Labour Productivity in ASEAN Countries in the Case of COVID-19 Pandemic

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DECLARATION

We hereby declare that:

(1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university,or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the research project.

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Research Overview

1.0 Research Background

1.0 Background of ASEAN countries

The Association of Southeast Asian Nations (ASEAN) is a regional organization that brings together ten Southeast Asian countries: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam to solve economic, security, and political concern, although its effect is limited (Maizland and Albert, 2020). ASEAN is formed by Adam Malik of Indonesia, Tun Abdul Razak of Malaysia, Narciso R. Ramos of Philippines, S. Rajaratnam of Singapore, and Thanat Khoman of Thailand on 8th August 1967 in Bangkok, Thailand (Association of Southeast Asian Nations, n.d.). Then later included Brunei in the year of 1984, Vietnam in the year of 1995, Laos PDR and Myanmar in the year of 1997. And lastly Cambodia in the year of 1999 (Moon, 2020).

The ASEAN countries have a total population of more than 650 million people and a total of more than 3 trillion dollars of gross domestic product (GDP) contributed to the world GDP in 2019 (Neill, 2021). In the ASEAN GDP, Singapore contributed the highest GDP per capita of 65,000 dollars and Myanmar contributed the lowest GDP per capita of 1,400 dollars based on the world bank in 2019 (Maizland and Albert, 2020). ASEAN four largest trading partner in term of goods are China, Europe, Japan, and United State. The trade between ASEAN and China have reached more than 4.43 Trillian yuan in the year of 2019 (Xianbai, 2020). While the trade between ASEAN and United States have reached more than 292 billion dollars in the year of 2019 (Maizland and Albert, 2020).

1.1 Labour productivity in ASEAN countries

For the past two decades, countries inside the ASEAN region have been having significant economic growth. When a country has a booming economy, this also means that a country will be able to provide a higher productivity in many types of jobs. Below this diagram shows the Labour productivity from the year 2000 until the year 2020

(OECD, 2021). During the late 20th century, the major factor that led to an improvement in the economy was the increasing capital investment in these countries. The reason of increasing in capital investment in ASEAN countries was that ASEAN countries having a cheaper labour cost leading to many Multinational company (MNC) willing to build up their subsidiary company in ASEAN countries (Hussin & Saidin, 2012). According to OECD (2021), the increase of this capital investment had led to an enormous increase in the Gross Domestic Product (GDP) in the ASEAN countries where the GDP had increased over 50%. From the diagram, it also showed that Singapore was having a great lead away from other nine countries where their Labours were able to provide a greater productivity than others. Due to the emergence of the coronavirus, the members of the ASEAN countries have suffered a considerable blow in terms of labour productivity. In the year of 2019 December, a global pandemic named Covid-19 hits China and causing the pandemic spread throughout the world and affected all of the countries including ASEAN countries in the sense of economic, industries, health, and others. Based on the diagram below, it can be seen that starting from the year 2019, all of the ASEAN countries suffered a severe decline in their labour productivity except Myanmar and Vietnam where their labour productivity is increase at a decreasing rate.

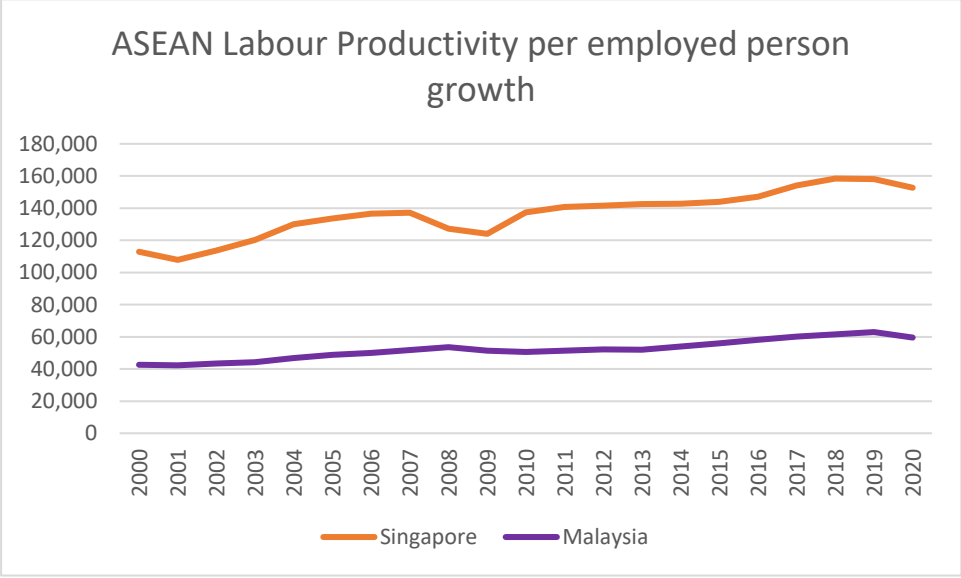


Figure 1.1.1 Labour Productivity Level, in Singapore and Malaysia

Source: OECD, Total Economy Database.

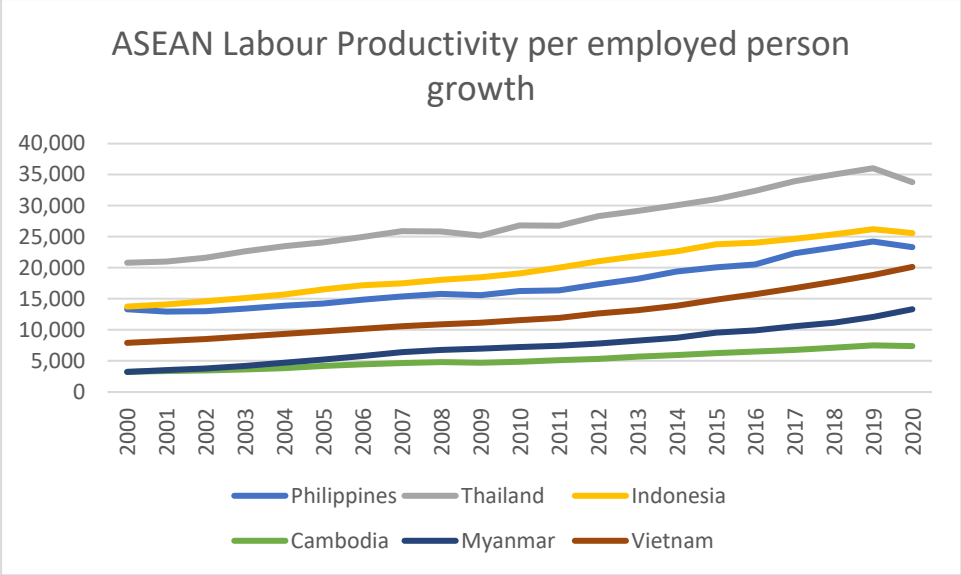


Figure 1.1.2 Labour Productivity Level in Philippines, Thailand, Indonesia, Cambodia, Myanmar and Vietnam

Source: OECD, Total Economy Database.

1.1.1 Malaysia

The Malaysia labour productivity has experienced an overall upward slopping with stable pace of increasing. However, there was some shocking dropping points such as during year 2008 to 2009 which has faced the Asian Financial Crisis. It is also happened in recent year whereby period between year 2019 to 2020 where in this analysis are discussing.

From the diagram below, it can be clearly seen that during the year of 2019 Malaysia suffered a severe decline in their labour productivity that is caused by the global pandemic COVID-19. According to Khalid (2021), the decline in the labour productivity was the worst in nearly 10 years where the labour productivity fell by 5.4% in 2020 where the Malaysia output per employed person have been decreased by 4.9 percent and output per hour worked also decreased by 0.7 percent (International Labour Organization, 2021). The influence of the COVID-19 pandemic on labour productivity impacted not just economies but also the industries. Starting from 18 March 2020, Malaysia government implemented Movement Control Order (MCO), such as widespread lockdown and internal mobility, to restrict the spread of COVID-19.

According to Bernama (2020), the implementation of MCO have caused a reduction in the total hour worked from an average of 45 hours a week in 2019 quarter 4 to 44.3 hours per week in 2020 quarter 1. Aside from the lockdown, there has been a border closure, which has resulted in a decrease in internal tourism. As a result, service industries such as transportation, tourism, and hospitality were among the worst-affected businesses. According to International Labour Organization (2021), Malaysia labour productivity per hour worked for transportation and storage were decreased by 21.2%, for accommodation and food services also decreased by 21.7%, for wholesale and retail trade also decreased by 7.9%, and an increase of 10.1% in manufacturing sector. Malaysia manufacturing productivity growth was driven by a decrease in manufacturing output that was less than the reduction in sectoral working hours.

Figure 1.2 Labour Productivity Level in Malaysia

Source: OECD, Total Economy Database.

1.1.2 Vietnam

Vietnam has a steady increase and remain stable increase in Labour productivity between the period of year 2000 to 2011. As the same case with Indonesia, Vietnam has less affected by the financial crisis in year 2008 and 2009. In recent couples of years, Vietnam is experiencing the economy growth and big improvement in labour

productivity. Although COVID-19 crisis has hugely affected almost all of the countries in this planet, Vietnam is able to constantly ensure the labour productivity in the increasing path.

