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Article

Human capital efficiency and firm performance across sectors in an emerging market

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MANAGEMENT | RESEARCH ARTICLE

Human capital efficiency and firm performance across sectors in an emerging market

Ngoc Phu Tran¹ and Duc Hong Vo^{1*}

Abstract: Human capital is considered the cornerstone of any progress in economic growth and development for any country. Vietnam and other emerging markets are no exception. One effect of human capital efficiency on firm performance is considered in various empirical studies. However, the examination of this efficiency on firm performance in Vietnam and other emerging markets has largely been ignored in the current literature, in particular with the use of a value-added intellectual coefficient (VAIC) model, which has been widely used to measure the value added generated by tangible and intangible assets. This paper is conducted to examine the contribution of human capital efficiency to firm performance across 12 sectors in the Vietnamese economy for the period 2011 to 2018. The generalized method of moments (GMM) technique is used in this paper. Empirical results in this paper strongly confirm that human capital efficiency makes a positive contribution to firm performance across sectors in Vietnam. In addition, the findings in this paper indicate that the banking sector does not have the highest level of human capital accumulation as previously thought. In the context of the Vietnamese economy, the level of human capital efficiency varies across sectors and the oil and gas and

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Duc Hong Vo is a Professor and practitioner of Applied Economics and Finance. He has been working for the Australian public sector at both Federal and State levels at an executive role since 2008. More than 60 papers from his research have been published in international journals including *Applied Economics*, *Journal of Economic Surveys*, *Sustainability*, and many others. He has also received many research grants from Australia and Vietnam. His current research interest covers corporate finance, international finance and public finance, including cost of capital; market and credit risks; fiscal federalism; energy; financial integration and inequality.

Ngoc Phu Tran is a PhD student at Ho Chi Minh city Open University, Vietnam. His research interests include issues on intellectual capital, corporate governance, agriculture. He has published findings from his research on various international journals including *Emerging Markets Finance and Trade*, *Annals of Financial Economics* and *Journal of Risks and Financial Management*.

PUBLIC INTEREST STATEMENT

Human capital is considered the cornerstone for economic growth and development for any country, in particular for the emerging markets such as Vietnam. Efficient use of human capital at firm's level is an important component to enhance firms' performance. However, an important link between human capital efficiency and firms' performance has largely been ignored in the current literature for emerging markets. This study is conducted to examine this possible link across sectors in Vietnam using updated dataset and advanced quantitative approach. The results indicate that an efficient use of human capital does vary across sectors in Vietnam and that efficiency of human capital does contribute positively to firms' performance in Vietnam. As such, firms should implement policies to encourage a formation of human capital and its efficient use. The government should also consider an importance of human capital and its efficient use so that an appropriate framework can be established to support firms' policy on human capital efficiency.

energy sectors are the best at human capital efficiency. We outline the policy implications from our findings in this study.

Subjects: Economics and Development; Business, Management and Accounting; Industry & Industrial Studies

Keywords: firm performance; GMM; human capital efficiency; VAIC; Vietnam

1. Introduction

In the era of globalization, Vietnamese firms face increasing competition from not only domestic enterprises but also foreign firms. At times, financial capital has generally been considered a competitive advantage for local firms. However, the ability to mobilize a huge amount of financial capital has eased. Technology has also become a competitive advantage, together with advancements in science and technology. However, even when firms have abundant financial resources and modern technology, good quality services, and solid infrastructure without a high-quality labor force, it is difficult for them to be successful in the long term and to create a competitive advantage. Human capital plays an important role in enhancing productivity and efficiency, and they are among the key factors in the successful implementation of business strategies (Bontis et al., 2000; Yusuf, 2013).

Pulic (1998, 2000) introduced a value-added intellectual coefficient (VAIC) model including human capital efficiency, structural capital efficiency, and capital employed efficiency to measure the value added from tangible and intangible assets. This model is considered a standard measurement method, allowing comparisons between sectors and countries. In addition, due to its simplicity in the use of available data from financial statements, this model has widely been employed in many empirical studies (Mohammadi & Taherkhani, 2017; Nazari et al., 2007; Phusavat et al., 2011; Xu & Wang, 2018).

