses **health**, which affects productivity, labor supply, and skill accumulation. **Strauss and Thomas (1998)** demonstrated strong micro-level links between health and productivity, while **Weil (2007)** and **Bloom, Canning, and Sevilla (2004)** identified macroeconomic channels through which improved health indicators enhance growth via productivity and savings. From a demographic perspective, **Bloom and Canning (2000)** and **Bloom, Canning, and Chan (2006)** formalized the concept of the **demographic dividend** : when declining mortality and fertility coincide with a more skilled working-age population, age structure becomes a growth lever. Persistent regional disparities thus stem from divergent education and health trajectories and from the varying capacity of economies to integrate human capital stocks into dynamic production systems.

The effects of human capital are also **contextual and nonlinear**. **Moretti (2004)** identified local externalities of human capital : a higher share of educated workers raises the productivity of all through knowledge spillovers, social learning, and network complementarities. In frontier economies, **Aghion and Howitt (2006)** argued that the **composition of human capital**, general versus advanced skills, must adapt to a growth regime driven by innovation rather than imitation, calling for differentiated policies depending on the distance to the frontier. Moreover, aggregate impacts are mediated by institutions : inclusive institutions and competitive markets facilitate the transformation of skills into productivity (Hall & Jones, 1999), while inefficiency, weak governance, and labor market segmentation may neutralize potential gains (Pritchett, 2001).

Transversal dimensions, such as **gender inequality in education (Klasen, 2002), education-employment mismatch**, and **brain drain (Docquier & Rapoport, 2012)**, further explain heterogeneity in outcomes.

Applied to the catch-up process between **SEMCs** and **EAEs**, this body of literature suggests that **secondary education**, the foundation of technical and cognitive skills, and the **quality of learning** (STEM and digital skills) play a disproportionate role in facilitating technology adoption and global value chain integration. Their impact is magnified when educational reforms align with health improvements, institutional quality, and industrial and innovation policies that transform skills into total factor productivity.

Within this framework, the rise in human capital affects both the **speed of conditional convergence** and the **steady-state level of income**, accelerating the catch-up process whenever these complementarities are present.

4. Methodology

To test the existence of an economic convergence process between SEMCs and EAEs, and to assess the role of human capital in this process, the following model was estimated:

$$g_{i,t}=\alpha+\beta\log(PIB\_hab_{i,t0})+\gamma_1 CapitalHumain_{i,t0}+\gamma_2[\log(PIB\_hab_{i,t0})\times CapitalHumain_{i,t0}]+\mu_i+\lambda t+\varepsilon_{i,t}$$

Where :

$g_{i,t}$: Average annual growth rate of per capita GDP for country *i* during period *t*;

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PIB_hab$_{i,t0}$: Initial GDP per capita level ;

CapitalHumain$_{i,t0}$: A synthetic human capital indicator composed of an educational dimension and a health dimension, constructed by the authors using Principal Component Analysis (PCA) ;

μ_i : Country-specific fixed effects (capturing unobservable characteristics that remain constant over time) ;

λt : Time fixed effects (capturing shocks common to all countries during the period) ;

$\varepsilon_{i,t}$: Random error term.

The study covers two groups :

SEMCs : Morocco, Tunisia, Egypt, and Jordan.

EAEs : China, Indonesia, Vietnam, the Philippines, and Malaysia. The observation period spans 2000–2022, using annual data.

5. Results of empirical stydy

Table 1 : Regression Results – Convergence Equation

Independent Variable	Coefficient	Std. Error	t-Statistic	Significance
Log (Initial GDP per capita)	-0.045	0.012	-3.75	***
Human Capital	0.023	0.009	2.56	**
Interaction (Log GDP × Human Capital)	-0.008	0.003	-2.67	**
Country Fixed Effects	Yes	Significant at 1%, ** at 5%, * at 10%.		
Time Fixed Effects	Yes			
Adjusted R^2	0.62			
Observations	207			

Source : STATA 14.2

The econometric results derived from the estimation of the convergence equation reveal several key insights into the dynamics of economic catch-up between the Southern and Eastern Mediterranean countries (SEMCs) and the Emerging Asian Economies (EAEs).

First, the negative and statistically significant coefficient of the logarithm of initial GDP per capita (–0.045 ; t = –3.75; p < 0.01) confirms the existence of a process of conditional β-convergence. In other words, countries with initially lower levels of per-capita income tend to experience faster subsequent growth, ceteris paribus. This finding is consistent with the seminal work of Barro and Sala-i-Martin (1992), who demonstrated that less-developed economies progressively converge toward a steady-state level of income, provided that they share similar structural characteristics.

Second, human capital displays a positive and significant coefficient (0.023; t = 2.56; p < 0.05), underscoring its decisive role in stimulating economic growth. This result confirms that investment in human capital, through education, training, and skills enhancement, acts as a fundamental lever for accelerating the convergence process. It is in line with the predictions of

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endogenous growth theory (Lucas, 1988 ; Romer, 1990), which identifies human capital as a key determinant in the accumulation of knowledge and technological innovation.

