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**Article**

## Does financial development improve human capital accumulation in the Southeast Asian countries?

Cogent Business & Management

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*Suggested Citation:* Duc Hong Vo; Ngoc Phu Tran; Ha Minh Nguyen (2021) : Does financial development improve human capital accumulation in the Southeast Asian countries?, Cogent Business & Management, ISSN 2331-1975, Taylor & Francis, Abingdon, Vol. 8, Iss. 1, pp. 1-18, <https://doi.org/10.1080/23311975.2021.1932245>

This Version is available at:

<https://hdl.handle.net/10419/245043>

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To cite this article: Duc Hong Vo, Ngoc Phu Tran & Ha Minh Nguyen | (2021) Does financial development improve human capital accumulation in the Southeast Asian countries?, Cogent Business & Management, 8:1, 1932245, DOI: [10.1080/23311975.2021.1932245](https://doi.org/10.1080/23311975.2021.1932245)

To link to this article: <https://doi.org/10.1080/23311975.2021.1932245>



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Published online: 30 May 2021.



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Received: 3 January 2021  
Accepted: 6 April 2021

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Reviewing editor:  
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## MANAGEMENT | RESEARCH ARTICLE

# Does financial development improve human capital accumulation in the Southeast Asian countries?

Duc Hong Vo<sup>1\*</sup>, Ngoc Phu Tran<sup>1</sup> and Ha Minh Nguyen<sup>1</sup>

**Abstract:** Financial development and human capital's crucial roles in economic growth have been widely recognized in the literature. However, a direct link between financial development and human capital, in the long run, has not been investigated, in particular in emerging markets in Asia. This study investigates the nexus between financial development and human capital for a group of nine emerging markets in the Southeast Asian region over the period 1990–2018. Econometric techniques allowing for cross-sectional dependence and panel co-integration, such as the dynamic least squares (DOLS) and fully modified least squares (FMOLS), are used. We also use three indicators as the proxies for financial development: broad money supply, bank credit, and private sector credit. Empirical findings from this paper indicate that financial development contributes positively and significantly to human capital accumulation. We also find that economic growth enhances the formation of human capital. Results from our Granger causality tests confirm a bi-directional relationship between financial development and

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Duc Hong Vo is Professor, and practitioner, of Applied Economics and Finance. Duc has more than 20 years of teaching experience in Australia and Vietnam. More than 100 papers from his research have been published in international journals including *Renewable Energy*, *Applied Economics*, *Journal of Intellectual Capital*, *Journal of Economic Surveys*, *Journal of Asian Economics* and many others.

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### PUBLIC INTEREST STATEMENT

Emerging markets in the Association of Southeast Asian Nations (ASEAN) have been achieving impressive economic growth and a reduction in poverty in the past 20 years. However, economic indicators on health, education and skills development from these nations are well below expectations. We argue that a direct link between financial development and human capital, key pillars to economic growth and development in these countries, in the long run has not been investigated. Our study is conducted to provide empirical findings and policy implications on this important link. Our findings confirm that financial development contributes positively and significantly to human capital accumulation. We also find that economic growth enhances the formation of human capital. A bi-directional relationship between financial development and human capital is found in this analysis. Policymakers from the Southeast Asian emerging markets may need to enhance and extend a degree of financial development which is closely linked with human capital accumulation.

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**Subjects: Sustainable Development; Development Policy; Economics and Development**

**Keywords: Financial development; economic growth; Human capital; FMOLS; DOLS; Asian emerging markets**

## 1. Introduction

Economic growth is a multidimensional concept that reflects the changing process of the economy and society. This important process leads to social welfare change such as education, life expectancy, death and many others. The relationship between financial development and economic growth has been widely examined. Findings from previous studies (Bittencourt, 2012; Menyah et al., 2014; Phan et al., 2019) indicate that financial development is an essential factor for economic growth. Financial development supports economic growth by creating efficient markets through intermediary institutions between savers and borrowers, reducing transaction costs and enhancing market integration (Aziz & Duenwald, 2002).

Besides, there has been an increasing interest in the role and importance of human capital to economic growth. Among various components, education is generally considered a key factor of human capital for economic growth. Becker (1964) points out that better educational outcomes will improve economic outcomes. As such, both financial development and human capital contribute significantly to economic growth.

Emerging markets in the Association of Southeast Asian Nations (ASEAN) have been achieving impressive economic growth and a reduction in poverty in the past 20 years. However, economic indicators on health, education and skills development from these nations are well below expectations. Investing even more in people, especially children and adolescents, remains a significant challenge for the ASEAN members (World Bank, 2019a). Each country member of the ASEAN has a similar economic growth pattern, institutional arrangements and integration efforts. These countries have recognized that both human capital and financial development are crucial factors for economic growth. Investing in human capital has become a solution that the ASEAN can take to ensure that their economies are competitive in the future (World Bank, 2019b). Studies on financial development, economic growth and human capital have been conducted mainly for other regions (Chi, 2008; Shan & Morris, 2002). A limited number of studies have been conducted for the developing countries in Asia (Sehrawat & Giri, 2017; Sethi et al., 2019). In particular, empirical studies on the relationship between financial development, economic growth and human capital are relatively limited, especially for emerging countries in the ASEAN region.