In the year of 2019, Vietnam Labour productivity is increase at a decreasing rate. This is because Vietnam is currently experiencing an economy booming which will lead to a huge increase in the Labour productivity. However, at the same time, the global pandemic Covid-19 attacked Vietnam economy which led to the Labour productivity to increase at a decreasing rate. According to PwC Vietnam (2020), PwC also stated that Vietnam is expected to grow in the year of 2020 even though there is still the global pandemic Covid-19. In addition, Vietnam government also implemented a nationwide lockdown during the early stage on 1st April 2020 where it did control the spread of the pandemic Covid-19. From the statement above, it seems that Vietnam is doing quite well, but Vietnam has been affected by the pandemic Covid-19 in the sense of Labour productivity. According to Onishi (2021), Vietnam was expected to reach a target growth of 6.5% in the year of 2020 but failed to reach the target due to the attack of global pandemic Covid-19. Furthermore, the lock down has affected the Labour market where the working hours will drop by 6.7% in 2020 quarter 2 and an increase in the unemployment rate of 2.73%. (Huong, Tham, Vu, Long, …, Huong, 2020 and International Labour Organization, 2020). Moreover, Vietnam is experiencing a supply chain problem during Covid-19. According to PwC Vietnam (2020), Vietnam is one of the countries that is highly depends on other countries' economies because Vietnam is a country which specialize in manufacturing goods and will in needs of a huge import of raw material to produce the finalize goods. According to Samuel (2020), China is one of the countries that Vietnam relies on for the import of raw material, however, China was unable to have trade with Vietnam due to the impact of Covid-19 and this have caused all sector in Vietnam in facing disruption and certain sector, such as automobile, to suspense their production.

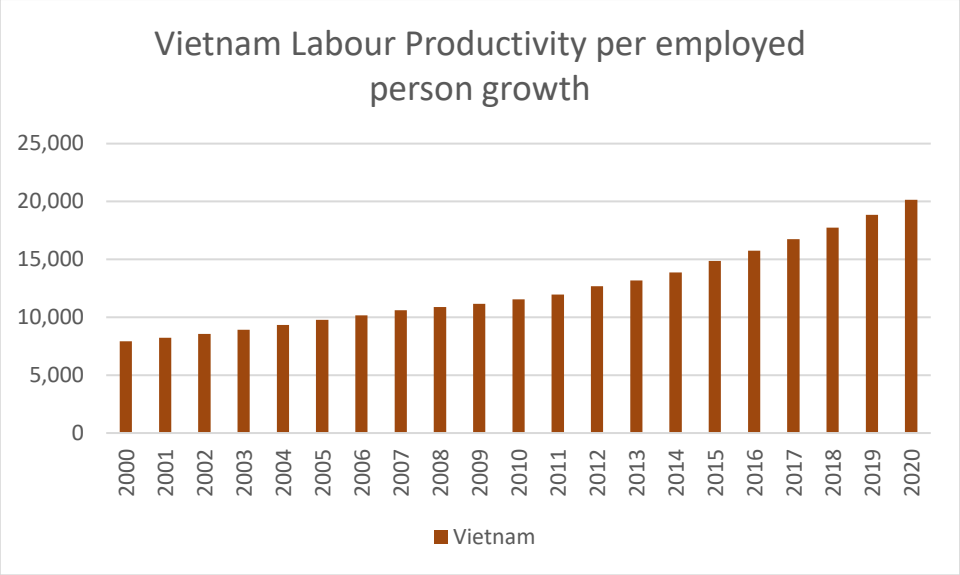


Figure 1.3 Labour Productivity Level in Vietnam

Source: OECD, Total Economy Database.

1.1.3 Indonesia

Compared to others ASEAN countries, Indonesia has less affected by the financial crisis during the period of year 2008-2009. The labour productivity was increase in a decreasing rate but has gone through a positive path in terms of the efficiency of production output.

According to Ssenyonga and Shafiullah (2021), Indonesia is one of the most affected countries by the global pandemic Covid-19 in ASEAN. Based on the diagram below, it is clearly shown that Indonesia labour productivity start to drop at the year of 2019 by 2.4% where Indonesia's output per employed person dropped by 1.6% and output per hour worked increased by 0.9% (International Labour Productivity, 2021). According to Muhyiddin and Nugroho (2021), Indonesia aggregate growth dropped to -2.1% in 2020 quarter 2 and Indonesia economy have dropped to -5.3% in quarter 2, -3.5 in quarter 3 and 2.2% in quarter 4. The influence of the COVID-19 pandemic on labour productivity impacted not just economies but also the industries. According to International Labour Organization (2021), Indonesia's labour productivity by hour worked for transportation and storage decreased by 13.2%, for accommodation and

food services decreased by 7.7%, for wholesale and retail trade decreased by 1.9% and for manufacturing sector increased by 5.2%. The increase in the manufacturing in Indonesia is shaped by the decrease in the output was lesser compared to the decrease in the working hours. According to Mufti (2020), Wataru Ueno, JETRO Jakarta senior director, stated that Indonesia manufacturing productivity is the lowest among the ASEAN country with the score of 74.4 and Indonesia score also below the ASEAN average productivity score of 78.2.

Figure 1.4 Labour Productivity Level in Indonesia

Source: OECD, Total Economy Database.

1.1.4 Thailand

Among the ASEAN countries, Thailand has a significant of increasing trend and huge improvement in their Labour productivity in these recent 20 years. Nevertheless, Thailand also faces the same issues of other countries experienced or experiencing the collapse in financial market and COVID-19 hit.

From the diagram below, it can be clearly seen that during the year of 2019 Thailand suffered a severe decline in their labour productivity that is caused by the global

pandemic COVID-19. According to The World Bank in Thailand (2022), Thailand economies have decreased by 6.2% in 2020 due to a decline in the internal and external demand of tourism, trade, supply chain and domestic consumption. Other than that, Thailand's output per employed person dropped by 6.3% and output per hour worked dropped by 1.6% (International Labour Productivity, 2021). The influence of the COVID-19 pandemic on labour productivity impacted not just economies but also the industries. Starting from 26 March 2020, Thailand government called for a nationwide lockdown which is something like Malaysia's MCO to restrict the spread of COVID-19 (The ASEAN Post, 2020). According to the world Bank in Thailand (2021), the early lockdown in Thailand have causes an increase in the unemployment between youngster, decrease in the working hours, as well as decrease in the wages. According to International Labour Organization (2021), Thailand's labour productivity by hour worked for transportation and storage decreased by 17.9%, for accommodation and food services decreased by 32.2%, for wholesale and retail trade decreased by 1% and for manufacturing sector increased by 2.8%. The labour productivity in manufacturing increase because the decrease in the manufacturing output is smaller than the decrease in the working hours.

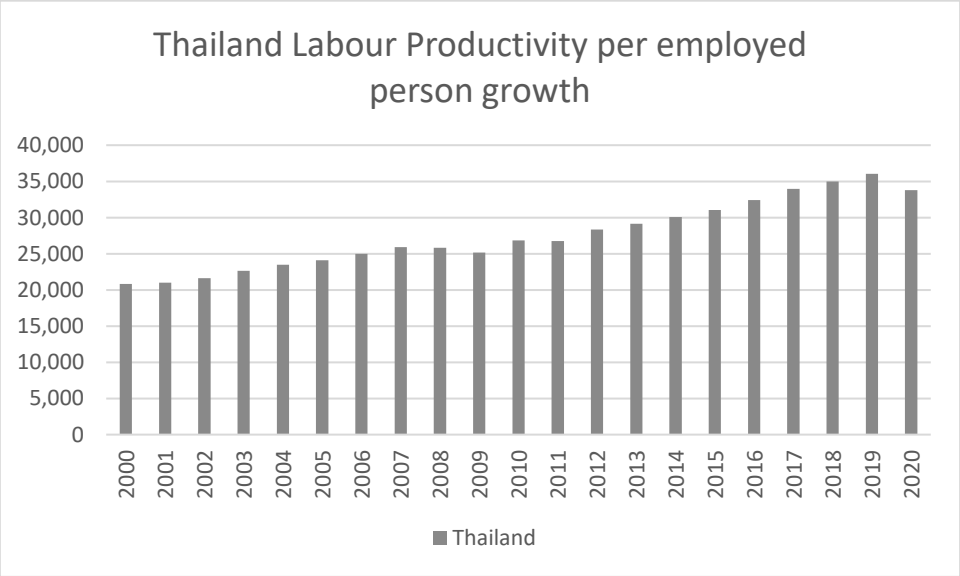


Figure 1.5 Labour Productivity Level in Thailand

Source: OECD, Total Economy Database.

1.1.5 Philippines

Philippines has experienced an overall slow upward slopping trend in their labour productivity. There was a slight dropping during period of year 2008 to 2009 and period of year 2019 to 2020 despite increasing trend of the Labour productivity during these 20 years. It is a similar case with Malaysia which faced the crisis in financial market and pandemic crisis.