Conversely, the interaction term between initial GDP and human capital is negative and significant (–0.008 ; $t = –2.67$; $p < 0.05$). This relationship suggests that although human capital fosters overall growth, its effect on convergence tends to diminish as the initial income level increases. In other words, human capital appears to play a stronger role in low-income economies, where it contributes more significantly to narrowing development gaps. This finding highlights the decreasing marginal effectiveness of human capital in more advanced economies, where the returns to education and training are already relatively stable.

The inclusion of country and time fixed effects controls for unobserved heterogeneity across countries and over time. The adjusted coefficient of determination (adjusted $R^2 = 0.62$) indicates that the model explains approximately 62 percent of the variation in per-capita GDP growth, which is satisfactory for a macro-panel analysis.

6. Discussion

The results confirm the hypothesis of economic convergence between the Southern and Eastern Mediterranean countries and the Emerging Asian Economies, consistent with the framework proposed by Barro and Sala-i-Martin (1992). The negative sign of the initial GDP coefficient reflects a catch-up dynamic, whereby countries with lower income levels at the beginning of the period experience faster growth rates thereafter.

The role of human capital emerges as central in this process. Its positive effect on growth aligns with the predictions of endogenous growth models (Lucas, 1988 ; Romer, 1990), which posit that the accumulation of skills and knowledge functions as an internal engine of economic development. Countries with higher levels of secondary education enrollment exhibit stronger economic performance, emphasizing the strategic importance of educational investment.

The significant and negative interaction between human capital and initial GDP highlights an amplifying mechanism: not only does human capital enhance growth, but it also facilitates a faster catch-up among lagging economies. This result suggests that public policies focused on improving access to education, raising skill levels, and enhancing health conditions are likely to reduce developmental disparities more effectively across regions.

However, despite these encouraging findings, several limitations must be acknowledged. Other structural factors, such as institutional quality, trade openness, or political stability, were not explicitly incorporated into the model. Future research could extend the analysis by integrating these dimensions to refine the understanding of convergence trajectories and their underlying mechanisms.

7. Conclusion

The empirical analysis conducted in this study confirms the existence of an economic convergence process between the Southern and Eastern Mediterranean countries and the Emerging Asian Economies over the period 2000–2022. This result is consistent with the theoretical predictions of neoclassical growth models and is further reinforced by the inclusion of human capital as a key explanatory variable.

The findings highlight the pivotal role of human capital, measured through secondary education enrollment, in accelerating economic catch-up. Human capital not only directly stimulates per-capita GDP growth but also acts as a catalyst for the convergence process, helping to reduce income disparities across countries more rapidly.

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These results carry significant policy implications. In an increasingly competitive global environment, SEMCs must intensify their investments in education, health, and vocational training to promote sustained and inclusive catch-up. Human capital thus emerges as a strategic lever, essential not only for stimulating national growth but also for fostering deeper integration into the global economy.

Future research could build upon this work by incorporating additional structural variables such as governance quality, technological innovation, and trade openness to capture more comprehensively the complex developmental trajectories of emerging economies.

8. References

[1] Abramovitz, M. (1986). Catching up, forging ahead, and falling behind. *The Journal of Economic History, 46*(2), 385-406.

[2] Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development : An empirical investigation. *American Economic Review, 91*(5), 1369-1401.

[3] Acemoglu, D., Johnson, S., & Robinson, J. A. (2002). Reversal of fortune : Geography and institutions in the making of the modern world income distribution. *Quarterly Journal of Economics, 117*(4), 1231-1294.

[4] Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica, 60*(2), 323-351.

[5] Aghion, P., & Howitt, P. (2006). Appropriate growth policy : A unifying framework. *Journal of the European Economic Association, 4*(2–3), 269–314.

[6] Barro, R. J. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics, 106*(2), 407–443.

[7] Barro, R. J. (1997). *Determinants of Economic Growth: A Cross-Country Empirical Study*. MIT Press.

[8] Barro, R. J., & Sala-i-Martin, X. (1992). Convergence. *Journal of Political Economy, 100*(2), 223-251.

[9] Baumol, W. J. (1986). Productivity growth, convergence, and welfare: What the long-run data show. *American Economic Review, 76*(5), 1072-1085.

[10] Becker, G. S. (1964). *Human Capital : A Theoretical and Empirical Analysis, with Special Reference to Education*. University of Chicago Press.

[11] Benhabib, J., & Spiegel, M. M. (1994). The role of human capital in economic development: Evidence from aggregate cross-country data. *Journal of Monetary Economics, 34*(2), 143–173.

[12] Bernard, A. B., & Durlauf, S. N. (1996). Interpreting tests of the convergence hypothesis. *Journal of Econometrics, 71*(1-2), 161-173.

[13] Bils, M., & Klenow, P. J. (2000). Does schooling cause growth? *American Economic Review, 90*(5), 1160–1183.

[14] Bloom, D. E., & Canning, D. (2000). The health and wealth of nations. *Science, 287*(5456), 1207–1209.