Many studies have been conducted to examine the impact of human capital efficiency (using the VAIC model) and firm performance in developed countries (Ozkan et al., 2017; Sardo & Serrasqueiro, 2017). In addition, in recent years many empirical studies have also been conducted on Asian economies (Al-Musali & Ismail, 2014; Mondal & Ghosh, 2012; Poh et al., 2018; Tran & Vo, 2018). Vietnam's human capital index is the highest among middle-income countries. However, there are disparities between ethnic groups and sectors. As such, it is considered necessary to enhance the skills of the workforce to improve productivity. In addition, Vietnam's industry-relevant skill set for graduate students is ranked low in the 2018 Global Competitiveness Index report. This low ranking reflects a lack in value added per employee in Vietnam's performance compared with other countries (World Bank, 2019a). At the same time, the Vietnamese government has issued a series of guidelines and policies that aim to raise labor productivity and to support the development of human capital for firms. However, our intensive examination of the current literature indicates that the role of human capital efficiency and its impact on firm performance have largely been ignored, in particular in Vietnam and other emerging markets. Hoang et al. (2018) conducted a survey of 319 Vietnamese information and communications technology firms to measure the effect of intellectual capital (including human capital, social capital, and organizational capital) on firm performance. Regardless of its advancement and popularity, the VAIC method has not been used to examine the relationship between human capital efficiency and firm performance in the study. Santarelli and Tran (2012) stated a strong impact of human capital (proxy by learning) on the performance of 1,398 Vietnamese start-up firms. In addition, Firer and Williams (2003) argued that the banking sector has accumulated a higher level of intellectual capital than other sectors. Kubo and Saka (2002) emphasized that employees in the banking sector have achieved a higher level of homogeneity than the other sectors. The literature considers staff identity important because intellectual capital is one of the key measures of the competence of employees. In addition, financial firms operating in a heavily regulated environment tend to be more compliant with regulatory expectations whereas non-financial firms are not (Ulum et al., 2016), leading to different levels of accumulation of human capital.

This study contributes to knowledge on human capital efficiency in the following ways. First, we examine the important role of human capital efficiency across various sectors to provide additional evidence in support of policy recommendations in Vietnam and other emerging markets. Second, in Vietnam for the first time, the VAIC model is used to measure and understand the relationship between human capital efficiency and firm performance across sectors. We outline some policy implications based on important findings in this paper.

This paper is structured as follows. Following this Introduction, Section 2 presents briefly reviews research on human capital and firm performance in Vietnam. Section 3 discusses and synthesizes the definition and measure of human capital efficiency using the VAIC model and then reviews previous empirical studies in Section 4. Section 5 discusses our research methodology and data. Empirical findings and discussions are presented in Section 6, followed by Conclusions in Section 7.

2. Human capital and firm performance in Vietnam

Vietnam's economy has enjoyed great progress and achievements over the past 30 years. Since the early years of the 21st century, Vietnam's GDP has increased on an average of 7 per cent per year, one of the fastest growth countries in the world (World Bank, 2019b). As a result, income per capita has improved markedly. In 2000, the average income of Vietnamese people was 390 USD per year per person, belonging to the low-income group in the world. By 2018, this figure had increased more than 6.5 times to 2 USD,566. Vietnam is now a low-middle-income country with the economies of scale ranked among the top 50 in the world.

Both quantity and quality of the Vietnam's economic growth has shown positive changes. Previously, labor and especially capital were the main factors driving growth. However, recently the aggregate total factor productivity (TFP) has been playing an increasingly important role in the national economic growth. Since 2001, the contribution of capital to economic growth has continued to decline, from 67 per cent in the 2001–2005 period to 41 per cent in the 2016–2018 period. In the opposite direction, TFP tends to increase, from about 12 per cent in the 2001–2005 period to 40 per cent in the most recent period to 2018. Although this figure is still low compared to many countries in the region, such as China (52 per cent), Thailand (53 per cent), Indonesia (49 per cent) and Malaysia (49 per cent), it is still a good sign for the Vietnamese economy.

Among the factors that contribute to growth of Vietnam's economy and firms, human capital is considered the nation's largest resource—the most important resource of the enterprise (TVET, 2019). The Vietnamese Government has put great effort to increase the scale and quality of vocational education and training, which is the key and fundamental factor to economic growth and development of the nation. Vixathep et al. (2017) conducted a study of 600 manufacturing enterprises in Vietnam, emphasizing the importance of human capital in promoting innovation and promoting firm's productivity. Hoang et al. (2018) concluded that human capital and social capital are strongly linked to firm performance when a study using data from 319 Vietnamese information communication technology (ICT) firms. Dang et al. (2018) examined the impact of human resource management on the productivity of small and medium enterprises in Vietnam. The authors argued that the more frequent a firm provides training to new employees, the greater the productivity is. Nguyen (2020) studied the impact of human capital, capital structure choice and firm profitability of 48,673 Vietnamese construction firms in 2016. Findings from this study indicate that human capital exhibits a positive relationship with firm's wealth. However, empirical studies on examining the impact of human capital on firm performance, with a particular emphasis on human capital across sectors, have been largely ignored in the current literature.

