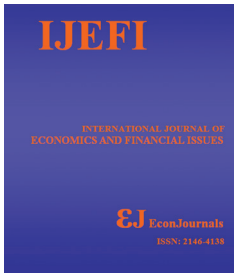

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The Impact of Financial Development on Human Capital: Evidence from Emerging Market Economies

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ABSTRACT

This study aims to analyze the effect of financial development on human capital in emerging market economies over the years 1990-2015. To this aim, two different panel data models including different proxies for human capital are constructed. Results from both models indicate that financial development positively affects the human capital level of emerging market economies. Besides, some causality linkages are obtained between financial development and human capital indicators. Based on the findings of the study, some important policy implications could be suggested.

Keyword: Financial Development, Human Capital, Economic Growth, Panel Data Analysis, Emerging Market Economies
JEL Classifications: E44, G20, J24, O16

1. INTRODUCTION

The text a strong and well-developed financial system is essential to economic growth (King and Levine, 1993). Therefore, since the nineteenth century, a large body of academic literature highlights the relationship between financial development and economic growth (Sehrawat and Giri, 2014). Researchers have identified different channels through which the financial system affects economic growth over time[1] (inter alia, Ansari, 2002; Ang, 2008; Beck et al., 2000; De Gregorio and Guidotti, 1995; Gurley and Shaw, 1955; Goldsmith, 1969; McKinnon, 1973; King and Levine, 1993; Levine, 1997; Levine and Zervos, 1998). For instance, Levine (1997) argued that financial systems facilitate the trading, hedging, diversifying, and pooling of risk; allocate resources; monitor investments and exert corporate control; mobilize and pool savings; and ease the exchange of goods and services.

Apart from its growth enriching effects, an efficient and well-developed financial system also contributes to economic development. Economic development is a broader concept than economic growth based purely on gross domestic product (GDP). It is a multi-dimensional concept reflecting social and economic progress including other welfare indicators, such as life expectancy at birth, infant mortality rate and educational attainment rate. Investments in human resources and therefore human capital are likely to enrich individual productivity, leading to more economic development (Nik et al., 2013). Human capital includes both knowledge and skills gained through education, health and nutrition (Hakeem and Oluitan, 2012). In the literature, education, health, training, migration as well as other investments in human beings are broadly used terms to define human capital. The role of human capital in the economic growth process has been widely studied since the emergence of new growth theory (endogenous growth theory) in the mid-to-late 1980s (Chou and Chin, 2001). Endogenous growth theory inspired largely by Romer (1986) and Lucas (1988) asserts that output per capita can grow over time because of endogenous forces within the economy such as human capital and knowledge base. In this theory, human capital generates new forms of technology and efficient production that contribute to economic growth.

Early studies mostly focused on the nexus of financial development and economic growth and overlooked the nexus of financial development and human capital (Hatemi-J and Shamsuddin,

1 There is a vast literature on financial development and economic growth nexus. However, we abstain a detailed literature review as the main interest of this paper is not to analyze the nexus of finance-growth.

2016). However, human capital may also have a close relationship with financial development as well as economic growth. A well-developed financial market more efficiently mobilizes resources that raise investment in human capital through education expenditure, health expenditure and welfare activities (Sehrawat and Giri, 2017). Access to financial services raises the welfare and productivity levels of both consumers and producers (Kumar et al., 2005). More efficient institutions ease borrowing constraints and facilitate individual investments in education and health (Pascucci, 2012). In particular, credit constraints have a major role in limited human capital investment choices in developing countries. For instance, the low level of schooling in Latin America is ascribed to the presence of binding constraints that prevent the access to credit to finance higher education (Attanasio and Kaufman, 2009). Likewise, human capital may affect financial development as well because skilled and well-educated people (people with high human capital level) have generally better access to information and are less risk averse (Outreville, 1999). Additionally, education allows people to move from informal sector to formal sector opportunities, resulting in easier access to formal financial services (Kargbo et al., 2016). Human capital may create financial innovations necessary for financial development which in turns facilitates the acquisition of new human capital (Chou and Chin, 2001). Thus, it can be concluded that there could be a causality running either way.

Based on the scarcity of the studies analyzing the finance-human capital nexus, we examine this issue for a group of emerging market economies (EMEs hereafter) using dynamic panel data models. The contributions of this study to the existing literature are manifold. First, the existing studies are insufficient to adequately address this issue. Second, we construct and use a financial development index based on four bank-based indicators, whereas other studies have employed individual indicators for financial development. Because including all these indicators in a model is likely to create a multi-collinearity problems, we avoid this problem by employing principle component analysis. Third, we use panel unit root, co-integration and causality tests allowing for cross-sectional dependence and slope heterogeneity. Last, this paper is the first to analyze this issue for EMEs based on a panel data framework.

