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### Public Human Capital Spending and Economic Growth in Vietnam: The Bayes Approach

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#### ABSTRACT

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*Adding the role of human capital, the article aims to analyze the impact of public human capital expenditure on economic growth in Vietnam using the Bayesian approach to process data of 63 provinces and cities in Vietnam during the period of 2010 – 2021. The study shows that public expenditure on human capital has a relatively strong influence on economic growth in Vietnam: greater public education expenditure promotes economic growth while increasing spending on medical and social security results in economic constraints, with the probabilities of these impacts are 53,19%, 52,82%, and 57,02%, respectively. Moreover, the researchers also provide empirical evidence that human capital can moderate how much public expenditure impacts economic growth. Specifically, fluctuating literacy rates (*liter\_rate*) and growth rates of labor (*labor\_g*) increase/decrease the influence of public spending on education, medical care, and social security on economic growth in Vietnam.*

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#### INTRODUCTION

Human capital is indispensable for the development of a country. C. Mac has confirmed that humans are considered as the most important factor in the labor workforce, who plays a direct role in contributing to the development of the society. According to Smith (1776), a nation's wealth involves with the level of in-depth knowledge, training, talent, and labor workforces' experience and productivity. Traditionally, economic development was narrowly defined through real Gross National Product (GNP) per capita, but its definition has recently extended to education, health care, "quality of life", Gross Domestic Product (GDP). It is more obvious that human capital is closely related to a country's economic growth and development and become one of critically important criteria in assessing how much a nation has grown and developed over the year (Pearce et al., 1994). Therefore, national governors are suggested to invest in human capital

(OECD, 1996). To provide profound evidence for the impact of human capital public expenditure on economic growth, many studies have been conducted with different following results. Becker (1975) indicates that investment in human capital regarding education training and medical care helps individuals to increase income or raising the national economic growth, which is consistent with (Adeyemi and Ogunsola, 2016; Collin and Weil, 2020; Ponzetto and Troiano, 2018). Other studies investigating (both public and private investments) into the effect of medical care investments on economic growth (Cuong, 2018; Erçelik, 2018; Ifa and Guetat, 2018; Mallick et al., 2016; Piabuo and Tieguhong, 2017). Rangongo and Ngwakwe (2019); Trabelsi (2018) provide empirical evidence on the impact of public investment in education on economic growth. Most research results point out a positive correlation between public education and medical care spending with economic growth. However, depending on the studied period and characteristics of the research country, the influence direction can be reversed. Ifa and Guetat (2018) points out that in the short run public spending on education positively affects economic growth in Morocco, but this relationship has been found negative in Tunisia. However, the two countries experience positive impacts of state education expenditure on economic growth in the long run. Piabuo and Tieguhong (2017) finds out that public spending on medical care strongly impacts economic growth in both the short and long terms. Using a threshold model to determine the threshold for public education spending, Trabelsi(2018) indicates that public education spending only positively contributes to economic growth if the level of education expenditure is above the threshold and the country is governing its public expenditure well.

The authors have not found a positive impact direction of public human capital spending on economic growth within the limited literature review. As a key position in the development of a country, the role of human capital or specially the role of public human capital expenditure distribution in the relationship with economic growth has just been mentioned in a few previous studies. Among investments on human capital, education and medical care are the main focus in most of recent studies noticing that health and knowledge is critically important to humans. Apart from these variables, public human capital expenditure includes other specific investments i.e. public spending on social security, which is the amount of money that the government spends mainly on citizens with an award for meritorious services to the revolution, pensions, or social allowance, etc. Social welfare issues are the focus of the current trend of sustainable development, meaning that a long-term development in which current needs of present people will not affect those of future generations (Brundtland, 1987). In other words, it is a close and harmonious combination between economic growth, social justice, environmental protection, and respect for human rights. As an agricultural country with nearly 70% of the population are farmers with very low average income, Vietnam is facing a big problem of poverty concentrated in ethnic minority areas. To achieve sustainable development goals in the future, public spending on social security, therefore, becomes an urgent issue for many countries including Vietnam. As a result, the authors decide to study on the public human capital spending on economic growth in Vietnam.