3. Theoretical framework

Human capital is a broad concept that encompasses many components but primarily describes the quality of the workforce. The identification of employees is human capital, in which employees are investors in a business, paid by human capital and the expected return on their investment (Davenport, 1999). Three basic views have been expressed on the concept of human capital. The first

view is that human capital is the result of investment, so the value of human capital is invested to enhance physical strength and personal intelligence and to gain knowledge and skills (Schultz, 1961). This is an investment perspective. The second view of partial output considers human capital the exclusive knowledge, skills, experience, and relevant working capacity of managers and technical innovators (Weijie & Zhao, 2001). Finally, the overall output perspective views human capital as the total value of personal physical strength, knowledge, intelligence, and skills used to create products (Wang et al., 2005). The third view, namely that human capital is the working capacity of any person, has received strong support. It sees human capital as not limited to managers or technical personnel. Micah et al. (2012) referred to human resources as talents, skills, energy, and knowledge, which can be applied to produce goods or to provide useful services. According to Baron (2011), human resources include knowledge, skills, development ability, and creativity possessed by employees of an organization. At the same time, Shih et al. (2010) argued that human capital cannot be traded and is not possessed by an organization; rather, it is the result of employee knowledge and professional skills. Ting and Lean (2009) wrote that human capital includes know-how and previous experience, teamwork, creativity, employee flexibility, ability to tolerate ambiguity, motivation, satisfaction, academic competency, loyalty, training, and formal education. Chen et al. (2004) held that value cannot be created without human capital. Human capital is a form of intangible assets that create future economic value, including frontline staff and organizational capacity (Schmidt, 2004). Human capital can be useful for investors in assessing efficiency and predicting future profits and productivity (Friedman & Lev, 1974; Morse, 1973).

Pulic (1998) developed the VAIC model, which considers the efficiency of value creation for a firm's tangible and intangible assets (dividing intellectual capital into customer capital and structural capital). Nazari et al. (2007) believed that the VAIC consists of three-dimensional elements: human capital efficiency, structural capital efficiency (including both internal and relational capital efficiency), and capital employed efficiency (physical and financial capital efficiency). The VAIC model was developed to enable managers, shareholders, and other stakeholders to monitor and evaluate the effectiveness of a company's total resources and each of the key resource components. The model offers new insight into how effectively the value creation process at companies is measured and monitored using accounting-based metrics. Human capital efficiency is the key component of the VAIC model, and it is defined as employees' skills, general knowledge, innovation, and ability (Bontis et al., 2000). Human capital is a basic strategic resource, which supports success and is necessary for it because employees' knowledge and skills are essential in the context of a constantly changing business environment (Subramaniam & Youndt, 2005). Human capital efficiency assesses the knowledge and skills of individuals, and that knowledge provides individuals with increased cognitive ability, leading them to be more efficient.

4. Empirical literature review and hypotheses development

Previous studies have confirmed the positive relationship between human capital efficiency and firm performance (Ghosh & Mondal, 2009; Goh, 2005; Ting & Lean, 2009). Opong et al. (2019) examined data on 33 insurance firms in Ghana from 2008 to 2016 to measure intellectual capital and the effect of its components on firm performance. They revealed that human capital efficiency has a significant effect on the productivity of insurance firms. In addition, Ulum et al. (2019) revealed that human capital has indicated a positive relationship with the interest of new students in the future.

Smriti and Das (2018) examined the impact of intellectual capital on financial performance at 710 Indian companies from 2001 to 2016. The results indicated that employed capital efficiency and structural capital efficiency are equally important contributors to firms, while human capital efficiency has a major impact on firm productivity.

Hoang et al. (2018) conducted a survey of 319 Vietnamese ICT firms to measure the effect of intellectual capital (including human capital, social capital, organizational capital) on firm performance. On the basis of exploratory factor analysis, confirmatory factor analysis, and moderating analysis, they concluded that human capital and social capital are strongly linked to firm performance.

