Thematic Article

Competence and economy: International adult literacy assessments, knowledge capital and economic performance

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Abstract

After reviewing the measurement of adult literacy (IALS and PIAAC), the paper examines how its outcome – referred to as knowledge capital – differs from human capital. The paper also analyses the relationship between adult literacy and economic performance, briefly highlighting the debates surrounding this issue. In addition, the article examines the relationship between knowledge capital and economic development in Hungary. Finally, the study discusses adult education as a possible policy response. The analysis points to the relatively weak performance of Hungarian adult literacy competence in international comparison. This highlights the potential importance of adult education in improving competitiveness, employability, and democratic participation.

Keywords: adult literacy measurement; PIAAC; knowledge capital; economic development

Introduction

At the end of 2024, the report of the 2023 PIAAC survey was published, whose telling title draws attention to the significance of the research. (OECD 2024a) Several analyses have pointed out that the results of adult literacy tests are related to economic development and its various aspects. One early work Coulombe et al. (2004), and several other studies are also noteworthy, in addition to the aforementioned OECD report, OECD (2024b), Hanushek et al. (2015), Gustafsson (2016), and Schwerdt et al. (2020). Hanushek and Woessmann (2008; 2020) argue that the cognitive skills of the population – referred to as a nation's "knowledge capital" – are a more relevant indicator of a country's economic development potential than human capital.

In this paper, after reviewing the measurement of adult literacy, we examine how its results relate to economic growth, what knowledge capital means, how it differs from human capital, and we also discuss domestic data and characteristics. In the study, the term cognitive skills refers to individual competencies measured by literacy and numeracy assessments. The expression cognitive skill base is used to denote the aggregate distribution of these skills at the societal or national level. Following the OECD-related literature, the term knowledge capital refers to the economically relevant stock of such competencies embodied in the adult population.

Although the literature on knowledge capital primarily focuses on long-term economic growth rates, the present analysis examines cross-sectional associations between adult literacy performance and the level of GDP per capita. Consequently, the empirical results refer to differences in economic development levels rather than to dynamic growth processes over time. The findings should therefore be interpreted within a development-level framework rather than as direct evidence on growth rates.

This paper contributes to the literature in three ways. First, it compares the relationship between adult literacy performance and economic development across three major international adult skill assessment waves (IALS, PIAAC first cycle, and PIAAC 2023), thereby examining the stability of the association over time.

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Second, the study places Hungary's adult literacy performance into a long-term comparative international perspective, with particular attention to the distribution of low-performing adults. Third, unlike strongly causal interpretations in parts of the knowledge capital literature, the paper adopts a descriptively oriented and methodologically cautious approach, focusing on stable macro-level associations rather than causal claims.

Measuring Adult Literacy

The Programme for the International Assessment of Adult Competencies (PIAAC) is a programme of assessment and analysis of adult skills (survey of adults aged 16-65 years). The Survey measures adults' proficiency in key information-processing skills - literacy, numeracy and problem solving – which represent skills needed for individuals to participate in society and for economies to prosper[2]. As Martin (2018) writes, the PIAAC survey built on the experience gained from two previous surveys of adult skills in OECD countries. „The first such survey – the International Adult Literacy Survey (IALS)—was developed as a collaborative effort between OECD, Statistics Canada and the US-based Educational Testing Service. IALS assessed three skill domains: prose literacy, document literacy and quantitative literacy. It was accompanied by a background questionnaire designed to elicit information about respondents' socio-demographic, education, training and labour market histories. In total, 22 OECD countries took part in IALS over the period 1994 to 1998" (Martin, 2018, p. 6). Hungary was among the 22 countries. The IALS survey was followed by the ALL (Adult Literacy and Lifeskills) survey, which also assessed skills in the areas of prose and document comprehension, but the area of quantitative literacy was replaced by numeracy, and a new area of problem solving was added to the survey, in which only 9 OECD countries participated between 2002 and 2007 (including Hungary). PIAAC was also established at the initiative of the OECD – but with the participation of the European Commission (Martin, 2018). The first cycle of the survey started in 2008 – in this case, Hungary only joined the third data collection wave in 2015. Preparations for the second cycle of the survey began in 2019 with the participation of 33 countries and continued until the end of 2022 (KSH, n.d.). The survey was divided into two cycles: "The first cycle of PIAAC measured four groups of basic cognitive skills frequently used in everyday life: reading comprehension, basic reading skills, numeracy and problem-solving skills in an information technology environment. In the second cycle, in addition to measuring reading comprehension, reading and numeracy skills, adaptive problem-solving skills were examined" (KSH, n.d. para. 2-3).