The establishment of the ASEAN Economic Community requires member states to improve the tertiary school enrollment levels and form an innovative economy. The demand for highly qualified labour is increasing due to the demand for innovation-oriented economies. Access to high-quality tertiary education is one way to solve this problem (Muhamad et al., 2018). We consider that studies on the link between financial development and human capital, leading to enhance and support economic growth in the emerging markets in the ASEAN, will provide important policy implications for policymakers.

Sarwar et al. (2021) consider that financial development and human capital positively and significantly affect emerging economies' economic growth. Sethi et al. (2019) find that both the market size and financial development play an important role in developing human developing Asian countries. In another study, Sehrawat and Giri (2017) show that human capital is motivated by financial development, which positively affects six of the above studies. We argue that there is

a relationship between financial development, economic growth and human capital. This study contributes to the existing literature on the relationship between financial development, economic growth and human capital on the following grounds. First, we focus on a long-term relationship between financial development (proxied by broad money supply, bank credit and private sector credit) and human capital using the dynamic least squares (DOLS) and fully modified least squares (FMOLS) methods. Besides, pooled mean group mBesidesis also utilized for robustness check. Second, we examine a causal relationship between financial development, economic growth and human capital to identify appropriate starting policies for the region. Third, we focus exclusively on the ASEAN region over the period 1990–2018 to provide direct policy implications for the region's governments. Developing countries, especially the ASEAN countries, are largely ignored in studies on financial development and human capital. In addition, our motivation is to examine the accumulation of human capital based on consideration of the impact from financial development and economic growth. Our empirical findings indicate that financial development and economic growth have a long-run relationship with human capital accumulation. In addition, the findings provide evidence to confirm a view that economic growth contributes positively to human capital accumulation. Furthermore, human capital supports economic growth. The ASEAN countries' governments may consider implementing policies that improve and enhance human capital formation and accumulation to promote economic growth. Besides, these countries may also need to strengthen the development of the financial markets, which are generally considered an effective mechanism to support economic growth and human capital accumulation.

The structure of this paper is as follows. Following this introduction, section 2 discusses and synthesizes a literature review on the relevant topics of financial development, human capital and economic growth. Section 3 discusses data sources, variables measurements and econometric framework. Empirical findings and discussions are presented in section 4. Section 5 discusses conclusions and policy implications.

## 2. Literature review

In the classical economic theory, the labour force's productivity is generally considered an exogenous factor depending on the ratio between employees, physical capital, and technical progress. However, this theory does not consider the role of education in productivity growth. Besides, the market value theory considers the importance of human capital factors such as education and innovation to long-term economic growth (Muhamad et al., 2018). Becker (1964) and Mincer (1974) point out that education affects productivity and innovation.

Lucas (1988), Mankiw et al. (1992), and Siggel (2001) consider that human capital is one of the most important factors to support economic growth concerning (i) a growth rate effect from its decisive influence on production through labour productivity and (ii) the level effect contributing to enhancing competitive advantage through innovation and technology diffusion. Schultz (1993) emphasizes the importance of human capital and its significant contributions to economic growth. A well-educated labour force contributes to innovation and economic growth (Benhabib & Spiegel, 1994). Additionally, Levine (1997) asserts that finance has been considered an important factor in supporting economic growth. Chou and Chinn (2001) argue that human capital affects the formation of innovation and financial development, leading to the accumulation of human capital. In addition, financial development and the accumulation of human capital also contribute to an increase in economic productivity. On the other hand, Dutta and Sobel (2018) consider that financial development (the banking system that channels capital investment) can significantly affect the productivity of human capital and economic growth. The literature describes human capital as a direct expenditure on education, training, health and internal migration, which has been well acknowledged as a crucial input in promoting economic growth (Mankiw et al., 1992).

Asia is the largest regional economy, accounting for a share of 32 per cent in 2000 and 42 per cent in 2017 in the global GDP. This region plays an essential role in shaping globalisation's next phase (Tonby et al., 2019). Various studies have been conducted to examine the link between

human capital, sustainable development and the accumulation of capital sources that contribute to the competitive advantage of the Asian countries. For example, Arshad et al. (2020) examine the impact of information technology, trade, economic growth, financial development and energy consumption on carbon emissions in South and Southeast Asia from 1990 to 2014. Tran and Vo (2020a) compare human capital contribution to different industries in Vietnam in the period 2011–2018. In a different study, Tran and Vo (2020b) examine the accumulation of sustainable competitive advantages (based on firms' intellectual capital) in the ASEAN emerging market. Zafar et al. (2021) examine the role of renewable energy use, natural resource abundance and education in environmental quality by controlling the role of financial development and economic growth in the Asian countries in the period 1990–2018. Saeed et al. (2018) explore the relationship between governance and operations of microfinance institutions (MFIs) of six South Asian countries in the 2005–2009 period. These studies all emphasize that intangible assets such as human capital, intellectual capital or the application of information technology provide a significant impact on the sustainable development of the economies in the Asian region. Barry and Tacneng (2014) emphasize that microfinance institutions (MFIs) are playing an important role in reducing poverty in both underdeveloped and developing countries. MFI contributes to human development through six complementary tools such as education, job creation, income generation; women's empowerment; social and financial inclusion; and access to services (Arouri et al., 2014). Since then, human capital has been enhanced, contributing to sustainable development (Sarwar et al., 2021).