From the figure 1.6 below, it can be clearly seen that during the year of 2019 Philippines suffered a severe decline in their labour productivity that is caused by the global pandemic COVID-19. According to International Labour Organization (2020), It is the first time in 22 years that Philippine's economics have contracted where Philippines GDP growth have decreased by 16.5% in 2020 quarter 2 and have been recorded as the lowest GDP growth (-16.9%) since 1981. Philippine's output per employed person dropped by 2.6% and output per hour worked increased by 14.2% (International Labour Productivity, 2021). Philippines working hour reduced by 20.8% more than the reduction in gross domestic product (GDP), 14.2%, which causes the output per hour worked. The influence of the COVID-19 pandemic on labour productivity impacted not just economies but also the industries. Starting from 16 March 2020, Philippines government implemented Enhanced Community Quarantine (ECQ), where only one household member able to go purchase essential needs and only certain critical sector were able to stay open, to restrict the spread of COVID-19 (International Labour Organization, 2020). Due to this, many people losses job and Philippine's unemployment rate (10.3%) in 2020 recorded as the highest since 2005 (Future learn, 2021). According to International Labour Organization (2021), Philippine's labour productivity by hour worked for transportation and storage increased by 9.5%, for accommodation and food services decreased by 7.5%, for wholesale and retail trade increased by 13.6% and for manufacturing sector also increased by 25.1%. Philippines increased in the labour productivity for transportation and storage indicated that the employment condition is getting worse, with working-hour losses reaching 36.9% compared to a 30.9% drop in industrial production.

Figure 1.6 Labour Productivity Level in Philippines

Source: OECD, Total Economy Database.

1.2 COVID-19 pandemic

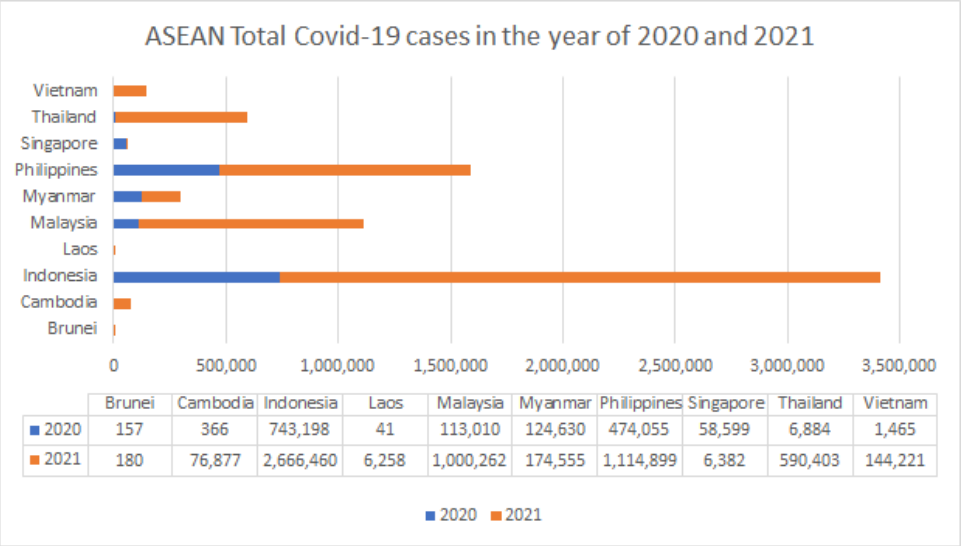
A health crisis is defined as any crisis or significant occurrence caused by a hazard of human, animal, plant, food, or environmental origin that has a health dimension and necessitates immediate response by authorities (Law insider, n.d.). In general, health crisis has influence on the economy, death, as well as community health. One of the examples of the health crisis is severe acute respiratory syndrome (SARS) which is a respiratory illness caused by the SARS-associated coronavirus that occur during the end of February in the year of 2003 (World Health Organization, n.d.). SARS is an airborne virus that, like a common cold, may spread by tiny droplets of saliva. Besides, another example is influenza A virus subtype H1N1 which is a respiratory illness known as swine flu in humans during the spring of year 2009 (Mayo clinic, n.d.). H1N1 is a virus, like seasonal flu, which may spread from a tiny drop from cough or sneeze (WebMD, n.d.). These two examples of health crisis that happened in the past were spreading fast around the world that the World Health Organization (WHO) declared as a pandemic. Hence, the currently ongoing health crisis that was declared as global pandemic was coronavirus disease (COVID-19).

The first official coronavirus disease case (COVID-19) has been discovered at Wuhan China in December 2019 and since the start of this virus spreading, it turns out to be a global pandemic and causes everyone in the world to suffer (Bhargava, 2020). Based on the research, COVID-19 virus was one of the family of coronavirus where it can cause a mild to moderate upper-respiratory tract illness where previously there was also other coronavirus causing some country to suffer such as the severe acute respiratory syndrome (SARS) that happen in Asia since 2003 and the Middle East respiratory syndrome (MERS) in Saudi Arab since 2012 (Carmosino, 2020). Until now, there were 200 million reported cases in the world and 4 million deaths being reported all around the globe where the diagram is being showed in the appendix (Worldometer, 2021). COVID-19 pandemic not only arising the public health crisis, but also caused the disruption of the countries' economy and productivity of the firms (Pak, Adegboye, Adekunle, Rahman, McBryde, and Eisen, 2020)

In ASEAN countries, they have also inevitably experienced the storm of the coronavirus pandemic. Among them, the most serious situation is the Philippines, Indonesia, and Malaysia. According to the official report, Indonesia has a high mortality rate of 262.16 and ranks first among ASEAN countries, while the Philippines has a mortality rate of 248.73 and ranks second (CSIS, 2021). The hope rate between the two is abnormally high and awfully close. After them is Malaysia, they have a death rate of 208.43 and rank third. Although there is a certain gap with the former two, there is a huge gap with the subsequent countries. In addition, at the beginning of April 2020, the economic growth forecast of the 10 ASEAN countries fell from 4.4% in 2019 to 1% (OECD, 2020). At the same time, the Asian Development Bank (ADB) Southeast Asian economies have already experienced global trade tensions. When the situation is negatively affected. Due to the virus, the region is now facing the prospect of a global shock and recession. Southeast Asian economies have been affected by the disruption of Chinese supply and trade and the sharp decline in international tourism. The blockade and social containment measures adopted by many countries has further affected the economic activities of many economic sectors. However, among these, small and medium-sized enterprises, the service industry and the tourism industry have been most affected. In addition, in ASEAN countries, the unemployment rate has soared to almost unimaginable levels due to the pandemic. Among them, Thailand is expected to experience the worst economic recession among ASEAN countries due to its heavy dependence on global tourism. Thailand's unemployment rate rose from 1% in the same month last year to 1.9% in August 2020 (Jingyi, Lim, Pazim & Furuoka,

2021). Moreover, the number of unemployed in Malaysia has also increased by 42% year-on-year in the first quarter of 2020.

Therefore, to determine whether a country's pandemic is being under control, the number of cases confirmed, and the number of deaths will be the key indicators. Pandey and Saxena (2022)'s study has showed the COVID-19 cases will be reduce when government implemented an effective government policy and government management. In other words, government effectiveness is the concern of the government and the people. Effectiveness is a measure of the quality of output and how well a policy achieves its intended goals. Beyond that, all things being equal, the more effective a country's government is, the higher the level of social welfare (Duho, Amankwa & Musah-Surugu, 2020). Therefore, according to the theory, as long as the government is very effective, the spread of the epidemic will be well controlled, and the disease will be killed in the cradle. However, based on the current spread of the epidemic, it is not difficult to see that the country still needs to make more progress in government effectiveness.



	Brunei	Cambodia	Indonesia	Laos	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
2020	157	366	743,198	41	113,010	124,630	474,055	58,599	6,884	1,465
2021	180	76,877	2,666,460	6,258	1,000,262	174,555	1,114,899	6,382	590,403	144,221

Figure 1.8 Total Covid-19 cases, ASEAN-10 and comparator countries

Source: Worldometers.info, 2021.

1.3 Employment

The COVID-19 health catastrophe is an extraordinary shock that is affecting people's lives and livelihoods all across the world. Its impact is expected to be felt in the near, medium, and long term. Severe health consequences have been followed by substantial drops in economic activity and labour market volatility (Scarpetta, Queisser, Garnero & Konigs, 2020). State-imposed lockdowns and firm closures have had a huge impact, reducing or eliminating the lives of millions of people in various countries. Most typically, some businesses may permanently suspend operations amid government-imposed restrictions, so they did not hire any new employees after containment measures were relaxed (Scarpetta, Broecke & Lane, 2020). Then there's the widespread knowledge that, in this uncertain atmosphere, many employers may be more ready to postpone new employment if the virus spreads and poses a health risk, as some rules are reduced. Third, aggregate economic demand, the primary driver of labour demand, may not increase soon after limitations are lifted, since some consumers may be hesitant to return to pre-crisis spending levels owing to uncertainty or lost income during the shutdown.

