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The Relationship Between Human Capital and Financial Development: A Case Study of Hungary

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Abstract

This study examines the relationship between financial development and human development in Hungary during 1970-2019. For this purpose, the autoregressive distributed lag approach and the bounds test were performed, which revealed the presence of a cointegration relationship between the two variables. The empirical findings revealed that the overall effect of financial development on human capital can be positive or negative, depending on the variables used, and several robustness tests confirmed these results. The analysis also identifies the primary policy possibilities by which improvements in financial reforms impact human capital. It is recommended to eliminate inefficiencies in spending to achieve high efficiency in education and healthcare, particularly in terms of both quality and inclusion.

Keywords: finance; autoregressive distributed lag approach; human capital; Hungary.

العلاقة بين رأس المال البشري والتنمية المالية: دراسة حالة من المجر

فائزة برهوم

الملخص

تتناول هذه الدراسة العلاقة بين التنمية المالية والتنمية البشرية في المجر خلال الفترة من ١٩٧٠ إلى ٢٠١٩. لهذا الغرض تم استخدام نموذج الانحدار الذاتي للفجوات الزمنية الموزعة و اختبار الحدود، الذي كشف عن وجود علاقة تكامل مشترك بين المتغيرين. أظهرت النتائج التجريبية أن التأثير العام للتنمية المالية على رأس المال البشري يمكن أن يكون إيجابيًا أو سلبيًا، اعتمادًا على المتغيرات المستخدمة، وأكدت اختبارات الصلابة هذه النتائج. كما يحدد التحليل الفرص السياسية الرئيسية التي تؤثر بها التحسينات في الإصلاحات المالية على رأس المال البشري. إزالة الفجوات في الإنفاق لتحقيق كفاءة عالية في التعليم والرعاية الصحية، وخصوصًا من حيث الجودة والشمول.

الكلمات المفتاحية: تمويل؛ استخدام نموذج الانحدار الذاتي للفجوات الزمنية الموزعة ؛ رأس المال البشري؛ المجر.

Introduction

Human Capital (HC) plays a crucial role in achieving the Sustainable Development Goals (SDGs), (Barua, 2021; Vo & Tran, 2021). There are good examples of those countries with high HC levels (such as Singapore and Japan) having high inclusive economic growth, sustainability, and equality. Given the importance of HC in spurring inclusive economic growth, achieving people's financial well-being objectives, improving equality, mitigating poverty (Barro, 1990; Galor & Zeira, 1993), it is at the center of the global strategy for economic development in recent decades and prioritizing investment in human beings has been given more attention.

In theoretical literature, Becker (1962) and Schultz (1961) are among those who attributed the differences in economic growth and incomes between countries owing to differences in HC levels. In this context, next to physical capital, HC acquired prominence in Endogenous Growth Theory (EGT) models as one primary determinant of long-term economic growth (Lucas, 1988; Romer, 1986). Further, the models of the EGT in the early 1990s confirmed the multiple interrelationships between those three variables (Galor & Zeira, 1993). In other words, economic growth could result not only from both Financial Development (FD) and HC accumulation but also from their reason (Ozcan, 2018). However, FD steals talent from productive industries and reduces growth because financial services reward talent more than entrepreneurship, resulting in stagnation in business (Arcand et al., 2015, Tobin, 1984).

Similarly, EGT suggests that FD and HC appear to reinforce each other also, implying that each variable can be a reason or a consequence of each other (Tekin, 2020; Ozcan, 2018). According to EGT, advancing the financial system can play a catalytic role in building HC by reducing information asymmetry, risks, and financing costs (Galor & Zeira, 1993; Satrovic, 2017; Sehrawat & Giri, 2017;). This is significant in promoting welfare and facilitates household investments in education and health. For low-income households especially this is among the biggest challenges for building their HC, as well as mitigating the impacts of unexpected shocks for them (Demirgüç-Kunt & Levine, 2009; Galor & Zeira 1993). HC accumulation, likewise, enhances more formal lending, and investment in high innovation which encourages savings activities and lowers loss because of financial literacy (Eryigit et al., 2015; Kendall, 2012). Thus, it can be said that HC is one of the primary determinants of FD (Ozcan, 2018).

In fact, HC and human development have always been crucial socioeconomic issues for policymakers, economists, and sociologists in any country, and Hungary is not exceptional. In the past decades, Hungary made significant strides in improving both its economic and social status by raising the level of the HC index, which measures life expectancy, education, and standards of living. This has also impacted development among regions and improved socioeconomic conditions in poor areas. However, HC composites outcomes in Hungary have been below the EU average and regional peers since 2010 (UNDP, 2020). Arguably, HC is still a big challenge for the economy, policymakers, and people together. The low level of HC may be because of limited financial resources to finance learning institutions and the health sector. Particularly, Hungary is one of the OECD countries with the lowest share of GDP spent on education and healthcare (OECD, 2023), and among the lower incomes in EU countries.

Credit constraints may be one barrier to HC investment choices in Hungary, as in several countries. Especially, the high costs of private schools lead to them remaining out of the financial reach of average citizens. On the other hand, socioeconomic status via education also in turn has effects on life expectancy and mortality rates owing to exposure to different risk factors. In addition, the low share of coverage of health and unmet needs require high out-of-pocket payments. Moreover, disparities in HC in Hungary have a regional dimension, which limits SDGs achievement according to the Europe Sustainable Development Report (EU, 2022),

The economic theory and the global strategy for socioeconomic development focus on both finance and investment in HC because these factors are crucial for both social and economic development, thus achieving the SDGs for countries. However, there are very few studies predicting the relationship between these two variables, especially in Hungary. Accordingly, I aim to assess the role of finance in HC empirically by examining whether the FD of Hungary has a relationship with HC in the short and long run. The study also contributes to understanding what is a necessary policy for the improvement of HC in Hungary, which is

necessary for the economy to increase its competitive advantage, and for people to increase their choices and improve their living standards together.

The main contributions of this study include: (i) providing further evidence to the scarce literature about the specific relationship between finance and HC in Hungary and filling the gap in the extant literature and contributing to the debate on the effectiveness of FD on HC; (ii) understanding the finance-HC relationship in Hungary to know if the financial policies can promote HC in Hungary; (iii) helping policymakers in formulating policy for the growing field of achieving HC objectives in Hungary based on empirical results; and (iv) understanding what financial policy needs to be adopted (or adjusted) to address the HC challenge by FD.