## **1. THEORETICAL FRAMEWORK**

### **1.1. Relationship between public expenditure on human capital, economic growth and human capital**

#### **1.1.1. Public expenditure on human capital and economic growth**

The classic economic growth model represented by William Petty (1623 -1687); Adam Smith (1723 -1790); David Ricardo (1772 -1823) propose that land, labor and capital are three basic resources contributing to the economic growth of a country of which land is the most important factor due to its limit of growth. When the population is increasing, the fact that limited productive land bank forces farmers to cultivate on poor agricultural areas causes a decrease in agricultural productivity, resulting in higher agricultural land prices but lower corporate profits. As a result, the country's accumulated profits for investment decrease, thereby inhibiting economic growth. It is noted that the economic growth of a country depends on many other factors apart from land, so the root cause of economic growth issues cannot be sorted out by the above classic model. To address the above, growth models based on neoclassical

economics were born with the addition of new factors. Typically, the Slow – Swan exogenous growth model developed by Robert Solow and Trevor Swan in 1956 is built based on a Cobb – Douglas type synthetic production function:  $Y = f(K, L)$  where K represents the physical capital element and L stands for the labor factor. Solow (1957) has added an exogenous factor of technology ( $\bar{A}$ ) that also contributes to economic growth. Romer (1990) introduces a production function, but the researcher considers the firm's supply of labor as utility ( $L=1$ ),  $y = f(AK)$ . With this assumption, however, the way to accumulate knowledge is not clearly illustrated, which results in the second Romer model. While the Slow (1957) model focuses on technological progress generated from knowledge in the public science sector, the second Romer model concentrates on the knowledge-creating function of researchers. It is assumed that technological knowledge helps workers to increase their labor productivity. Illustrated as the form of  $Y = K\alpha(AL)^{1-\alpha}$ , the second endogenous growth model of Romer (1990) recognizes human capital as a main source of technological progress, which in turn leads to economic growth. Furthermore, it is asserted from the 2<sup>nd</sup> Romer model that technological progress depends on economic decisions. Therefore, creative ideas are critically important to increase the profits in manufacturing firms, requiring an investment in human capital to create new knowledge. It is obvious that the increasing profits will contribute to GDP, which in turn promotes economic growth. In short, human capital plays a very important role in a country's economic development. It is noted that expenditure on human resources, especially public human capital spending via basic investments in science, technology, education, and medical care can help to promote economic growth.

Based on the theoretical foundation of the relationship between investments in human capital development and economic growth, several empirical researchers have studied the impact of public spending on human capital on economic growth with the main focus on state education and medical care expenditure such as Adeyemi and Ogunsola (2016); Collin and Weil (2020); Ponzetto and Troiano (2018) or the effect of the public particular education expenditure on economic growth (Ifa and Guetat, 2018; Mallick et al., 2016; Rangongo and Ngwakwe, 2019; Trabelsi, 2018) and the impact of public medical care spending on economic growth (Cuong, 2018; Erçelik, 2018; Piabuo and Tieguhong, 2017). Most of the research have revealed that public human capital spending has a positive impact on a country's economic growth.

### **1.1.2 The role of human capital in the relationship between public expenditure on human capital and economic growth**

Among several factors determining the economic growth and development of a country, human capital is characterized as the key element. As a part of the society, humans can perceive the world in different views and adapt to various living environments. Therefore, the more the society grows, the better people will develop by gaining and accumulating knowledge, skills, and health care experience. However, it is noted that adaptation level of humans is different from person to person, which affects each person's contributions to the economy.

Many studies related to the relationship between human capital and economic growth confirm that difference in human capital factor may result in restraining level of economic growth of a country with poor resources. Countries with different levels of development also exist despite similarities in resources, which can be explained via the way people in that country behave. People can increase saving instead of spending; People can also accumulate knowledge to improve their own level; People can also receive different investment resources from the country where they live and work (Lewis, 2013; Robinson, 1965). In addition, the environment in which people live also affects the human resources of that country. Studies by Lucas Jr (1988) and Rauch (1992) suggest that the geographical area is the place where human capital is concentrated, and the more human capital develops, the more productivity in that area is generated. Urban areas will have a higher level of productivity because of the concentration of quality human resources, implying better economic growth and development. Moreover, to examine the effectiveness of an investment in human capital, the factor of workforce and human capital policy applied in the country should be considered (Sikayena et al., 2022).

## 2.2. Literature Review

### 2.2.1 Research theories

The impact of human capital public spending on economic growth has become a great concern to many scientists. Using a macroeconomic model, Collin and Weil (2020) study the change of economic growth and the poverty status of a country by increasing investments in human capital of the new workforce with actual demographics via developing two specific scenarios and differentiating their research outcomes. The first scenario observed the investment in human capital of studied countries in 10 years and completed by 2015. The second scenario lasts a decade during which each country increases its investment in human capital by 75% compared to the observed data in the last decade. To achieve the goals of income growth and poverty alleviation, investing in human capital is found more effective than investing in physical capital. Using a retrospective data with fixed effects in two developing countries in sub-Saharan Africa from 1987 to 2016, Rangongo and Ngwakwe (2019) provide empirical evidence that investments in education contributes to economic growth in a certain time. Applying a random endogenous growth model with imperfect political system, Ponzetto and Troiano (2018) indicates that social capital will increase economic growth by raising investments in human capital. Using ARDL cointegration analysis to examine the relationship between human resource development and economic growth in Nigeria in the period of 1980-2013, Adeyemi and Ogunsola (2016) points out that public spending on medical care has a long-term negative impact on economic growth, but no correlation between state education expenditure and economic growth has been found. Applying the same approach to examine the impact of public education spending on GDP per capita in countries of Tunisia and Morocco during the period of 1980-2015, Ifa and Guetat (2018) confirm that public education expenditure positively influences GDP per capita in Morocco but negatively affects Tunisia in the short term. In contrast, a long-term positive impact between the two variables is found in both Morocco and Tunisia in the long run.