Also, previous studies have been conducted to examine the relationship between financial development, economic growth and human capital for various countries (Sethi et al., 2019 for six selected South Asian economies; Maitra, 2018 for Bangladesh; Sehwat & Giri, 2017 for ten selected Asian economies; Akhmat et al., 2014 for five South Asian Association for Regional Cooperation (SAARC); Nik et al. (2013) for Iran; Bittencourt (2012) for four Latin American countries; Kendall (2012) for India; Chi (2008) for China; Shan and Morris (2002) for 19 OECD countries and China; Ranis et al. (2000) for 76 developing countries. In these studies, various techniques have been used, including the ordinary least squares—OLS (Bittencourt, 2012; Ranis et al., 2000; Sethi et al., 2019); dynamic ordinary least squares—DOLS and fully modified ordinary least squares—FMOLS (Akhmat et al., 2014; Sehwat & Giri, 2017); generalized method of moments—GMM (Chi, 2008; Dutta & Sobel, 2018; Zhang & Zhuang, 2011); autoregressive distributed lag—ARDL (Muhamad et al., 2018); two-stage least squares—2SLS (Kendall, 2012) and other techniques.

A positive relationship between financial development, economic growth and human capital is reported in previous studies (Chi, 2008; Ranis et al., 2000; Sehwat & Giri, 2017; Sethi et al., 2019; Shan & Morris, 2002). In contrast, an inverse relationship between human capital, financial development and economic growth is also found (Christcou, 1993; De Gregorio, 1996; Nik et al., 2013). Sethi et al. (2019) also indicate that a large market size and a faster degree of financial development result in better human capital formation. Maitra (2018) also finds a long-term relationship between life expectancy and the investment in education, health care and income. Nik et al. (2013) confirm that an inefficient banking system with inadequate facilities and resources negatively impacts human development. Similarly, Kendall (2012) considers that the local banking sector's underdevelopment is associated with slower growth at India's district level. The results indicate that the presence of human capital may decouple this relationship in some districts. Besides, Chi (2008) argues that public spending on female education and social services have played a crucial role in the relationship between human capital and economic growth. Ranis et al. (2000) state that public expenditures on health and education, especially for females, play an important role in economic growth and human development. Also, investment and income distribution affect the relationship between human development and economic growth.

The above literature review confirms that emerging markets in the ASEAN region has been largely ignored in previous empirical studies on the link between financial development and human capital. In addition, we note that the causal link between these critical factors has been

under-examined in current studies. Our analyses focusing on the long-term relationship and the causal link between human capital and financial development are warranted to provide additional evidence on this important issue for the ASEAN.

### 3. Data sources and measurements of variables

#### 3.1. ASEAN’s human capital

ASEAN countries have been achieving tremendous economic and social progress in recent decades. However, there is still a significant gap in development among countries in the region. This gap is due to inequality in access to health care and education services, leading to a higher degree of income inequality. The 4.0 technology revolution’s impact requires that future workforce skills need to be kept up with digital transformation. The human capital index (HCI) developed by the World Bank, which benchmarks and quantifies how nations are developing and deploying their human capital. Figure 1 presents the HCI of the ASEAN countries in 2018. ASEAN’s human capital potential development and deployment ranges from 45 per cent in Lao PDR to 88 per cent in Singapore compared to an optimal extent of 100 per cent. Improving human resource development is considered important and essential to improving ASEAN countries’ competitive advantages (ASEAN, 2019). The World Bank (2019a) considers that a child born in ASEAN will only reach 59 per cent of their full productivity potential. Therefore, investing in education, health care, and social protection programs will be the crucial factors to build substantial human resources which contribute to a sustainable, fair and prosperous future for the ASEAN nations.

#### 3.2. Data sources and measurement of variables

Annual data in the period 1990–2018 for nine ASEAN economies are utilized in this paper. These countries include Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand and Vietnam. Table 1 presents a summary of measurements of the variables used in this study, together with relevant data sources. Data is extracted from the World Development Indicators (WDI) (World Bank, 2020).

In this paper, human capital is measured by tertiary school enrollment because educational attainment is a way to measure human capital (Akhmat et al., 2014; Zhang & Zhuang, 2011). According to World Bank (2020), tertiary school enrollment is measured as the ratio between the number of students enrolled in tertiary education regardless of age and the total population of the age group which corresponds to tertiary education. Well-educated people are generally likely to present good manners. Also, higher education leads to higher savings and lower risk aversion (Kelly, 1980). In our paper, economic growth is proxied by GDP per capita (constant 2010 US\$) (Sehrawat & Giri, 2017; Sethi et al., 2019).

**Figure 1. Human capital index 2018—the ranking of the ASEAN countries.**

Source: World Bank (2018).