Theory and Background

The theory (Becker, 1962; Schultz, 1961) defines the HC concept as the set of skills and knowledge, and the health of an individual as a result of an investment in education and healthcare, in particular, investment in formal education and post-school education in individuals (Chiswick, 1971). These lead to promoting economic growth through higher productivity, stabilizing societies, and reducing time spent in the unemployment market. Besides, a better quality of life with more years of schooling enhances access to better-paying jobs and better healthcare.

Indeed, the HC theory was first discussed by Adam Smith (1776), who proposed fostering human capabilities to improve human proficiency. And then, nearly two centuries later, the idea gained prominence with the seminal works of Schultz (1961), Becker (1962), and Rosen (1976), who developed Smith's view. They emphasized the importance of HC in explaining the income differences among regions and countries.

The HC concept has become the subject of growth literature with the emergence of the EGT models in the 1980s. For example, the models of Lucas (1988) and Romer (1986) stated that the interaction between finance and HC contributes to the continuation of economic growth through the generation of new forms of technology and knowledge, thus increasing productivity, rather than diminishing as neoclassical models assume. Similarly, all the models of EGT in the 1990s also support the role of finance in both HC and economic growth and in influencing each other. For example, Barro (1990) states that public investments in education and health contribute to economic growth and increase efficiency. Recently, this view has been confirmed by mounting evidence from Asian and European countries that the countries with high-quality HC have high rates of growth (Agenor & Montiel, 2015) because they can effectively manage their physical capital.

As mentioned earlier, HC is not only a channel for economic growth finance but is also a main target of FD. Theoretical literature related to the finance-HC nexus suggests FD promotes HC by increasing savings and easing access to credit by all households, and low-income households especially, who are unable to access it due to strict safeguards, information asymmetry, and high financing costs (Satrovic, 2017). Advancing the financial system can play a catalytic role in building HC by ensuring healthcare and educational needs, even during temporary difficult times, regardless of their parent's income (Galor & Zeira, 1993). In addition, FD can affect HC accumulation by raising individuals' economic opportunities, fostering economic growth (Hong Vo et al., 2021), and increasing government expenditure on human development dimensions (Sehrawat & Giri, 2017).

Furthermore, some studies in the existing literature report that HC is not only a consequence of finance, but HC accumulation is also among the reasons that can explain the FD gap within regions and countries (Arora, 2012; Eryigit et al., 2015) since it has significant effects on formal lending and savings activities and loss rates, and on using high technology and innovation either by the financial system or by borrowing corporates (Eryigit et al., 2015; Kendall, 2012). Hence, in countries with poor-quality HC, FD levels are low (Arora, 2012; Ozcan, 2018).

From an empirical perspective, literature has been devoted to investigating correlation and establishing causal linkages between two variables since the emergence of the EGT in the 1980s and 1990s. Some studies supported the role of finance in HC building. For example, Ozcan (2018) investigated the impact of FD on HC in emerging market economies, including Hungary, from 1990 to 2015. The author used the tertiary school enrollment rate and government expenditure on education as a proxy of HC, and four banking indicators (liquid liabilities as a share of GDP (M3 to

GDP), broad money supply as a share of GDP (M2 to GDP), domestic credit provided by the banking sector as a percentage of GDP, and domestic credit to private sector as a percentage of GDP) to represent FD.

Fully modified OLS (FMOLS) and dynamic OLS (DOLS) approaches were performed for cointegration analysis in the study. In addition, he found that higher education is a cause of FD, but the opposite is not true. The findings of the study indicate that FD has a positive impact on HC. This is consistent with the results reported by Monacelli et al. (2012) when examining the relationship between two variables by using data from 68 countries (including Hungary) between 1990 and 2005.

Focusing on the health and GNP per capita (measure the welfare) perspectives, Tekin (2020) examines the relationship between the FD index and human development. He used Pedroni and Kao cointegration analysis and Dumitrescu and Hurlin panel causality analysis for data gathered from developing countries between 1970 and 2016. The study concluded that there is a long-term cointegration relationship between financial and human development and there is a two-way causality between them. Tekin reported that there is bidirectional causality between the two variables. While other research suggested that there is a unidirectional causal running from finance to HC, for example, Nar (2020) in Turkey, and Osuka et al., (2018) in Nigeria between 1991 and 2015. Although Ha et al. (2022) failed to find a causal relationship between FD and HC, they examined the lead-lag structure between FD, economic growth, and HC in Vietnam from 1980 to 2017. The authors used the wavelet analysis and the scale-by-scale Granger's causality. This finding is consistent with the results reported by Hatemi-J and Shamsuddin (2016).

Other researchers reported that FD harms HC. For example, Nik, et al. (2013) reported facilities provided by the banking system have contributed to a negative effect on HC in Iran because of the high costs of long-term investments because of inflation. They employed the application of a VAR model to test the relationship between FD and HC in Iran, covering 1977 and 2010. Akhmat et al. (2014) reached the same findings in some South Asian countries over the period 1988-2008, while studies reported a weak relationship between FD and HC (e.g., Hakeem & Oluitan, 2012) in South Africa. Among the most important channels through which FD indirectly influences human development is economic growth and government expenditure. These have been identified by several researchers (e.g., Ha et al., 2022; Nguyen, 2022; Ozcan, 2018).

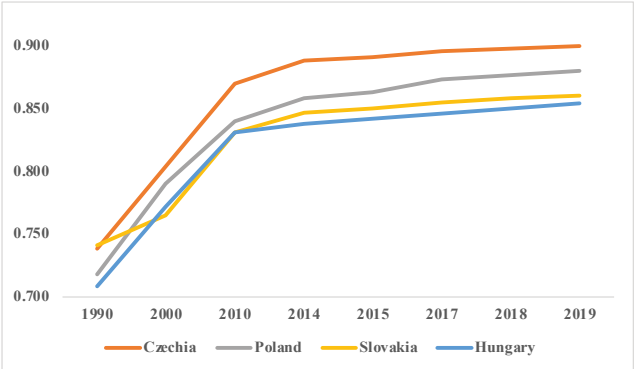
Overall, the relationship between finance and the human development nexus is also different according to analysis methods, period, or the financial indicators used. For example, bank credit has a negative and significant effect on HC, while M2 to GDP has a positive impact (Ali et al., 2021). While Ha et al. (2022) revealed that the relationship between FD and HC was strong between 1980 and 1988, it was weak from 1989 to 2017. And, after scrutinizing and reviewing the literature on the relationship between FD and HC, it is apparent that it has only been investigated in a very small number of studies and their findings are conflicting and inconclusive. Moreover, the Hungarian empirical studies are conflicting and inconclusive and are also dominated by cross-country analysis. Thus, the impacts of FD on the human factor need to be carefully examined considering the characteristics of a country and its policies.

