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Income-dependent impacts of financial development and human capital on economic growth. A non-stationary panel analysis

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Abstract. *We investigate the interdependency of financial development and human capital on economic development in a cross-country setting. We show that the impacts exhibit interesting variations across different income levels. In fact, human capital is the most important element in fostering economic growth in high-income countries, but its importance falls with the country's income level. Financial development, however, is relatively more important for mid-income countries but does not seem to have a significant impact on high-income nations. We find that low-income countries do not benefit as much from either one of these factors.*

Keywords: economic growth, economic development, human capital, financial development, panel data, non-stationary panels.

JEL Classification: O11, I25, G28, C33.

Introduction

This paper investigates how the impacts of financial development and human capital on economic growth vary with the national income. Although the effects of both factors are extensively examined in the literature, whether they have a disproportionate impact on countries that are in different stages of development is not well understood. This issue the main question we tackle in our paper. To answer this question, we set a panel of 194 countries between 1965 and 2017. We divide these countries to three groups of high-income, mid-income, and low-income based on their national income level data. We use non-stationary panel data techniques to estimate the relative importance of these factors in each group. In particular, we use FMOLS and DOLS estimators to compare how financial development and human capital, in the long run, affect economic growth in different countries.

Romer (1990) is among the first to emphasize the importance of human capital by introducing R&D activities in his model. Since R&D activities are mostly carried out by educated workers, a rise in human capital increases R&D activities, thereby directly improving economic growth. Since then, several theories of endogenous growth have explored the role of human capital in enhancing output growth (e.g. Aghion and Howitt, 1992, 1998; Acemoglu, 1996). To further characterize its importance, Barro (1991) shows that a country's GDP growth rate is positively related to its initial human capital level; a finding that is similar to what Benhabib and Spiegel (1994) report. Also, Mankiw et al. (1992) augment Solow's growth model by incorporating human capital in the production function and show that this change helps explain a significant amount of cross-country differences in income per capita.

Building on these theories, we empirically examine whether the positive effects of human capital vary across countries with different income levels. Our results show that human capital is the most important element in fostering economic growth in high-income countries. We find that the relative importance of human capital for economic growth noticeably falls with countries' national income level. Low-income countries gain the least from an increase in their human capital level. This finding is robust across both FMOLS and DOLS estimations.

The observed decline in the effectiveness of human capital can be related to complexities of the relationship between human capital and output growth. For instance, human capital is believed to enhance economic growth through innovation and technological improvement. However, empirical investigations suggest that this impact depends on the technology frontier in the country (See, among others, Vandenbussche et al., 2006; and Ang et al., 2011). An important finding of our paper is that an increase in the level of human capital creates a larger boost in high-income countries than it does in low-income countries. This is perhaps because low-income countries suffer from institutional barriers such as lack of effective governance, skill mismatch, or corruption which diminish the effectiveness of human capital in fostering growth.

In addition to human capital, the importance of financial development has been central to the findings of many theoretical and empirical studies. Financial institutions improve the

allocation of capital in the economy by mitigating asymmetric information issue between borrowers and lenders. Fama (1985) argues bank loans have especially high return suggesting banks are superior in monitoring borrowers and in screening out bad ones, a function that cannot be achieved without these financial institutions. James (1987) presents further evidence on bank loan's uniqueness by looking at firm's stock market reaction to announcement of receiving a bank loan and shows that unlike other methods of borrowing, the announcement has a positive impact on firm's value. Financial intermediaries also reduce the risk a lender is prone to by disconnecting the direct lender-borrower relationship, sitting between the two, and undertaking risk sharing practices.

Our estimates show that financial development is most effective in mid-income countries. That financial development is not effective in developed countries pinpoints the friction-reducing nature of financial development and suggests that high-income countries have already undertaken a well-functioning financial market that mitigates the possible frictions in the real economy so that there in not much room to provide further financial services. On the other hand, the significance of financial development in mid-income countries implies that in these countries there are still non-negligible financial frictions that prevent the economy from performing at its full capacity and removing them would accelerate economic growth.

Low-income countries do not benefit from financial development as much as mid-income countries. This could be related to the distribution of capital in the economy. How efficiently the financial system allocates capital in the economy has enormous effects on technological innovation and growth. Financial development in low-income countries does not lead to economic growth as it does in mid-income countries. However, perhaps lower efficiency and accessibility of financial services can be blamed for its mild effect in these countries. It is worth mentioning that, as it is customary in the literature, our financial proxy measures the depth of the financial system.

