The Role Of Education In Encouraging The Economy In The Digital Age From The Viewpoint Of Human Capital Theory And Cobb-Douglas Production Function

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Abstract

This research seeks to learn more about the Cobb-Douglas production function using the Human Capital Theory approaches in the digital era that focuses on information and communication technology. In this study, we use secondary data from the world bank with a research period from 1990 to 2020 in 10 countries in Southeast Asia that are members of the ASEAN organization, and to estimate the equations that we have built, we use the SYS GMM panel data. We found that education plays an important role in the development of the digital economy in the Southeast Asia region. Human capital is a vital factor in intellectual-based economic development in the digital era combined with the right government policies. Job participation is the main driver of the economy in the digital era, reinforced by sufficient human capital, as well as the availability of capital to encourage production and create economic growth. Internet literacy does not guarantee economic growth without the presence of human capital and community work participation in the economy.

Keyword: Education, Economy,Digital Age, Human Capital Theory, Cobb-Douglas Production Function

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Background

The pandemic caused by Covid-19 has accelerated the digitization process of the economies of developed countries (Amankwah-Amoah, Khan, Wood, & Knight, 2021). One of the many indirect effects of the health crisis is the intensification of robotization, artificial intelligence, or big data. This is a process that already exists but has been strengthened in recent months with important implications for education and employment. Online training and teleworking have become the best alternatives available to keep many activities going, including educational offerings (Konovalova, Mitrofanova, Mitrofanova, & Gevorgyan, 2022).

The central theme of the economy is the production of goods and services. Productive activities are carried out through productive units called companies. Due to technological advances and the standard of living achieved by modern society, there are millions of products and, consequently, millions of companies. Every product demanded and consumed in society has been made or produced by combining different quantities of factors of production (Gatto, 2020).

The economic theory of production adequately deals with this particular problem and its aim is to provide the entrepreneur or manager with the necessary information so that the firm can organize its production processes efficiently, use those factors of production efficiently, are limited in number and expensive, and therefore maximize profits or owner's profits (Priyono, Moin, & Putri, 2020). To describe the relationship between the product obtained, the variation of capital input and labor, which is then added to the technology, is also called the total factor productivity. This is a production function that is often used in economics. A very

specialized production function and very useful in the micro and macroeconomic analysis is the Cobb-Douglas production function (Van Elk, ter Weel, van der Wiel, & Wouterse, 2019).
Neoclassical economic theory starts from the individual or company as a unit of analysis to study the determination of supply and demand at the micro-macro economic level, the functioning of markets, and the processes by which equilibrium is reached. In this approach, the market is the central element which is understood as an efficient resource allocation mechanism (Radhakrishna, 2021). Labor in this school of economic thought (a certain amount of working time) is seen as a factor of production (such as capital and land) that is exchanged in a given market according to its marginal productivity which is understood as its price. The combination of work that complements or replaces other factors in the production process aims to produce goods or services. The aggregate labor market is presented as the result of the horizontal aggregation of the supply and demand curves of individual labor, thus fulfilling the premise that social aggregates are the result of adding up their individual components due to the homogeneity of employment (Bianchi & de Man, 2021).
Neoclassical theory views economic systems as the result of individual will and behavior, where the ideal representation of a system is a set of markets (present, future, and contingent) in which market conditions are met. that. In the proposed scenario, perfect competition becomes the essential basis for giving scientific meaning to the neoclassical current (based on rationality and the notion of representative agency), the labor market is a meeting room between suppliers and applicants, who are in it (Arthur, 2021). Although perfect competition is the essential basis for giving scientific meaning to the neoclassical current (based on rationality and the notion of representative agency), a series of questions are formulated for this conception of the labor market because it is unable to explain it. the emergence of certain phenomena in reality, such as differences in salary and heterogeneity of occupational factors (Cincotti, Raberto, & Teglio, 2022).
Starting from a series of problems and questions accepted by the conventional neoclassical theory of the labor market regarding the impossibility of understanding the existence of wage differences between workers and their layoffs with certain phenomena that occur in reality, the theory of capital emerged. trying to solve some of these problems and at the same time trying to provide an explanation that is more closely related to the reality of the behavior of agents in the labor market (Spash & Hache, 2022).
The treatment of human capabilities as a type of capital in the neoclassical tradition studies the effect of demand on income distribution. An important element for explaining wage differentials is the complementary relationship between labor and capital. In this way, an increase in capital not only in quantity, but also in technological complexity, leads to an increase in the quantity and quality of work demanded (Shanks, 2019). Wage efficiency as wages per unit of labor efficiency that is, wages are measured not as remuneration for piece work with reference to the number of products produced, but by reference to the effort of skill and efficiency required by workers; thus, efficiency wages cause different wages to be paid to workers with different levels of efficiency (Irawan, 2021). Thus, competition for individual levels of education is introduced as a determinant of wage differentials for workers. Paying the difference for different types of work, taking concepts such as educational training, and integrating the notion of return on human capital investment (Lazear, 2018).
Society itself can be considered as a form of wealth that cannot be ignored in the calculation of the wealth of a nation (Pfeiffer, 2021). However, the means of measuring the wealth of nations is almost entirely confined to the non-human factors of production, namely, physical capital and land (Smith, 2022). But Human factor has a significant effect on the economy. Human abilities offer economic services, but because they result from the distribution of limited resources, they are not free products. In this sense, it is proposed that the process of