Human Capital and Financial System Experiences of Hungary

Human Capital

As I discussed earlier, and similar to other countries, HC is at the center of the national policies of Hungarian policymakers. However, the human development index in Hungary has been the lowest among the Visegrád countries (Poland, Czechia Republic, Slovakia, and Hungary) since 2010 (UNDP, 2020; see Figure 1) and it faces challenges.

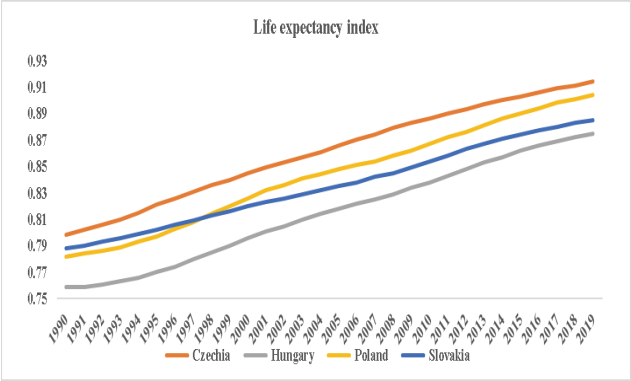
Figure 1: Human Development Index trends in Visegrád countries, 1990-2019.

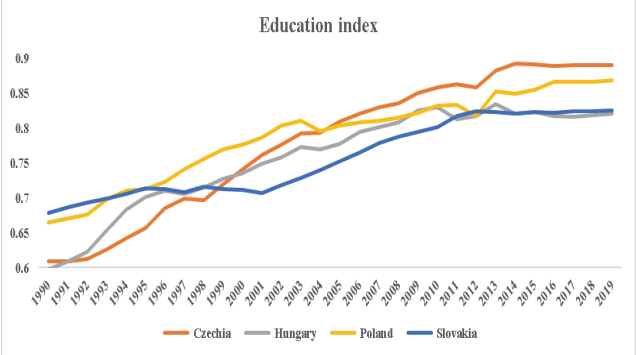


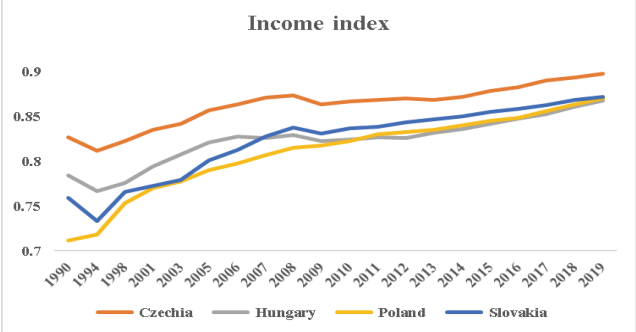
Source: Data collected from the United Nations Development Program (UNDP) databases, http://hdr.undp.org/en/human-development-report-2020.

Three basic dimensions of human development in Hungary (Figure 2) are among the lowest in the EU and lag behind other Visegrád (V3) countries in the last decade.

Figure 2: Three basic dimensions of human development in Visegrád countries.







Source: Data collected from (UNDP) databases.

The composites of the HDI are different between countries according to their investment in each dimension and have changed over the years. In addition, several studies show that there is a positive relationship between the three basic dimensions of human development. Educational attainment, access to high-quality healthcare, and healthy life years influence the income and employment/participation ratios of individuals through the quantity, and quality of labor available, and life expectancy years. Large differences in educational attainment may lead to starker healthcare differences as well.

In terms of the education dimension, results of PISA surveys have shown a marked decline in the quality of education and the education system, which impedes social mobility. The quality of public education has also drastically declined, and the high cost of private schools leads to them remaining out of the financial reach of average citizens, particularly at the tertiary level, where 31% of expenditure comes from private sources. Although changes in the demand for educated and highly skilled people have accompanied a rise in digital technology, preparation of students in tertiary education as a percent of the total population decreased by 0.73 points between 2013 and recent years according to the Hungarian Central Statistical Office (HCSO, 2023). Furthermore, tertiary attainment has a regional dimension, which is reflected in income and development.

In addition, Hungary saw the highest share of early leavers from education and training among V4 countries, which was also above the average of the EU., on the other hand, according to the 2020 HC Index (HCI), the productivity of a child born in Hungary when s/he grows up is lower than the average for the Europe and Central Asia region and the average for high-income countries. Similarly, life expectancy in Hungary is among the lowest in the EU and lags behind Visegrád countries. Indeed, investments in education or health are low even in regional comparison, according to the OECD database (2023), and public funding is the key source, which can be among the reasons for those outcomes.

Overview of the Hungarian Banking System

The Hungarian financial system has experienced considerable changes since the transition process in the 1990s after its efficiency was relatively low in the 1980s. It has seen the launching of various financial restructuring programs, including the establishment of the two-tier banking system by the 1980s, and the government rescue plan in the earlier 1990s. This system has witnessed a significant, rapid privatization process. In parallel, the regulatory framework was developed, including the introduction of new laws and regulations for the securities market and credit institutions, additionally, the shift in monetary policy enhanced financial services and investment transactions further. Those changes led it to become one of the best-developed systems in the EU at the begin-

ning of the new millennium when it became an integral part of large international banking systems and adopted modern models of operation (Bod, 2017; Kovács, 2019). Indeed, the European integration process served as one of the driving forces behind improved regulation and monitoring, whereby Hungary abolished restrictions on capital movements.