**Table 1. Measurements of variables and data sources**

Variables	Abbreviation	Measurement	Data source
<i>Dependent variable</i>			
Human capital	LHCT	School enrollment, tertiary (per cent of gross)	WDI
<i>Independent variables</i>			
Economic growth	LPGDP	GDP per capita (constant 2010 US\$)	WDI
Labour force	LLABF	Labour force participation rate (per cent of total population ages 15–64)	WDI
Broad money supply	LBM	Broad money (per cent of GDP)	WDI
Bank credit	LBR	Domestic credit provided by the banking sector (per cent of GDP)	WDI
Private sector credit	LCR	Domestic credit to the private sector (per cent of GDP)	WDI
<i>Control variables</i>			
Government expenditure on education	LGEE	Total government expenditure on education (per cent of GDP)	WDI
Foreign direct investment	LFDI	Foreign direct investment, net inflows (per cent of GDP)	WDI

**Table 2. Regression models**

Model	Regression
1	$LHCT_{it} = \beta_0 + \beta_1 LPGDP_{it} + \beta_2 LLABF_{it} + \beta_3 LBM_{it} + \beta_4 LGEE_{it} + \beta_5 LFDI_{it} + \epsilon_{it}$
2	$LHCT_{it} = \beta_0 + \beta_1 LPGDP_{it} + \beta_2 LLABF_{it} + \beta_3 LBR_{it} + \beta_4 LGEE_{it} + \beta_5 LFDI_{it} + \epsilon_{it}$
3	$LHCT_{it} = \beta_0 + \beta_1 LPGDP_{it} + \beta_2 LLABF_{it} + \beta_3 LCR_{it} + \beta_4 LGEE_{it} + \beta_5 LFDI_{it} + \epsilon_{it}$

**LHCT:** Human capital; **LPGDP:** Economic growth; **LLABF:** Labor force; **LBM:** Broad money supply; **LBR:** Bank credit; **LCR:** Private sector credit; **LGEE:** Government expenditure on education; **LFDI:** Foreign direct investment, net inflow.

For other key variables, skilled labour is measured using the labour force participation rate (per cent of total population ages 15+) (Sethi et al., 2019). Financial development is proxied by each of the following three indicators: (i) broad money supply (per cent of GDP) (Bittencourt, 2012); (ii) domestic credit provided by bank sector (per cent of GDP) (Nik et al., 2013) and (iii) domestic credit to the private sector (per cent of GDP) (Kar et al., 2011). We also use total government expenditure on education (per cent of GDP) and foreign direct investment, net inflow (per cent of GDP) as two control variables.

In this paper, the following models are utilized to examine the long-term relationship between financial development and human capital accumulation, as shown in Table 2.



**Table 3. Descriptive statistics of the total sample**

Variables	Observations	Mean	Min.	Max.	Std. Dev.
HCT	261	0.1885	0.0065	0.5225	0.1336
PGDP	261	6220.6	190.0	37,848.1	10,750.6
LABF	261	0.7076	0.5973	0.8539	0.0710
BM	261	0.6211	0.0489	1.5806	0.3916
BR	261	0.5026	0.0068	1.6650	0.4240
CR	261	0.5111	0.0096	1.6650	0.4443
GEE	261	0.0301	0.0078	0.0765	0.0136
FDI	252	0.0379	-0.0275	0.1625	0.0319

**HCT:** Human capital; **PGDP:** Economic growth; **LABF:** Labor force; **BM:** Broad money supply; **BR:** Bank credit; **CR:** Private sector credit; **GEE:** Government expenditure on education; **FDI:** Foreign direct investment, net inflow.

Table 3 shows that human capital (represented by tertiary school enrollment) of the ASEAN countries vary from 0.65 per cent to 52.25 per cent. These figures confirm a large disparity in human resources from these countries during the 1990–2018 period. The difference in economic growth (proxied by a GDP per capita) is also significant, ranging from 190 USD to 37,848 USD. The average GDP per capita of the ASEAN countries in the period is 6,220 USD.

#### 4. Empirical findings and discussions

##### 4.1. Cross-sectional dependence test

Cross-sectional dependence often occurs in panel estimation. When cross-sectional dependencies in regression are omitted, the estimation may cause loss of estimator efficiency and invalid test statistics. We utilize the following four tests to examine the presence of cross-sectional dependence, including Breusch-Pagan LM (Breusch & Pagan, 1980), Pesaran scaled LM (Pesaran, 2004), Pesaran (2004), and Baltagi, Feng, and Kao bias-corrected scaled LM (Baltagi et al., 2012). The null hypothesis ( $H_0$ ) for all these tests is that variables are not cross-sectionally dependent. The results of these tests are presented in Table 4. Our results indicate that cross-section independence's null hypothesis cannot be accepted at the 1 per cent significance level, indicating that the first-difference generation's panel unit root tests should provide more reliable inference. It signifies that disturbance in one country will affect other economies.

##### 4.2. Panel unit root test

In order to avoid spurious regression, we employ the panel unit-root test to identify the stationary properties of the relevant variables. Four unit-root tests are used, including LLC (Levin et al., 2002); IPS (Im et al., 2003); ADF-Fisher  $\chi^2$  and PP-Fisher  $\chi^2$  (Fisher, 1932; Maddala & Wu, 1999). The panel unit root test results presented in Table 5 are mixed, especially in government expenditure on education (LGEE) and foreign direct investment (LFDI), where all the unit root tests indicate stationarity in both levels and first differences. For GDP per capita (LPGDP), the finding is more prominent, where all unit root tests indicate non-stationarity in levels and stationarity in the first differences.