What is PIAAC for?

The IES-NCES [Institute of Education Science - National Center for Education Statistics] defines the purpose of PIAAC as follows: "PIAAC is designed to measure adult skills across a wide range of abilities, from basic reading and numerical calculations to complex problem solving. To achieve this, PIAAC assesses literacy, numeracy, and problem solving. The tasks developed for each domain are authentic, culturally appropriate[3], and drawn from real-life situations expected to be important or relevant in different contexts. The content and questions within these tasks reflect the purposes of adults' daily lives across different cultures, as well as the changing nature of complex, digital environments," (NCES, n.d., para. 1) According to the OECD (n.d.), the purpose of the Programme for the International Assessment of Adult Competencies (PIAAC) is " to allow cross-cultural and international comparisons of results of skill-formation systems and their outcomes, and international benchmarking regarding adult skills; and, to allow policy makers to monitor the development of key aspects of human capital in their countries."

OECD (2019) compares the Adult Skills Assessment[4] and the measurement of human capital. The paper concludes that although human capital is a reasonable and comprehensive measure of educational attainment, it has some well-documented limitations:

- Educational attainment only certifies knowledge and skills acquired during education. It is an important feature of an individual's skills, especially for young adults.
- Skills attested by educational attainment change over time, can be lost, maintained and developed.
- The quality of education and training offered at different levels of education and training systems can vary significantly across and within countries over time. Thus, the level of knowledge and skills attested by qualifications of the same type and level can vary greatly.

[2] https://www.oecd.org/en/about/programmes/piaac.html
[3] In this formulation of the NCES description, it refers to adaptation across different linguistic and national contexts.
[4] Survey of Adult Skills (PIAAC) 2013, 2016 and 2019 measurements

The paper compares the output of adult skills assessments (knowledge capital) and the measurement relevance of educational outcomes (human capital) based on four criteria. The four criteria are:

- Coverage: the extent to which the measure covers the different dimensions of human capital.
- Contextuality: the extent to which the measure covers the skills acquired in a given setting, such as an educational institution.
- Timeliness: the extent to which the measure is "current" as a measure of skills at the time the information is collected.
- Comparability: the extent to which the measure is comparable across countries and within countries over time.

The comparison is summarized in table form in Table 1.

Table 1. Comparison of direct measures from the Survey of Adult Skills (PIAAC) and qualifications on four criteria

	Direct assessment (Survey of Adult Skills)	**Qualifications**
Coverage (content)	Limited (only 3 cognitive skills tested)	Broad
Context dependence	Low	High
Currency	High	Variable (depends on the time elapsed since the respondent's highest qualification was completed
Comparability	High	Variable both between and within countries

Source: OECD (2019, Table 8.4, p. 107)

Ultimately, the paper emphasizes—based on previous OECD analyses—that direct skill assessments and educational attainment measure partly overlapping but not identical dimensions of human capital. Direct measurement of skills should therefore be regarded as complementing rather than substituting for educational attainment indicators.At the same time, Hanushek and Woessmann (2020) argue that the cognitive skills of the population—referred to as a nation's "knowledge capital"—are a more relevant indicator of a country's economic development potential than human capital.

In this paper, knowledge capital is used in the sense developed by Eric Hanushek and Ludger Woessmann, referring to the aggregate stock of cognitive skills of the adult population as measured by standardized competence assessments (e.g. PISA, PIAAC). In this interpretation, knowledge capital is not identical with years of schooling or formal qualifications; rather, it captures the quality-adjusted cognitive skill base of the labour force.

However, it is important to note that PIAAC measures only selected domains of cognitive proficiency (literacy, numeracy and adaptive problem solving). Therefore, in empirical terms, this study treats national mean literacy performance as a proxy indicator of knowledge capital, not as its exhaustive measure. Knowledge capital, in a broader theoretical sense, may also include non-cognitive skills, domain-specific expertise, and innovation-related capabilities, which are not captured by PIAAC.

Accordingly, throughout this paper, the term knowledge capital refers to the measurable cognitive skill component of human capital as reflected in international adult skill assessments.