But this system also had two financial crises in 1991 because of the transition process and collapse of trade with trading East European partners, besides the great recession. In 2008, the crisis resulted from competition, financial liberalization, and integration with the international market, which considerably affected this system since it was unhealthy and became highly externally vulnerable because of its significant reliance on external funds. The Hungarian sector faced considerable challenges, and credit institutions witnessed a significant deterioration in their portfolios. Hungary had a liquidity problem, and it was forced to take out an IMF-EU loan. Supply lending decreased because of uncertainty in the general economic environment and government measures in response to the crisis (MNB, 2014). Several measures have been managed by the government to mitigate the impacts on banks through bailing them out by capital injection, and then unconventional monetary policy measures that aimed to address weak bank lending activity. This played a significant role in both lending activities recovery and the avoidance of a credit crunch. Recently, the financial sector has improved significantly, as its indicators showed (MNB, 2021). However, there is little empirical evidence informing the decision-makers of the effects of these changes on HC.

Data and Methodology

Data and Variables

Based on the standard literature on the link between FD and HC, we postulate the following model:

$$HC = f(FD, CV) \quad (1)$$

The logarithmic transformation of Equation (1) is defined in Equation (2).

$$LHC_t = \alpha_0 + \beta_1 LFD_t + \beta_2 LCV_t + \mu_t \quad (2)$$

Where L denotes the natural logarithm, T refers to the time. The parameters β1 and β2 represent the long-run, and μ_t is the white noise error term. HC: The Index as a measure of the level of HC per person in society is based on years of schooling (Barro/Lee, 2013) and returns to education (Psacharopoulos, 1994). Removing education financial barriers would increase graduation rates, improve educational qualifications, and improve income equality (Ozcan, 2018).

FD is a level of FD, that is measured through three proxies, which are: CPNF: the ratio of credit to the non-financial private sector/GDP; CPNFB: the ratio of credit to the non-financial private sector from only banks/GDP, due to it measuring a function key of financial intermediaries by allocation the society's savings to private sector projects (Beck et al., 2007); and CGOV: the ratio of credit to government (measuring the efficiency of the financial system according to the IMF FD database). The paper also employs a de facto index of financial openness (KOFF) to investigate the relationship between financial openness and HC. Despite previous studies showing mixed results on the impact of FD on HC, we expect financial proxies to affect HC positively.

CV: I added the control variables to the empirical model for the omitted variable bias. Following Barro (1990), GDP: gross domestic product per capita; and GOV: ratio of government expenditure divided by GDP, are control variables in our model since both are significant channels for influencing finance on HC. So, we assume that a higher value of both variables is better for HC.

We have considered using the new measure of HC drawn from the Penn World Table (version 10.1), which is implemented by Feenstra et al. (2015), instead of the UNDP data that covers only from 1990 as a source for data on HC. In addition, education contributes to HC directly and indirectly via other basic dimensions (healthcare and income) because of its effects on work opportunities, life expectancy, and mortality rates. Thus, this indicator is even more representative than the per capita GDP indicator that has been used widely in previous literature (Filippidis and Katrakilidis, 2015).

For robustness checks purposes, this paper replaced: the HCI with the average years of schooling index (SCH), the ratio of credit to non-financial sector/GDP (CNF) by the ratio of credit to only private non-financial sector/GDP (CNPF), and de-facto globalization index (KOFF) by de jure globalization index (KOJ).

This research is based on annual time series data from 1970 to 2019. The information comes from the World

Bank's World Development Indicators; the KOF Globalisation Index (http://globalization.kof.ethz.ch/); and Penn World Tables (PWT 10.01, 2023 - https://www.rug.nl/ggdc/productivity/pwt/).

The ARDL Estimation Technique

To investigate the relationship between HC and FD, researchers have used different techniques, including stationarity tests and several selections of cointegration approaches for the variables in the models. However, this paper used the ARDL bounds testing technique, which was developed by Pesaran et al. (2001), due to its advantages over other estimation approaches, such as the order of integration, I (0) or I (1), which should not be considered when using this technique, and because it is a more reliable technique than the conventional one (Pesaran et al., 2001). Contrary to other techniques, the ARDL enables the variables to have varied optimum lags, making it more statistically significant and resilient when we couldn't have an enormous sample size. In addition, we employed this approach to estimate the link between variables in the long run and short run from the model's equation simultaneously. Finally, using a simple linear transformation (Banerjee et al., 1993), the Error Correction Model (ECM) can be obtained from ARDL.

Analyzing the relationship between HC and FD in Hungary will be done based on the following model:

$$\Delta LHC_t = \alpha_0 + \sum_{i=1}^{p} \beta_{1\Delta} LHC_{t-1+} \sum_{i=1}^{k1} \beta_{2\Delta} LCPNF_{t-1} + \sum_{i=1}^{k2} \beta_{3\Delta} LCPNFB_{t-1} + \sum_{i=1}^{k3} \beta_{4\Delta} LCGOV_{t-1} + \sum_{i=1}^{k4} \beta_{5\Delta} LKOF_{t-1} + \sum_{i=1}^{k5} \beta_{6\Delta} LGDP_{t-1} + \sum_{i=1}^{k6} \beta_{7\Delta} LGOV_{t-1} + \delta 1\mathrm{LHC}t-1 + \delta 2\mathrm{LCPNF}t-1 + \delta 3\mathrm{LCPNFB}t-1 + \delta 4\mathrm{LCGOV}t-1 + \delta 5\mathrm{LKOF}t-1 + \delta 6\mathrm{LGDP}t-1 + \delta 7\mathrm{LGOV}t-1 + ut. \quad (3)$$

Where HC represents human capital as a dependent variable, while the other variables are independent as identified above, Δ: Denotes the first difference operator, and β1, …, β7 represents the short-run coefficients, δ 1, …, δ 7 are the long-run coefficients, μ is white noise errors and k1, …, k6 are the optimal lag length for each series.