However, some of the other variables are also found to be stationary at the level. Specifically, the Im test results, ADF-Fisher test and PP-Fisher test of bank credit (LBR) reveal stationarity in both levels and first differences. However, the LLC test results indicate only stability in the first differences. This result also occurs at broad money supply (LBM) and private sector credit (LCR). In terms of human capital (LHCT), the LLC test results indicate stationarity in both levels and first differences. However, the Im test, ADF-Fisher test and PP-Fisher test results show only stability in the first differences. Accordingly, if pooled data are stationary at the first differences, then the

**Table 4. Cross-section dependence test results**

<b>Variables</b>	<b>LHCT</b>	<b>LPGDP</b>	<b>LLABF</b>	<b>LBM</b>	<b>LBR</b>	<b>LCR</b>	<b>LGEE</b>	<b>LFDI</b>
Breusch-Pagan LM	849.502***	902.543***	230.293***	352.247***	210.585***	249.477***	91.583***	85.640***
Pesaran scaled LM	95.872***	102.123***	22.897***	37.270***	20.575***	25.158***	6.550***	5.850***
Bias-corrected scaled LM	95.711***	101.962***	22.737***	37.109***	20.414***	24.997***	6.389***	5.689***
Pesaran CD	29.066***	18.603***	-0.398	10.111***	4.846***	7.719***	2.402***	3.871***

**Notes:** \*\*\* significant at 1% level. The null hypothesis is cross-section independence.

**LHCT:** Human capital; **LPGDP:** Economic growth; **LLABF:** Labor force; **LBM:** Broad money supply; **LBR:** Bank credit; **LCR:** Private sector credit; **LGEE:** Government expenditure on education; **LFDI:** Foreign direct investment, net inflow.

**Table 5. Panel unit root test results**

Variables	LHCT	LPGDP	LLABF	LBM	LBR	LCR	LGEE	
<b>LFDI</b>								
<b>LLC (2002)</b>								
Level	-2.574***	2.014	-2.265**	-0.097	-0.391	0.121	-2.802***	-3.606***
First difference	-4.837***	-6.789***	-4.582***	-8.961***	-8.638***	-9.730***	-10.160***	-14.718***
<b>Im et al. (2003) W-stat</b>								
Level	1.015	6.673	1.760	-1.223	-2.818***	-1.862**	-5.307***	-6.357***
First difference	-6.835***	-6.988***	-6.556***	-9.586***	-8.845***	-8.451***	-13.210***	-14.292***
<b>ADF-Fisher <math>\chi^2</math></b>								
Level	12.400	3.438	19.071	34.290**	43.947***	35.776***	61.719***	75.280***
First difference	81.258***	81.040***	84.426***	114.147***	104.919***	98.670***	165.920***	171.859***
<b>PP-Fisher <math>\chi^2</math></b>								
Level	11.216	2.950	10.694	49.934***	37.839***	33.568**	45.989***	68.275***
First difference	144.016***	99.649***	79.167***	129.509***	136.536***	120.075***	214.557***	251.519***

**Notes:** \*\*, \*\*\* significant at 5%, 1% level, respectively.

**LHCT:** Human capital; **LPGDP:** Economic growth; **LLABF:** Labor force; **LBM:** Broad money supply; **LBR:** Bank credit; **LCR:** Private sector credit; **LGEE:** Government expenditure on education; **LFDI:** Foreign direct investment, net inflow.

series follow stochastic trends. Hence, it can be co-integrated as well. Based on the results, we conclude that the unit root's null hypothesis is firmly rejected at a 1 per cent level of significance for all series at their first differences. In other words, it is possible to have a long-run co-integrating relationship among these variables (Sethi et al., 2019).

#### 4.3. Panel co-integration test

In the next step, we examine the long-run relationship among the variables of interests employing Pedroni's (2004) and Kao's (1999) residual co-integration techniques. As presented in Table 6, results from Pedroni's (2004) heterogeneous panel tests confirm that the null hypothesis of no co-integration is rejected at the 1 per cent significance level except for the panel u-statistic, the panel p-statistic and the group p-statistic.

In addition, the results of Kao's (1999) residual panel co-integration tests presented in Table 7 reject the null of no co-integration at the 1 per cent significance level. There is a long-run relationship between financial development, economic growth and human capital in the ASEAN countries.

#### 4.4. Dynamic ordinary least squares (DOLS) and fully modified ordinary least squares (FMOLS)

Table 8 presents a long-run panel elasticity using the panel FMOLS estimator developed by Phillips and Hansen (1990) and the panel DOLS estimator proposed by Kao and Chiang (2000). The results from both the DOLS and FMOLS estimates indicate that financial development contributes positively and significantly to human capital accumulation (LHCT). In addition, economic growth (LPGDP) enhances and improves the formation of human capital. Government expenditure on education appears to impact human capital positively when the DOLS technique is used.