Lessons from international studies and debates on knowledge capital

The best-known theorists on the relationship between cognitive abilities measured in competency assessments and economic development are Erik Hanushek and Ludger Woessmann. The findings of the authors' three widely known publications (Hanushek and Woessmann 2008; 2015; and OECD, 2015) have been adopted by the OECD and the World Bank. The authors assume that high performance in PISA predicts a high level of knowledge capital. In their work, the authors demonstrate that PISA scores – which approximate the cognitive level of a given national workforce – determine economic growth. They do not simply claim that cognitive level is one factor in achieving higher economic growth (as mainstream human capital theorists claim, for example, Mankiw, 2007), but they demonstrate that PISA and PIAAC results determine economic growth and are causally related to it. This allows Hanushek and Woessmann to predict the future economic growth of countries, which would be achieved by gradually increasing students' test scores (Rappleye & Komatsu, 2019).

Hanushek and Woessmann (2020) provide a detailed analysis of the relationship between knowledge capital and economic development, while also highlighting the role of education policy. Their argument is that the traditional relationship between educational attainment and economic development may partly reflect reverse causality, since economically more developed societies tend to consume more education. In contrast,

they argue that there is "less reason to think that higher student achievement is caused by economic growth" (Hanushek & Woessmann, 2020, p. 176). They also emphasize that while educational attainment indicators mask qualitative differences across levels and fields of education, competency assessments make such differences measurable.In his article, Gustafsson (2016) draws the essentially logical conclusion based on a comparison of PISA and PIAAC results that the quality of school education (i.e. the competence results of students) has a lasting impact on the literacy and numeracy performance of adults.

Schwerdt et al. (2020) also point to the economic consequences of lagging behind in adult literacy, who, analyzing the results of the IALS study, write that in the long run, a 1% increase in literacy results in a 3% increase in GDP per capita. They emphasize that the relationship between labor productivity and literacy is equally strong. They also emphasize that, catching up adults who are lagging behind in literacy promises greater results than developing higher performers.

It is also worth citing another paper by Hanushek and Woessmann, in which they write that the results show that education policy is closely related to long-term economic growth. The eloquent title of their joint paper from 2012 also emphasizes this: "Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation". (Hanushek & Woessmann, 2012)

However, there have been serious counterarguments to the theory of the relationship between adult competences and economic development. As Williams (2021) writes, many researchers question the validity of Erik Hanushek and Ludger Woessmann's and the OECD's claims that there is a causal relationship between cognitive development and economic growth. Based on his calculations and analysis, he concludes that the Hanushek-Woessmann theory of knowledge capital is "degenerate".

Rappleye and Komatsu (2019) conclude from their analysis that there is no strong relationship between average PIAAC scores and growth in GDP per capita. Finally, they argue that the knowledge capital theory shows signs of theoretical degeneration.

Nevertheless, despite the controversies, the Hanushek-Woessmann approach is relevant in more recent publications by both the OECD and the World Bank. (See Égert et al., 2022, or the World Bank's Human Capital Index, of which PISA results are an important element, Kray, 2019).

The debate may be summarised along three key dimensions:

Strength of association – While Eric Hanushek and Ludger Woessmann argue that cognitive skills strongly predict long-term growth, critics such as John Rappleye question the empirical robustness of this relationship.

Causality – Proponents claim that skill improvements drive growth, whereas critics highlight endogeneity and model specification problems.

Policy implications – The knowledge capital approach supports strong education reform agendas, while critics warn against over-reliance on test-based indicators.

The present study does not attempt to adjudicate this theoretical dispute. Instead, it examines whether the macro-level association appears stable across three adult skill survey waves, while refraining from strong causal inference.

Methods

Data sources

- The empirical analysis relies on three large-scale international adult skills assessments organised by the Organisation for Economic Co-operation and Development:
    - International Adult Literacy Survey (IALS, 1994–1998),
    - Programme for the International Assessment of Adult Competencies (PIAAC, first wave 2012–2017),
    - PIAAC second cycle (2023).
- Country-level mean literacy scores were obtained from OECD publications (OECD 2024a, Annex A).
- Economic development is measured using GDP per capita (constant 2015 US dollars) from the World Bank World Development Indicators database.

Sample and comparability

To enhance cross-wave comparability, the analysis focuses on the subset of countries participating in all relevant survey waves where data are available. Due to differences in participation across cycles (e.g. Belgium referring to Flanders only, UK referring to England only), strict longitudinal comparability is limited. These territorial differences should be taken into account when interpreting the results.

Given the relatively small number of countries (N≈17–18 depending on wave), the statistical power of the correlation estimates is limited, and the findings are interpreted primarily as descriptive macro-level associations.