Greater effects of public education spending on GDP per capital are revealed in Morocco in comparison with that in Tunisia. With the application of the structural threshold regression (STR) model of Kourtellis et al. (2015) on the data of 109 developed and developing countries from 1980 to 2013, Trabelsi (2018) studies how economic growth is affected by state education expenditure together with the role of institution. The authors point out that public spending on education only contributes positively to economic growth in countries with performance above the threshold determined by a threshold regression model and the nation is under proper governance, otherwise the impact reserves to negative. Using the GMM method to study public medical spending on provincial economic growth in Vietnam from 2011 to 2016, Cuong (2018) medical care spending reveals medical care spending an increase in the quality of human resources with higher state medical expenditure, which in turn increases the Gross Domestic Product (GDP). Using the ADRL method to examine the impact of medical (private and public) expenditure in Turkey from 1980-2015, Erçelik (2018) confirms the existence of a long-term meaningful relationship between medical care spending and GDP of a country. By using the ordinary least squares (OLS), fully modified least squares (FMOLS) and dynamic ordinary least squares (DOLS) regression estimators in countries in the CEMAC subregion and five other African countries from 1995 to 2015, Piabuo and Tieguhong (2017) provide empirical evidence from which medical care public spending positively and significantly affects economic growth.

Applying the similar approach on the collected data across 14 major Asian countries from 1973 to 2012, Mallick et al. (2016) indicates a positive and statistically significant impact of education spending on economic growth. Many studies examine the role of human capital factor in the relationship between public human capital spending and economic growth. Adding a representative variable for human capital as life expectancy and population growth rate besides medical care expenditure variable, Piabuo and Tieguhong (2017) conduct a study on the relationship between medical care spending and economic growth. Researching on the relationship between education spending and economic growth, Trabelsi (2018) also adds an average number of years of schooling as a proxy variable for human capital. Regarding the impact of public human capital expenditure (education and health care) on economic growth, different research results have been revealed so far. In addition, none research on the impact of public spending

on social security (human capital) on economic growth has been conducted. The role of human capital is hardly found in studies on the relationship between state expenditure on human capital and economic growth. Therefore, the authors study the impact of public spending on human capital including expenditure on education, medical care, and social security on economic growth with the role of public spending on human capital, which is the novelty of this study.

## 2.2.2 Research methodologies

A wide range of research methodologies have been applied to examine the impact of public human capital spending on economic growth. Using a macroeconomic model with actual demographics through building two specific scenarios and differentiating research results, Collin and Weil (2020) study the change of economic growth and poverty status of a country by increasing investments in human capital of the new labor workforce. Applied a panel data regression with fixed effects, Rangongo and Ngwakwe (2019) research on the relationship between investment in human capital and economic growth in two developing countries in sub-Saharan Africa from 1987 to 2016. By using stochastic endogenous growth model with imperfect political authority, Ponzetto and Troiano (2018) conduct a study on the impact of social capital on economic growth through investments in human capital. cointegration analysis is applied in numerous studies health care including Adeyemi and Ogunsola (2016) on the relationship between human resource development and economic growth in Nigeria in the period of 1980-2013; Ifa and Guetat (2018) examines the impact of public spending on education on GDP per capita of Tunisia and Morocco in the period of 1980 - 2015; Erçelik (2018) investigate into medical care the effect of medical spending (both private and public) on Turkey's output from 1980 to 2015 via Gross Domestic Product (GDP). With the application of the Structural Threshold Regression (STR) model of Kourtellos et al. (2015), Trabelsi (2018) has added the role of institutions to study the impact of public education expenditure on economic growth with data collected from 109 countries during the period of 1980-2013.