Most governments have adopted aggressive social distancing measures that partially or completely reduce the physical presence of workers in the workplace in an effort to limit the spread of the coronavirus and minimise its death toll in the global effort to limit the spread of the coronavirus and minimise its death toll. As a result of COVID-19, economic activity has ceased and worker engagement in informal learning has decreased (Paciorek, Manca & Borgonovi, 2021). Seminars and employer-provided training are examples of informal learning, as are learning by doing and learning new things on the job. This is a significant learning loss that may not be easily recovered. Furthermore, the changing character of work as a result of COVID-19 containment measures has resulted in an increase in the number of job ads requiring "work from home." As a result, the COVID-19 situation has had a stronger negative impact on demand for lower-skilled occupations (Crivellaro, Manca, Asai & Borgonovi, 2021). Low-skilled workers are anticipated to be the hardest hurt by the COVID-19 crisis, as lower-skilled tasks are less likely to be performed remotely and are more prone to severe sectoral lockdowns.

On the other side, the goal of connecting people to good jobs will aid in a fair and long-term recovery from the COVID-19 crisis, most notably through Active Labour Market Policy

(ALMP). In many countries, a full Labour-market recovery is still a long way off, therefore it is vital to ensure that active Labour-market policies reach individuals in need and meet their requirements effectively. The ALMP can help to avoid excessive unemployment, which can stymie recovery, but it must be flexible and responsive in order to respond to economic shocks in a timely and balanced manner (Scarpetta, Keese, Butler, Langenbucher, Lauringson & Xenogiani, 2021). Aside from that, using time-limited, well-designed, and targeted recruitment subsidies is a low-cost strategy to reduce unemployment, improve worker employability, and assist the most disadvantaged. Finally, governments should prioritise particularly vulnerable workers, such as young and low-skilled workers, so that programmes can address specific needs while also providing possibilities for an inclusive and broadly shared recovery.

Based on Figure 1.9 and 1.10, we can see that both of these countries have face decrease in employment in quarter 2 of year 2020 as it is the hardest time during the COVID-19 pandemic. Fortunately, they were recover with the following two quarters as the government started to react on the impact of the pandemic. The most significant effect of employment get hit by COVID-19 is Philippines and Indonesia. On the other hand, Malaysia, Thailand and Vietnam have a least impact as the volatility of the figure is tiny.

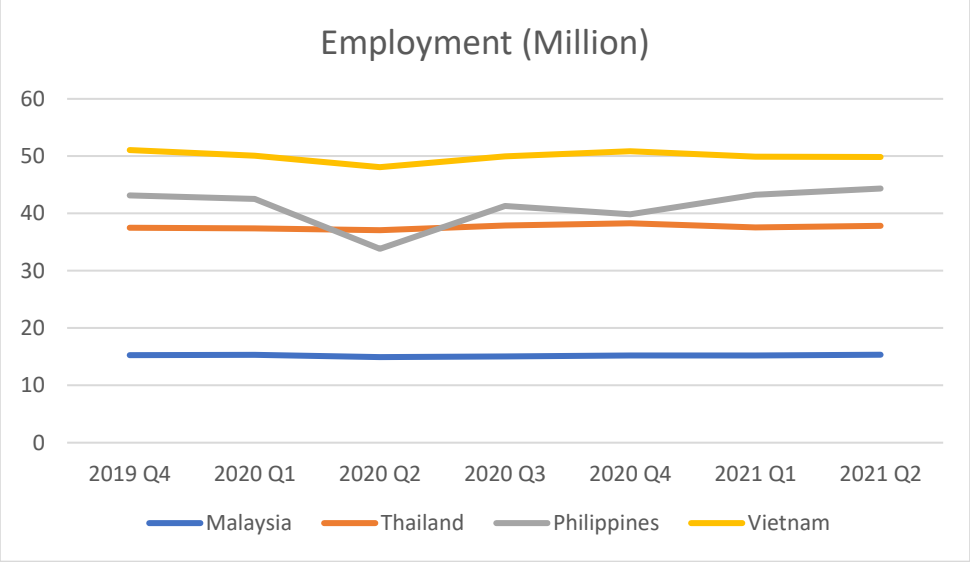


Figure 1.9 Employment (Million), Malaysia, Thailand, Philippines and Vietnam

Source: IFS, 2022

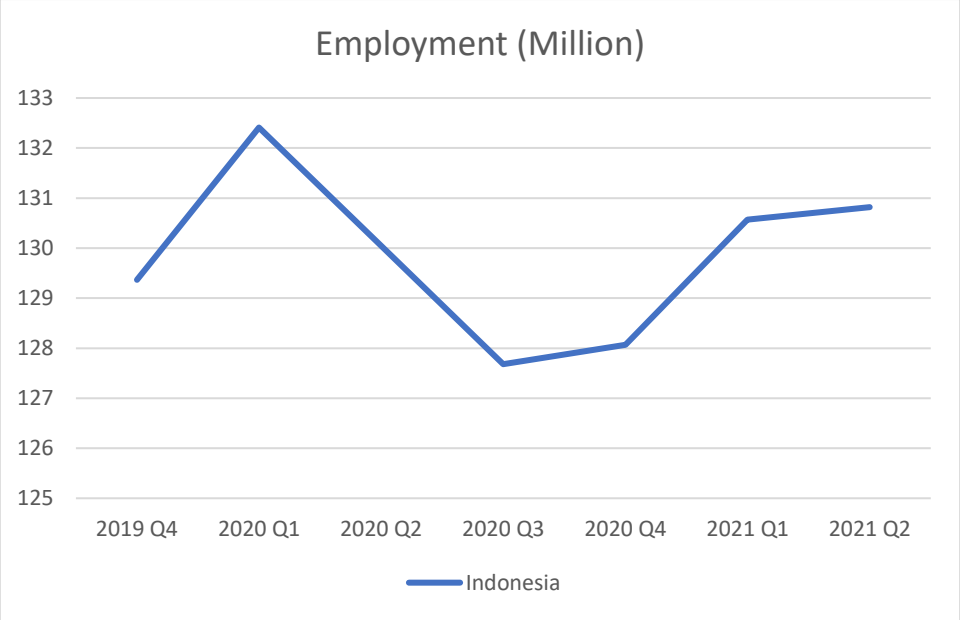


Figure 1.10 Employment (Million), Indonesia

Source: IFS, 2022

1.4 Gross Fixed Capital Formation

Gross fixed capital formation is essentially a net investment. It is an essential component of the expenditure technique used to calculate GDP. Gross fixed capital formation, in more specific terms, quantifies the net increase in fixed capital. Furthermore, gross fixed capital formation includes land improvement expenditures such as fences, ditches, drains, and so on. Furthermore, gross fixed capital creation includes the construction of plant, machinery, equipment purchases, roads, trains, private residential, commercial, and industrial buildings. As a result, developing countries often invest a greater proportion of their GDP (Pettingger, 2017). Countries with strong economic growth are heavily investing in fixed assets in order to attain rapid economic growth. However, as a result of the COVID-19 outbreak, the whole economic market is either struggling or in the midst of a recession. In Malaysia, for example, gross fixed capital formation is the second largest component of GDP. As a result of the pandemic's impact, its value decreased by 14.5 percent compared to last year (Mahidin, 2021).

Based on the Figure 1.11 and 1.12, we can see that there is a drop from quarter 1-year 2020 to quarter 2 year 2020 for Malaysia, Thailand, Philippines and Indonesia. They have a significant signal of being affect by the pandemic as shown in the figure except for Vietnam. As the

COVID-19 pandemic affect the global heavily, they face a decrease in Gross Fixed Capital Formation while the Vietnam almost at a standstill. However, this impact will not stay long as government have started to react against the pandemic, therefore they have a slight increase in the following quarters.

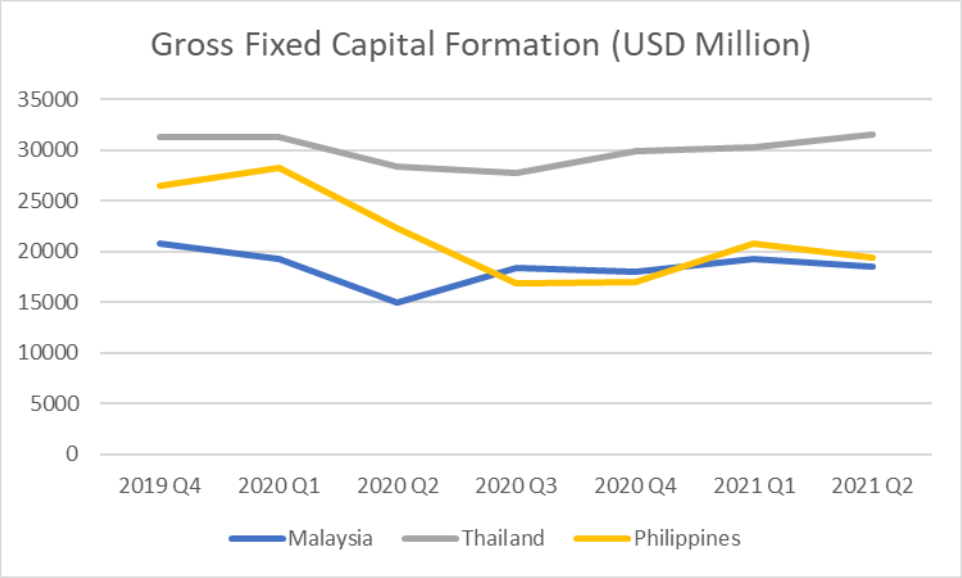


Figure 1.11 Gross Fixed Capital Formation (USD Million), Malaysia, Thailand and Philippines