The next step after determining the optimal lag lengths for the ARDL model is Pesaran et al.'s (2001) bound test. According to this test, the null hypothesis of no cointegration is that H0: δ1 = δ2 = δ3 = δ4 = δ5 = δ6 = δ7 = 0, if rejected, which means the alternative hypothesis of exiting of cointegration is accepted. Thus, H1: δ1 ≠ δ2 ≠ δ3 ≠ δ4 ≠ δ5 ≠ δ6 ≠ δ7≠ 0, and a long-run relationship between a dependent variable and independent variables exists. We will reject the null hypothesis when the value of the F-statistic is higher than the upper bound critical value. With co-integration between a dependent variable and independent variables being confirmed, the conditional autoregressive distributed lag model can estimate the long-run coefficient.

In the final step, we get the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is specified as follows:

$$\Delta \mathrm{LHC}t = \alpha 0 + \sum_{i=1}^{p} \alpha_{1i} LHC_{t-1+} \sum_{i=1}^{k1} \alpha_{2i} \Delta LCPNF_{t-1} + \sum_{i=1}^{k2} \alpha_{3i} \Delta LCPNFB_{t-1} + \sum_{i=1}^{k3} \alpha_{4i} \Delta LCGOV_{t-1} + \sum_{i=1}^{k4} \alpha_{5i} \Delta LKOF_{t-1} + \sum_{i=1}^{k5} \alpha_{6i} \Delta LGDP_{t-1} + \sum_{i=1}^{k6} \beta_{7i} \Delta LGOV_{t-1} \upsilon \mathrm{ECM\,t-1} + \mu t \quad (4)$$

The error correction model result indicates the speed of adjustment back to the long-run equilibrium after a short-run shock.

Hypothesis

Given the preceding discussion, the contradictory predictions about the finance-HC nexus in dominant economic theories, and a lack of empirical evidence about this relationship in Hungary, the hypotheses that will be tested are as follows:

H1. FD is cointegrated with HC in Hungary.

H2. FD is significantly and positively related to HC in Hungary.

H3: Economic growth significantly and positively affects HC.

H4. Government expenditure significantly and positively affects HC.

Empirical Results

Unit Root Test

To check whether there is perfect collinearity among the variables, avoid spurious avoiding, and determine their order of integration, I used Augmented Dickey-Fuller (ADF, 1979), Philips-Perron (PP, 1988), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) unit root tests to check the stationarity of each variable.

From Table 1, only LCPNF, LCPNFB, and LCGOV variables do not have a unit root in level, according to the results of the ADF unit root test; thus, I cannot reject the null hypothesis at the level I (0). While at the first difference, all series are stationary, only HC variables are not stationary. Similarly, the PP unit root test showed that LCFN and LCGOV variables are stationary at level, all series are stationary at the first difference and are significant at 1 percent level of significance, and HC variables are not, therefore, we rejected the null hypothesis.

The results of the stationarity KPSS test indicate the LCPNFB series only contains a unit root at the level I (0), while globalization indexes and GDP are stationary at the first difference. Accordingly, the results of all three-unit root tests suggest that the variables of the study are integrated at I (0) and I (1), thereby giving support to using the ARDL bounds approach rather than one of the alternative Co-integration tests.

Table 1: Unit root tests for stationarity.

Variables	At Levels			At 1st Difference		
	ADF	PP	KPSS	ADF	PP	KPSS
LHC	-0.344	-0.806	0.938	-1.994	-2.036	0.105
Prob.	[0.91]	[0.81]	[0.74***]	[0.288]	[0.271]	[0.119]
LSCH	-1.101	-1.720	0.938	-1.583	-1.672	0.235
Prob.	[0.71]	[0.42]	[0.74***]	[0.4833]	[0.439]	[0.347]
LCNF	-2.49	-2.69	0.73	-4.44	-4.40	0.27
Prob.	[0***]	[0.08*]	[0.463**]	[0***]	[0***]	[0.119]
LCPNF	-3.847	-2.082	0.630	-2.336	-4.435	0.123
Prob.	[0.02**]	[0.38]	[0.46**]	[0.0**]	[0***]	[0.347]
LCPNFB	-3.847	-1.796	0.079	-7.750	-4.438	0.096
Prob.	[0.03**]	[0.25]	[0.347]	[0***]	[0.0***]	[0.347]
LCGOV	-3.577	-3.429	0.612	-5.471	-5.471	0.307
Prob.	[0***]	[0.02**]	[0.5**]	[0***]	[0***]	[0.119]
LKOF	-1.20	-1.21	0.85	-7.38	-7.37	0.19
Prob.	[0.669]	[0.6624]	[0.74***]	[0***]	[0***]	[0.146**]
LKOJ	-1.124	-1.122	0.837	-6.691	-6.693	0.158
Prob.	[0.70]	[0.70]	[0.74***]	[0***]	[0***]	[0.146**]
LGDP	-0.640	-1.067	0.877	-3.649	-3.594	0.119
Prob.	[0.85]	[0.72]	[0.74***]	[0***]	[0***]	[0.119*]
LGOV	-2.118	-1.881	0.200	-5.945	-5.929	0.130
Prob.	[0.24]	[0.34]	[0.146**]	[0***]	[0***]	[0.119]

Note: **, and *** denotes statistically significant at 1%, and 5% level, respectively

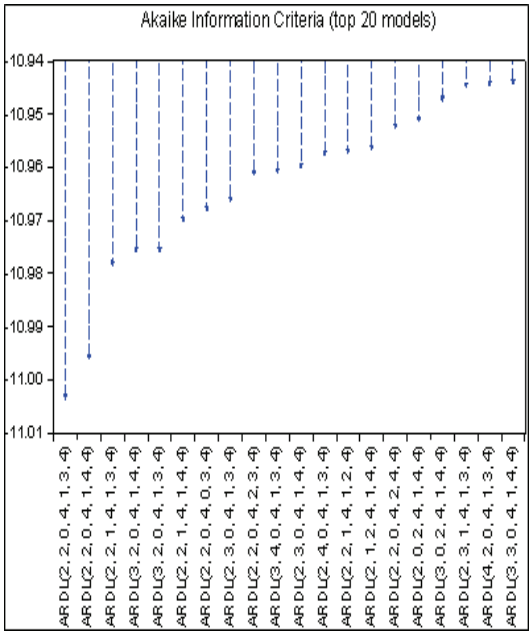
Source: Author's calculations.

Having ensured that all variables are not integrated into order two I (2), running the ARDL approach for testing the long-run relationship between HC and FD can be employed since the necessary condition to implement an ARDL model is achieved.