**Table 6. Pedroni (2004)'s residual co-integration test results**

	Model 1			Model 2			Model 3		
	NIT	I	IT	NIT	I	IT	NIT	I	IT
<i>Within-dimension</i>									
Panel $\nu$ -Statistic	-2.050	-2.750	-4.072	-2.081	-2.617	-3.927	-2.176	-2.762	-4.086
Panel $\rho$ -Statistic	-1.515*	-1.165	-0.522	-1.160	-0.661	0.226	-1.340*	-0.970	-0.139
Panel PP-Statistic	-6.381***	-7.015***	-7.292***	-5.939***	-7.065***	-7.811***	-6.264***	-7.630***	-8.100***
Panel ADF-Statistic	-5.905***	-6.861***	-7.293***	-5.706***	-6.738***	-7.135***	-6.054***	-7.360***	-7.641***
<i>Between-dimension</i>									
Group $\rho$ -Statistic	-0.351	0.223	0.799	-0.382	0.286	0.963	-0.406	0.193	0.744
Group PP-Statistic	-8.960***	-8.556***	-7.163***	-10.410***	-12.003***	-12.757***	-10.551***	-12.658***	-9.860***
Group ADF-Statistic	-6.998***	-6.462***	-6.351***	-7.240***	-7.084***	-8.008***	-7.433***	-7.461***	-7.804***

**Notes:** NIT, No trend and intercept; I, only intercept and no trend; IT, Both trend and intercept  
 \*, \*\*\* significant at 10 per cent and 1 per cent level, respectively

**Table 7. Kao's (1999) residual co-integration test results (LHCT as dependent variable)**

	Model 1		Model 2		Model 3	
	t-statistic	Probability	t-statistic	Probability	t-statistic	Probability
ADF	-5.137	0.000***	-4.400	0.000***	-4.130	0.000***

Notes: \*\*\* significant at 1 per cent level

Based on this paper's findings, we consider that financial development does provide a positive and significant effect on human capital for the emerging markets in the ASEAN. This paper's findings also confirm the important role of economic growth to support and enhance human capital accumulation in the ASEAN.

#### 4.5. Robustness check

Pesaran et al. (1999), Pirotte (1999), and Pesaran and Smith (1995) argue that the pooled mean group (PMG) method provides consistent mean values and effective long-term estimates of efficiency with large sample sizes. In order to enhance robustness, we also use the PMG technique in our study. The PMG results in Table 9 are very similar to those reported in Table 8. In the long run, economic growth and financial development positively and significantly affect human capital. Besides, in the short run, human capital is driven by financial development.

#### 4.6. Panel granger causality test

We now examine the causality between human capital and financial development using a panel Granger causality method (Engle & Granger, 1987). Table 10 confirms that human capital does Granger cause financial development regardless of the proxies used for financial development. In addition, financial development will Granger cause human capital accumulation only when the broad money supply (LBM) is used as a proxy for financial development. In addition, we also find that economic growth does Granger cause human capital accumulation. Figure 2 summarizes the results of these causal relationships between human capital and financial development.

### 5. Conclusions

A discussion on the contribution of financial development to human capital accumulation and vice versa, together with the causal relationship between them, has recently attracted great attention from policymakers, academics, and practitioners in emerging markets such as the ASEAN region. However, a limited number of studies had been conducted. As such, this study is conducted to provide additional empirical evidence for this vital link and their causal relationship. Using an updated panel dataset covering nine emerging countries, members of the ASEAN, over the 1990–2018 period, this paper examines the link and the Granger causal relationship between financial development and human capital. Our empirical findings indicate that financial development, which is proxied by each of the three different indicators, has a long-run relationship with human capital accumulation. Human capital is also found to provide a positive effect on economic growth. In addition, we find that financial development and economic growth do provide a positive and significant long-term effect on human capital accumulation.

We also find evidence to confirm that human capital does Granger cause financial development for all three proxies of financial development. Financial development Granger causes human capital accumulation when a broad money supply is used as a proxy for financial development. Findings from our analysis confirm a bi-directional causality is running from economic growth to human capital and vice versa. Precisely, the results present evidence to confirm a view that economic growth contributes positively to human capital accumulation and that human capital

**Table 8. Panel long-run elasticity (Human capital LHCT as dependent variable)**

Panel methods	Model 1		Model 2		Model 3	
	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS
LPGDP	2.037**	1.245***	10.489***	1.455***	9.720***	1.393***
LLABF	-10.286***	-5.486***	-8.785	-5.950***	-11.978	-5.595***
LBM	0.815*	0.226***				
LBR			1.431***	0.156***		
LCR					1.235***	0.190***
LGEE	0.107	-0.076	0.718**	0.045	0.742**	0.032
LFDI	0.132	0.022	-0.000	-0.027	-0.002	-0.024

Notes: \*, \*\*, \*\*\* significant at 10%, 5% and 1% level, respectively.