Source: CEIC, 2022

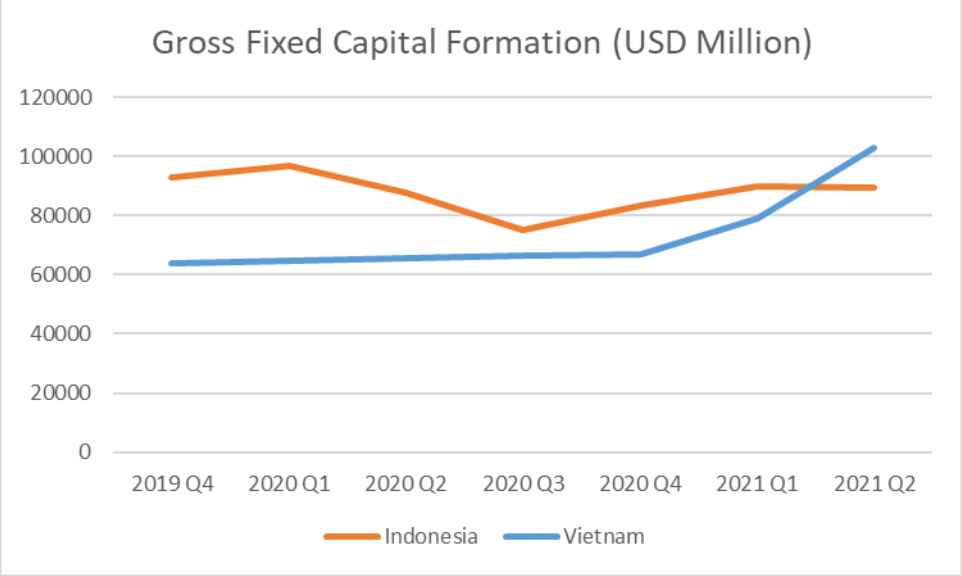


Figure 1.12 Gross Fixed Capital Formation (USD Million), Indonesia and Vietnam

Source: CEIC, 2022

1.5 Problem Statement

Most of the policies, strategies, and plans implemented by the government affect the labour productivity of various countries, especially in ASEAN countries, but at the same time, some labour is still suffering and marginalized (Soekiman, Pribadi, Soemardi & Wirahadikusumah, 2011). Understanding and explaining various factors such as employment and government efficiency that may affect labour productivity, has great prospects for policy and plan design of the nature of the matter. Due to the issuance of the lockdown order, various factories were forced to suspend business while the main daily necessities had to reduce their business hours (Jingyi, Lim, Pazim & Furuoka, 2021). Compared with the overall performance before the pandemic, it has become more dilapidated after being devastated by the pandemic.

Based on these problems, most companies will choose to reduce their employees' salaries or dismiss them to reduce their financial pressure and burden (OECD, 2021). According to UNESCAP (2020) and ASEAN (2020), their studies consistently show that the diagnosis rate of COVID-19 has a negative impact on labour productivity, and generally labour production has a continuous upward trend before the pandemic but has shown a decline during the pandemic. For example, as the diagnosis rate increase at the end of year 2019, the decline in labour productivity due to movement constrain have cause China industrial enterprises drop by 13.5% during first quarter of year 2020 (ILO, 2020). Specifically, the labour environment in these countries often faces the impact of changes in control orders during the pandemic, which leads to the loss of family income and wealth (Barany & Siegel, 2020). These risks make the economic conditions of many workers worse and at the same time plunge the country’s labour productivity into a depression (Singh & Mishra, 2021). All these causes and effects are based on the negligence of the government and the defects of the government's effeciency. If the government can achieve better efficiency, presumably the spread of the epidemic can be better controlled, and the virus can even be uprooted.

In view of the nature and extent of the infectiousness and hazards driven by the coronavirus that people are experiencing today, the government has formulated policies and strategies based on the period method of the pandemic. These policies and methods are intuitively closed to prevent all unnecessary activities in order to reduce the diagnosis rate. However, these policies

only focus on the core infection rate and harm of the pandemic, while ignoring many details. Many manufacturing industries are unable to operate and produce due to the operation of these policies, and the country's labour productivity has fallen sharply (Jin, Zhang, Sun & Cui, 2021). Industrial employees had to stop working and stay at home to fight the pandemic, but they did not know that such a situation would make their economic situation worse (Vo, Mazur & Thai, 2021). They are not unwilling to work, but due to current conditions, they are now unable to work. For example, the Philippines has been reported as high numbers record in terms of new COVID-19 cases since late July 2020 with a total number of 119,460 that surpassing Indonesia's total number of cases (ABVC, 2020). However, Indonesia remains as the highest COVID-19 death rate among ASEAN with the value of 8.64% since April 2020. Other than that, even though Malaysia has low death rate, but they have around a million total case and listed as no.28 in global ranking (Worldometer, 2021). Therefore, from this situation, worker is not encouraging to work outside to reduce the diagnosis rate and cause the labour productivity drop even deeper.

Due to the flaws in the Malaysia government's lockdown plan, the absence of all manufacturing employees, including local employees, has undoubtedly become a major factor affecting labour productivity, making the production market that has been weakened by the pandemic even worse (Jin, Zhang, Sun & Cui, 2021). Metaphorically speaking, the severity of the COVID-19 outbreak is far ahead of the previous 2008 financial crisis. As the so-called contrast, you can know the consequences more clearly. For example, the last financial turmoil mainly affected the economic market, but the COVID-19 outbreak has affected multiple levels, the most direct being health and the economy. In addition, the following table also interprets the results of the comparison in the form of data, from which we can also see the impact on Labour productivity.

Therefore, this research proposes to investigate the labour productivity performance of ASEAN countries during the coronavirus pandemic. It is not clear whether the government's lockdown plan provides any specific provisions based on the existing conditions of the workers. This poses a challenge to national government plans that consider the dynamic nature and extent of labour productivity in ASEAN countries. This is because the treatment method has the ability to let decision-makers understand various factor-oriented labour productivity and its adverse effects on sustainable development in the future. For the above reasons, including these five

countries in the study can reveal different data and research results. Also, the countries selected are based on the number of cases, reduction in labour productivity and data availability.

Table 1.1 Labour Productivity Rate for Malaysia, Vietnam, Indonesia, Thailand, and Thailand from 2007 to 2009 and 2018 to 2020

	Labour Productivity Rate (%)			
Countries/Year	2007-2008	2008-2009	2018 – 2019	2019 – 2020
Malaysia	3.43	-3.96	2.21	-5.53
Vietnam	2.81	2.57	6.32	6.85
Indonesia	2.98	2.49	3.19	-2.41
Thailand	-0.39	-2.51	2.95	-6.26
Philippines	2.72	-1.34	4.08	-3.64

Source: OECD

Besides, based on the table 1.1, from year 2007 to 2009 representing the financial crisis during year 2008 while from year 2018 to 2020 representing the COVID-19 pandemic. The table above shows that the overall impact of COVID-19 is much heavier than the 2008 financial crisis. For example, we can see that Malaysia, Indonesia, Thailand and Philippines in COVID-19 pandemic have decrease even further compared to the 2008 financial crisis except for Vietnam. This is because the Vietnamese government can keep abreast of international economic development trends, identify difficulties in a timely manner, and then take precise and synchronized measures to contain the serious impact of the economic crisis (APRACA, 2017). In addition to this, they are also good at seizing opportunities to maintain the country's growth potential and promote economic development.

1.6 Research Questions

The following research questions were developed from the problem statement of this research:

1. Does the government efficiency affect the labour productivity in ASEAN countries during COVID-19 pandemic?
2. How employment, gross fixed capital formation and government efficiency affect the labour productivity in ASEAN countries during COVID-19 pandemic?

1.7 Research Objectives

General objective:

To identify the factors that affect the labour productivity in ASEAN countries during COVID-19 pandemic.

Specific Objectives:

- To determine the effect of government efficiency on labour productivity in ASEAN countries during COVID-19 pandemic.
- To examine the effects of gross fixed capital formation, employment on labour productivity in ASEAN countries during COVID-19 pandemic.

1.8 Scope of Study

The countries that we focused on are ASEAN countries. Among the ASEAN countries, we have chosen Malaysia, Vietnam, Indonesia, Thailand, and Philippines. The reason is due to the data availability, number of COVID-19 cases and deaths and labour productivity trend. Besides, one of the reasons is that we choose the high COVID-19 cases countries as our analysis target such as Indonesia, Philippines, and Malaysia. On the other hand, the time period in our research is quarterly based data. In addition, the data sources that we used is from Organization for Economic Co-operation and Development (OECD), Department of Statistics Malaysia (DOSM).