EMEs deserve a special research interest due to their rapid economic growth rates and high financial development levels. The report prepared by the World Bank (2011) stresses that EMEs are increasingly becoming a source of growth in the complex global economy. In particular, six major EMEs - Brazil, Russia, India, Indonesia, China and South Korea - are projected to account for approximately 45 percent of global output by the year 2025. Regarding the financial system, most EMEs still depend largely on the banking sector; however, the stock market development in EMEs is expected to increase in the future (Sadorsky, 2010). Additionally, some large EMEs such as Brazil and China have higher levels of financial development than certain advanced economies such as Greece and Portugal (Sahay et al., 2015). Concerning the level of human capital, education standards in EMEs are improving significantly as a result of economic growth and strong public investments (Euromonitor, 2016). For instance, 22 out of 25 EMEs - Brazil, Chile, Colombia, Mexico, Peru, Czech Republic, Egypt, Greece, Hungary, Poland, Russia, South Africa, Turkey, United Arab Emirates, China, India, Indonesia, Republic of Korea, Malaysia, Pakistan, Philippines and Thailand - have compulsory education ranging from 6 (Malaysia and United Arab Emirates) to 14 years (Mexico, Brazil and Peru) (World Bank, 2017).

The present study aims to investigate the effect of financial development on human capital in EMEs for the years 1990-2015 in the framework of panel data analyses. The rest of the paper is organized as follows. Section 2 presents the literature review while Section 3 explains the data and the empirical model used. Section 4 discusses the empirical findings. Section 5 provides conclusion and policy implications.

2. LITERATURE REVIEW

The nexus of finance and human capital has been explored at the empirical level only since the end of 1990s. Since then, scholars and researchers have been investigating the issue by using different indicators for human capital, such as school enrollment rates, public expenditure on education or health, life expectancy at birth, and etc. In the existing literature, based on their samples, studies could be classified into two categories: Country specific studies and cross-country studies.

Country specific studies (inter alia, Hakeem and Oluitan, 2012; Nik et al., 2013; Sehrawat and Giri, 2014; Uddin and Masih, 2015) analyze the issue applying time series techniques, such as co-integration test, Granger causality test, vector autoregressive model and variance decomposition analysis. Hakeem and Oluitan (2012) found a weak relationship between financial development and human capital in South Africa. For Iran, Nik et al. (2013) studied the influence of financial development on human capital over the period 1977-2010 and found that financial development contributed marginally to human capital. Sehrawat and Giri (2014) examined the relationship between financial development and human development in India. Their findings found evidence of a significant unidirectional causality running from financial development and economic growth to human development index (HDI). For Malaysia, Uddin and Masih (2015) investigated how finance and growth affect human development and found that financial development promotes human development through the channel of economic growth. A recent study by Hatemi-J and Shamsuddin (2016) obtained a unidirectional causality running from human capital to financial development. Worlu and Omodero (2016) studied the effect of human capital on financial performance of banks in Nigeria without finding any significant effect. Last, Demirci and Ozyakisir (2017) analyzed the relationship between human capital and financial development for Turkey over the years 1971-2013 and provided evidence favoring a unidirectional causality from human capital to financial development in both the short-run and the long-run.

The second research avenue includes cross-country studies (Akhmat et al., 2014; Arora, 2012; Arora and Ratnasiri, 2011; Eryigit et al., 2015; Hong-Ho, 2013; Ostojic, 2013; Outreville, 1999; Pascucci, 2012; Sehrawat and Giri, 2017). These papers

generally employ panel data analyses, such as static panel data models (i.e., fixed effects, random effects, and pooled OLS) and dynamic panel data models (i.e., panel co-integration tests). One of the earliest panel studies by Outreville (1999), based on a cross-sectional analysis of 57 developing countries over the period 1988-1990, indicated that human capital and socio-political stability are important factors explaining the level of financial development. Pascucci (2012), using data on 68 countries, found that improvements of financial market depth are positively and robustly correlated with changes in HDI. In a panel consisting of 21 developing Asian countries, Arora (2012) found that in countries with low financial development, the quality of education is also very poor between the years 2000-2010. In another study, Arora and Ratnasiri (2011) showed that human capital positively affects financial development both in the India and the 23 Indian states during the period 1999-2008. For European Union, Ostojic (2013) proved that financial development had a strong positive effect on human development during the period 1990-2000. Depending on both a theoretical model and an empirical analysis, Hong-Ho (2013) provided evidence that credit market development facilitates human capital accumulation.

By making use of a panel including some selected South Asian Association for Regional Cooperation (SAARC) countries, Akhmat et al. (2014) investigated the impact of economic growth and financial development on human development over the period 1988-2008. They found that financial development acts as an important driver of human development. Likewise, Sehrawat and Giri (2017) revealed that both financial development and economic growth lead to increases in human capital for Asian countries with a unidirectional causality running from financial development and economic growth to human capital. For 81 provinces in Turkey, Eryigit et al. (2015) argued that human capital accumulation positively affects financial development and that human capital stock is one of the reasons for financial development gaps over the years 2005-2009.