Buallay (2017) examined the relationship between the components of intellectual capital (human capital efficiency, structural capital efficiency, and capital employed efficiency) and three indicators representing firm performance (including the return on assets [ROA], the return on equity [ROE], and Tobin's Q) of 171 listed firms on the Saudi stock exchange from 2012 to 2014. The results showed that human capital efficiency has a significantly positive impact on ROE. Similarly, Rahim et al. (2017) studied 55 Malaysian technology firms in 2009. The results showed that human capital efficiency has a significant and positive relationship with firm performance.

Kwarbai and Akinpelu (2016) used multiple linear regression models to analyze the impact of human capital efficiency on firm performance at industrial goods companies listed on the Nigerian Stock Exchange Market from 2009 to 2014. They found that human capital efficiency has a positively significant relationship with ROA and earnings per share, and lagged human capital efficiency has a negative relationship with growth in the number of employees.

Parham and Heling (2015) collected data on 33 Dutch production firms from 2007 to 2012 to measure the effect of human capital efficiency on firm performance. Their findings indicate a positive relationship between human capital efficiency and all three measures of corporate performance (ROA, ROE, and employee productivity).

Yusuf (2013) collected data on 14 banks on the Nigerian Stock Exchange over a five-year period. The results showed that human capital efficiency does not have any significant impact on banks' ROE. In contrast, Clarke et al. (2011) examined the impact of human capital efficiency on firm performance at 2,161 Australian listed firms between 2003 and 2008. They concluded that human capital efficiency has a significant impact on firm performance.

Phusavat et al. (2011) investigated the relationship between human capital efficiency and four indicators (ROA, ROE, growth in revenue, and employee productivity) at 11 Thai manufacturing firms from 2006 to 2009. The key finding in the paper is that human capital efficiency is related to employee productivity. In addition, Hsu and Wang (2010) studied the effect of human capital efficiency, relational capital efficiency, and structural capital efficiency on the performance of 242 high-technology firms from 2001 to 2008. They concluded that structural capital efficiency has strong effects on performance whereas human capital efficiency and relational capital efficiency have no effect on firm performance. Moreover, Iwamoto and Suzuki (2019) stated that human capital is a determinant of a firm's financial performance. Firms are increasingly interested in the role of human capital. In addition, the disclosure of human resources has become more substantive over time on providing more profound and coherent forms of publication of relevant information (Vithana et al., 2019).

As such, on the ground of various studies including Smriti and Das (2018), Buallay (2017), and Parham and Heling (2015) and others, the following hypothesis is developed:

H_a: Human capital efficiency has a positive impact on the profitability across sectors in Vietnam.

5. Research design

5.1. A measurement of human capital efficiency

This paper uses the VAIC method to measure human capital efficiency (Pulic, 1998; 2000). *HCE_i* (human capital efficiency) is the marginal contribution of each unit of human capital to value added:

$$HCE_i = \frac{VA_i}{HC_i}$$

where VA_i is the value added to the firms. In this study, VA_i is calculated by taking the profit before taxes plus employee expenditures because pretax profit indicates the residual value after deducting all costs from sales except employee expenditures (Tran & Vo, 2018). HC (human capital) is employee expenditures.

5.1.1. Dependent variables

To measure firm performance, previous studies have used various measurement techniques, such as return on capital employed, net profit after tax and total shareholder return (Khan & Johl, 2019), refined economic value added (Soukhakian & Khodakarami, 2019), and stock returns (Jokar & Daneshi, 2018). Like previous studies (Al-Musali & Ismail, 2014; Isanzu, 2015; Jordão & Novas, 2017; Nimtrakoon, 2015; Singh et al., 2016; Smriti & Das, 2018), this study uses ROA and ROE to measure financial performance. ROA reflects how profitable a company is relative to its total assets. ROE represents the profit for ordinary equity holders and is calculated by dividing net profit by equity.

5.1.2. Control variables

In this study, we use $SIZE$, calculated as the natural logarithm of total assets, as a control variable. The following regression models are estimated, as shown in Table 1.

Table 1. Regression models

Model	Regression
1	$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 HCE_{it} + \beta_3 HCE_{it-1} + \beta_4 SIZE_{it} + \epsilon_{it}$
2	$ROE_{it} = \beta_0 + \beta_1 ROE_{it-1} + \beta_2 HCE_{it} + \beta_3 HCE_{it-1} + \beta_4 SIZE_{it} + \epsilon_{it}$

5.1.3. Sample and data analysis approach

Previous studies considered that annual reports produce the most important performance indicators, followed by the effectiveness and workload (Adi et al., 2016; Clark, 2003). This paper focuses on analyzing data collected from the annual reports of 227/1,617 listed firms in Vietnam from 2011 to 2018. Data are divided into 12 sectors, as shown in Table 2. Some firms do not fully disclose information in their financial statements for the period 2011–2012. As such, an unbalanced panel data is utilized in this paper.