Using the GMM method, Cuong (2018) studies the impact of medical care spending on provincial economic growth in Vietnam in the period of 2011-2016. Piabuo and Tieguhong (2017) study the relationship of medical care spending and economic growth in the period of 1995 - 2015 using least squares (OLS) regression methods, the least squares regression estimate is obtained. fully modified (FMOLS) and dynamic state least squares regression (DOLS). Applied the similar approach, Mallick et al. (2016) conducts a study on the impact of education spending on economic growth across 14 major Asian countries in the period of 1973-2012. Among the study approaches, it is noted that frequency econometric is the most used method despite its improper assumptions following low accuracy. Currently, the strength of the Bayesian method has been found in several research (Gelman and Hill, 2006). Firstly, it does not depend on the research sample size. Secondly, the Bayesian method help the authors to overcome critical problems such as autocorrelation, variable variance, and endogeneity. Undoubtedly, the researchers decide to conduct this study using a Bayesian approach to address the issue of the research scope in Vietnam.

## 3. METHODOLOGY

### 3.1 Research Model

To study the impact of public human capital spending, the authors, based on the studies of (Piabuo and Tieguhong, 2017; Rangongo and Ngwakwe, 2019; Trabelsi, 2018), have built an empirical research model (1) as follows:

$$grdp_{i,t} = \alpha_o + \beta_x PEX_{H_{i,t}} + \beta_y X_{i,t} + \varepsilon_{i,t} (1)$$

To study the regulatory role of human capital in the relationship between public human capital expenditure and economic growth, the researchers, based on Lewis (2013) and Sikayena et al. (2022), have formed an empirical research model (2) as follows:

$$grdp_{i,t} = \alpha_o + \beta_x PEX_{H_{i,t}} + \beta_y PEX_{H_{i,t}} * HC_{i,t} + \beta_z X_{i,t} + \varepsilon_{i,t} (1)$$

Where:

$i$  is the province and  $t$  is the time

$grdp_g(i,t)$  – economic growth of province  $i$  in year  $t$ ;

$PEX_{H_{i,t}}$  are variables representing public human capital expenditure of province  $i$  in year  $t$  including  $edu\_ex$  – public education expenditure,  $medi\_ex$  – public medical expenditure health care,  $social\_se\_ex$  – public social security spending;

$HC_{i,t}$  are variables representing human capital of province  $i$  in year  $t$  including  $liter\_rate$  – literacy rate,  $labor\_rate$  – growth rate of labor

$X$  is a set of control variables including  $invest\_cap$  – actual total investment capital,  $pri\_cap$  – private investment capital,  $fdi$  – foreign direct investment capital,  $inf$  – inflation rate,  $unemp\_rate$  – unemployment rate,  $trade$  – trade openness,  $PCI$  – Provincial Competitiveness Index;

$\varepsilon$ : Error

### 3.2 Research Variables and Research Data

The research has collected data from 63 provinces and cities in Vietnam in the period of 2010–2021 compiled from reliable sources of General Statistics Office of Vietnam and the statistical yearbooks of the provinces in Vietnam. The methods of measurement and data sources of the research variables are presented in Table 1 as follows:

**Table 1.** Descriptive data

Variable	Symbol	Measure	Expectation	Data Source	Reference studies
<i>Dependent variables</i>					
Economic growth	Grdp <sub>g</sub>	Gross Domestic Product growth rate (%)		General Statistics Office of Vietnam	Magdalena and Suhatman (2020)
<i>Independent variables</i>					
<i>Public spending for human capital (PEX<sub>H</sub>)</i>					
Public spending on education	edu_ex	Recurrent expenditure on education (% of GRDP)	+	Statistical yearbook of provinces/cities in Vietnam	Mallick et al. (2016); Ifa and Guetat (2018); Trabelsi (2018); Rangongo and Ngwakwe (2019)
Public spending on health care	medi_ex	Recurrent spending on social security (% of GRDP)	+	Statistical yearbook of provinces/cities in Vietnam	Piabuo and Tieguhong (2017); Erçelik (2018); Cường (2018)
Public spending on social security	social_se_ex	Recurrent spending on social security (% of GRDP)	+	Statistical yearbook of provinces/cities in Vietnam	Brundtland (1987); Hone et al. (2019);
<i>Human Capital (HC)</i>					
Labor literacy rate	liter_rate	Literacy rate of total population (%)	+	Statistical yearbook of provinces/cities in Vietnam	Robinson (1965); Romer (1989); Azariadis and Drazen (1990); Desai (2012); Lewis (2013); Setyadi et al. (2020); Diebolt et al. (2022)
Employment growth rate	labor_g	Annual growth rate of the number of employees (from 15 years old and above) (%)	+	Statistical yearbook of provinces/cities in Vietnam	Robinson (1965); Lewis (2013); Ali et al. (2018); Han and Lee (2020)