creating human capital may be viewed and comprehended as an economic investment activity similar to the creation of physical capital. The creation of human capital through the skills and knowledge acquired by the owner (Widodo & Priyanto, 2021).

Having the right technology to manage digital human capital is part of an increasingly important strategy to attract and develop the talent companies need. By managing to optimize payroll administration, time control, vacations, absences, loans, internal communications, and having an electronic employee file, it is possible to create a solid and agile human resource area (Claus, 2019). The benefits that organizations derive from digital transformation are numerous. Staff attendance control is one of the big contributions that are part of digital and optimized human capital. Its basic function is to know when an employee enters or leaves the company. It is important for any organization to know which collaborators are working, when and everything to do with time in the office. This activity is one of the main tasks that a manager or human resources department should perform to have adequate control over their workers and the general operations of the company (Cichosz, Wallenburg, & Knemeyer, 2020).

Human capital and technological progress are two fundamental and interrelated factors that form the basis of economic development (Madyasta & Fayanni, 2021). Human capital is basically a special skill. Many companies invest in smart people in the hope that they will come up with a brilliant idea that sells, and sometimes it does. If in the previous industrial revolution the machine replaced the arm, now the machine begins to replace the brain (Yu, Zhang, Zhang, & Fan, 2022). The fourth industrial revolution marked by total connectivity, instant access to large amounts of information, the Internet, robotics, bionics, and artificial intelligence will generate many jobs. To take advantage of these opportunities, it is necessary to train young people in transversal skills that are not easily automated, such as analytical skills, problem-solving, creativity, critical thinking, teamwork, leadership, or social reciprocity. It is also important to teach students non-cognitive skills such as persistence, determination, and the ability to adapt to change, or self-control in an increasingly globalized and dynamic world (Moll, 2021). The citizens of the 21st century face an increasingly complex and challenging environment where the need for training capable of performing non-routine tasks and adding value to automated processes is undeniable (Alshare & Sewailem, 2018). This study aims to investigate the Cobb-Douglas production function using the Human Capital Theory approaches in the digital era that focuses on information and communication technology.