Table 2. Sample size

Sector	Number of firms
Banking	14
Technology	16
Oil and gas	11
Pharmaceuticals	28
Insurance	8
Real estate	36
Securities	14
Education	20
Aviation	11
Energy	28
Services	15
Food	26
Total	227

This study uses the Generalized Method of Moments (GMM). GMM model allows the use of lagged dependent variable and lag of all strictly exogenous variables (Arellano & Bond, 1991; Haris et al., 2019; Yao et al., 2018). We use two-step GMM system estimation. This choice overcomes the problems of homogeneity, serial correlation, unobservable heterogeneity (Roodman, 2009). The validity of instrumental variables (IVs) in GMM is reviewed through Sargan, Hansen, and Arellano-Bond statistics. Sargan and Hansen tests with the hypothesis that exogenous IVs are not correlated with errors. As such, the larger the p-value of the Sargan and Hansen tests, the better the findings are. Meanwhile, the Arellano-Bond test is used to detect autocorrelation. Although AR(1) exists, the GMM model is still valid when AR(2) is absent (Haris et al., 2019).

6. Empirical results and discussion

Table 3 summarizes the descriptive statistics of the dependent and independent variables. The average ROA and ROE of listed companies in Vietnam in 2011–2018 are 0.0922 and 0.1738 respectively. *Medicine, Aviation, Energy, and Food* have higher returns on total assets and equity, while the others have lower performance. The average HCE is 3.3948, in which *Insurance, Real estate, Securities, Aviation, and Energy* are higher than average. The average SIZE is 3.0614, in which *Technology, Pharmaceuticals, Education, Aviation, Services, and Food* have lower total assets than other sectors. Descriptive statistical results show that *Banking* has among the largest assets but the lowest return on total assets. Meanwhile, *Services* and *Pharmaceuticals* have lower assets but higher profitability. The average ROA of technology firms listed on Vietnam’s stock market is higher than the average of the members of the Association of Southeast Asian Nations (ASEAN). Meanwhile, the HCE and SIZE of Vietnamese firms are lower (see Nimtrakoon, 2015).

Table 4 is a correlation matrix from a Pearson’s correlation coefficient analysis. The correlation coefficient between the independent variable HCE and the dependent variables ROA and ROE of sectors is almost statistically significant at 1 percent. *Technology, Oil and Gas* and *Aviation* had correlation coefficients at a significance level of 5 percent. Meanwhile, the correlation coefficients of *Food* are not statistically significant.

Many estimation methods, such as ordinary least squares (OLS), fixed-effect estimation (FE), and random-effect estimation (RE), have been widely used in previous empirical studies. The OLS method relies heavily on the assumptions that the estimation coefficients are often unstable and biased or that the unobserved effect will affect ineffective estimators (Tran & Vo, 2018).

Table 3. Descriptive statistics

	ROA	ROE	HCE	SIZE
All firms	0.0922	0.1738	3.3948	3.0614
Banking	0.0109	0.1203	2.3887	5.3046
Technology	0.0497	0.1162	1.5703	2.7011
Oil and gas	0.0728	0.1789	2.8257	3.6025
Pharmaceuticals	0.1162	0.2010	1.8861	2.6145
Insurance	0.0459	0.1206	3.8872	3.7694
Real estate	0.0510	0.1363	5.3218	3.4158
Securities	0.0694	0.1137	6.5662	3.2063
Education	0.0999	0.1419	1.8598	1.7456
Aviation	0.2082	0.3759	2.2480	2.9694
Energy	0.0962	0.1841	4.9466	3.1208
Service	0.1345	0.1657	2.4926	2.3151
Food	0.1376	0.2361	3.2834	3.0479

Note: ROA is the return on assets; ROE is the return on equity; HCE is human capital efficiency; SIZE is the natural logarithm of the total assets of the firm.