Apart from these two main research streams, there are studies exploring the relationship between human capital and financial development in an indirect way through growth models (Buiter and Kletzer, 1992; De Gregorio and Guidotti, 1995; De Gregorio, 1996; Evans et al., 2002; Hakeem, 2010; Outreville, 1999; Pagano, 1993, Papagni, 2006). Among those, Buiter and Kletzer (1992) and De Gregorio (1996) showed that increasing borrowing constraints reduce human capital accumulation as well as economic growth. The studies in this category create an interaction term between finance and human capital, with the sign of its coefficient indicating whether there is a complementary or substitute relationship between human capital and financial development (Evans et al., 2002; Kargbo et al., 2016; Hakeem, 2010 for the complementary relationship and Kendall 2012 for the substitute relationship). Additionally, Sharma (2016) found no interaction between finance and human capital based on a diverse sample of 66 countries. Last, for the panel of Economic Community of West African States, Abubakar et al. (2015) concluded that financial development contributes significantly to economic growth through human capital development without exploring the interaction between human capital and financial development.

3. DATA AND MODEL

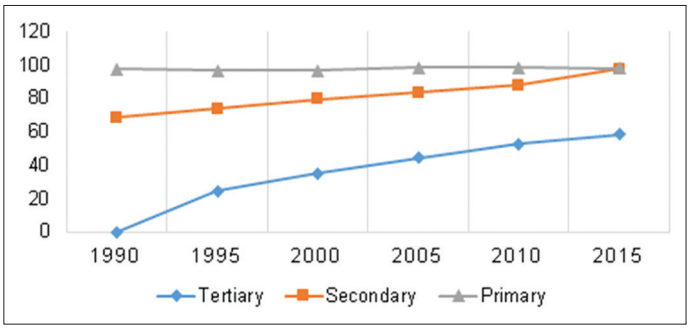
In this study, we use two popular indicators for human capital[2]. Gross tertiary school enrollment rate (the percentage of the relevant part of the population enrolled in tertiary school) and the government expenditure on education (as a percentage of GDP). As stated by De Gregorio (1996), education expenditure may have positive effects on human capital accumulation because it may reflect low private costs or high quality of education (Al-Yousif, 2008; Evans et al., 2002; Mekdad et al., 2014; Pradhan, 2009; Sehrawat and Giri, 2017). Additionally, primary, secondary and tertiary school enrollment rates are among the most popular indicators of human capital (Akhmat et al., 2014; Awad et al., 2013; De Gregorio, 1996; Evans et al., 2002; Hakeem and Oluitan, 2012; Kargbo et al., 2016; Nik et al., 2013; Sulaiman et al., 2015). However, we represent human capital with tertiary school enrollment rate (Awad et al., 2013; Hakeem and Oluitan, 2012; Nik et al., 2013; Sulaiman et al., 2015) because people with a higher educational background have a higher level of financial literacy (Eryigit et al., 2015). As such, higher educational background would be more determinative on financial development. Moreover, primary and secondary education are compulsory in most EMEs as stated before. As seen in Figure 1, in the panel of EMEs, primary school enrollment rate is stable over time as it is compulsory while secondary school enrollment rate is slowly rising and overlaps primary education. However, tertiary school enrollment rate has an upward trend over the years 1990-2015.

Due to the fact that banking sector is dominant in EMEs, we use purely bank-based indicators as our measure of financial development. The variables used to represent financial development are as follows: 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 banking sector as a percentage of GDP and domestic credit to private sector as a percentage of GDP. In the related literature, liquid liabilities[3] and the broad money supply are used to measure financial depth and the overall size of the financial intermediary sector (Akhmat et al., 2014; Hakeem, 2010; King and Levine, 1993; Outreville, 1999). They measure the level of monetization of the economy. Domestic credit to private sector (PRIV) is defined by World Bank (2017) as financial resources allocated to private sector via loans, purchases of non-equity securities, trade credits and other accounts receivable, which establish a claim for repayment (Akhmat et al., 2014; Levine and Zervos, 1998; Levine et al., 2000; Nik et al., 2013 used PRIV as a proxy for financial development). The last indicator-domestic credit provided by banking sector (BANK)—equals the ratio of bank credit divided by bank credit plus central bank domestic assets and measures the degree to which the central bank versus commercial banks are allocating credit (Levine, 1997). Further, we prefer constructing a financial development (FD) index based on these four indicators because there is no single variable that can

2 As a proxy for human capital, we first used the human capital index of Barro and Lee (2013). However, we couldn't include it in the model as it was integrated of order two.

3 "Liquid liabilities equal currency held outside of the banking system plus demand and interest-bearing liabilities of banks and nonbank financial intermediaries" (King and Levine 1993; Levine 1997).

Figure 1: Primary, secondary and tertiary school enrollment rates (gross, %)



Source: World Bank (2017). World development indicator database

capture all aspects of financial development. The simultaneously inclusion of these financial development indicators in the model leads to high correlations among them, indicating some redundancy of information (Menyah et al., 2014). Therefore, using principal component analysis[4], we construct a comprehensive index of financial development to mitigate potential multicollinearity problem (Gries et al., 2009; Menyah et al., 2014 for a similar methodology). As a control variable, real per capita GDP based on 2010 US dollars is included in the model to measure the real economic performance of EMEs.