A well-functioning financial system improves the economy's performance by directing the capital to the hands of the most productive firms and individuals (Levine and Zervos, 1998). Our findings suggest that if the financial system is already well-developed- as it is the case in high-income countries- or if institutional barriers are so high that prevent an efficient allocation of resources among those seeking funds- as it is the case in low-income countries- then economic policies that focus on financial development may not have a strong impact on output growth.

It should be noted that several studies have investigated the interactions of financial development and human capital as it relates to economic growth. For example, it has been argued that a developed financial system leads to an increase in investment in human capital (Sehrawat and Giri, 2017; Kilic and Ozcan, 2018). This augments the effects of both factors on economic growth. Such arguments led to a number of empirical studies both at the national and international level. Kargbo et al. (2016) show that financial development and human capital amplify the effect of each other on economic growth in Sierra Leone. Also, in a cross-country analysis, Das et al. (2014) show that the reliance of economic growth on financial development lessens as human capital improves.

The empirical results on how financial development and human capital interact with one another, and how this interaction affects economic growth have been mixed. Some conclude that these factors are complements (Hakeem, 2010) while other argue that they are substitutes (Kendall, 2012). We contribute to this literature by examining the relative importance of financial development and human capital conditional on national income level. We show that the importance of financial development on economic growth is not monotonic with respect to human capital. In fact, its impact peaks for mid-income countries with a coefficient higher than that of both high-income and low-income countries. The dependence of the interaction between financial development and human capital on national income level could explain previous mixed findings in the literature. For instance, Hassan et al. (2011) study the role of financial development on economic growth in different geographic regions. Consistent with our results and contradicting Das et al. (2014), they argue that financial development is more effective in mid-income countries than low-income countries because of lack of other important determinants of growth in low-income countries. Moreover, Acikgoz and Ali (2019) consider MENA countries and argue their economic growth is mostly due to physical capital accumulation rather than human capital accumulation. As MENA countries are mostly categorized as mid-income and low-income countries, their results are consistent with our results that human capital is less effective for less developed countries.

The remainder of this paper is organized as follows; section two describes our data. Section three introduces our econometric model, and reports panel unit root tests and panel co-integration tests. Section four discusses our estimation results, and section five concludes.

2. Data

To measure economic growth, we use GDP per capita (constant 2005 USD) of each country as reported by the World Development Indicators (WDI) provided by World Bank and available online. The level of financial development is proxied by the ratio of total liquid liabilities to the aggregate output. Liquid liabilities (Liquidity), also known as broad money, are the sum of currency and deposits in the central bank (M0), plus transferable deposits and electronic currency (M1), plus time and savings deposits, foreign currency transferable deposits, certificates of deposit, and securities repurchase agreements (M2), plus travelers checks, foreign currency time deposits, commercial paper, and shares of mutual funds or market funds held by residents. International Financial Statistics (IFS) and International Monetary Fund (IMF) report this ratio.

Human Capital Index (HCI) is a hybrid national level index, which is calculated by Penn World Tables (PWT). This index is constructed based on the average years of schooling and an assumed rate of return to education, based on Mincer equation estimates around the world. Also, control variables in our statistical model are the size of government, and inflation. The ratio of government expenditures to the GDP, and the consumer price index (2010 = 100) (CPI) measure these economic factors, respectively.

Table 1. *Summary statistics*

	Output		Liquidity		HCI		Gov. Size		CPI	
	mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.	Mean	s.d.
High-income	10.01	0.73	4.09	0.68	2.81	0.50	0.16	0.05	3.36	2.95
Mid-income	7.81	0.84	3.44	0.65	1.94	0.55	0.21	0.10	2.66	3.34
Low-income	6.25	0.51	2.83	0.99	1.36	0.37	0.19	0.11	2.10	5.31

Table 1 reports mean and standard deviation of all six variables in our econometric model. Our panel data covers 164 countries between 1965 and 2017. These countries are divided to three different categories: "High-income" countries, "Mid-income" countries, and "Low-income" countries. For this categorization, we follow the world bank's classification based on GNI threshold. Our sample consists of 41 high-income, 102 mid-income, and 21 low-income countries.