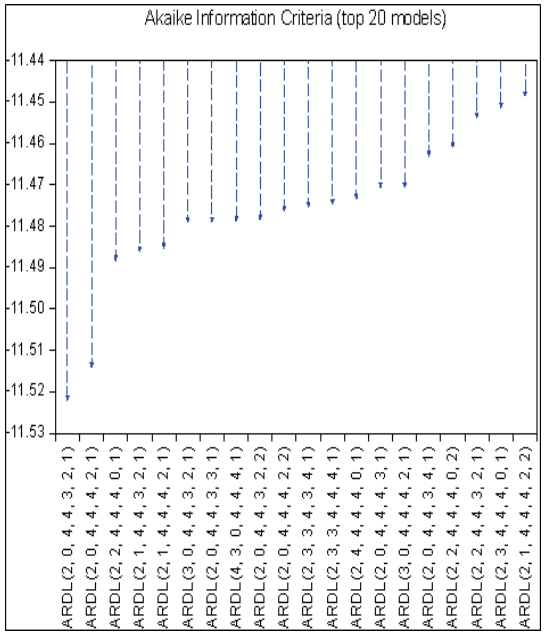
Bounds Test and Result of the Long-run Relationship

The second step in the ARDL approach is determining the optimal lag length based on Akaike information criteria over other criteria (top 20 models), and the optimal ARDEL are (2, 2, 0, 4, 1, 3, 4) and (2, 0, 4, 4, 3, 2, 1) for model 1 and model 2, respectively, as we see in Figure 3.

Figure 3: The optimal model using the Akaike Criterion.



Dependent Variable: D(LSCH)



Dependent Variable: D(LHC)

Table 2 shows the results of the bound test when the SCH (and HC) as dependent variables are used, showing that the calculated F-statistic for both models is equal to 4.51 for model 1 (and 6.791 for model 2). Those values are higher than the upper bound 4.057 (and 5.331) critical values reported in Pesaran et al. (2001) at the 95% and 99% significance levels. Therefore, the null hypothesis of no cointegration has been rejected, and the alternative hypothesis for both models is accepted. The existence of long-run cointegration relationships amongst the models' variables is valid. This indicates that there is a long-run relationship between HC and the representative of the FD variables and among HC and control variables as well.

Table 2: Bounds test.

Dependent Variable: D(LSCH)					**Dependent Variable: D(LHC)**				
Test Statistic	Value	Signif.	I(0)	I(1)	**Test Statistic**	Value	Signif.	I(0)	I(1)
F-statistic	4.506	10%	2.309	3.507	**F-statistic**	6.791	10%	2.309	3.507
k	6	5%	2.726	4.057	**k**	6	5%	2.726	4.057
		1%	3.656	5.331			1%	3.656	5.331

Source: Author's calculations.

Table 3 displays the results of estimating the long-run coefficients of the two models, showing that HC is positively associated with credit to the non-financial sector, but negatively associated with credit to the government and credit provided by banks, and that all the effects of those financial indicators are significant. While the effects of financial openness on HC are insignificant in the long run. This means that the changes in the ratio of credit to GDP in Hungary are a matter of HC in the long run. A one percentage point (hereafter, pp) increase in credit to the private non-financial sector (or to all non-financial sectors) will increase HC by 0.357462 pp (and 0.828719 pp). Contrary to the study's expectations, a one pp increases in credit to the government or the private non-financial sector by banks will decrease years of studies by 0.117026 pp and 0.296053 pp, respectively, while the HCI decreases by 0.335352 pp and 0.627108 pp. The control variable GDP and government expenditure ratio have significant positive effects on years of schooling, but their effects on the HCI are insignificant in the long run.

Table 3: Long-run estimation (dependent variable = human capital).

Model 1: ARDL(2, 2, 0, 4, 1, 3, 4)				**Model 2: ARDL (2, 0, 4, 4, 3, 2, 1)**			
Dependent Variable = SCH				**Dependent Variable = HC**			
Regressor	Coefficient	T-ratio	Prob.	**Regressor**	Coefficient	T-ratio	Prob.
LSCH (-1)*	-0.054	-3.167	0.004	**LHC (-1)***	-0.030	-1.748	0.094
LCPNF	0.357	4.617	0.000	**LCNF**	0.829	2.657	0.014
LCPNFB	-0.296	-4.886	0.000	**LCPNFB**	-0.335	-3.107	0.005
LCGOV	-0.117	-2.310	0.030	**LCGOV**	-0.627	-2.266	0.033
LKOF	0.056	1.111	0.278	**LKOJ**	-0.003	-0.091	0.928
LGDP	0.184	3.265	0.003	**LGDP**	0.128	1.503	0.147
LGOV	0.368	2.487	0.021	**LGOV**	0.469	1.399	0.175

Note: * p-value incompatible with t-bounds distribution.

Source: Author's calculations.

Error Correction Model Results

The empirical tests of the short-run coefficient estimate in Table 4 indicate that the speed of adjustment to restore equilibrium in the dynamic models is negative and significant at a 1% significance level in both models. This suggests that it is further proof of the existence of a long-run relationship among the variables of the model (Narayan & Smyth, 2005). Further, 5.5 percent correlated the deviation from the short-run in SCH over each year in a long period. While in model 2, the value of the lagged error correction term is 3, present every year. Hence, 5.5% (3%) of the change in SCH (and HC) is corrected towards its long-run equilibrium. The coefficients of R2 are high in both models, which are 0.953 and 0.949 in model 1 and model 2, respectively.

The short-run estimations of the link between HC and FD support the idea that credit to the nonfinancial sector, or the private sector, and financial openness, improve HC in Hungary, while credit to the government (or the efficiency of the financial system) is harming human resources. The effects of the FD indicators are significant at 1 percent. Regarding the control variables, the coefficient of GDP and GOV variables on the human index does not support the initial findings obtained by the long-run regression but enhances the HCI in the short run. However, the effects of GDP on years of schooling are insignificant in the short run.

Table 4: Short-run and ECM analysis (dependent variable = human capital).