Table 4. Correlation matrix

	ROA-HCE	ROA-SIZE	HCE-SIZE	ROE-HCE	ROE-SIZE
All firms	0.1545***	-0.2427***	0.1240***	0.2019***	-0.0550**
Banking	0.7567***	0.1639*	0.0574	0.6935***	0.3483***
Technology	0.3781***	0.3703***	0.2124**	0.2037**	0.4400***
Oil and Gas	0.2868**	-0.1898	-0.0646	0.2745**	-0.1639
Pharmaceuticals	0.3194***	0.0370	0.2065***	0.1913***	0.0748
Insurance	0.8306***	-0.2269*	0.0607	0.7539***	-0.0184
Real estate	0.3430***	-0.1166*	0.1285**	0.4539***	0.0192
Securities	0.7370***	0.1040	0.0955	0.7271***	0.2668***
Education	0.6469***	0.1495*	0.4297***	0.7437***	0.2714***
Aviation	0.2419**	-0.2973***	0.4064***	0.2277**	-0.1976
Energy	0.4697***	-0.3436***	0.1780***	0.4027***	-0.2567***
Service	0.6925***	-0.0258	0.2454***	0.6424***	0.0444
Food	0.0799	0.1040	0.0915	0.0255	0.1142

Note: *p < 0.10; **p < 0.05; ***p < 0.01.

Other methods have been used to overcome some OLS defects, such as the FE and RE estimation (Ozkan et al., 2017), PLS-SEM analysis (Liem & Hien, 2020). However, it is generally considered that the FE and RE estimations are not always better than the OLS; it depends on the data type and research model. In particular, the model suffered from issues of heteroskedasticity and autocorrelation in this study. To solve these problems, we used the generalized method of moments (GMM). This consideration is similar to that of recent studies (Anifowose et al., 2018; Haris et al., 2019; Kehelwalatenna & Premaratne, 2014; Sardo & Serrasqueiro, 2017; Tran & Vo, 2018). Even in the context of endogeneity assumptions, GMM produces robust, non-biased, and efficient estimates. The validity of instrumental variables (IVs) in GMM is reviewed through Sargan, Hansen, and Arellano-Bond statistics. Sargan and Hansen tests with the hypothesis that exogenous IVs are not correlated with errors. As such, the larger the p-value of the Sargan and Hansen tests, the better the findings are. Meanwhile, the Arellano-Bond test is used to detect autocorrelation.

Empirical results using GMM are presented in Table 5. The p-value of the AR (2) test in both models is greater than 5 percent, so it is not possible to reject the null hypothesis that “second-order autocorrelation does not exist in the model.” In other words, the variables in both models do not have second-order autocorrelation. In addition, the Sargan test determines the suitability of IVs in the GMM model. This is a test of overidentification with the null hypothesis that “the IV is exogenous.” The Sargan test results show that *Pharmaceutical*, *Real estate*, *Securities*, *Energy*, and *Services* have endogenous phenomena in the IVs. Based on these tests, the GMM model is valid only for *Banking*, *Technology*, *Oil and Gas*, *Insurance*, *Education*, *Aviation*, and *Food* when assessing the impact of human capital efficiency on ROA. Meanwhile, for the relationship between HCE and ROE, the GMM model is valid in *Banking*, *Technology*, *Oil and Gas*, *Insurance*, *Securities*, *Education*, and *Food*. In addition, the GMM model is valid for all firms in both Models 1 and 2.

6.1. Model 1: Impact of human capital efficiency on ROA

For all firms, the relationship between ROA and HCE and HCE_{t-1} is not statistically significant. ROA_{t-1} has a correlation of 0.6967 at the 1 percent level of significance. This result shows that HCE has no effect on ROA, while profitability in previous years has an impact on profitability in the current year. In addition, SIZE reduces the profitability of firms.

In *Banking*, ROA_{t-1} , HCE, and HCE_{t-1} have an impact on ROA at the 99 percent level of confidence. In other words, profit in previous years and human capital efficiency in current year increased profits, but human capital efficiency in previous years reduced profit in the current year. In