There are some notable trends in the data. The stock of both liquid liabilities and human capital steadily rise with the national income. Advanced economies, on average, have smaller governments while the largest governments are in mid-income countries. In addition, though price levels seem to fall in national income, their standard deviation significantly rises, which is a sign of higher volatility in nominal variables in lower income countries suggesting less-effective stabilizing policies or less-effective governance.

3. Model and empirical analysis

The main objective of this paper is to compare the relative importance of financial development and human capital accumulation for economic growth. The general effect of these two factors has been already established in the literature. However, in this paper we investigate whether the magnitude of such effects varies with the national income level. In particular, as far as GDP growth is concerned, we are interested in examining if human capital is as important in low-income economies as it is in high-income ones. To answer this question, we set three different panels of 164 countries combined, which run from 1965 to 2017.

In each panel, we estimate the following augmented growth model:

$$Y_{it} = \alpha_i + \beta_0 t + \beta_1 Liquidity_{it} + \beta_2 HCI_{it} + \beta_3 Gov_{it} + \beta_4 CPI_{it} + \varepsilon_{it}$$

Where Y_{it} is per capita GDP of country i in year t. $Liquidity_{it}$ is the financial indicator while HCI_{it} represents the human capital index. The size of government, Gov_{it}, is measured by the ratio of governments' total expenditure to GDP. Finally, CPI_{it} is the consumer price index. Given the nature of our data, we include country-specific intercepts and a time trend in our co-integrating equation.

An important topic in cross-country panels is the issue of non-stationarity. Since the data series of our model are found to have unit roots at their level, we follow methods and procedures to estimate non-stationary panels. We first report the results of panel unit root tests for both the level and the first difference of each data series and investigate their co-integration orders. After establishing that all series are integrated of order one, we run panel co-integration tests to verify the existence of a long-run relationship between variables.

Finally, we estimate the coefficients of long-run models, which will illustrate whether the impact of human capital (or financial development) on economic growth depends on income level.

3.1. Panel unit root tests

Most common panel unit root tests are extensions of residual based tests that are frequently used in non-stationary time series analyses. These tests, in particular, extend the Augmented Dickey–Fuller test (ADF) to apply to panel data series. Broadly speaking, such panel unit root tests can be divided into two categories: (1) tests that assume homogeneity in the data generating processes across all cross section units of the panel, e.g. Levin, Lin and Chu (2002); (2) tests that allow for some form of heterogeneity across units, especially in the autoregressive parameters, e.g. Im, Pesaran and Shin (2003). These tests offer a more flexible specification of the data generating process and capture a wider range of non-stationarity in the data as they only require one or some of the panel series to have unit root. The null hypothesis of these tests implies the presence of a unit root. Therefore, when the null hypothesis is rejected, we conclude that the series is stationary.

In this study, for each series we conduct five different unit root tests. Table 2 shows the results of these tests performed first at the level, and then after taking the first difference. With the exception of some irregularities in human capital index, the results strongly confirm that all series have a unit root at the level. However, after taking the first difference, the series become stationary. This establishes that all the variables are integrated of order one, i.e. I(1).

Table 2. *Panel Unit Root Tests*

	Output		Liquidity		HCI		Gov. Size		CPI	
	Log	Δlog	log	Δlog	Log	Δlog	log	Δlog	log	Δlog
High-income Countries										
Fisher-ADF	18.32	-16.23***	9.67	-26.10***	2.59	-5.48***	3.41	-33.30***	5.05	-7.11***
Fisher-PP	24.72	-19.34***	0.88	-18.23***	9.39	-1.42*	3.60	-36.09***	17.52	-8.03***
IPS	0.77	-20.14***	0.26	-17.11***	1.40	-1.43*	-0.71	-14.93***	16.35	-6.86***
LLC	-1.10	-21.03***	0.31	-12.96***	4.75	-2.36***	1.09	-29.17***	3.39	-8.40***
Breitung	4.89	-16.69***	-0.95	-9.43***	3.38	-1.98**	0.57	-10.8***	5.69	-8.83***
Mid-income Countries										
Fisher-ADF	-4.98	-23.66***	1.07	-30.11***	9.60	-2.99***	0.95	-50.04***	12.81	-14.07***
Fisher-PP	0.85	-30.75***	-1.14	-34.34***	9.36	1.39	1.15	-59.51***	23.49	-18.02***
IPS	3.09	-29.29***	-0.42	-33.65***	3.31	-4.25***	-2.11	-6.51***	2.49	-19.28***
LLC	18.95	-27.51***	-1.26	-32.70***	9.25	-1.21	0.75	-38.91***	14.98	-26.59***
Breitung	7.52	-16.45***	1.06	-24.82***	0.54	0.72	0.53	-34.39***	2.64	-10.25***
Low-income Countries										
Fisher-ADF	1.83	-14.02***	0.48	-14.86***	4.21	-2.07***	-1.24	-15.98***	-0.65	-8.54***
Fisher-PP	3.23	-19.37***	0.32	-19.26***	8.54	1.32	0.72	-22.58***	2.53	-10.78***
IPS	2.28	-18.26***	1.15	-14.70***	3.56	-2.78***	1.31	-14.39***	-1.23	-9.45***
LLC	1.97	-18.12***	-0.31	-13.14***	0.38	0.95	0.17	-14.91***	-1.11	-10.54***
Breitung	3.28	-9.17***	-1.21	-9.64***	7.12	-5.57**	1.11	-9.17***	1.06	-8.55***