Model 1: ARDL(2, 2, 0, 4, 1, 3, 4)				Model 2: ARDL (2, 0, 4, 4, 3, 2, 1)			
	Dependent Variable = SCH			Dependent Variable = HC			
Variable	**Coefficient**	**t-Statistic**	**Prob.**	**Variable**	**Coefficient**	**t-Statistic**	**Prob.**
Δ(LCPNF)	0.0189	5.150	0***	Δ(LCNF)	0.0212	4.6377	0***
Δ(LCPN (-1))	0.0081	2.813	0.01***	Δ(LCNF(-1))	0.0113	2.9138	0.01***
Δ(LCGOV)	0.0014	0.706	0.487	Δ(LCGOV1)	-0.0129	-4.9535	0***
Δ(LCGOV(-1))	0.0002	0.089	0.93	Δ(LCGOV(-1))	-0.0070	-2.9859	0.01***
Δ(LCGOV(-2))	0.0032	1.497	0.148	Δ(LCGOV(-2))	0.0036	2.2622	0.03**
Δ(LCGOV (-3))	0.0095	4.651	0***	Δ(LCGOV(-3))	0.0082	5.0552	0***
Δ(LKOF)	0.0077	3.227	0***	Δ(LKOJ)	0.0042	3.2763	0***
Δ(LGDP)	0.0077	1.639	0.115	Δ(LGDP)	0.0082	2.2808	0.03***
Δ(LGDP(-1))	-0.0156	-2.592	0.02**	Δ(LGDP(-1))	-0.0065	-1.4972	0.148
Δ(LGDP(-2))	0.0180	3.529	0.01***	Δ(LGDP(-2))	0.0184	4.4044	0***
Δ(LGOV)	0.0202	5.413	0***	Δ(LGOV)	0.0202	6.6163	0***
Δ(LGOV(-1))	-0.0028	-0.776	0.446	Δ(LGOV(-1))	0.0015	0.5734	0.57
Δ(LGOV(-2))	0.0123	3.494	0.002***	Δ(LGOV(-2))	0.0060	2.2878	0.03**
Δ(LGOV(-3))	-0.0078	-2.557	0.018**	Δ(LGOV(-3))	-0.0079	-3.2683	0.0***
CointEq(-1)*	-0.0535	-6.307	0***	CointEq(-1)*	-0.0301	-7.7418	0***
R-squared	0.953	Akaike info criterion	-11.264	R-squared	0.949	Akaike info criterion	-11.782
Adjusted R-squared	0.927	Schwarz crite-rion	-10.588	Adjusted R-squared	0.920	Schwarz criterion	-11.106
F-statistic	36.939	Han-nan-Quinn criter.	-11.011	F-statistic	33.535	Han-nan-Quinn criter.	-11.529
Prob(F-statistic)	0	Durbin-Wat-son stat	2.101	Prob(F-statistic)	0	Durbin-Wat-son stat	2.333

Note: * p-value incompatible with t-bounds distribution.

Source: Author's calculations.

Results for the Stability Tests and Diagnostic Tests

To ensure the fitness of the models of study, various diagnostic tests were conducted. The results in Table 5 show that the models seem to pass all diagnostic tests successfully, and the residuals are free from serial correlation, heteroscedasticity, and normally distributed (all P values are higher than critical values of 0.05; see Figure 4).

Table 5: Residual tests.

		Model 1: D(LSCH)	Model 2: D(LSCH		Model 1: D(LSCH)	Model 2: D(LSCH
Breusch-Godfrey Serial Correlation LM Test:	F-statistic	0.090	1.086	Prob. F(1,22)	0.77	0.31
	Obs*R-squared	0.187	2.164	Prob. Chi-Square(1)	0.67	0.14
Heteroskedasticity Test: Breusch-Pagan-Godfrey	F-statistic	1.335	1.604	Prob. F(22,23)	0.25	0.13
	Obs*R-squared	25.798	27.847	Prob. Chi-Square(22)	0.26	0.18
	Scaled explained SS	6.490	4.750	Prob. Chi-Square(22)	1.00	1.00
Heteroskedasticity Test: ARCH	F-statistic	2.266	2.850	Prob. F(2,41)	0.12	0.10
	Obs*R-squared	4.380	2.797	Prob. Chi-Square(2)	0.11	0.09

Source: Author's calculations.

Figure 4: Normality test.

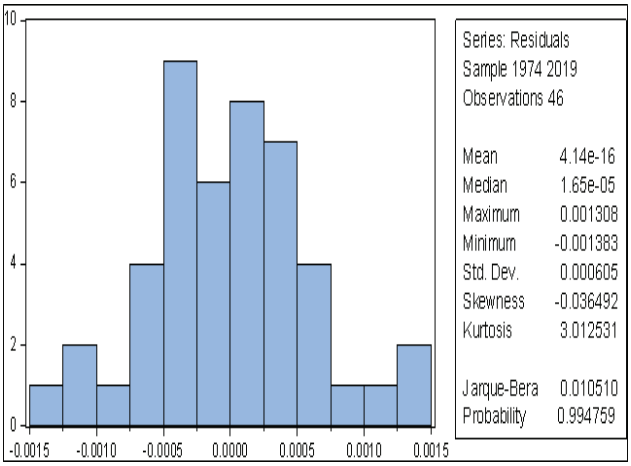


Figure 4a: Model one normality test.

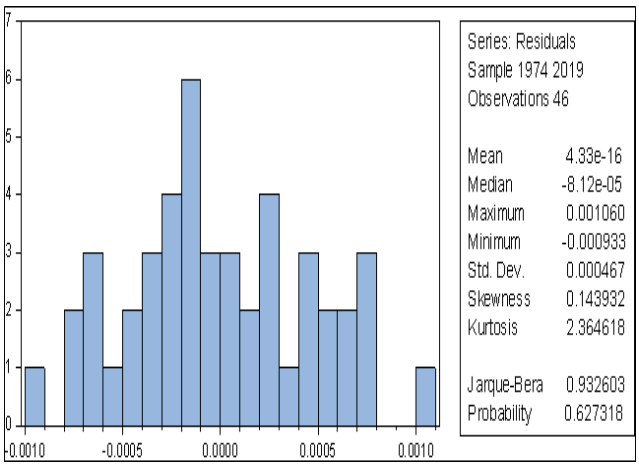


Figure 4b: Model Two Normality Test

The study also applied two tests to examine the stability of the ARDL models used, which are the cumulative sum of recursive residuals (CUSUM) to know whether there is a structural break in the series, and the cumulative sum of the squares of recursive residuals (CUSUMSQ) tests to help examine the date of a structural break if one occurs. Figure 5 shows that the two models are stable at a 5% degree of liberty, which is the lie between the critical bounds (red lines).