[15] Bloom, D. E., Canning, D., & Chan, K. (2006). Higher education and economic development in Africa. *World Bank!* (Background paper).

[16] Bloom, D. E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth : A production function approach. *World Development, 32*(1), 1–13.

[17] Cohen, D., & Soto, M. (2007). Growth and human capital : Good data, good results. *Journal of Economic Growth, 12*(1), 51–76.

Technium Social Sciences Journal
Vol. 78, 140-148, December, 2025
ISSN: 2668-7798
www.techniumscience.com

[18] Comin, D., & Hobijn, B. (2010). An exploration of technology diffusion. *American Economic Review, 100*(5), 2031-2059.
[19] Docquier, F., & Rapoport, H. (2012). Globalization, brain drain, and development. *Journal of Economic Literature, 50*(3), 681–730.
[20] Fagerberg, J. (1994). Technology and international differences in growth rates. *Journal of Evolutionary Economics, 4*(3), 259-284.
[21] Frankel, J. A., & Romer, D. (1999). Does trade cause growth? *American Economic Review, 89*(3), 379-399.
[22] Gerschenkron, A. (1962). *Economic Backwardness in Historical Perspective*. Harvard University Press.
[23] Hall, R. E., & Jones, C. I. (1999). Why do some countries produce so much more output per worker than others ? *Quarterly Journal of Economics, 114*(1), 83-116.
[24] Hall, R. E., & Jones, C. I. (1999). Why do some countries produce so much more output per worker than others ? *Quarterly Journal of Economics, 114*(1), 83–116.
[25] Hanushek, E. A., & Woessmann, L. (2008). The role of cognitive skills in economic development. *Journal of Economic Literature, 46*(3), 607–668.
[26] Hanushek, E. A., & Woessmann, L. (2012). Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation. *Journal of Economic Growth, 17*(4), 267–321.
[27] Islam, N. (1995). Growth empirics: A panel data approach. *Quarterly Journal of Economics, 110*(4), 1127-1170.
[28] Klasen, S. (2002). Low schooling for girls, slower growth for all ? Cross-country evidence on the effect of gender inequality in education on economic development. *World Bank Economic Review, 16*(3), 345–373.
[29] Krueger, A. B., & Lindahl, M. (2001). Education for growth : Why and for whom? *Journal of Economic Literature, 39*(4), 1101–1136.
[30] Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics, 22*(1), 3-42.
[31] Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics, 22*(1), 3–42.
[32] Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics, 107*(2), 407-437.
[33] Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics, 107*(2), 407–437.
[34] Mincer, J. (1974). *Schooling, Experience, and Earnings*. Columbia University Press.
[35] Moretti, E. (2004). Estimating the social return to higher education: Evidence from longitudinal and repeated cross-sectional data. *Journal of Econometrics, 121*(1–2), 175–212.
[36] Nelson, R. R., & Phelps, E. S. (1966). Investment in humans, technological diffusion, and economic growth. *American Economic Review, 56*(1/2), 69-75.
[37] Nelson, R. R., & Phelps, E. S. (1966). Investment in humans, technological diffusion, and economic growth. *American Economic Review, 56*(1/2), 69–75.
[38] Phillips, P. C. B., & Sul, D. (2007). Transition modeling and econometric convergence tests. *Econometrica, 75*(6), 1771-1855.
[39] Pritchett, L. (1997). Divergence, big time. *Journal of Economic Perspectives, 11*(3), 3-17.

Technium Social Sciences Journal
Vol. 78, 140-148, December, 2025
ISSN: 2668-7798
www.techniumscience.com

[40] Pritchett, L. (2001). Where has all the education gone ? *World Bank Economic Review, 15*(3), 367–391.
[41] Psacharopoulos, G., & Patrinos, H. A. (2004). Returns to investment in education: A further update. *Education Economics, 12*(2), 111–134.
[42] Quah, D. (1996). Twin peaks: Growth and convergence in models of distribution dynamics. *The Economic Journal, 106*(437), 1045-1055.
[43] Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions rule: The primacy of institutions over geography and integration in economic development. *Journal of Economic Growth, 9*(2), 131-165.
[44] Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy, 98*(5), S71-S102.
[45] Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy, 98*(5), S71–S102.
[46] Sala-i-Martin, X. (1996). The classical approach to convergence analysis. *The Economic Journal, 106*(437), 1019-1036.
[47] Schultz, T. W. (1961). Investment in human capital. *American Economic Review, 51*(1), 1–17.
[48] Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics, 70*(1), 65-94.
[49] Strauss, J., & Thomas, D. (1998). Health, nutrition, and economic development. *Journal of Economic Literature, 36*(2), 766–817.
[50] Verspagen, B. (1991). A new empirical approach to catching up or falling behind. *Structural Change and Economic Dynamics, 2*(2), 359-380.
[51] Weil, D. N. (2007). Accounting for the effect of health on economic growth. *Quarterly Journal of Economics, 122*(3), 1265–1306.