Variables

- Literacy performance: national mean literacy score.
- Low-performance share: percentage of adults scoring at level 2 or below.
- Economic development: GDP per capita (constant 2015 USD).

GDP values are aligned as closely as possible to the assessment year of each survey wave. Minor discrepancies in timing do not materially affect the descriptive patterns.

It should be noted that GDP per capita is used as an indicator of the level of economic development, not as a measure of economic growth rates. The analysis therefore captures cross-country differences in economic performance at given points in time, rather than changes in growth trajectories.

Analytical strategy

The study applies:

- descriptive cross-country comparisons,
- ranking analysis,
- bivariate Pearson correlation coefficients,
- graphical inspection with linear trend lines.

Since the objective of the analysis is exploratory rather than causal, no multivariate regression models are estimated. The analysis instead focuses on the strength and stability of macro-level associations across time.It is important to stress that macro-level correlations between literacy performance and GDP per capita do not in themselves establish causal direction. Reverse causality (economic development improving educational quality), omitted institutional variables, or common structural determinants (e.g. governance quality, innovation systems, sectoral composition) may influence both variables simultaneously.

Moreover, given the relatively small number of observations, the correlation coefficients are sensitive to outliers (for example, Ireland or Switzerland in the 2023 data). The findings are therefore interpreted as descriptive macro-level associations rather than evidence of causal relationships. As the analysis relies on cross-sectional correlations, strong causal claims should be treated with methodological caution.

Analysis

Cross-country performance

Tables 2–3 summarize literacy performance and the share of low-performing adults. Nordic countries consistently lead, while Hungary and other Central/Eastern European countries remain below the OECD average. The distributional dimension, especially the proportion of low performers, is crucial for understanding functional literacy challenges.

Table 2. Results of competency assessments related to adult literacy

	IALS (1994-7)	**GDP per capita**		**PIAAC (2012)**	**GDP per capita**		**PIAAC (2023)**	**GDP per capita**
Sweden	305,5	33862,0	Finland	287,5	43507,9	Finland	302,7	45588,5
Norway	294,5	65197,9	Netherlands	284,0	44631,9	Sweden	284,1	54449,8
Denmark	289,0	46437,2	New Zealand	280,7	38639,4	Norway	282,8	78912,3
Finland	287,5	34457,5	Sweden	279,2	48788,9	Netherlands	282,3	51305,6
Netherlands	285,8	33054,4	Norway	278,4	73661,7	Denmark	279,6	61296,0
Germany	282,2	31609,1	Belgium	275,5	40074,5	Belgium	278,5	44731,0
Canada	278,9	32074,2	Czech Rep.	274,0	16772,4	Canada	273,0	44468,7
Belgium	277,1	31862,7	Canada	273,5	42320,6	UK	272,1	47322,7
Czech Rep	276,8	11850,8	UK	272,6	42802,0	Switzerland	270,9	89555,6
USA	273,5	41107,0	USA	270,9	58703,1	Germany	269,7	44336,8
Switzerland	271,8	67391,8	Denmark	270,8	51470,7	Czech Rep	265,2	20245,7
New Zealand	266,7	28571,4	Germany	269,8	40829,0	Ireland	263,3	91647,8
UK	266,4	33777,5	Poland	266,9	11542,2	New Zealand	259,6	41766,9
Ireland	264,2	26290,9	Ireland	266,5	47217,4	USA	259,3	65875,2
Hungary	**246,9**	**8282,4**	**Hungary**	**264,0**	**13628,4**	**Hungary**	**249,4**	**16282,8**
Italy	243,5	30892,2	Italy	250,5	31292,1	Italy	245,7	34088,1
Poland	232,2	5262,3	Chile	220,1	13433,9	Poland	235,7	17391,1
Chile	222,7	8287,5				Chile	217,9	14226,5
Average	270,3	31681,6	Average	269,7	38783,3	Average	266,2	47971,7