1.9 Significance of Study

Through the observation since 19 May 2021, this research emphasizes on the outcome of labour productivity between the ASEAN (Malaysia, Vietnam, Philippines, Indonesia, and Thailand) during COVID-19 pandemic. The major contribution of this research is that the countries selected are based on the number of cases, death, reduction in labour productivity and data availability. These were one of the reasons that makes this research an important reference for plenty of users such as economists and policy makers for them to make a more effective decision. Other than that, our specification is that we focus our study on

COVID-19 health crisis which is different from past studies. The impact of this coronavirus on ASEAN countries is unprecedented. Due to its severity, the World Bank predicted in June 2020 that global GDP will contract by 5.2% (Chong, Li & Yip, 2020). ASEAN countries are the fourth largest economy after China, the United States and India, so their impact is inevitable. To be more specific, although ASEAN countries have implemented tax cuts and other relief programs, their economic performance is still weak, so it is predicted that these countries will experience negative economic growth and economic output will also decline in 2020 (Chong, Li & Yip, 2020).

Besides, in our research, we imply three variables which are the employment, gross fixed capital formation and government efficiency. As employment are the usual factor that influence the labour productivity, by adding the other two variables we can examine it in different perspectives especially due to COVID-19 pandemic that affecting the whole economy. We believe that under the raging pandemic, the market situation will be different from the usual market, so we use various sources of information to complete this research.

With the addition of the number of cases on this study, we are also able to imply these with our research objectives which is the government efficiency. According to Achuo (2020), the study showed that the government plays an important role on reducing the spread of COVID-19 in the African country. This study also indicates that a stricter government restriction on the policy implication would be helping the reduction of COVID-19 cases in the community. The government able to reduce the spread of COVID-19 cases by providing more testing and screening capacities so that they can have a better COVID-19 measures in the community.

Furthermore, analyzing labour productivity is an indispensable part of the national economy, which also means that this factor is very important. The key indicator to measure the possible long-term prosperity and growth opportunities of a society has always been productivity growth (Erber, Fritsche & Harms, 2017). Therefore, the changing trend of labour productivity growth has always been a factor that stabilizes or destroys the distribution conflict between capital and labour. Labour productivity can also indicate short-term and cyclical changes in the economy and may even turn for the better. If output increases while labour hours remain the

same, it means that the productivity of labour has increased. In addition, it can also be seen during the economic recession, because when the unemployment rate rises, workers will increase labour intensity and avoid the threat of losing their jobs and being laid off (Rasure, 2020). So, analyzing the labour productivity during this pandemic could lead the research findings more interesting.

In our research, readers or researchers can obtain information about the impact on labour productivity in ASEAN countries during the coronavirus pandemic. We want to bring information to employees, employers and policy makers. Our research can help most people understand the labour productivity of ASEAN countries during the COVID-19 pandemic, especially policy makers, employers and employees. The result of our analysis is to let them understand the impact on labour productivity during the pandemic. This not only allows them to pay more attention to the influencing factors in this area, but also prevents them from making wrong decisions. For example, it can prevent them from expanding when most companies are hit by the coronavirus, because it will not only double their losses or even face bankruptcy. In addition, employees will cherish their work more and work harder after knowing the severity of the market. But on the other hand, employers will also reduce expenditure through layoffs to maintain daily access. Therefore, this research allows them to have knowledge in this field and allows them to make rational decisions under such circumstances.

1.10 Organization of Chapters

Chapter 1 discussed the background of our selected ASEAN countries and labour productivity, and then the COVID-19 pandemic. In addition, we stated our problem statement, research problem, research objectives, and significance of the study. In Chapter 2, we mainly focus on past studies and theories. Past studies are about the theories that they used to examine in their research. Also, the relationship between the variables that we choose with past studies. In Chapter 3, we want to apply the mathematical econometrics model to determine the relationship between variables.

Chapter Two

Literature Review

2.0 Introduction

In Chapter 2, literature review will provide a complete and comprehensive summary of previous past studies on the Labour productivity during the health crisis. It will give a clearer understanding of this topic and give a critical evaluation based on other researchers' studies.

2.1 Theoretical Review

Cobb-Douglas production function theory has been used in our study that explains the relationship between the production factors and productivity measurement. Production factors, mainly the contribution of Labour and capital, will impact on the performance of supply-side productivity. From the perspective of Cobb-Douglas, once the capital growth increases, it will be accompanied by an increase in total productivity. The production function in Cobb-Douglas is combination of Labour input, capital input, and the total factor productivity (TFP) equivalent to the real GDP (Hájková and Hurník 2007).

Cobb-Douglas production functions are widely used by most of the researchers in calculating the ratios of inputs required to efficiently produce the outputs. Also included the calculation of technological change to the production measurement. For example, according to Afrooz, Rahim, Noor, and Chin (2010), in this study which is applying Cobb-Douglas production function for the analysis of skilled and unskilled, educated and uneducated workers towards the Labour productivity in the food industries of Iran. Moreover, in a study he examined the rate of technological change and the emergence of the New Economy towards the Labour productivity in its methodology. Therefore, Cobb-Douglas production function is a core methodological function for researchers, especially in capital changes and technological changes toward overall productivity.

Maslow's Hierarchy of needs has five levels of needs, physiological, safety, belongingness and love, esteem, and self-actualization. These five levels of needs are essential behavioral

motivations tool to supply-side for sustaining and further growth of productivity among the workers. Physiological needs and safety needs are the basic level of needs for people as a motivational factor. Physiological needs such as food, clothing, and residential places meanwhile the safety needs related to security, health, and job employment. In this study security needs take important places influence productivity as due to the health crisis of COVID-19. On the other hand, belonging and love needs are the social connection with friends, families and colleagues. Next, esteem needs individual status in terms of freedom, respect and recognition from others. The highest level of need is self-actualization which is related to the success of achieving one's full potential in job and life (Taormina and Gao, 2013).

Maslow Hierarchy of needs essential explaining the relationship between the employment, and the number of COVID-19 cases accompanied with productivity. The employment rate will reflect job security to the Labour affecting the emotional factors on their job performance whether it will create motivational or demotivational influence to the Labour productivity. An example of the application of Maslow Hierarchy of needs in previous past studies is Wong and Low (2018), a study who is examine on the motivation drive the job performance and Labour productivity. The fulfilment of the different level of needs helping the firm and management team to improve on their workers and subordinates as the positive determinants for them to improve number of output and total Labour productivity. Therefore, Maslow Hierarchy of needs is essential for our research to determine the key referencing theory observing the scenario of increasing or decreasing of the Labour productivity. Maslow Hierarchy of needs helps to explain the motivational and human psychological factors influencing workers' changes of working performance and productivity.

2.2 Empirical Review

2.2.1 Labour productivity and Application of Cobb-Douglas Production Function

According to Knapp (2007), a study shows that health condition of human capital has significant influence in changes of productivity. The analysis shows that nutrition has a significant role in influencing productivity growth. Net nutrition, the measurement for health of workers, has a positive effect on productivity. This net nutrition mainly affects productivity through the development of human capital and increasing vitality and cognitive abilities.

Healthy workers have a better performance allowing them to work normally and better than workers who are sick or infected by diseases.

While the wages are considered an influential determinant for the Labour productivity. Based on Ozturk, Durdyev, Aras, Ismail, and Banaitienė (2020), this study claimed that there is a positive relationship between Labour wage and Labour productivity. However, the unemployment rate negatively also illustrates that the higher the salary, the more productive of the Labour. It is because increasing salaries can motivate workers in the belief in their work which also raises the workers' loyalty and trust towards their employers.

There are many studies has contained the application of Cobb-Douglas production function in their analysis such as the study by McCombie, Pugno, and Soro (2002), Hajkova and Hurnik (2007) and Verdoorn (2002) which explaining the relationship between capital requirement, Labour requirement, and other variables considering in correlation with Labour productivity.

2.2.2 Government Efficiency and Labour Productivity

During the pandemic, the effect of the health crisis led to people unable to work because of sickness and the government restrictions orders. According to Lai (2020), the government restrictions order, also known as the first MCO had led to the unemployment risen to 3.9% in Malaysia. When people are unable to work, the Labour productivity will be affected.

The negative relationship can be showed by the research from Quezon & Ibanez (2021) where the construction Labour productivity decreased during this covid19 pandemic. Under their research, they are using both qualitative and quantitative analysis to do their study where they constructed a questionnaire for the construction Labour. After that, they are also using correlation analysis to find the highest coefficient factors that affect their productivity during this pandemic. This has also been supported by the analysis from Bloom, Bunn, Mizen, Smietanka, & Thwaites (2020), The research showed that during the COVID-19 pandemic, the Labour productivity for the private sectors in United Kingdom were estimated to dropped by 5% at the end of quarter four, 2020. Under this research, they used Cobb-Douglas production function on estimating the Labour productivity which they called as total factor production

(TFP). According to Fornaro & Wolf (2020), the research was using the New Keynesian model on determining the Labour productivity on the global output. However, inside this research also constructed a new model which mentioned about the coronavirus negatively affecting the Labour productivity growth. Meanwhile, referring to the work by Gibbs, Mengel, and Siemroth (2021), the work from home working pattern popular during the imposition of movement control order and travel restriction in which has showed a similar or slightly lower level of output produced based on the conducted sample by these researchers. Therefore, a pandemic will have a negative relationship between the Labour productivity or at least a slight dropping in worker's productivity due to the changing pattern of working environment and procedures.