Figure 5: Plots of the CUSUM, and CUSUM sq. tests.

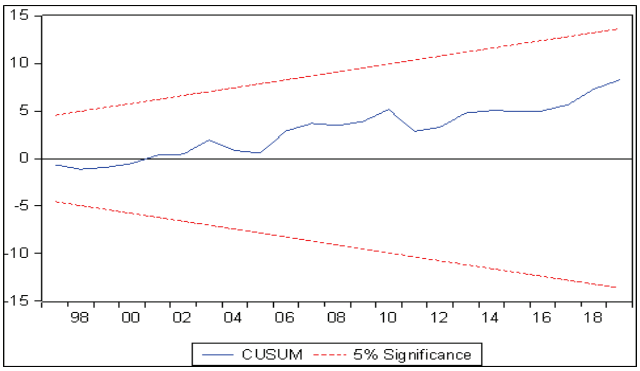


Figure 5a: Model 1, ARDL (2, 2, 0, 4, 1, 3, 4).

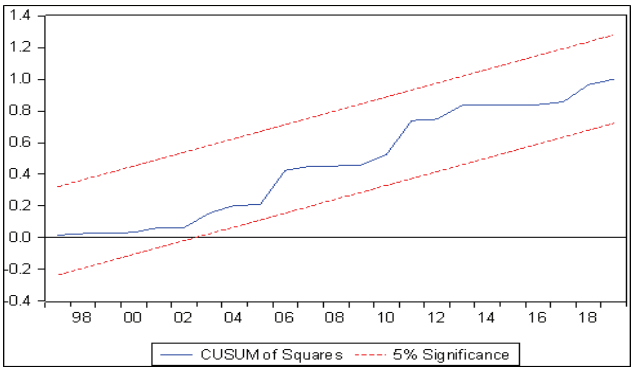


Figure 5b: Model 2, ARDL (2, 0, 4, 4, 3, 2, 1).

Note: The straight lines represent critical bounds at a 5% significance level.

Hypothesis Tests

First Hypothesis Test

We can test the first hypothesis by looking at the values of the calculated F-statistic in both models (4.506 and 6.791) of the bound tests, which are higher than the lower and upper bound critical values at 1%. Therefore, the null hypothesis of no cointegration is rejected, and the study confirms the existence of long-run cointegration between FD and HC in the presence of other control variables. Also, the values of the error correction in both models (ECM-1) have a negative sign and are significant at a 1 percent level, which is other evidence for the existence of short-run cointegration.

Second Hypothesis Test

We can test the second hypothesis by looking at the signs of the coefficients of financial variables in Tables 3 and 4, which are different according to the financial indicator is used. We can accept it only in case of the use of both credits to the non-financial sector/GDG and credit to the private non-financial sector/GDP, from all sectors in the long and short run, as a proxy of FD. We rejected the hypothesis in the case of the credits provided through banks or the government. The hypothesis (H2) also rejected the relationship between financial openness and HC because, in the short run, financial openness does positively affect HC, but the effect is not significant in the long run.

Third Hypothesis Test

According to the sign coefficients of GDP in the long run Table 3, we can accept this hypothesis only in the case of the average years of schooling since the effect of GDP on HC is positive but insignificant. While the relationship between HC variables and GDP in the short run is opposite in the long run. Thus, we rejected the hypothesis.

Fourth Hypothesis Test

Testing the H4 hypothesis by looking at the signs of the coefficients of government expenditure in Tables 3 and 4, indicates these are positively affecting HC variables in the long and short run, but effects on HC in the long run are insignificant.

Discussion and Conclusions

Considering the importance of HC in personal, social, and economic well-being, prioritizing HC investment has recently received increased attention. In Hungary, however, qualified human resources are insufficient, and HC outcomes (education and health) are below the EU average, and its regional peers. Hungarian young people are not prepared for labor work resulting in low income, and more exposure to the risk of unemployment, which rises sharply during crises and recessions. As a result, a thorough examination of all policies relating to any aspect of HC, including education and health policies, is required. In addition, there are not enough studies about the finance and HC nexus. Accordingly, the objective of this study was to analyze the effect of FD on HC in Hungary over the period 1970-2019.

The empirical results showed that FD variables have a significantly effect on both HC variables (years of schooling and HCI) in Hungary in the long run. The effects of the financial openness variables on HC are insignificant, although they are significant in the short

run. Regarding the control variables, the coefficient of GDP and GOV variables are correlated positively and significantly with HC indicators in the short and long run, only with HCI in the long run are insignificant.

Credit to the non-financial sector/GDP and credit to the private non-financial sector/GDP, from all sectors, exerts positive impacts on human resources. While credit through banks or the government significantly harms HC in the long run, which indicates the low levels of efficiency of the Hungarian financial system in allocation of the financial resources, despite it being characterized by high levels of financial depth. Contrarily, the effect of financial openness on HC, in the long run, is insignificant

We can deduce some policy implications from the findings based on the availability of HC indicators and the presented analyses:

1. Like other countries, Hungary may be unable to achieve its SDGs, unless it strengthens its HC.
2. The main challenges identified in Hungary in terms of access to high-quality education and healthcare are a lack of both human and financial resources. Thus, Hungary requires more significant investments in foundational HC dimensions, including smart and efficient spending, which would promote educational quality and change the skill composition of the labor force.
3. It appears that rethinking national education policies is necessary to achieve high education, educational quality, and improved performance, beginning with early childhood education and continuing through adult learning with adequate funding. Similarly, early access to high-quality healthcare contributes to living a healthier and longer life.
4. More highly skilled workers, changing the economy's business models, increasing productivity and competitiveness, as well as increasing the efficiency and development of financial institutions, are necessary.
5. It is important to eliminate inefficiencies in government spending to achieve high efficiency in education and healthcare, particularly in terms of both quality and inclusion. This implies that strengthening HC formation in Hungary necessitates not only increased public spending but also more efficient spending.

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