The sample of the study includes two separate panels: The first panel consists of 16 EMEs, namely Chile, Colombia, Mexico, Peru, Czech Republic, Hungary, Poland, Russia, Turkey, China, India, Indonesia, Korea Republic, Malaysia, Philippines and Thailand for the years 1990-2015. The second panel includes 17 emerging markets, namely Brazil, Chile, Colombia, Czech Republic, Hungary, India, Indonesia, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Thailand and Turkey for the period 1998-2015. As a proxy for human capital, the first panel uses tertiary school enrollment rate, whereas the second panel utilizes government expenditure on education. The selection of time periods and countries in the panels was dictated by data availability. The Morgan Stanley Capital International (MSCI) classification is used in the selection of EMEs. Real per capita GDP and tertiary school enrollment data are extracted from the World Bank (2017) - World Development Indicators Database - while government expenditure on education data are obtained from the United Nations Educational, scientific and cultural organization institute for statistics (UNESCO UIS, 2017).

Following the related literature (Akhmat et al.2014; Sehrawat and Giri 2014, 2017), we define our model as follows:

$$HCAP=f(FD, PGDP) \quad (1)$$

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

$$\ln HCAP_{it}=\alpha_i+\beta_{1i} \ln FD_{it}+\beta_{2i}\ln PGDP_{it}+\varepsilon_{it} \quad (2)$$

Where, ln denotes the natural logarithm; I = 1,2.,…,N indicates the number of countries in each panel while t = 1,….,T refers to the time period. The parameters β_1 and β_2 represent the long-run elasticity estimates of human capital (lnHCAP) with respect to financial development (lnFD) and economic growth (lnPGDP), respectively and ε_{it} is the white noise error term. Note that two models are estimated as there are two different panels of countries.

4. METHODOLOGY AND EMPIRICAL RESULTS

4.1. Results from Cross-sectional Dependence Test and Panel Unit Root Tests

Before proceeding to the empirical analysis, we provide plots of human capital indicators (tertiary enrollment rate and government expenditure on education) versus financial development and real per capita GDP in Figure 2. Visually, there appear to be positive relationships between human capital and financial development and also between human capital and economic growth. As will be discussed below, our empirical results support these visual inspections as well.

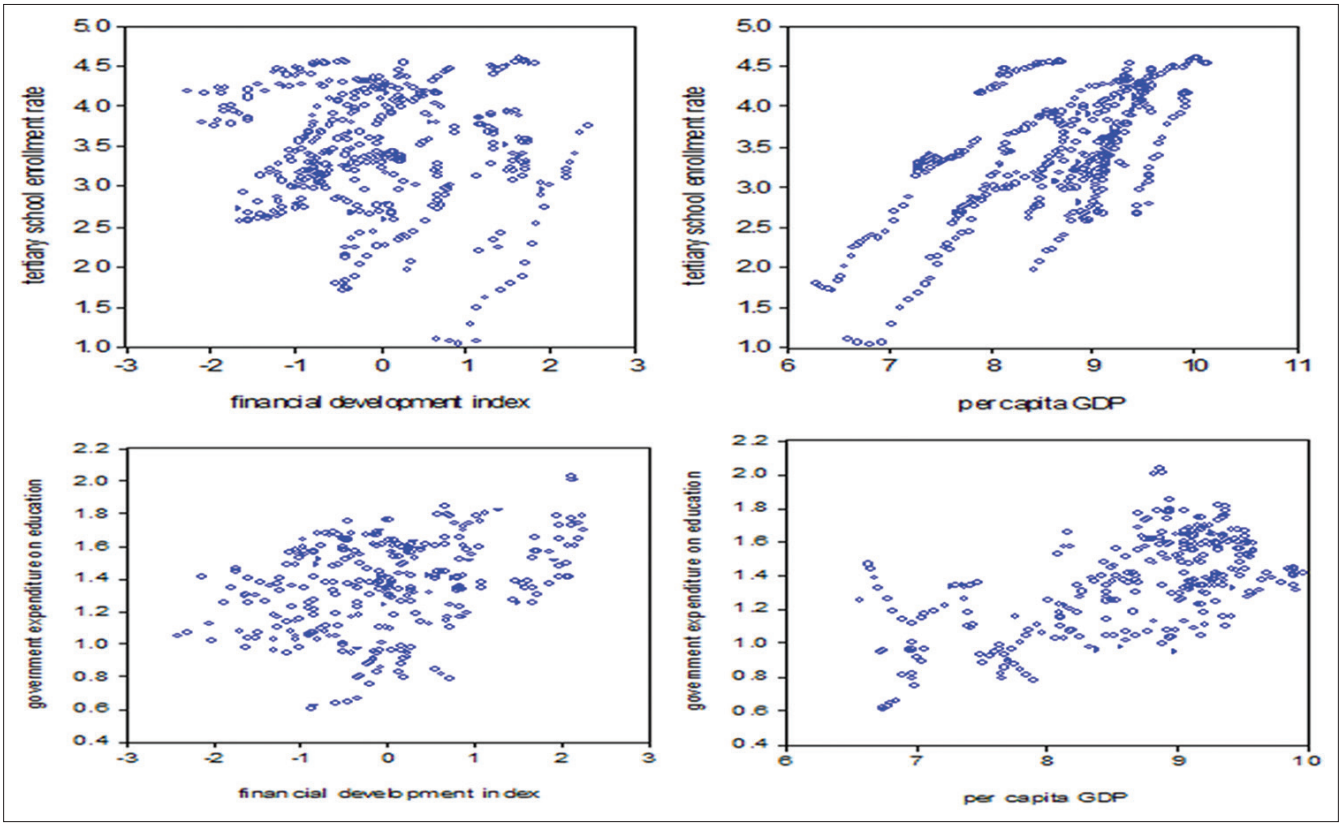
Text As seen in Table 1, the mean values of variables range from −1.31E-09 (lnFD) to 8.6490 (lnPGDP) while their standard deviation values differ between 0.2795 (lnHCAP) and 1.000 (lnFD)[5]. Thus, it reveals that data are fairly dispersed around the mean, justifying further estimation of data. At the first stage of analysis, we need to test the cross-sectional dependence to decide on the appropriate unit root test. To this aim, we use the Lagrange multiplier (LM) test, which has the null hypothesis of cross-sectional independence and follows χ^2 distribution, developed by Breusch and Pagan (BP, 1980). The LM test is preferred to other cross-sectional dependence tests suggested by Frees (1995) and Pesaran (2014) in case that T is larger than N as in our case. The test results are provided in Table 2.