Note: *, **, and *** denote significance at 10, 5, and 1 percent, respectively.

3.2. Co-integration tests

To avoid spurious regression analysis, we conduct panel co-integration tests that establish the existence of a long run relationship between our panel variables. Establishing the existence of such a relationship is crucial for our study because the focus of our question is

on how certain channels affect economic growth. Investigating these effects requires a long run relationship between variables as economic growth, in essence, is a long-term concept.

In this paper, we conduct Pedroni co-integration tests that are the most widely used tests in non-stationary panel data analysis. It should be noted that our panels are macro panels consisting of country level data that are not systematically linked to each other and cross-sectional dependence is less of a concern.

Pedroni (1999 and 2004) extends his previous residual-based tests and proposes several tests to examine whether panel variables are co-integrated. These tests are based on applying standard unit root tests on the residuals of a regression equation. The null hypothesis of all of these tests is that variables are not co-integrated. Therefore, rejecting the null hypothesis implies a co-integration relationship. The main difference between these seven tests is the degree of heterogeneity that they assume among cross-sectional units. Based on this assumption, Pedroni tests are divided to two major groups: within-dimension and between-dimension test statistics. The within-dimension statistics allow for heterogenous autoregressive parameters across panel whereas the between-dimension statistics are constructed with the average of individual coefficients.

Table 3. *Panel co-integration tests*

	High-income	Mid-income	Low-income
Panel Specific Parameter:			
Modified PP-t	2.17**	2.77***	-2.35***
PP-t	3.88***	4.84***	-2.36***
ADF-t	3.96***	3.91***	-3.88***
Common Parameter:			
Modified v- ratio	-0.19	2.26**	3.88***
Modified PP-t	4.09***	4.61***	-0.98
PP-t	4.09***	5.03***	-1.69**
ADF-t	5.78***	4.43***	-0.27

Note: *, **, and *** denote significance at 10, 5, and 1 percent, respectively.

The results of Pedroni co-integration tests are reported in Table 3. Given the nature of our variables, in the specification of the equation, a panel-specific time trend is included. Also, the optimal number of lags are determined using the Akaike Information Criterion (AIC). The overall results strongly confirm that variables in all three panels are co-integrated. Once the presence of a co-integration is approved, we proceed to estimate the co-integrating vectors. The coefficients of these vectors allow us to answer the main question of this paper.

3.3. Long-run relations

We estimate the co-integrating vector between variables using two widely used methods in non-stationary panels; namely Dynamic Ordinary Least Squares (DOLS) and Fully Modified Ordinary Least Squares (FMOLS). FMOLS estimator was first developed by Pedroni (2000 and 2001) as a consistent method to estimate co-integrating vectors in dynamic panels. FMOLS follows a non-parametric approach to correct for biases caused by endogeneity. In contrast, the Dynamic OLS estimator proposed by Kao and Chiang (2000) includes leads and lags of variables to resolve this issue.

Table 4. *Dynamic ordinary least square estimators*

	Liability	HCI	Government	CPI
High-income Countries	-0.055** (0.028)	1.09*** (0.045)	-0.973*** (0.234)	-0.014*** (0.003)
Mid-income Countries	0.207*** (0.031)	0.737*** (0.038)	0.301** (0.141)	-0.016*** (0.003)
Low-income Countries	0.109*** (0.021)	0.326** (0.128)	0.060 (0.163)	-0.076*** (0.013)

Note: numbers in parenthesis are standard errors. *, **, and *** denote significance at 10, 5, and 1 percent, respectively.