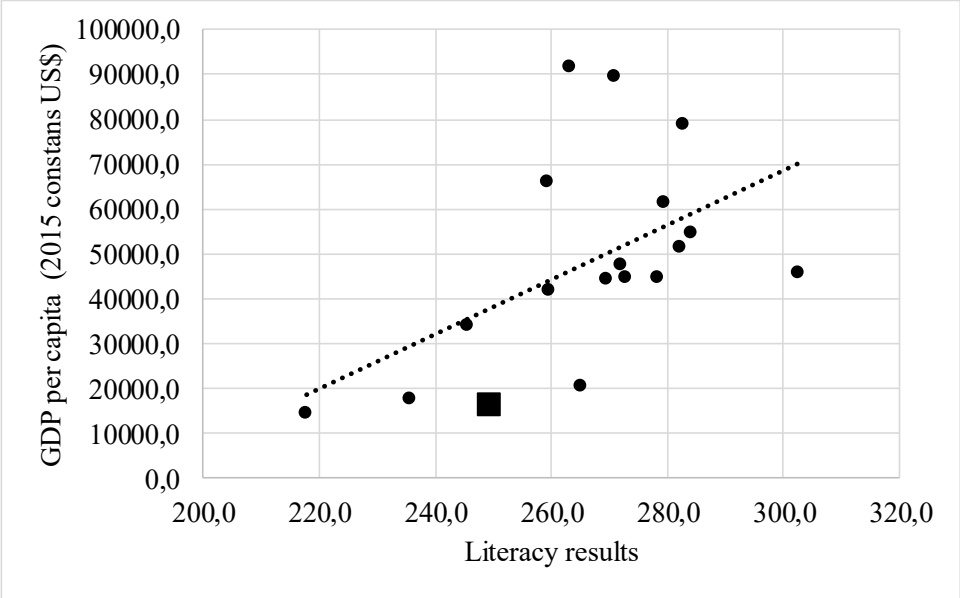
Source: OECD (2024a) Annex A, p.194. Table A.3.23 (L)
Note: UK = England only, Belgium = Flemish region only

Literacy and economic development

Figures 1–3 illustrate correlations between literacy scores and GDP per capita. Positive associations are observed across all survey waves. Deviations from the overall trend may be associated with structural or institutional factors beyond measured competencies, although measurement issues and differences in data collection or processing may also contribute to these patterns.

Appendix 1 and 2 report the correlations between competency assessments and GDP per capita. The estimated correlations are positive and statistically significant at the 5% level. Some contributions in the literature, including Hanushek and Woessmann, interpret these relationships in causal terms.

Figure 1. Relationship between PIAAC literacy scores and GDP per capita in 2023



Source: World Bank: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD (The black square is Hungary)
Note: GDP per capita (constant 2015 US$)

If we take a closer look at the reasons for Hungary's ranking, it is clear (Table 3) that in both the IALS and PIAAC 2023 surveys, Hungary was among the countries where two-thirds of the adults surveyed achieved only level 2 or lower in reading comprehension, meaning that they are among those who struggle with comprehension difficulties.

Table 3. Percentage of adults with literacy proficiency at level 2 or below

	IALS 94-97		**PIAAC 2012**		**PIAAC 2023**
Sweden	23,6	Finland	37,1	Finland	26,7
Norway	28,3	Netherlands	39,0	Sweden	37,0
Denmark	33,8	Sweden	42,3	Norway	38,4
Netherlands	35,8	New Zealand	42,8	Netherlands	39,5
Finland	35,8	Norway	43,4	Denmark	41,8
Canada	40,2	Belgium	46,0	Belgium	42,6
Belgium	42,5	Canada	48,5	Canada	47,8
Germany	43,0	Czech Rep.	49,6	Switzerland	48,4
Czech Rep.	46,2	Denmark	49,9	Germany	48,7
USA	46,3	UK	50,2	UK	48,9
Switzerland	47,0	USA	51,8	USA	55,7
UK	51,5	Germany	52,2	New Zealand	56,2
Ireland	54,3	Ireland	55,3	Czech Rep.	56,6
New Zealand	54,7	Poland	55,3	Ireland	58,7
Italy	68,3	**Hungary**	**57,6**	**Hungary**	**67,9**
Hungary	**72,4**	Italy	70,1	Italy	70,1
Poland	76,0	Chile	85,4	Poland	79,1
Chile	86,4			Chile	83,9

Source: OECD (2024a) Annex A, p. 195, Table A.3.25 (L)