Text the results provided evidence of cross-sectional dependence in all variables (Table 2), indicating that a shock affecting one EME could be easily transmitted to other EMEs due to globalization, financial integration and international trade (Nazlioglu et al., 2011). Therefore, we should apply a panel unit root test allowing for cross-sectional dependence. To that aim, Smith et al. (2004) developed five panel unit root tests - $L\bar{M}$, $\bar{t}$, $Mi\bar{n}$, $Ma\bar{x}$ and $W\bar{S}$ tests - that handle cross-sectional dependence via a bootstrap procedure. test is the average of individual LM test statistics (LM_t) proposed by Solo (1984); $\bar{t}$ tests is a bootstrap version of the IPS test of Im et al. (2003); the $Ma\bar{x}$ test was developed by Leybourne (1995) and is the mean of individual Max_i statistics $(Ma\bar{x} = N^{-1}\sum_{i=1}^{N} Max_i)$; $Mi\bar{n}$ test $(Mi\bar{n} = N^{-1}\sum_{i=1}^{N} Min_i)$ is a more powerful variant of the LM statistics and based on both forward and reverse ADF regressions,

4 Principal component analysis was applied based on the natural logarithm values of FD variables.

5 We didn't report country level descriptive statistics to conserve space; however, they are available from the corresponding author upon request.

Figure 2: Scatter plots of variables of interest



Source: Author's own calculation

Table 1: Summary statistics of variables

Statistics	Model 1			Model 2		
	lnPGDP	lnHCAP	lnFD	lnPGDP	lnHCAP	lnFD
Mean	8.6271	3.4326	−1.23E-08	8.6490	1.3634	−1.31E-09
Median	8.8305	3.4113	−0.1004	8.9285	1.3830	−0.0490
Maximum	10.127	4.6017	2.4514	9.9624	2.0362	2.2491
Minimum	6.2849	1.0451	−2.2901	6.5602	0.6080	−2.4412
Standard deviation	0.8517	0.7426	1.0000	0.8476	0.2795	1.0000
Skewness	−0.7027	−0.5883	0.3181	−0.8706	−0.3782	0.3080
Kurtosis	2.8644	3.1533	2.4299	2.7715	2.6495	2.7895
Observations	416	416	416	306	306	306

Model 1 includes gross tertiary school enrollment rate as a proxy for human capital while Model 2 includes government expenditure on education

providing the statistics LM_{fi} and LM_{ri} based on their minima; and finally $\overline{WS}$ test is the mean of individual WS_i statistics defined by Pantula et al. (1994). They have a unit root null hypothesis and allow for heterogeneous autoregressive roots under the alternative hypothesis. In this respect, stationarity holds for at least one panel member if the null hypothesis is rejected.

Probabilities are reported in parentheses; [a]Indicates the rejection of the unit root null hypothesis at the 1% significance level. 5000 bootstrap replications are used to control for cross-sectional dependence, as well as the finite - sample bias. A block size that equals 100 is used. The maximum lag order of the individual unit root test regressions is set to 2. Model 1 includes gross tertiary school enrollment rate as a proxy for human capital while Model 2 includes government expenditure on education.