Table 4 and Table 5 report the FMOLS and DOLS estimators for each panel of countries separately. We include a deterministic trend in our co-integrating vectors, and in both methods, use pooled estimators. Also, leads and lags in all Dynamic OLS estimations were determined using the AIC. Given the nature of our economic question, we only analyze the long run coefficients of the co-integrating vectors.

Table 5. *Fully modified ordinary least square estimators*

	Liquidity	HCI	Government	CPI
High-income Countries	0.026 (0.020)	1.103*** (0.033)	-1.473*** (0.205)	-0.014*** (0.003)
Mid-income Countries	0.252*** (0.025)	0.668*** (0.037)	-0.179*** (0.121)	-0.017*** (0.003)
Low-income Countries	0.027 (0.021)	0.532*** (0.115)	0.299* (0.168)	-0.049*** (0.011)

Note: numbers in parenthesis are standard errors. *, **, and *** denote significance at 10, 5, and 1 percent, respectively.

4. Discussion

As our main contribution, we add a new dimension to the existing analysis of how financial development and human capital accumulation affect output growth. We separate countries based on their income levels to investigate whether the relationship between economic growth, on the one hand, and financial development or human capital, on the other, varies with national income level.

Our findings reported in Table 4 and Table 5 suggest that when we consider all countries together (1) human capital accumulation has the strongest positive impact on economic growth; (2) financial development measured by the size of total liquid liabilities has a positive impact on growth, though its effect varies throughout the entire sample; (3) size of government almost always negatively affects economic growth. And (5) a rise in nominal prices moderately lowers production.

These findings are in line with the existing literature. In our analysis, human capital emerges as the dominant economic factor in determining the national income. This is consistent with a long tradition of endogenous growth theory models that emphasize on the role of human capital in the aggregate production of the economy (e.g. Romer, 1990; Lucas, 1988). Our findings do not suggest a robust and undisputable positive role for financial development. This could be related to two factors: (1) the friction-reducing nature of financial development. High-income with already well-functioning financial markets do not seem to benefit from financial development as much as mid-income countries do.

Also, (2) this finding could be because of the proxy we use for measuring financial development. Previous studies have shown that the effect of financial development on growth varies with the financial indicator (e.g. Khan and Senhadji, 2000). In particular, when it comes to financial liberalization, it's been noted that different countries respond differently to measures of volume or efficiency. This depends on the regulatory environment in the country, and the channel through which financial development transmits to growth (De Gregorio and Guidotti, 1995).

When we turn our attention to an income-based analysis of the size of these effects, however, we can identify an important trend. The relative importance of human capital, measured by its long run coefficient, steadily falls with the national income. Human capital is highly effective in high-income countries, but its importance drastically falls in low-income countries. This is robust across estimation methods, though best seen in DOLS methods. On the other hand, financial development seems to have no effect in high-income countries while it strongly contributes to growth among mid-income countries.

The sizeable change in the impacts of human capital that this paper documents has important implications for policy makers. Our findings suggest that investing in human capital is a far more effective policy in advanced economies than it is in mid-income or low-income nations. This could be because of the skill complementarity of technology. More developed nations have access to better technologies that require highly skilled workers. In other words, when a country is using a technology that is closer to the frontier, an increase in human capital is much more effective to achieve sustained economic growth. On the other hand, in lower-income countries, though still effective, human capital accumulation is not as important. We believe this could be attributed to institutional barriers such as skill mismatch or bad governance that cause problems in the transformation of human capital to innovation and technological improvement.

5. Conclusion

The relationship between economic growth, financial development, and human capital has been extensively studied in the literature. It is well accepted that both financial development and human capital enhance economic growth. However, perhaps due to the complex nature of their interaction, not every aspect of these relations is fully understood. This study explores whether the relative importance of these factors for economic growth vary with country' national income level. Our findings could have valuable policy implications for designing growth-inducing economic policies for countries in different development stages.

We collect data for 164 countries between 1965 and 2017, and based on their national income, divide them to three groups of high-, mid-, and Low-income countries. For each group, we set up a panel that includes output per capita, liquid liability, and human capital index, as well as some control variables. We first establish the existence of a long-run relationship between variables in all panels. Then, we estimate the parameters of the co-integrating vector using DOLS and FMOLS techniques.