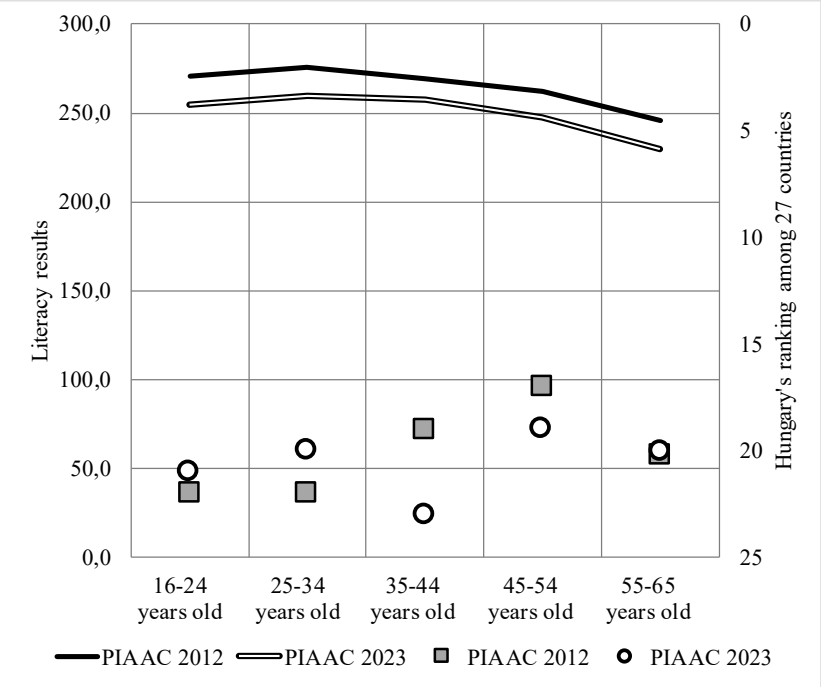
If we examine the results of the last two PIAAC measurements of Hungarian literacy and numeracy by age group, two things become clear. One is that the age-related trends for the two competencies differ somewhat: literacy scores peak in the 25-34 age group and then decline, while numeracy peaks at age 35-44 and then

declines. The other, truly striking difference is that the results in 2023 are 5-6% weaker than they were in 2012 (Figures 2 and 3).

Looking at Hungary's PISA results, we can probably expect a further decline in adults' reading and writing skills (if we believe the Gustafsson 2016 research cited earlier), as Hungary's PISA results have been declining since 2009 (see Appendix 3), and the quality of our education is also deteriorating (see Polónyi, 2023).

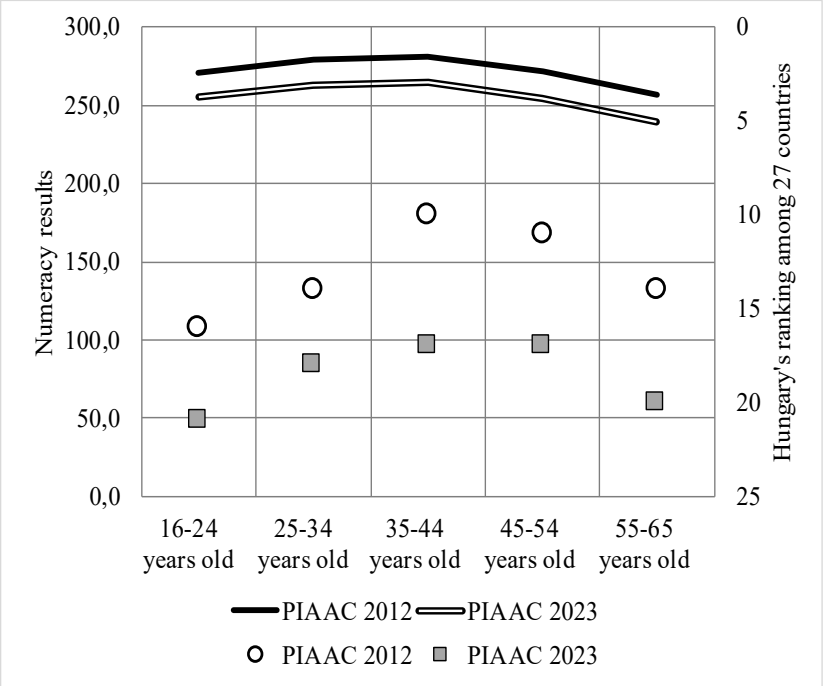
Hungary's relatively weak literacy outcomes may be associated with a range of structural and institutional characteristics discussed in the literature, including early tracking within the school system, regional inequalities, limited participation in adult learning, and comparatively low levels of employer-supported training. Demographic change and selective migration may also affect the aggregate distribution of skills. However, the present analysis does not allow the relative importance of these factors to be identified. The decline observed between 2012 and 2023 suggests that generational replacement contributes to improving adult literacy outcomes only if younger cohorts enter adulthood with stronger literacy skills than preceding generations. Recent PISA trends in Hungary, however, do not indicate such improvement.