Table 2: Breusch and Pagan (BP, 1980) LM test results

Model 1	LM test statistics	Model 2	LM test statistics
lnHCAP	346.182[a] (0.000)	lnHCAP	226.984[a] (0.000)
lnPGDP	352.894[a] (0.000)	lnPGDP	205.267[a] (0.000)
lnFD	261.158[a] (0.009)	lnFD	222.503[a] (0.000)

Model 1 includes gross tertiary school enrollment rate as a proxy for human capital while Model 2 includes government expenditure on education. Probabilities are reported in parentheses; a indicates the rejection of independence null hypothesis at 1% significance level

The test results provided in Table 3 indicate that all variables are nonstationary in their levels, whereas they are stationary in their first-differences, i.e., they are integrated of order one.

4.2. Results for Co-integration Test and Long-run Parameter Estimates

Having established that all variables are integrated of order one, we examine the co-integration relationship among the variables. To that

Table 3: Smith et al. (2004) panel unit root tests results

Variables	$\bar{t}$	$L\bar{M}$	$L\bar{M}$	$Mi\bar{n}$	$W\bar{S}$
Model 1-level					
lnHCAP	−1.56 (0.97)	3.43 (0.97)	2.57 (0.93)	−1.29 (0.92)	−1.66 (0.96)
lnFD	−2.13 (0.39)	5.00 (0.481)	2.60 (0.91)	−1.23 (0.91)	0.788 (1.00)
lnPGDP	−2.28 (0.31)	5.22 (0.32)	2.98 (0.75)	−1.42 (0.82)	−1.76 (0.87)
Model 1-first-difference					
lnHCAP	−4.17[a] (0.00)	11.02[a] (0.00)	9.18[a] (0.00)	−3.49[a] (0.00)	−3.89[a] (0.00)
lnFD	−607.41[a] (0.00)	22.03[a] (0.00)	21.96[a] (0.00)	−606.14[a] (0.00)	−88.99[a] (0.00)
lnPGDP	−4.05[a] (0.00)	10.48[a] (0.00)	7.88[a] (0.00)	−3.16[a] (0.00)	3.45[a] (0.00)
Model 2-level					
lnHCAP	−2.37 (0.19)	5.46 (0.17)	3.38 (0.60)	−1.67 (0.55)	−2.19 (0.51
lnFD	−2.15 (0.46)	4.69 (0.43)	3.63 (0.41)	−1.79 (0.39)	−2.24 (0.39)
lnPGDP	−2.16 (0.45)	4.67 (0.44)	2.56 (0.81)	−1.06 (0.93)	−1.70 (0.89)
Model 2-first-difference					
lnHCAP	−4.52[a] (0.00)	10.18[a] (0.00)	8.48[a] (0.00)	−3.74[a] (0.00)	−4.35[a] (0.00)
lnFD	−4.11[a] (0.00)	9.08[a] (0.00)	8.29[a] (0.00)	−3.64[a] (0.00)	−4.16[a] (0.00)
lnPGDP	−3.50a (0.00)	8.14a (0.00)	7.26a (0.00)	−3.13a (0.00)	−3.59a (0.00)

purpose, we apply the LM co-integration test proposed by Westerlund and Edgerton (WE, 2007). The WE (2007) proved that their test is efficient in small samples and allows for dependence both within and between the cross-sectional units. WE (2007) test depends on the LM test suggested by McCoskey and Kao (1998) and the sieve-sampling scheme is used in the implementation of the bootstrap procedure. It has an advantage of reducing the distortions of the asymptotic test. Its null hypothesis denotes the cointegration for all countries in the panel; however, some countries in the panel are not co-integrated under the alternative hypothesis. Its results are provided in Table 4.

Table 4: Results from WE (2007) and BP (1980) tests

Models			
WE (2007) test	**LM test statistic**	**Bootstrap prob.**	**Asymptotic prob.**
Model 1	2.629	0.716	0.000
Model 2	1.217	0.938	0.112
BP (1980) LM test	LM test statistic		Prob.
Model 1	431.993[a]		0.000
Model 2	268.772[a]		0.000

1000 bootstrap replications are used. The lag length selection is based on the approach by Campbell and Perron (1991). Constant is included as a deterministic term. The null hypothesis of WE (2007) test is the cointegration between lnHCAP and its potential determinants across countries. The BP (1980) test has an independence null hypothesis. a implies the rejection of the null hypotheses in both tests