Literature Review

The Cobb Douglas function has certain special features that facilitate the explanation of theories such as utility and production. Positive and diminishing marginal productivity. This property reflects the law of diminishing returns for factors. Therefore, this shows that when one factor of production increases, while the other factor remains constant, its productivity decreases (Zhang, Liu, & Huang, 2021). Production elasticity measures the percentage change in production, given changes in the inputs used. In the case of the Cobb-Douglas function, it is constant and equal to capital and labor. To estimate future economic growth, it is more useful to reformulate the Cobb Douglas function by applying the natural logarithm. This formula is widely used in the stock market to forecast economic growth. Empirical studies show that it is reasonable to assume that employment growth has a linear effect on employment growth.

Human capital is considered a very important factor of production. Thus, the main variables of the Cobb-Douglas production function, namely the labor factor, can be developed into human capital factors and maintaining technology and financial capital (Khatun, & Afroze, 2016). Generally, the human capital factor is represented by education and health. Each

worker, when put into a productive system, not only contributes his physical strength and natural abilities but also brings with him a wealth of knowledge acquired through education (Rusmingsih, Widarni, & Bawono, 2021). The amount of money used in education as an investment provides value-added services to the economy and causes individuals to receive higher income streams in the future. Therefore, because education is part of a set of human qualities and is integrated into it, education can be considered a form of human capital. The latter is a consequence of the capacity that education has to expand the marginal productivity of the workforce (Widarni & Bawono, 2021).

The main element for contributing to the well-being of individuals is investing in the quality of the population, as it largely determines the prospects for future life. The problem of poverty in the world is emphasized because it states that the majority of the world's population is poor and with very low wages, which is spent in a larger proportion on food (Laborde, Martin, & Vos, 2021). Advances in science and improving the quality of life of the population are the determining factors for the welfare of the population. Therefore, the acquisition of skills through education and health investment should be pursued, especially for low-income people to improve living conditions (Drean, 2021).

Digital technology relates not only to marketing but also to human resource management, such as task and demand management, helping to keep employees' work and personal data up-to-date on an ongoing basis. Not only does it ensure effective time management, productivity, and internal communication, but it also allows you to organize and simplify other processes around workers. From the digital platform, it is possible to control absences, manage sick leave, schedule absences for vacations, and request and accept shift changes to manage returns and reimbursements, among many other features related to the management of deviations in planning (Jaiswal, Arun, & Varma, 2022). The main pillar of productivity and effectiveness for companies, time management is the process of planning hours, which fulfills the goal of increasing performance and efficiency in what workers do (Xiang & Feng, 2021). Good time management requires a significant shift in focus from activity to results and having the idea that being busy is not the same as being effective. Solid and efficient human resources, making it possible to consolidate the organization. It's not just about having the ideal equipment, but also maximizing productivity, without wasting time and resources (Kaushik & Guleria, 2020).

Increased digitization will deepen the changing demand for skills and competencies in the labor market. Jobs based on routine tasks that can be automated will gradually disappear or be modified (Zemtsov, 2020). Robotization and additional work will undergo substantial changes in the tasks to be performed. In other words, jobs will be significantly affected by robotization, and people with a lower educational level will experience them more (Fusté-Forné & Jamal, 2021). But new jobs will also be generated that will produce goods and services derived from new technologies and that will depend on the entrepreneurial initiatives of people and the adequate supply of human resources generated by the educational system (Tambe, Cappelli, & Yakubovich, 2019).

Research Method

We adopt the Cobb-Douglas system of equations in estimating the control variables that we use which is also developed from the Cobb-Douglas production function equation where production is simply a function of labor and capital which is mathematical as follows:

$Y = f(L,C)$

Where Y is production output, L is labor and C is capital. In this study, we examine the role of information technology in influencing production output, where nationally, production output is an indicator of economic performance. We use panel data so that there are

additional n countries so that we develop the previous equation in the panel data logarithm equation as follows:

$\Delta \ln Y_{it} = \beta_0 + \beta_1 \Delta \ln L_{it} + \beta_2 \Delta \ln C_{it} + \beta_3 \Delta \ln ICT_{it} + e_{it}$