Control variables					
Total actual investment	invest_cap	Total actual investment for local social development (% of GRDP)	+	Statistical yearbook of provinces/cities in Vietnam	Fashina et al. (2018); Ifa and Guetat (2018); Sharma (2018) ; Amna Intisar et al. (2020) ;Pomi et al. (2021)
Private investment capital	pri_cap	Actual investment capital of individuals and local businesses (% of GRDP)	+	Statistical yearbook of provinces/cities in Vietnam	Fashina et al. (2018); Ifa and Guetat (2018); Sharma (2018) ; Amna Intisar et al. (2020) ;Pomi et al. (2021)
Foreign Direct Investment	fdi	Local source of Foreign Direct Investment (% of GRDP)	+	Statistical yearbook of provinces/cities in Vietnam	Fashina et al. (2018); Ifa and Guetat (2018); Sharma (2018) ; Amna Intisar et al. (2020) ;Pomi et al. (2021)
Inflation rate	inf	Movement of CPI next year compared to the previous year (%)	-	Statistical yearbook of provinces/cities in Vietnam	Fashina et al. (2018); Ifa and Guetat (2018); Sharma (2018) ; Amna Intisar et al. (2020) ;Pomi et al. (2021)
Unemployment rate	unemp_rate	Annual rate of unemployed workers	+	Statistical yearbook of provinces/cities in Vietnam	Cường (2018)
Trade openness	trade	Total value of local imports and exports (% of GRDP)	+	Statistical yearbook of provinces/cities in Vietnam	Fashina et al. (2018); Ifa and Guetat (2018); Sharma (2018) ; Amna Intisar et al. (2020) ;Pomi et al. (2021)
Provincial Competitiveness Index	PCI	The Provincial Competitiveness Index (PCI) is conducted by the Vietnam Chamber of Commerce and Industry (VCCI) with the support of the United States Agency for International Development (USAID) in Vietnam.	-	<a href="https://pcivietnam.vn/">https://pcivietnam.vn/</a>	Cường (2018)

Source: Summarized by the authors

## 4. RESULTS AND DISCUSSION

### 4.1 Descriptive statistics

In this study, the author takes a sample of 63 provinces and cities in Vietnam from 2010 to 2021. Before conducting the regression, the authors carry out descriptive statistics of variables related to economic growth, variables representing public expenditure on human capital and others with the specific results illustrated in Table 2.

As shown in Table 2, economic growth (grdp) does not fluctuate much because the coefficient of variation of the data (Coefficient of Variation) is less than 1. Regarding investments on human capital, an average fluctuation with the coefficient variation less than 1 is also found among variables of public education spending (edu\_ex), public social security expenditure (social\_se\_ex) represent state human capital expenditure, while the literacy rate (liter\_rate) and control variables of total investment capital (invest\_cap), private investment (pri\_cap), inflation rate (inf), trade openness, Provincial Competitiveness Index (PCI). At

the variation coefficient larger than 1, quite strong fluctuations are recognized among variables of public spending on medical care (*medi\_ex*), growth rate of labor (*labor\_rate*), Foreign Direct Investment (*fdi*) and unemployment rate (*unemp\_rate*). Typically, the standard deviation of Foreign Direct Investment is revealed nearly 6 times higher than the average value.

**Table 2.** Descriptive statistics

<i>Variable</i>	<i>Obs</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>grdp</i>	756	0.8903	0.2070	-0.4167	2.0326
<i>edu_ex</i>	756	0.6623	0.4362	-2.3452	2.9979
<i>medi_ex</i>	756	0.0898	0.4510	-2.9167	2.6841
<i>social_se_ex</i>	756	-0.1630	0.4213	-3.0805	2.4147
<i>liter_rate</i>	756	1.9669	0.0355	1.7723	1.9965
<i>labor_g</i>	756	0.1102	0.4400	-2.6434	0.9700
<i>invest_cap</i>	756	1.6188	0.3798	-1.3277	4.6335
<i>pri_cap</i>	756	1.3121	0.4015	-1.5402	4.4247
<i>fdi</i>	756	0.1577	0.9647	-3.2326	3.9017
<i>inf</i>	756	0.6368	0.4239	-1.2218	2.0703
<i>unemp_rate</i>	756	0.2668	0.3627	-2.5873	1.0866
<i>trade</i>	756	19.3645	0.6641	16.6462	23.1247
<i>PCI</i>	756	1.7817	0.0331	1.6543	1.8756

Note: Table 2 shows descriptive statistics of unbalanced panel data from 756 observations in 63 provinces and cities in Vietnam from 2010 to 2021. Symbols and definitions of the research variables are shown in Sections 2.1 and Table 1.