As seen in Table 4, we can reject the cross-sectional independence null hypothesis at 1% significance level for both models. Therefore, in the WE (2007) cointegration test, instead of asymptotic probability values, we should rely on the bootstrap probability values indicating that the null hypothesis of cointegration cannot be rejected in both models. Given the presence of cointegration, we proceed to estimate the long-run parameters in the co-integrating vector. However, we should ascertain the slope heterogeneity in order to choose the right estimator. Therefore, we employ Delta ($\tilde{\varnothing}$) and Adjusted Delta ($\tilde{\varnothing}_{adj}$ tests suggested by Pesaran and Yamagata (2008). Delta tests reject the null hypothesis of slope homogeneity in both models.[6] Thereafter, we utilize Pedroni's (2000, 2001) group mean-fully modified OLS (GM-FMOLS) and the group-mean dynamic OLS (GM-DOLS) approaches to estimate the long-run parameters in the co-integrating vector. Pedroni's (2000) GM-FMOLS estimator incorporates a semi-parametric correction to the OLS estimator so as to eliminate the endogeneity and serial correlation problems while Pedroni's (2001) GM-DOLS estimator parametrically corrects the OLS estimator (Sadorsky, 2009). Moreover, Pedroni (2000; 2001) asserts that in the presence of heterogeneity in the co-integrated panel data, the group-mean estimators produce more consistent estimates compared to their pooled and weighted counterparts. Before estimating the long-run parameters in the co-integrating vector, we demeaned the data with respect to common time effects as GM-FMOLS and GM-DOLS approaches do not take cross-sectional dependence into account. The results for long-run parameter estimates are tabulated in Table 5.

As seen in Table 5, FMOLS and DOLS estimators indicate that financial development and economic growth positively affect human capital in both models. However, economic growth has a higher impact on human capital compared to financial development. For instance, FMOLS results indicate that 1% increases in FD index and economic growth raise tertiary school enrollment rate about 0.1% and 1.4%, respectively, while public expenditure on education goes up by 0.09% and 0.2%. Overall, the empirical findings confirm that financial development encourages human capital in EMEs. College enrollment rates in EMEs rise as a result of financial development as people can finance their education expenditures using bank credits. As stated by Pascucci (2012), a well-developed financial system solves the borrowing constraints and facilitates individual investments in education. This result is similar to that reached by Akhmat et al. (2014), Nik et al. (2013), Pascucci (2012), Uddin and Masih (2015), Ostojic (2013) and Sehrawat and Giri (2017). Further, economic growth affects human capital positively as well. In this respect, wealthy and fast

6 The values of $\tilde{\varnothing}$ test are 20.821 in Model 1 and 14.061 in Model 2 with zero probability values, while the values of $\tilde{\varnothing}_{adj}$ test are 22.537 and 15.826 with zero probability values in Models 1 and 2, respectively.

Table 5: Result for long-run parameter estimates

Independent variables	GM-FMOLS		GM-DOLS	
	Model 1	Model 2	Model 1	Model 2
lnFD	0.121[a] (0.008)	0.099[a] (0.000)	0.134[b] (0.044)	0.080[b] (0.045)
lnPGDP	1.491[a] (0.000)	0.283[a] (0.000)	1.467[a] (0.000)	0.363[a] (0.000)

Constant is included as a deterministic term; [a] and [b] refer to significance at 1% and 5% levels, respectively. Model 1 includes gross tertiary school enrollment rate as a proxy for human capital while Model 2 includes government expenditure on education

Table 6: Results from the pairwise Dumitrescu-Hurlin (2012) panel causality test

Null hypothesis	W_{NT}^{HNC} Stat.	Z_{NT}^{HNC} Stat.	Prob.
Model 1			
lnHCAP does not homogeneously cause lnFD	5.648[a]	5.427[a]	0.000
lnFD does not homogeneously cause lnHCAP	2.540	0.484	0.628
lnPGDP does not homogeneously cause lnFD	7.986[a]	9.143[a]	0.000
lnFD does not homogeneously cause lnPGDP	4.364[a]	3.385[a]	0.000
lnPGDP does not homogeneously cause lnHCAP	4.014[a]	2.828[a]	0.004
lnHCAP does not homogeneously cause lnPGDP	8.186[a]	9.462[a]	0.000
Model 2			
lnHCAP does not homogeneously cause lnFD	5.506[a]	4.120[a]	0.000
lnFD does not homogeneously cause lnHCAP	7.144[a]	6.323[a]	0.000
lnPGDP does not homogeneously cause lnFD	23.78[a]	28.71[a]	0.000
lnFD does not homogeneously cause lnPGDP	6.287[a]	5.170[a]	0.000
lnPGDP does not homogeneously cause lnHCAP	7.053[a]	6.201[a]	0.000
lnHCAP does not homogeneously cause lnPGDP	4.383[a]	2.609[a]	0.009

growing EMEs invest more in their education sectors. As a result of economic growth, more people will get the advantage of higher education and the governments may allocate more money from their budgets for education. This result is in accordance with that of Sehrawat and Giri (2014, 2017), while it is in sharp contrast with that of Akhmat et al. (2014), who found a negative effect of growth on human capital in SAARC countries.