Our findings confirm that human capital has a strong positive impact on output in all panels. However, an important finding of our paper is that high-income nations gain the most from accumulating human capital. As the national income falls, the impact of human capital on output per capita steadily shrinks such that low-income countries benefit the least from this economic factor. Based on the existing literature, one could argue that various institutional barriers such as legal system and corruption may impede skilled workers ability to innovate and improve the level of technology in the economy, which translates into lower aggregate output. Another explanation for this pattern is that further accumulation of human capital in high-income countries that are closer to the technology frontier is more prolific compared to lower-income nations that rely on technologies that are far from the frontier. Anyhow, more studies are necessary to shed light on the underlying reasons behind this pattern.

As for the role of financial markets, our findings suggest that mid-income countries seem to gain the most from developing their financial system. This is perhaps due to the fact high-income countries are already enjoying a well-functioning system that allocates financial resources efficiently. Therefore, further de-regulation may not be as impactful as long as economic growth is the main concern.

Our results have strong policy implications regarding international organizations and national authorities who design a development path for a country. As we show in this paper, countries in different stages of economic development have varying responsiveness to changes in financial development and human capital. If the policy target is to maximize growth rates, the optimal policy solution should take into account these differential impacts and accordingly adjust the weights attributed to different growth determinants so to successfully lead the country to higher economic growth rates.

References

Acemoglu, D., 1996. A Microfoundation for Social Increasing Returns in Human Capital Accumulation. *Quarterly Journal of Economics, 111*(3), pp. 779-804.

Acikgoz, S. and Ali, M.S., 2019. Where does economic growth in the Middle Eastern and North African countries come from? *The Quarterly Review of Economics and Finance*, pp. 172-183.

Aghion, P. and Howitt, P., 1992. A Model of Growth through Creative Destruction. *Econometrica, 60*(2), pp. 323-351.

Ang, J.B., Madsen, J.B. and Isla, R., 2011. The effects of human capital composition on technological convergence. *Journal of Macroeconomics, 33*(3), pp. 465-476.

Benhabib, J. and Spiegel, M.M., 1994. The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary economics, 34*(2), pp. 143-173.

Das, K., Harper, J. and Arora, R., 2014. Financial development, economic growth and human capital accumulation: what is the link? Working Paper.

Fama, E.F., 1985. What's different about banks? *Journal of monetary economics, 15*(1), pp. 29-39.

De Gregorio, J. and Guidotti, P.E., 1995. Financial development and economic growth. *World Development, 23*(3), pp. 433-448.

Hakeem, M., 2010. Banking development, human capital and economic growth in Sub-Saharan Africa (SSA). *Journal of Economic Studies, 37*(5), pp. 557-577.

Hassan, M.K., Sanchez, B. and Yu, J.-S., 2011. Financial development and economic growth: New evidence from panel data. *The Quarterly Review of Economics and Finance*, pp. 88-104.

Howitt, P. and Aghion, P., 1998. Capital Accumulation and Innovation as Complementary Factors in Long-Run Growth. *Journal of Economic Growth, 3*, pp. 111-130.

Im, K.S., Pesaran, M. and Shin, Y., 2003. Testing for unit roots in heterogeneous panels. *Journal of Econometrics, 115*(1), pp. 53-74.

James, C., 1987. Some evidence on the uniqueness of bank loans. *Journal of financial economics, 19*(2), pp. 217-235.

Kao, C. and Chiang, M., 2000. On the estimation and inference of a co-integrated regression in panel data. *Advances in Econometrics, 15*, pp. 179-222.

Kargbo, A.A., Ding, Y. and Kargbo, M., 2016. Financial development, human capital and economic growth: New evidence from Sierra Leone. *Journal of Finance and Bank Management, 4*(1), pp. 49-67.

Kendall, J., 2012. Local financial development and growth. *Journal of Banking and Finance, 36*, pp. 1548-1562.

Khan, M.S. and Senhadji, A., 2000. Financial Development and Economic Growth: An Overview. *IMF Working Paper,* pp. 1-24.

Kilic, C. and Burcu, O., 2018. The Impact of Financial Development on Human Capital: Evidence from Emerging Market Economies. *International Journal of Economics and Financial Issues, 8*(1), pp. 258-267.