LHCT: Human capital; LPGDP: Economic growth; LLABF: Labor force; LBM: Broad money supply; LBR: Bank credit; LCR: Private sector credit; LGEE: Government expenditure on education; LFDI: Foreign direct investment, net inflow.

accumulation boosts economic growth. These findings are consistent with previous studies' findings (Sarwar et al., 2021 for 83 emerging countries; Sethi et al., 2019 for six South Asian countries; Sehrawat & Giri, 2017 for ten major Asian countries; Ranis et al., 2000 for 76 developing countries). Sarwar et al. (2021) confirm that financial development and human capital are positively and

**Table 9. Pooled mean group regression**

Variables	Model 1		Model 2		Model 3	
	Coefficient	Prob*	Coefficient	Prob*	Coefficient	Prob*
<i>Long-run coefficients</i>						
LPGDP	-2.4168*	0.074	-12.0214***	0.000	-0.3668***	0.002
LLABF	8.1849*	0.098	32.6772***	0.002	9.548*	0.041
LBM	2.5045***	0.001				
LBR			-0.6189*	0.080		
LCR					1.5322*	0.092
LGEE	1.4863	0.154	-0.3944	0.492	0.9394	0.450
LFDI	-0.0457	0.760	-0.2044*	0.093	0.0472	0.122
Error correction coefficients	0.0577**	0.044	0.0329*	0.062	0.0543*	0.085
<i>Short-run coefficients</i>						
D(LPGDP)	0.7968	0.320	1.5009	0.269	0.5798	0.362
D(LLABF)	-3.3118	0.605	-3.1447	0.591	-1.3123	0.195
D(LBM)	0.1402**	0.029				
D(LBR)			0.1491**	0.035		
D(LCR)					0.0253*	0.068
D(LGEE)	0.0387	0.485	0.0176	0.708	0.0673	0.587
D(LFDI)	-0.0146	0.275	-0.0447	0.200	-0.0763	0.384
C	-1.3392	0.154	-4.5715	0.345	-1.1354	0.482

Notes: \*, \*\*, \*\*\* significant at 10%, 5% and 1% level, respectively.

LHCT: Human capital; LPGDP: Economic growth; LLABF: Labor force; LBM: Broad money supply; LBR: Bank credit; LCR: Private sector credit; LGEE: Government expenditure on education; LFDI: Foreign direct investment, net inflow.

**Table 10. Panel causality test results**

Hypothesis	F-statistic		Conclusion
LPGDP → LHCT	2.760**		Bidirectional causality between economic growth and human capital.
LHCT → LPGDP	2.844**		
LLABF → LHCT	0.441		Unidirectional causality from human capital to labour force.
LHCT → LLABF	3.210**		
LBM → LHCT	2.473**		Bidirectional causality between broad money supply and human capital
LHCT → LBM	3.972***		
LBR → LHCT	2.000		Unidirectional causality from human capital to bank credit.
LHCT → LBR	4.019**		
LCR → LHCT	5.146***	1.889	Unidirectional causality from human capital to private sector credit.
LHCT → LCR			
LGEE → LHCT	0.972	0.992	There is no causal relationship between government expenditure on education and human capital.
LHCT → LGEE			
LFDI → LHCT	0.418	2.236	There is no causal relationship between foreign direct investment and human capital.
LHCT → LFDI			
LLABF → LPGDP	0.113	0.973	There is no causal relationship between the labour force and economic growth.
LPGDP → LLABF			
LBM → LPGDP	0.302	0.781	There is no causal relationship between broad money supply and economic growth.
LPGDP → LBM			
LBR → LPGDP	4.227**	1.022	Unidirectional causality from economic growth to bank credit.
LPGDP → LBR			
LCR → LPGDP	7.344***	0.020	Unidirectional causality from economic growth to private sector credit.
LPGDP → LCR			
LGEE → LPGDP	0.476	2.353*	Unidirectional causality from government expenditure on education to economic growth.
LPGDP → LGEE			
LFDI → LPGDP	0.830	2.938*	Unidirectional causality from foreign direct investment to economic growth.
LPGDP → LFDI			
LBM → LLABF	0.106	0.677	There is no causal relationship between the labour force and the broad money supply.
LLABF → LBM			
LBR → LLABF	0.134	0.059	There is no causal relationship between the labour force and bank credit.
LLABF → LBR			
LCR → LLABF	0.103	0.144	There is no causal relationship between the labour force and private sector credit.
LLABF → LCR			
LGEE → LLABF	0.448	0.251	There is no causal relationship between the labour force and government expenditure on education.
LLABF → LGEE			
LFDI → LLABF	2.286	0.684	There is no causal relationship between the labour force and foreign direct investment.
LLABF → LFDI			
LBR → LBM	9.753***	1.273	Unidirectional causality from broad money supply to bank credit.
LBM → LBR			

(Continued)

**Table 10. (Continued)**

Hypothesis	F-statistic	Conclusion
LCR → LBM LBM → LCR	0.747	2.110 There is no causal relationship between broad money supply and private sector credit.
LGEE → LBM LBM → LGEE	0.112	0.017 There is no causal relationship between broad money supply and government expenditure on education.
LFDI → LBM LBM → LFDI	0.963	0.595 There is no causal relationship between broad money supply and foreign direct investment.
LCR → LBR LBR → LCR	0.397	33.590*** Unidirectional causality from private sector credit to bank credit.
LGEE → LBR LBR → LGEE	0.131	1.001 There is no causal relationship between bank credit and government expenditure on education.
LFDI → LBR LBR → LFDI	0.132	0.934 There is no causal relationship between bank credit and foreign direct investment.
LGEE → LCR LCR → LGEE	0.452	3.915** Unidirectional causality from government expenditure on education to private sector credit.
LFDI → LCR LCR → LFDI	0.791	1.744 There is no causal relationship between private sector credit and foreign direct investment.
LGEE → LFDI LFDI → LGEE	1.023	0.277 There is no causal relationship between government expenditure on education and foreign direct investment.