## 4.2 Research results from the Bayes regression model

**Table 3.** Regression results of the impact of public human capital spending on economic growth in Vietnam (Equation 1)

<i>grdp</i>	<i>Mean</i>	<i>MSCE</i>	<i>Equal-tailed [95% Cred. Interval]</i>	
<i>edu_ex</i>	-0.1365	0.0011	-0.5179	0.2465
<i>medi_ex</i>	0.0089	0.0010	-0.3143	0.3311
<i>social_se_ex</i>	-0.0354	0.0005	-0.2160	0.1452
<i>liter_rate</i>	-0.7847	0.0050	-2.4765	0.8976
<i>labor_g</i>	-0.0124	0.0003	-0.1074	0.0830
<i>invest_cap</i>	0.2107	0.0009	-0.0934	0.5159
<i>pri_cap</i>	-0.0167	0.0007	-0.2504	0.2180
<i>fdi</i>	0.0206	0.0002	-0.0551	0.0973
<i>inf</i>	0.0153	0.0003	-0.0832	0.1128
<i>unemp_rate</i>	0.0051	0.0004	-0.1236	0.1314
<i>trade</i>	0.0056	0.0003	-0.0992	0.1091
<i>PCI</i>	-0.4615	0.0039	-1.8022	0.8713
<i>_cons</i>	2.8988	0.0119	-1.1556	6.9193
<i>var</i>	0.3092	0.0002	0.2798	0.3426
Avg acceptance rate	0.7157			
Avg efficiency: min	0.2221			
Max Gelman-Rubin Rc	1.000234			

Source: Summarized from STATA results by the authors)



**Table 4.** Posterior probability for equation 1

	<i>Mean</i>	<i>Std. Dev</i>	<i>MCSE</i>
prob1: (grdp:edu_ex) < 0	0.7595	0.4274	0.0025
prob1: (grdp:medi_ex) > 0	0.5200	0.4996	0.0029
prob1: (grdp:social_se_ex) < 0	0.6473	0.4778	0.0028
prob1: (grdp:liter_rate) < 0	0.8161	0.3874	0.0022
prob1: (grdp:labor_g) < 0	0.6030	0.4893	0.0028
prob1: (grdp:invest_cap) > 0	0.9105	0.2854	0.0016
prob1: (grdp:pri_cap) < 0	0.5558	0.4969	0.0029
prob1: (grdp:fdi) > 0	0.7016	0.4576	0.0027
prob1: (grdp:inf) > 0	0.6225	0.4848	0.0028
prob1: (grdp:unemp_rate) > 0	0.5324	0.4990	0.0029
prob1: (grdp:trade) > 0	0.5410	0.4983	0.0029
prob1: (grdp:PCI) < 0	0.7526	0.4315	0.0025

Source: Summarized from STATA results by the authors

**Table 5.** Regression results of the impact of public human capital spending on economic growth in Vietnam including the role of human capital (Equation 2)

<i>grdp</i>	<i>Mean</i>	<i>MCSE</i>	<i>Equal-tailed [95% Cred. Interval]</i>	
edu_ex	0.4569	0.0333	-10.8115	11.6480
medi_ex	-0.3792	0.0333	-11.6298	10.9021
social_se_ex	-0.8055	0.0263	-9.7315	8.05850
liter_rate	-0.3985	0.0137	-5.0436	4.2647
labor_g	-0.1743	0.0017	-0.7639	0.4164
liter_rate_educ_ex	-0.3179	0.0168	-5.9847	5.3826
labor_g_educ_ex	0.2214	0.0026	-0.6667	1.1060
liter_rate_medi_ex	0.2042	0.0168	-5.5049	5.9051
labor_g_medi_ex	0.0015	0.0021	-0.7272	0.7166
liter_rate_social_se_ex	0.3932	0.0134	-4.1243	4.9227
labor_g_social_se_ex	-0.0960	0.0012	-0.5054	0.3200
invest_cap	0.2116	0.0009	-0.1017	0.5304
pri_cap	-0.0256	0.0007	-0.2662	0.2159
fdi	0.0219	0.0002	-0.0559	0.0990
inf	0.0199	0.0003	-0.07871	0.1193
unemp_rate	0.0031	0.0004	-0.1237	0.1314
trade	0.0096	0.0003	-0.0965	0.1141
PCI	-0.4780	0.0040	-1.8301	0.8693
_cons	2.1182	0.0275	-7.3051	11.4606
var	0.3101	0.0002	0.28017	0.3432
Avg acceptance rate	0.7293			
Avg efficiency: min	0.2224			
Max Gelman-Rubin Rc	1.000494			