Table 5. Empirical Results

	All firms	Banking	Technology	Oil and Gas	Pharmaceuticals	Insurance	Real estate	Securities	Education	Aviation	Energy	Services	Food
Model 1: ROA													
ROA _{t-1}	0.6967***	1.2293***	0.4434***	1.1713***	0.4608***	-0.2631	0.6793***	0.04472	1.5391***	0.6172***	0.5561***	0.6278***	0.5224***
HCE	0.0030	0.0077***	0.0198**	-0.0057	0.0465***	-0.0014	0.0012	0.0115***	0.1039***	0.0706***	0.0033	0.0231***	-0.0007***
HCE _{t-1}	-0.0009	-0.0097***	0.0068*	0.0031	-0.0123	-0.0022	-0.0005**	0.0007	-0.1022***	-0.0429***	-0.0038	-0.0159	0.0011***
SIZE	-0.0009**	-0.0006	0.0012	-0.0063**	-0.0159**	-0.0274	-0.0009	-0.0088	-0.0007	-0.0242***	-0.0117	-0.0133	0.0019
Constant	0.0502**	0.0062	-0.0016	0.0153	0.0433**	0.1755	0.0166	0.0125	-0.0464	0.0907***	0.0780	0.0537***	0.0557
AR(2) test	0.125	0.982	0.290	0.051	0.381	0.708	0.652	0.519	0.733	0.409	0.702	0.342	0.259
Sargan test	0.401	0.079	0.206	0.665	0.020	0.518	0.027	0.004	0.900	0.170	0.000	0.001	0.736
Hansen test	0.323	0.102	0.504	0.931	0.098	0.926	0.039	0.461	0.693	0.349	0.344	0.190	0.983
Model 2: ROE													
ROE _{t-1}	0.4156*	0.8315***	0.2385	1.0207***	0.6788***	0.3522	-0.2794	-0.3143***	0.8405***	-0.1124	0.4091**	0.7368***	0.4124***
HCE	0.0137**	0.1106***	0.0158	-0.0234	0.0388	0.0269	0.0044***	0.0214***	0.0961***	-0.0377	0.0111**	0.0396***	-0.0009
HCE _{t-1}	-0.0034**	-0.0942***	-0.0030	0.0148*	-0.0223	-0.0064	0.0006	0.006***	-0.0793***	0.0042	-0.0074**	-0.064***	0.0014***
SIZE	-0.0116**	-0.0021	0.0381**	-0.0013	-0.0098	-0.0585	0.0099	0.0399***	0.0078	-0.0583	-0.0215	0.0271*	0.0237
Constant	0.0998**	0.0024	-0.0409	0.0037	0.0555	0.222	0.1011	-0.1526***	-0.0194**	0.5883***	0.1582*	0.0309	0.0591
AR(2) test	0.219	0.288	0.244	0.406	0.751	0.163	0.289	0.188	0.656	0.299	0.364	0.314	0.563
Sargan test	0.110	0.884	0.097	0.070	0.000	0.822	0.002	0.185	0.297	0.000	0.007	0.004	0.763
Hansen test	0.316	0.371	0.480	0.682	0.217	1.000	0.165	0.419	0.410	0.315	0.163	0.190	0.329

Notes: *p < 0.10; **p < 0.05; ***p < 0.01
 ROA is return on assets; ROE is return on equity; HCE is human capital efficiency; SIZE is the natural logarithm of the total assets of the firm.

Pharmaceuticals, ROA in previous years and human capital efficiency in the current year have a positive impact on profit in the current year.

In *Oil and gas*, ROA in previous years has a positive impact on ROA in the current year (1.1713 at the 99 percent level of confidence), while human capital efficiency in the current year and previous years has no relationship to ROA in current year. In addition, SIZE has a negative impact on profitability at a significance level of 5 percent. The relationship between human capital efficiency and ROA of insurance firms is not statistically significant.

In *Education*, the impact of ROA in previous years and human capital efficiency in previous years and the current year affect ROA in the current year at a 99 percent confidence level. However, whereas ROA in previous years and human capital efficiency in the current year have a positive impact (respectively 1.5391 and 0.1039), human capital efficiency in previous years reduced ROA in the current year, with a correlation coefficient of -0.1022 .

In *Aviation*, all independent variables have an impact on ROA at the 99 percent level of confidence. Although profit in previous years and human capital efficiency in the current year have a positive impact (0.6172 and 0.0706, respectively), the previous year's human capital efficiency and SIZE reduce ROA in the current year.

6.2. Model 2: Impact of human capital efficiency on ROE

For all firms, the ROE in previous years and human capital efficiency in the current year are positively correlated (respectively 0.4156 at the 10 percent level of significance and 0.0137 at the 5 percent level of significance). Human capital efficiency in previous years and the size of the total assets reduce ROE in the current year.

In *Banking*, ROE_{t-1} , HCE , and HCE_{t-1} have an impact on ROE. Return on equity in previous years and human capital efficiency in the current year increase ROE in the current year. However, human capital efficiency in previous years reduces ROE in the current year. The relationship between human capital efficiency and ROE in *Technology* is not statistically significant.