Figure 2. Literacy results for major age groups in Hungary and rankings among the 27 participating countries



Source: Author's compilation based on OECD (2024a) Annex A, p 195, Table A.3.7(L)

Figure 3. Numeracy results and rankings of Hungarian age groups among the 27 participating countries



Source: Author's compilation based on OECD (2024a) Annex A, p. 195, Table A.3.7(N)

Discussion

While correlations are clear, the analysis does not establish causation. Omitted variables (institutional quality, sectoral composition, innovation intensity) may influence both literacy and economic outcomes. Nevertheless, the persistence of the relationship across time suggests that knowledge capital may represent an important dimension of economic potential.

Although the present analysis does not evaluate policy effectiveness directly, the observed literacy trends may indicate a potential role for adult education and lifelong learning policies in mitigating skill deterioration. This may be particularly relevant in Hungary, where the data suggest persistent weaknesses across cohorts. Previous studies and policy reports have emphasized that lifelong learning can contribute to employability, economic competitiveness, and social inclusion (EAEA, 2018; Ebner & Várkonyi, 2024).

Limitations

Several limitations of the present analysis should be acknowledged.

First, the empirical investigation relies on cross-sectional country-level data with a relatively small number of observations (N≈17–18 depending on survey wave). While correlation coefficients indicate a positive macro-level association between literacy performance and GDP per capita, the limited sample size constrains statistical power and the robustness of inference.

Second, the analysis does not employ multivariate regression techniques or identification strategies. No controls are introduced for potentially confounding structural factors such as institutional quality, innovation capacity, capital intensity, demographic structure, or labor market characteristics. Consequently, omitted variable bias cannot be ruled out.

Third, comparability across survey waves is imperfect. Although the International Adult Literacy Survey (IALS) and the Programme for the International Assessment of Adult Competencies (PIAAC) are designed to ensure measurement continuity, changes in test frameworks, scaling procedures, and sampling strategies may introduce measurement inconsistencies over time.

Fourth, territorial differences limit strict longitudinal comparability. In some cases, survey results refer only to subnational entities (e.g. Belgium representing Flanders, the United Kingdom representing England), whereas GDP per capita data are reported at the national level. This mismatch may slightly distort cross-country comparisons.

Fifth, the use of GDP per capita as the sole indicator of economic development abstracts from broader dimensions of economic performance, such as productivity structure, income distribution, and innovation

dynamics. Economic output may reflect sectoral composition or capital inflows rather than skill endowments alone.

Finally, the ecological nature of the analysis implies a risk of aggregation bias. Associations observed at the macro level do not necessarily translate into individual-level causal relationships between skills and earnings or productivity.

Taken together, these limitations imply that the results should be interpreted as descriptive evidence of stable macro-level associations rather than proof of causal effects of knowledge capital on economic growth.

Conclusion

This paper demonstrates a consistent macro-level association between adult literacy performance and economic development. Hungary's lag in both mean scores and distributional outcomes highlights structural challenges with policy relevance. While causal inference is not possible, international evidence supports the importance of knowledge capital and adult education in promoting long-term economic growth and societal inclusion.

While adult education is frequently presented as a direct lever for improving economic performance, the results of this study suggest a more nuanced interpretation. Enhancing adult literacy may contribute to employability, productivity, and social cohesion; however, its macroeconomic impact is likely mediated by institutional quality, labour market structures, and innovation capacity. Thus, knowledge capital should be understood as one important, but not exclusive, component of long-term economic development.

The analysis contributes to the literature by showing that the positive association between adult literacy and economic development remains observable across multiple survey waves, while also demonstrating the importance of distributional aspects of literacy performance in the Hungarian case.

Acknowledgments: This study serves as a tribute to Professor Gabriella Pusztai on the occasion of her 60th birthday.