Source: Summarized from STATA results by the authors

**Table 6.** Posterior probability for equation 2

<b>Grdp</b>	<i>Mean</i>	<i>Std. Dev</i>	<i>MCSE</i>
prob1: (grdp:edu_ex) > 0	0.5319	0.4990	0.0029
prob1: (grdp:medi_ex) < 0	0.5282	0.4992	0.0029
prob1: (grdp:social_se_ex) < 0	0.5702	0.4951	0.0029
prob1: (grdp:liter_rate) <	0.5643	0.4959	0.0029
prob1: (grdp:labor_g) < 0	0.7190	0.4495	0.0026
prob1: (grdp:liter_rate_edu_ex) < 0	0.5436	0.4981	0.0029
prob1: (grdp:labor_g_edu_ex) > 0	0.6864	0.4639	0.0027
prob1: (grdp:liter_rate_medi_ex) > 0	0.5296	0.4991	0.0029
prob1 : (grdp:labor_g_medi_ex) > 0	0.5011	0.5000	0.0029
prob1: (grdp:liter_rate_social_se_ex) >0	0.5670	0.4955	0.0029
prob1: (grdp:labor_g_social_se_ex) < 0	0.6785	0.4671	0.0027
prob1: (grdp:invest_cap) > 0	0.9069	0.2906	0.0017
prob1: (grdp:pri_cap) < 0	0.5824	0.4932	0.0028
prob1: (grdp:fdi) > 0	0.7111	0.4533	0.0026
prob1: (grdp:inf) > 0	0.6544	0.4756	0.0027
prob1: (grdp:unemp_rate) > 0	0.5154	0.4998	0.0029
prob1: (grdp:trade) > 0	0.5731	0.4947	0.0029
prob1: (grdp:PCI) < 0	0.7541	0.4306	0.0025

Source: Summarized from STATA results by the authors

The research sampling is considered a success as shown from the Bayesian linear regression results of Equation 1 (Table 3) and Equation 2 (Table 5) via the MCMC algorithm. Also, the MCMC series of both models (1) and (2) satisfy the convergence requirements with the average acceptance rate (Avg acceptance rate) of models (1) and (2) is 0.7157 and 0.7293, respectively. The minimum average efficiency (Avg efficiency: min) of the model of equation 1 is 0.2221 and equation 2 is 0.2224, which is both larger than the minimum allowable level of 0.01, so the efficiency index of the parameters of both equations are greater than 0.01. It is recommended that the Gelman-Rubin Rc value should be examined. According to Gelman and Rubin (1992), the model in which the Gelman-Rubin Rc diagnostic value of any coefficient of the model that is greater than 1.2 would be considered null converging. From that, the maximum Gelman-Rubin Rc values of the equation 1 and equation 2 are 1.000234 and 1.000494, respectively, which is not exceeding 1.2, meets the study requirements. Besides, the standard deviation (Standard Deviation) for the regression coefficient, the Bayesian regression results also provides the parameter of the Monte-Carlo Standard Error – MCSE, which clearly indicates the stability of the MCMC chains. According to Flegal (2008), MCSE is less than 6.5% then the standard deviation is acceptable; MCSE is less than 5% then the standard deviation is optimal. The research output indicates that the MCSE values of the regression coefficients are optimal because they are all less than 5%. Whether the regulatory role of human capital is examined or not, the impact level and direction of research variables representing public human capital expenditure on economic growth also change as shown the verification of consequences of model 1 (Table 4), and model 2 (Table 6). Details are as follows:

#### *Impact of public human capital spending on economic growth in Vietnam*

Public expenditure on education (edu\_ex) has a negative impact on economic growth in Vietnam when the mean parameter of the variable edu\_ex is less than 0, with quite high probability of a negative impact of the variable edu\_ex on economic growth, at 75.95%. Negatively affect economic growth, public expenditure on social security (social\_se\_ex) indicates a lower probability of impact of the variable edu\_ex, only

close to 65%. It can be inferred that the possibility of a negative effect of the social\_se\_ex variable is less than that of the variable edu\_ex. In fact, Vietnam has distributed much lower state budget expenditure on social security compared with that on education.

On the other hand, public expenditure on medical care (medi\_ex) has a positive impact on economic growth in Vietnam with mean parameter value is greater than 0 and the probability of a positive impact of this variable is not too high, at 52%. As shown, public human capital spending regarding expenditure on education, medical care and social security has a relatively strong influence on a country's economic growth, but this impact can either be positive or negative. A country with proper governance of state budget expenditure can promote the national economic growth via public spending on human capital. In contrast, a country with exceeding public expenditure and/or under poor governance of the state expenditure can experience economic constraints via their public investments in human capital (Trabelsi, 2018).