Levin, A., Lin, C.F. and Chu, J.C., 2002. Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of Econometrics, 108*(1), pp. 1-24.

Levine, R. and Zervos, S., 1998. Stock markets, banks, and economic growth. *American economic review*, pp. 537-558.

Lucas, R.E., 1988. On the mechanics of economic development. *Journal of Monetary Economics, 22*(1), pp. 3-42.

Mankiw, N.G., Romer, D. and Weil, D.N., 1992. A contribution to the empirics of economic growth. *Quarterly journal of economics, 107*(2), pp. 407-437.

Pedroni, P., 2000. Fully Modified OLS for Heterogeneous Co-integrated Panels. *Working Papers No 2000-03*.

Rajan, R. and Zingales, L., 1998. Financial development and growth. *American Economic Review, 88*(3), pp. 559-586.

Romer, P.M., 1990. Endogenous technological change. *Journal of political Economy, 98*(5), pp. 71-102.

Sehrawat, M. and Giri, A.K., 2017. An empirical relationship between financial development indicators and human capital in some selected Asian countries. *International Journal of Social Economics, 44*(3), pp. 337-349.

Vandenbussche, J., Aghion, P. and Meghir, C., 2006. Growth, distance to frontier and composition of human capital. *Journal of Economic Growth, 11*, pp. 97-127.

Appendix

We provide country names that we have classified as high-, mid-, and low-income in Table 6. The classification is based on that of World Bank. We consider both lower middle income and upper middle income classes as mid-income class. Our dataset includes 41 high-income, 102 mid-income, and 21 low-income countries.

Table 6. *List of countries in each income level*

High-income	Mid-income			Low-income
Argentina	Angola	Kyrgyz Republic	Tonga	Burundi
Australia	Albania	Cambodia	Tunisia	Benin
Austria	Armenia	Kiribati	Turkey	Burkina Faso
Belgium	Azerbaijan	Lao PDR	Tuvalu	Central African Republic
Bahrain	Bangladesh	Lebanon	Ukraine	Congo, Dem. Rep.
Barbados	Bulgaria	Libya	Uzbekistan	Ethiopia
Canada	Belarus	St. Lucia	St. Vincent and the	Gambia, The
Switzerland	Bosnia and	Sri Lanka	Grenadines	Haiti
Chile	Herzegovina	Lesotho	Venezuela, RB	Liberia
Cyprus	Belize	Morocco	Vietnam	Madagascar
Germany	Bolivia	Moldova	Vanuatu	Mali
Denmark	Brazil	Maldives	Samoa	Mozambique
Spain	Bhutan	Mexico	Kosovo	Malawi
Finland	Botswana	Marshall Islands	South Africa	Niger
France	China	North Macedonia	Zambia	Nepal
United Kingdom	Côte d'Ivoire	Myanmar		Rwanda
Greece	Cameroon	Montenegro		Senegal
Hong Kong SAR, China	Congo, Rep.	Mongolia		Sierra Leone
Hungary	Colombia	Mauritania		Togo
Ireland	Cabo Verde	Mauritius		Tajikistan
Iceland	Costa Rica	Malaysia		Tanzania
Israel	Cuba	Namibia		Uganda
Italy	Djibouti	Nigeria		Yemen, Rep.
Japan	Dominica	Nicaragua		Zimbabwe
Korea, Rep.	Dominican Republic	Nauru		
Luxembourg	Algeria	Pakistan		
Macao SAR, China	Ecuador	Peru		
Malta	Egypt, Arab Rep.	Philippines		
Netherlands	Fiji	Papua New Guinea		
Norway	Micronesia, Fed. Sts.	Paraguay		
New Zealand	Gabon	West Bank and		
Panama	Georgia	Gaza		
Poland	Ghana	Romania		
Portugal	Equatorial Guinea	Russian Federation		
Saudi Arabia	Grenada	Sudan		
Singapore	Guatemala	Solomon Islands		
Slovenia	Guyana	El Salvador		
Sweden	Honduras	Serbia		
Trinidad and Tobago	Indonesia	São Tomé and		
Uruguay	India	Principe		
United States	Iran, Islamic Rep.	Suriname		
	Iraq	Eswatini		
	Jamaica	Thailand		
	Jordan	Turkmenistan		
	Kazakhstan	Timor-Leste		
	Kenya			