Works contributed by Chisadza, Clance, and Gupta (2021), and Martínez-Córdoba, Benito, and García-Sánchez (2021) has argued on the number of cases infection by the COVID-19 has been significant in explaining the government effectiveness including other variables such as deaths, usage of hospital beds, and available number of physician and nurses servicing. It reflects the messages of importance of government controlling public health crisis and governing stability the public health system by providing supports of medical equipment and also effectiveness in implementation of necessary health restrictions.

2.2.3 Employment and Labour Productivity

The research conducted by Landmann (2004) has investigated on the employment particularly the Labour force participation and the relationship between it with GDP per total population. There was productivity slowing down can be seen as complementary explanation for the result of serious and poor employment with certain degree of investment involving to the production factor. This statement indicated that there is negative correlation between the Labour productivity and employment. Moreover, allocation of employment in which the over skilled over educated workers of mismatching the job scope and job assignment will be harming the productivity growth (McGowan and Andrews, 2015). It is important for the firms assigning the rightful and suitable position to a particular skilled Labour and particular specialist background area.

Employment usually interacts with unemployment another side of the macroeconomic of employment rate side. Based on the study from previous researchers, it shows different results

as one of them has a direct relationship between Labour productivity and unemployment. However, there was also another study for showed a correlation between unemployment and Labour productivity. According to Burda, Genadek, & Hamermesh (2017), the study shows that there was a positive correlation between Labour productivity and unemployment. This indicated that when there is an increase in unemployment, Labour productivity will also correlatedly increase. This was because there was a rise in the intensive margin which indicated the actual effort per hour from the Labour force. This can be also showed by the example from the period of "The Great Recession" where the Labour productivity increased during the contradiction period.

Also, there was another study that showed a direct relationship between unemployment and Labour productivity. According to the study from Koshal, Gupta, Koshal, Akkihal, & Mine (2008), the study showed that there was a negative relationship between these two variables. The study showed that when the unemployment rate increases, the Labour productivity will decrease in the long run. The reason is that during the period of 2003, the unemployment rate had increased to 5.3 percent, which mostly laid off those younger workers who are usually more productive and lower paid. This causing unemployment negatively affects Labour productivity.

Therefore, employment reflecting to the Labour forces or manpower of a firm available in their production. However, based on the above-mentioned research result has shown the importance of assigning suitable job scope to specific Labour based on their background or skills. Also, firms have to consider the number of Labours required in their production in order to ensure the maximization of the efficiency production line.

2.2.4 Capital Input and Labour Productivity

With the work of Choi, Haque, Lee, Cho and Kwak (2013), supported on the stands of capital involving a decisive factor influencing the productivity. It is due to the reasons of technological and organizational innovation assist in improvement of most of the industries. With the supports of advancement of capital, Labours able to generate more profitable outcomes contributing to the companies and manufacturing sectors. It helps the workers in transformation

of working style which moving towards smart working rather than hard working. Chauvin and Hirschy (1993) argued on the capital-intensive industries which the firms highly focused on the investment of assets and machinery advancement to maximize the production may potentially lead to the situation of huge price-competition. They tend to spend greater amount of funds into the capital investment which indirectly high concerning on cost efficiency and realizing the improvement in Labour productivity.

Human capital considered as the investment by the employers and manufacturers providing the upgrading skills and knowledge a typical investment on Labour as a whole. Providing such investments such as on-the-job-trainings, seminars and further educations on licensing and backgrounds believed to be improvement on the productivity efficiency (Asghar, Danish, and Rehman, 2017). Nevertheless, human capital and assets capital must compliant together which argued by Basri, Karim, and Sulaiman (2018). With quality skilled Labour combining with advancement of capital able to construct a crucial change toward the Labour productivity.

2.3 Chapter Summary

The findings result from this review have indicated that several scenarios have the same perspectives and answers. From the theory, Maslow Hierarchy of Needs and Cobb-Douglas Production Function were being used to explain Labour productivity. Whereas for the framework, it illustrated the overview of the dependent variable and independent variables. Theories above mentioned has make the research and analysis in this project more persuasive with solid content. Besides, while looking toward the empirical study, there were research being overviewed on the relationship between Labour productivity and the health crisis in the past of facing SARs and also the current COVID-19 pandemic. The government health protection and control action such as travel restriction and requirement of vaccines proof has illustrated the government efficiency encountering it. Also, studies has brought important message on the health condition has to be taken into account influencing the productivity changes in various industries around the world.

The employment showing the Labour involvement in the macroeconomic sense contribute decisive factors of the Labour productivity. Meanwhile, unemployment results from various studies showed that there was a negative relationship between these two variables. While the

relationship between unemployment and Labour productivity also consists of positive correlation due to the reason of rising intensive margin on the actual effort per hour of a Labour worked. On the other hand, for the results shown from capital including the human capital and Labour productivity has displayed the same and obvious result of the investment requirement. Both must be taken into account for employers or policies makers which combination of them make greater performance in the Labour productivity showing in the past studies. It provides the readers upon the clear explanation by the past studies researchers and giving an overall direction of the path of analysis in this project in the coming chapters.

Chapter Three

Methodology

3.0 Introduction

In this chapter, it focuses on the introduction and application of several suitable econometric models fit into our research topic, Labour productivity. These models are applied to be used as tools to investigate the relationship between data sets as the result of our research analysis. Data set is the combination of dependent variables and independent variables such as workers' wage and the Labour productivity. In the model estimation, we are going to derived from Cobb-Douglas production function. However, we will only be focusing on the investigation of the relationship between capital, workers, and the Labour productivity. After that, since we are using the data sets with the combination of time series and cross section, panel data analysis will be applied in our study. The combination with our panel data will be the government efficiency which we will be analyzing it by using the number of COVID-19 cases, the number of employed person in each ASEAN countries, and the gross fixed capital formation. The three model that are going to implied in our study is Pooled Ordinary Least Square model (Pooled OLS), Fixed Effect Model (FEM), and Random Effect Model (REM). The analysis method of which model suits our study the most was also indicating in this Chapter where we are using Hausman test, Poolability F-test, and Breusch Pagan Lagrange Multiplier test for the determination of the best model. Also, normality and Multicollinearity test was also applied in determination of the validity of the model.

3.1 Research Design

To clarify the doubt in research questions and to achieve the research objectives outlined in Chapter 1, this chapter applying the quantitative method to analyze the data in a numerical way to perform on the results of relationship between the data set we focused on. It is to improve the validity of this research in interpreting and concluding the results obtained.

3.2 Data Description

In this research, panel data analysis presents to gauge the impacts of 3 variables, employed person, gross fixed capital formation, and the government efficiency in our study. The traditional Cobb-Douglas production function itself is not sufficient for the determination of the Labour productivity. The reason is that there might be other external factors and unforeseen circumstances that might be influencing it. In this study, the COVID-19 pandemic is one of the major unforeseen circumstances that results in a major impact on the Labour productivity which could not be avoided.

We will be obtained a set of data from various professional and certified databases for Labour productivity, gross fixed capital formation, employed person, and the government efficiency followed the respective period. The time period for the government efficiency will be some different due to the COVID-19 pandemic outbreak was just occurred within the year of 2020. However, not all ASEAN countries are included in our study due to lack of complete data or some extreme data which will affect the normality of the study. One of the examples is that Singapore's Labour productivity is performing way outstanding compared to other ASEAN countries which causing the exclusion of our data. Thus, only Malaysia, Thailand, Indonesia, Philippines, and Vietnam are included in our methodology studies. The source of data obtained for these countries will based on each of the variable. All of data will be in quarterly basis within the year of 2019 Q4 to 2021 Q2.

The Labour productivity, it will be using the Labour productivity growth as the determination of the dependent variables. According to Verdoorn (2002), they are using the percentage change in the Labour productivity to determine each countries' Labour productivity. Labour productivity growth was known as the overall workforce productivity for each of the country where it was being determined by the changes in economic output per Labour hour (Rasure, 2020). The data was being obtained from CEIC. Moreover, the employed person was meant by the population of the Labour force that are having a job. The employed person was referred from the International Financial Statistics (IFS) data source. For the gross fixed capital formation, it was being referred for the acquisition of the produced assets which indicates as capital for our model specifications. The data set was also being derived from the IFS. Whereas

for the government efficiency, the data set applied will be number of COVID-19 cases which means the total number of people infected from the COVID-19 virus from year 2020 to 2021 as referred from Worldmeter.info. The table 3.3 below showed the summary of both endogenous and exogeneous variables applied in this analysis.

Table 3.3

Endogenous Variable	**Variables Description**	**Sources**
Labour Productivity Growth	The measurement of percentage change in output per employed.	CEIC
Exogenous Variables	**Variables Description**	**Source**
Employment	People who are able to work which derived from the Labour force	IFS
Government Efficiency	How the government handle the pandemic in terms of the number of covid cases.	Worldometers.info
Gross Fixed Capital Formation (GFCF)	the acquisition of the produced assets	IFS

3.3 Model Specification

The analysis for our model specification will be panel data analysis which was used to investigate the impact of each independent variable towards the Labour productivity in the five ASEAN countries. The model specification will be constructed as below:

3.3.1 Econometric Model

Cobb-Doulas Production function was commonly used to determine the relationship between capital, Labour, and the output. This production function was first introduced by Paul Douglas and his colleague Charles Cobb in the year 1927 (Cottrell, 2019). The assumption of this model stated that an increase in the amount of output will depend on the increase in the amount of capital and Labour invested.