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Appendix

Appendix 1. Data used to calculate the correlation between adult literacy scores and GDP per capita

	Year	IALS Mean 1994-98	GDP per capita	Year	PIAAC Mean 2012-17	GDP per capita	Year	PIACC Mean 2023	GDP per capita
Belgium (Fl)	1996	277,1	31862,7	2012	275,5	40074,5	2023	278,5	44731,0
Canada	1994	278,9	32074,2	2012	273,5	42320,6	2023	273,0	44468,7
Chile	1998	222,7	8287,5	2015	220,1	13433,9	2023	217,9	14226,5
Czech Rep.	1998	276,8	11850,8	2012	274,0	16772,4	2023	265,2	20245,7
Denmark	1998	289,0	46437,2	2012	270,8	51470,7	2023	279,6	61296,0
Finland	1998	287,5	34457,5	2012	287,5	43507,9	2023	302,7	45588,5
Germany	1994	282,2	31609,1	2012	269,8	40829,0	2023	269,7	44336,8
Hungary	1998	246,9	8282,4	2017	264,0	13628,4	2023	249,4	16282,8
Ireland	1994	264,2	26290,9	2012	266,5	47217,4	2023	263,3	91647,8
Italy	1998	243,5	30892,2	2012	250,5	31292,1	2023	245,7	34088,1
Netherlands	1994	285,8	33054,4	2012	284,0	44631,9	2023	282,3	51305,6
New Zealand	1996	266,7	28571,4	2015	280,7	38639,4	2023	259,6	41766,9
Norway	1998	294,5	65197,9	2012	278,4	73661,7	2023	282,8	78912,3
Poland	1994	232,2	5262,3	2012	266,9	11542,2	2023	235,7	17391,1
Sweden	1994	305,5	33862,0	2012	279,2	48788,9	2023	284,1	54449,8
Switzerland	1994	271,8	67391,8				2023	270,9	89555,6
UK (England)	1996	266,4	33777,5	2012	272,6	42802,0	2023	272,1	47322,7
USA	1994	273,5	41107	2017	270,9	58703,1	2023	259,3	65875,2

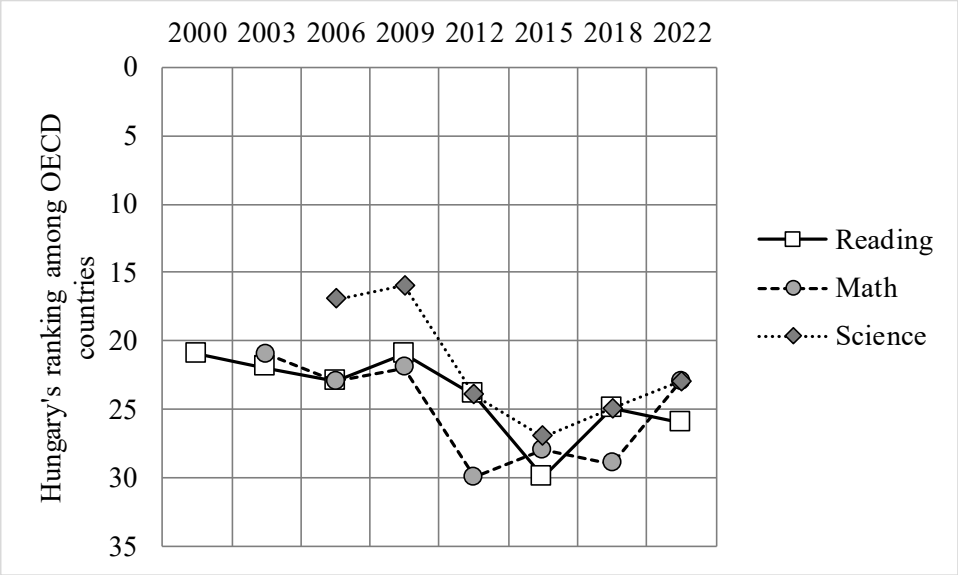
Source: Literacy results OECD (2024a) Annex A, p. 195, Table A.3.23 (L), GDP/capita: (constant 2015 US$) World Bank https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

Appendix 2. Correlation analysis ($p < 0.05$)

	IALS 1994-98	GDP/cap (1994-98)	PIAAC 2012-17	GDP/cap (2012-17)	PIACC 2023	GDP/cap (2023)
IALS 1994-98	1					
GDP/fő	**0,6191**	1				
PIAAC 2012-17	0,7768	0,4614	1			
GDP/fő	0,7480	0,9579	**0,5135**	1		
PIACC 2023	0,9167	0,5967	0,8419	0,6783	1	
GDP/fő	0,5459	0,8240	0,4196	0,8932	**0,5184**	1

Source: author's own calculations based on data from Appendix 1

Appendix 3. Hungary's ranking among OECD countries in terms of PISA results



Source: Compiled by the author based on OECD PISA database