Where i is the nth country in the study, t is time series, is constant, is a change of variable, Ln is natural log, L is labor, C is Capital (money), ICT is information technology capital, e is the error term. The ICT variable based on previous research can be developed into 3 variables that form the influence of ICT on production output. These variables are the education variable as a mechanism for developing human capital in mastering ICT, ICT literacy in the form of ICT users, government spending in building infrastructure which has an impact on the use of ICT, and the impact on production output. So based on the development of the ICT variable, we develop the following equation:

$\Delta \ln Y_{it} = \beta_0 + \beta_1 \Delta \ln L_{it} + \beta_2 \Delta \ln C_{it} + \beta_3 \Delta \ln EDU_{it} + \beta_4 \Delta \ln ICTU_{it} + \beta_3 \Delta \ln GOV_{it} + e_{it}$

Where EDU is education, ICTU is ICT users or ICT literacy, GOV is government policy which is reflected in government spending.

In this study, we use secondary data from the world bank with a research period from 1990 to 2020 in 10 countries in Southeast Asia that are members of the ASEAN organization, and to estimate the equations that we have built, we use the SYS GMM panel data. The SYS-GMM method is to estimate a system of equations both at the first difference first-difference and at the level where the instrument used at the level is the lag first difference.

Result and Discussion

We provide an overview of the variables in table 1 prior to performing the estimation.

Table 1. Description Of The Variables

Variable	Description	Source
Y	GDP growth in percent	World Bank
L	Labor participation % of population	World Bank
C	Total investment % of GDP	World Bank
EDU	Education investment % of GDP	World Bank
ICTU	Internet users % of population	World Bank
GOV	Total Government expenditure % of GDP	World Bank

Descriptive statistics of each variable are presented in the table 2.

Table 2. Descriptive statistics

Variable	Mean	Min	Max	Std.Dev
Y	0.335	0.216	0.451	0.116
L	0.027	0.014	0.041	0.018
C	0.046	0.041	0.049	0.021
EDU	0.045	0.036	0.052	0.016
ICTU	3.176	1.478	5.251	0.589
GOV	0.135	0.064	0.214	0.034

Table 3 shows the estimation results we obtained.

Table 3. Estimated Results

Variable	Pooled OLS	Fixed Effects	System GMM
L	0.291* (0.311)	0.182* (0.292)	0.096* (0.121)
C	0.587** (5.48)	0.326** (3.012)	0.107** (1.002)
EDU	1.112* (1.512)	0.782* (1.072)	0.241* (0.621)
ICTU	1.971 (0.341)	1.269 (0.672)	0.609 (0.431)
GOV	0.121* (0.097)	0.089* (0.093)	0.027* (0.047)

The dependent variable is Y , *α < 0.10, ** α < 0.05, *** α < 0.001;
From the estimation results using Pooled OLS, Fixed Effects, and SYS GMM or System GMM, it can be seen that in addition to Internet users % of the population, all variables have a significant positive effect on economic growth which can be concluded in Southeast Asia with a sample of 10 ASEAN member countries, vital variables in the development of the digital economy. is the right government policy in terms of budget spending and increasing human capital to master technology. The level of digital technology literacy in the research period did not have a significant effect on economic growth. This can happen because, in the digital world, competition does not only occur from domestic companies but also from various international companies. Increasing digital technology literacy has not guaranteed economic growth without appropriate government policies and improving human quality as reflected in human capital. Education is an important variable in increasing human capital in mastering technology and the development of digital technology in the Southeast Asia region.

Conclusion

Education plays an important role in the development of the digital economy in the Southeast Asia region. Human capital is a vital factor in intellectual-based economic development in the digital era combined with the right government policies. Job participation is the main driver of the economy in the digital era, reinforced by sufficient human capital, as well as the availability of capital to encourage production and create economic growth. Internet literacy does not guarantee economic growth without the presence of human capital and community work participation in the economy.

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