**Notes:** \*, \*\*, \*\*\* significant at 10%, 5% and 1% level, respectively

A → B denotes unidirectional Granger causality running from A to B.

**LHCT:** Human capital; **LPGDP:** Economic growth; **LLABF:** Labor force; **LBM:** Broad money supply; **LBR:** Bank credit; **LCR:** Private sector credit; **LGEE:** Government expenditure on education; **LFDI:** Foreign direct investment, net inflow.

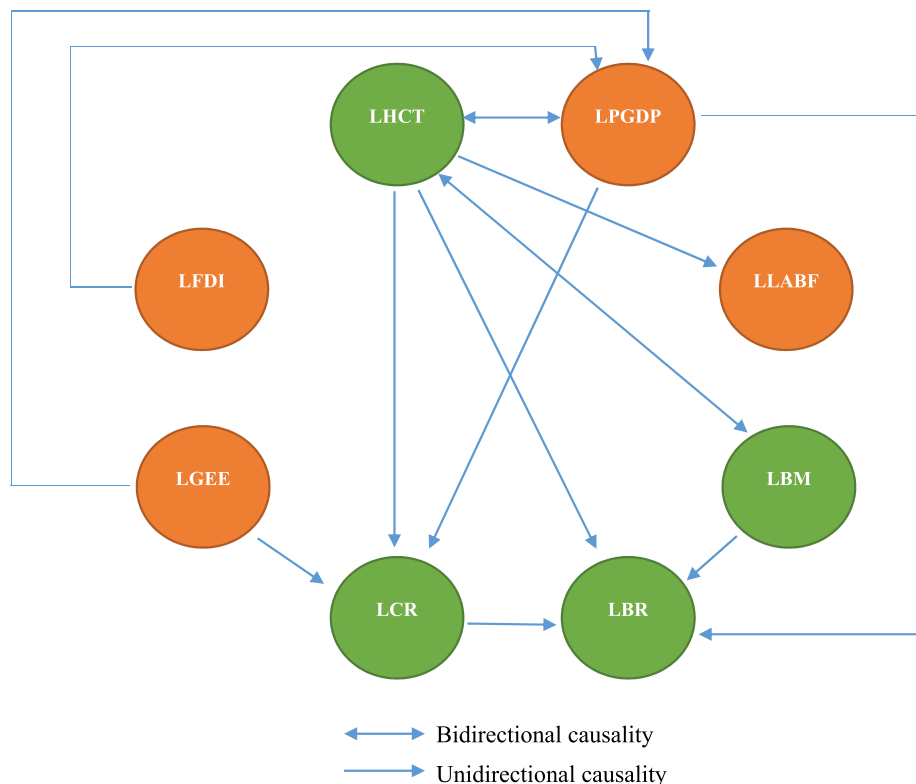
significantly related. In addition, the joint effect between human capital and financial development supports economic growth for emerging economies. Sethi et al. (2019) state that both market size and financial development are the main drivers of human capital accumulation. Also, Sehwat and Giri (2017) argue that human capital is enhanced by financial development, which positively affects economic growth. Moreover, Ranis et al. (2000) confirm a bi-directional relationship between economic growth and human development.

Policy implications have emerged based on the findings of this paper. First, the emerging markets' governments, the members of the ASEAN countries, should introduce and implement policies to promote education and health care for the poor and the underprivileged. Doing so will improve and enhance the formation and accumulation of human capital, contributing to economic growth. Second, enhancing further development of the financial markets, or financial development, is important to ensure access to financial products and services by the poor, the underprivileged, and small firms. These policies will increase the extent of financial development, contributing to economic growth and then human capital accumulation. It is important to note that a strong link is found between human capital and financial development. Targeting to improve financial development also means to improve the accumulation of



**Figure 2. Causality relationship flows.**

*LHCT*: Human capital; *LPGDP*: Economic growth; *LLABF*: Labor force; *LBM*: Broad money supply; *LBR*: Bank credit; *LCR*: Private sector credit; *LGEE*: Government expenditure on education; *LFDI*: Foreign direct investment, net inflow.



**LHCT**: Human capital; **LPGDP**: Economic growth; **LLABF**: Labor force; **LBM**: Broad money supply; **LBR**: Bank credit; **LCR**: Private sector credit; **LGEE**: Government expenditure on education; **LFDI**: Foreign direct investment, net inflow.

human capital and vice versa. Any policy on these areas of importances will provide double effects to the economy and the society.

Limitations of this study do exist. This study uses only one indicator (tertiary school enrollment) to represent human capital accumulation. We consider that it is appropriate for studies to use different indicators or even to develop a composite index of human capital accumulation. The index of human capital may represent reasonably a level of human capital accumulation. Besides, other econometric techniques may also be considered to enhance the robustness of empirical findings.

**Funding**

This work was supported by the Ministry of Education and Training Vietnam [B2020-MBS-02].

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**Citation information**

Cite this article as: Does financial development improve human capital accumulation in the Southeast Asian

countries?, Duc Hong Vo, Ngoc Phu Tran & Ha Minh Nguyen, *Cogent Business & Management* (2021), 8: 1932245.

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