### *The impact of public human capital spending on economic growth in Vietnam involving the role of human capital*

When the role of human capital is included in the model, public spending on education now has a positive effect on economic growth and the probability of the positive effect of this variable reaches 53,19%. Meanwhile, public medical care spending has a negative impact on economic growth with a negative probability of 52,82%. This can be explained by the fact that differences in human capital can change the effect of public human capital expenditure on economic growth of a country (Lucas Jr, 1988; Rauch, 1992). Particularly, public spending on social security still maintains a strong negative impact on economic growth with the probability of negative influence of this variable at 57,02% despite the added variable of human capital. This is because the public expenditure is for retirees, policy beneficiaries, people with meritorious services to the revolution, and those with difficult circumstances with little changes in qualification, health, and contribution to GDP. Level of impact of public human capital spending on economic growth in Vietnam is also different with the participation of human capital. Representing human capital, an increase in literacy rate (liter\_rate) variable reduces the positive impact of edu\_ex on economic growth with the effect probability of 54,36%. Similarly, the negative impacts of medi\_ex and social\_se\_ex variables on economic growth are deducted with the influence probability of 52,96% and 56,7%, respectively. This is because higher level of literacy rate of the labor workforce is equivalent with better knowledge that people acquire to take care of their health. Compared with manual workers, those with greater literacy level can also get high-paying jobs and overcome certain difficult circumstances. Thanks to the rising literacy spending, the effectiveness of spending on medical care and social security is also improved. However, different results are revealed when it comes to public education expenditure. When the rate of labor literacy is higher, or cognitive level of labor workforces tends to be higher and improved, satisfying certain job requirements. Investments in education, as a result, can become a waste if this amount is not properly spent. Meanwhile, an increase in the growth rate of the number of employees (labor\_g) increases the positive impact of edu\_ex variable with the influence probability of 69%. It is noted that the increasing number of workers and greater investments in qualifications and skills enhancement contribute to higher labor productivity as well as greater national GDP. However, an increase in the number of workers following higher possibility of difficult cases and greater risks of unemployment, leading to a rise in public spending on social security, but a drop in the contribution to GDP. In other words, the country's economic growth is limited.

Among the control variables, the variable total real investment (invest\_cap), Foreign Direct Investment (fdi), inflation rate (inf), unemployment rate (unemp\_rate) and trade openness (trade) positively influence economic growth while the variables of private investment (pri\_cap), Provincial Competitiveness Index (PCI) have a restraining effect on economic growth. In addition, different level reliability of these control variables is shown in the research results including sufficient evidence with the probability of influence over 50% for variables pri\_cap, inf, unemp\_rate, trade, strong evidence with probability of influence over 60% to 75% for fdi, PCI variables), and very strong evidence of the variable invest\_cap with a probability of influence up to 90%.

## CONCLUSIONS AND POLICY IMPLICATIONS

This paper studies the impact of public human capital expenditure on economic growth in Vietnam adding the role of human capital. By using the Bayesian linear regression method on the collected data from 63 provinces and cities of Vietnam in the period of 2010–2021, the authors conclude that public spending on human capital has a strong impact on economic growth with the involvement of human capital. Details are summarized as follows:

- Economic growth in Vietnam is negatively impacted by state expenditure on social security and medical care, but positively affected by public education spending.
- An increase in literacy rate reduces the positive impact of public education spending as well as the negative influence of public medical care and social security spending on economic growth in Vietnam.
- A rise in numbers of the labor workforces positively increases the impact of public education spending but negatively raises the influence of public medical care spending. Nevertheless, the growth of the labor workforces number reduces the negative impact of public medical care and social security spending on economic growth in Vietnam.

Additionally, control variables of total real investment (*invest\_cap*), Foreign Direct Investment (*fdi*), inflation rate (*inf*), unemployment rate (*unemp\_rate*) and trade openness (*trade*) have a positive effect on economic growth while private investment (*pri\_cap*), and Provincial Competitiveness Index (*PCI*) show the reversed influence.

From the above results, the authors propose some policy implications as follows:

- The government of Vietnam should focus on education investments to improve the qualifications and skills of the labor workforces, generating qualified human resources, thereby contributing to increasing labor productivity and promoting economic growth and development. Public spending on health and medical care should be strictly controlled to minimize its negative effects on economic growth. As the state social security expenditure should cater for policy beneficiaries only, to ensure fairness in the society and avoid those taking advantage of the resources, the government needs to be more careful in reviewing the list of participants as well as strictly control the management system in order not to waste the national budget.
- The government also needs to promote the growth of workers combined with their improvement of qualifications and skills. However, investing in the qualifications of workers should be put in consideration. When the labor workforces have obtained the proper qualifications for the jobs, the continuing qualification investments would become a waste of the national budget.
- In addition, greater care on medical care and qualifications improvement for policy beneficiaries can help them to overcome certain difficulties, reducing public expenditures for social security in the future, contributing to promoting economic growth.

The paper only considers the impact of public human capital expenditure on economic growth in a particular country, not worldwide nations, which is a research limitation. Moving forwards, the researchers can further investigate into the impact of public human capital spending on economic growth in groups of developed and developing countries.

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