In *Oil and gas*, ROE in previous years has a positive impact on profit in the current year while human capital efficiency in the current year has a negative impact on ROE in the current year. In addition, human capital efficiency in previous years has a positive effect on ROE.

In *Securities*, all independent variables have an impact on ROE. In particular, ROE in previous years reduces profit in the current year while human capital efficiency in the current year and previous years and the size of total assets have a positive effect on ROE in the current year.

In *Education*, ROE in previous years and human capital efficiency in the current year have a positive impact on ROE (0.8405 and 0.0961 at the 1 percent significance level, respectively). Human capital efficiency in previous years have a negative impact on ROE (-0.0793 at the 99 percent level of confidence).

The results obtained from both models support H_a hypothesis. Human capital can be utilized to improve products and processes (Berg, 1969). In addition, Becker et al. (2001) asserted that an increase in investment on employee competencies leads to improved financial performance. An insignificant relationship between human capital efficiency and firms performance was also found in previous studies (Firer & Williams, 2003; Puntillo, 2009). Our findings are consistent with the findings of Haris et al. (2019) in Pakistan; Al-Musali and Ismail (2016) in GCC countries; Mondal and Ghosh (2012) in India; Ting and Lean (2009) in Malaysia. In addition, the impact of human capital efficiency on financial performance of the banking sector is higher than the impact from other sectors in Vietnam. Moreover, the impact of human capital efficiency in Vietnam's banking sector is also higher when it is compared with other countries such as Pakistan (Haris et al., 2019), Turkey (Ozkan et al., 2017). On the other hand, for the

pharmaceuticals sector, the impact of human capital efficiency on firm performance in Vietnam is lower than that from other countries such as Pakistan (Amin et al., 2014) and Iran (Mehralian et al., 2012).

7. Summary and conclusions

7.1. Findings

The importance of human capital efficiency to firm performance of listed firms in Vietnam and other emerging markets in Asia has largely been ignored in the literature. Using an unbalanced panel dataset, this paper provides empirical evidence in relation to the impact of human capital efficiency on ROA and ROE for listed firms in Vietnam from 2011 to 2018, using the GMM technique. Our empirical findings partially confirm the generally held view that human capital efficiency intensity is higher in the banking sector than other sectors (Firer & Williams, 2003; Kubo & Saka, 2002). In Vietnam in particular, we find that human capital efficiency is higher in the banking sector than the manufacturing sector and technology and pharmaceuticals sector. However, it is lower than that in oil and gas, energy, and food sectors. In addition, using the widely used VAIC method, we find that human capital efficiency affects firm financial performance. This finding is in line with the results from previous studies (Nimtrakoon, 2015; Opong et al., 2019; Parham & Heling, 2015; Smriti & Das, 2018; Tran & Vo, 2018). The impact of human capital efficiency of the banking sector in Vietnam is higher than in other countries.

7.2. Implications

Our results lead to some policy implications for the government and firm management. The empirical evidence in this study shows that human capital efficiency has an impact on firm performance. As such, listed firms in Vietnam should pay more attention to the accumulation process of human capital. For example, firms should consider to offer staff competitive salaries and good benefits which are commensurate with their dedication, creating opportunities for promotion and career development. At the same time, firms need to develop training programs, improve staff qualifications, and invest in facilities and working conditions so that employees can improve productivity and contribute to firm performance via human capital accumulation. For manufacturing firms, it is necessary to rethink the growth model—shifting from mainly relying on exploiting natural resources, investment of capital and labor to synthesizing and effectively using the resources of the enterprise; especially high-quality human capital with scientific, technological and creative competence. Concentrating on synchronous implementation of solutions to improve labor productivity, quality, efficiency, competitiveness and sustainable development of firms.

7.3. Contributions

Apart from using an advanced and widely used VAIC model, this study contributes to the existing literature by providing insights on human capital efficiency and firm performance relationship across various sectors in Vietnam. These findings can provide policymakers and managers with empirical evidence to understand the current situation of human capital efficiency across sectors and its contributions to firm performance. As such, the Government and firm managers can develop policies and strategies to emphasize the importance of human capital accumulation on financial performance of firms in each sector.

7.4. Limitations

The limitation of this study is its focus on the impact of human capital efficiency on firm profitability, so for a more comprehensive analysis of the role of intellectual capital in firm financial performance, further research should extend our work to the other components of intellectual capital, such as structured capital efficiency, employed capital efficiency, and relational capital efficiency. It is also important to understand how human capital efficiency can be improved and which factors need to be considered to best manage these intangible assets.

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