4.3. Dumitrescu-Hurlin (DH 2012) Panel Causality Test Results

We employ panel causality test proposed by Dumitrescu and Hurlin (DH 2012) to define the directions of causality linkages between the variables. DH (2012) test is a simple Granger (1969) non causality test in heterogeneous panel data models with fixed coefficients and allows for two dimensions of heterogeneity: (i) The heterogeneity of regression models used to test the Granger causality and (ii) the heterogeneity of the causal relationships. The DH (2012) test has two test statistics: The first test statistic W_{NT}^{HNC} is based on the individual Wald statistics of Granger non causality averaged across the cross-section units, while the second test is the standardized statistic Z_{NT}^{HNC} based on an approximation of the moments of Wald statistics. Furthermore, Monte Carlo analyses demonstrate that the small sample properties of the standardized panel statistics are efficient even in the presence of cross-sectional dependence (DH, 2012). The null hypothesis assumes that there is no causal relationship for any of the cross-sectional units in the panel, whereas the alternative hypothesis proposes a causal relationship for a subgroup of panel.[7] DH (2012) test results are provided in Table 6.

As shown in Table 6, there are bidirectional causality relationships between all pairs of variables except for the pair financial development and tertiary school enrollment rate. In Model 1, the causality is running from human capital (tertiary education) to financial development, but not vice versa. It means that college students use bank credit to finance their college tuition payments and other education expenditures which in turn results in a more developed and efficient financial system (Hatemi-J and Shamsuddin, 2016; Demirci and Ozyakisir, 2017 for the similar results). However, in Model 2, there exists a bidirectional causality or a feedback relation between government expenditure on education and financial development. In this respect, governments can increase education expenditures with the aid of a well-developed financial system. For instance, governments may provide education loans for students through the banking channel. In this case, more government expenditure on education results in an efficient and a developed financial system as well. For instance, banks can open new branches in the college campuses to provide a better service for students. However, studies in the existing literature generally found a unidirectional causality running from financial development to human capital instead of bidirectional causality (see, inter alia, Sehrawat and Giri, 2014, 2017).

Concerning the finance-growth nexus, we obtain a bidirectional relationship, supporting neither the supply-leading hypothesis (a unidirectional causation that runs from financial development to economic growth) nor the demand-following hypothesis (a unidirectional causation running from economic growth to financial development) in the finance literature. Financial system and economic growth appear to reinforce each other (Abu-Bader and Abu-Qarn, 2008; Gries et al., 2011; Singh, 2008; Wolde-

7 Interested readers may refer to DH (2012) for the detailed methodological explanation of the test.

Rufael, 2009 for similar results). With regard to human capital and economic growth nexus, the results provided evidence of a feedback relationship as well (Awel, 2013; Hassan and Kalim, 2012; Hussin et al., 2012; Rahman, 2011; Rehman et al., 2014 for similar results). On one hand, investments in national human capital stock are likely to create wealthier and fast growing economies as emphasized in the endogenous growth theory. In this regard, countries can compete against other countries by investing more in knowledge, technology, innovation and research and development areas. On the other hand, economic growth creates more investments in human capital stock.

5. CONCLUSION AND POLICY IMPLICATIONS

The objective of the present study is to analyze the effect of financial development on human capital in EMEs over the period 1990-2015. To represent human capital, tertiary school enrollment rate and government expenditure on education are used as proxy variables while an index of financial development is constructed by using four bank-based indicators. Based on the availability of human capital indicators, we have composed two samples of countries, including 16 and 17 emerging economies, respectively.

The empirical findings suggest that financial development and economic growth have significant and positive impacts on both human capital indicators. Additionally, the results provided evidence of a bidirectional causality linkage between government expenditure on education and financial development and a unidirectional causality linkages running from tertiary school enrollment rate to financial development. In this regard, human capital appears to cause financial development in EMEs. Bank-based financial system creates a channel through which governments of EMEs may invest more in their education sectors. However, financial development is not a cause of higher education, in contrast, it is the result of higher education. Moreover, some feedback relationships between financial development and economic growth and between economic growth and human capital are also supported. In this respect, economic growth is a reason for and a result from both financial development and human capital accumulation.

Based on the results, we can infer some policy implications. First, the governments of EMEs should consider financial development level while making projections for the future national human capital demand. Otherwise, further developments in financial markets can increase human capital in a way that has not been accounted for, resulting in more difficulties for EMEs to meet their planned human development targets. Second, the policies of economic development, finance and education should be simultaneously considered as there are strong bilateral relations among the corners of the development-finance and human capital triangle. Financial policies targeting more investment in education (e.g. lowering interest rates for educational loans) will likely create more educated people with high financial literacy rates. Educated people will likely support the development of financial sector as they have sufficient acquaintance with financial instruments and services. Moreover, as stated by Sehrawat and Giri (2017) investments in financial sector and human capital will likely enrich economic prosperity and reduce poverty and income inequality as more investment in human capital will generate higher returns in EMEs.

As a final note, future studies can expand the scope in several ways. First, a financial index can be constructed based on different proxies for financial development, such as capital market based indicators. Likewise, different proxies for human capital or human development, such as HDI, could be used. Moreover, the existing literature is still in its infancy and needs further studies to analyze the issue for different countries.

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