In this analysis, the Cobb-Douglas production function played an important role as we are analyzing the Labour productivity growth for the five ASEAN countries which was related to the production function. The original production function was being showed as below:

$$Y = f(A, L, K)$$

$$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{\beta}$$

Since we are going to find the Labour productivity, and we knew that Labour productivity is measured by using the output per employed, the new equation 1 will be derived as below:

$$\frac{Y_{it}}{L_{it}} = A_{it} \left(\frac{K_{it}}{Lit}\right)^{\alpha} L_{it}^{\alpha+\beta-1} \qquad (1)$$

If we assuming there is a constant return for scale, our $\alpha + \beta - 1 = 0$

The initial Cobb-Douglas Production Function will be shown as below:

$$\frac{Y_{it}}{L_{it}} = A_{it} \left(\frac{K_{it}}{Lit}\right)^{\alpha} \qquad (2)$$

From equation 2, the $\frac{Y_{it}}{L_{it}}$ indicates our Labour productivity, the A_{it} indicates the government efficiencies, and the $\frac{K_{it}}{Lit}$ will be our capital deepening. Capital deepening meant by the capital-Labour ratio where it is an usual determination of the Labour productivity. According to Apostolov (2016), it is also one of the main dependent for Labour productivity in the analysis. In order to estimate the Cobb-Douglas function, we are going to use the regression analysis where:

$$\frac{Y_{it}}{L_{it}} = \beta_0 A_{it} \left(\frac{K_{it}}{Lit}\right)^{\alpha} e^{u} \quad (3)$$

The β_0 was indicating the correlation coefficient. Since we wanted to linearize our model, we will further do it by using the logarithm format in terms of linear-log form which will be showed as below:

$$\frac{Y_{it}}{L_{it}} = \beta_0 + \ln (A)_{it} + \alpha \ln \left(\frac{K_{it}}{L_{it}}\right) + u \qquad (4)$$

Equation 4 showed our complete model estimation. However, in this study, since we are using the Labour productivity growth as the dependent variable, the model will be further modified as being shown as below:

$$\frac{\Delta Y_{it}}{\Delta L_{it}} = \beta_0 + \alpha_0 \ln (A)_{it} + \alpha_1 \ln \left(\frac{K_{it}}{L_{it}}\right) + u_{it} \quad (5)$$

From the equation 5, we further simplified it as using abbreviations for our model:

$$LPG_{it} = \beta_0 + \alpha_0 \ln (GE)_{it} + \alpha_1 \ln(CD)_{it} + u_{it} \quad (6)$$

The LPG_{it} was indicating the Labour productivity growth, ln $(GE)_{it}$ representing the logarithm for the government efficiency, $\ln(CD)_{it}$ representing the capital deepening, which showed the ratio of the capital and Labour, u_{it} representing the error terms and the α showing the estimated coefficients and the i and t are representing the countries and time frame respectively.

3.4 Model Estimation

3.4.1 Pooled Ordinary Least Square Method (Pooled-OLS)

Pooled OLS model is the most used model on the constant model estimation within different groups. Pooled OLS model estimates the dataset which is same as other cross-sectional data where we will be ignoring the time effect on the changes in the dimensions (Alam, 2020). This makes the assumption of the Pooled OLS be just as same as ordinary linear regression which are linearity, no multicollinearity, error terms are normally distributed, no autocorrelation problem, and the constant variance of the error terms (homoscedasticity) (Subramanian, n.d.). Under Pooled OLS model, the assumptions are that the intercept should be constant across the independent variable, the slopes are constant, and there is no time effect as stated above.

The equation estimation for the Pooled OLS model will be shown as below:

$$Y_{it} = \alpha_0 + \Sigma \alpha_p X_{it} + \mu_{it} \ (3)$$

From the equation 3 above, Y_{it} represents the dependent variable, β_0 represents the intercept of the model, β_i indicates the estimated coefficient for the independent variable where (p= 1,2,…n) , X_{it} itself indicates the independent variable for the model, the *i* indicates the cross sectional dimensions for the ASEAN countries, while *t* represents the time series dimension for the model, and μ indicates the residual or error term.

However, pooled OLS model is hard for us to estimate our model accurately since the ignorance of the time effect might cause us to lose some of the important variables that could only been observed through time effect. Besides, heterogeneity exits among the observations over a period of time will lead to the estimated coefficient become biased and lead to inefficiency and inconsistency in our model.

3.4.2 Fixed Effects Model (FEM)

FEM model was almost similar as the Pooled OLS model, but it adds on the effect of difference between individual countries. Under this FEM, we assume that the intercept should be different across countries, the slopes are constant and there is no time effect. Under this FEM, it also assumes that there will be no heterogeneity problem inside the model where the E(X_{it}: $\mu_{it} \neq 0$). However, under these FEM, there will be different type of variation for the model which only one will be suitable for our model estimation. The second type of the FEM will have a little difference as the normal FEM where there will be time effect in our model. This means that real life effect such as government policy or technological changes will become an external effect on the model. The third type of the model is that the slope will be different as compared to the normal FEM. Also, the model should not include too much dummy variable since the intercept will absorb it and leading to multicolinearity problem (Williams, 2018).

After done the assumption, the model estimation should be shown below:

$$Y_{it} = \Sigma \alpha_p X_{it} + \gamma_i + \mu_{it} \quad (4)$$

From the equation 4 above, the Y_{it} represents the dependent variable where the i and t will be capturing the cross section and time series dimension respectively, γi indicates the unknown intercept for each country in our model, X_{it} represents the independent variables, β_p is the intercept and the estimated coefficient for the independent variables where (p=1,2..n) and the μ_{it} represents the error term of the model.

3.4.3 Random Effects Model (REM)

Random Effect Model could be classified as a model that took into both individual variations as well as time variation factors. Under REM we assume that the intercept is different across the countries, the slopes are the same, and the error term inside the model should be normally distributed. The REM also suggested that the error term could be assumed to be not correlated with the independent variable but still have effect on the ASEAN countries. By using the REM, it has its own advantage compared to FEM which is the number of unknown parameters has been reduced compared to FEM. This showed that it successfully eliminates the bias on the variables inside the model (Alam, 2020). By the reduction of the variables, it also reduces the possibility of the multicollinearity problem that exists in the Pooled OLS model. After the discussion on the REM, we can construct the equation as shown below:

$$Y_{it} = \Sigma \alpha_p X_{it} + \varepsilon_i + \mu_{it} \quad (5)$$

Equation above showed the model estimation for the REM. Y_{it} indicates the dependent variable, β_p indicates the intercept and the estimated coefficient for the model, X_{it} is the independent variables, ε_i is the individual specific error component for the cross-section dimension, μ_{it} is the combination between the time series and cross-sectional error component.

From the equation above, it showed that we have added an additional individual specific error term on the model. The individual specific error component must have no correlation with the independent variables to prevent the autocorrelation problem.

3.5 Model Selection

3.5.1 Poolability F-test

The purpose of using this poolability F test is to determine whether Pooled Ordinary Least Square method or Fixed Effects Model method suits our model estimation. Under our model. For an unrestricted model, it is suitable for using F test for running a regression for each cross-section data. Under this test, the null hypothesis indicated that

all the fixed effects are equal to zero (Qizele, 2013). The test statistic that is being used in this test will be the F statistic which the formula is shown as below:

$$F = \frac{\frac{SSE_r - SSE_u}{df_1}}{\frac{SSE_u}{df2}} ;$$

Where SSE_r is the error sum of squares for the restricted model and SSE_u is the error sum of squares from the unrestricted FEM. The degree of freedom, df_1 will be equal to one-way models and (N-1) + (T-1) for 2-way models. Whereas for the df_2 is equal to the error degree of freedom estimation from the fixed-effect model.

To investigate which model best suits our estimation, the hypothesis test was constructed as below:

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ (Pooled OLS being preferred)

H_1: At least on $\beta_i \neq 0$, where i= 1, 2, 3, 4 (FEM being preferred)

The null hypothesis indicates that there are no independent effects, and this means that the Pooled Ordinary Least Square model (POLS) is recommended to be used under this assumption that ordinary least square estimators could be fulfilled. On the other hand, if the alternative hypothesis signifies that there is an occurrence of the independent effects, the Fixed Effect Model (FEM) will be recommended as our model estimation.

3.5.2 Hausman test

In using this Hausman test, we can find out whether Random Effects Model (REM) or Fixed Effects Model (FEM) is preferred as our inference for the model estimation. Usually using Hausman test will results in REM becoming more efficient than FEM, but we still must use this test to determine whether the result is the same as the assumption on Hausman's hypothesis. The test statistic for this test will be the Hausman test statistic which is shown below:

$$H = (\beta_R - \beta_F)' [Var(\beta_R) - Var(\beta_F)]^{-1} (\beta_R - \beta_F) \quad \sim X^2(k)$$

The β_R indicates the beta value for the REM while the β_F indicates the beta value for the FEM. Whereas the Var for both β_R and β_F indicate the beta variance for REM and FEM respectively. For the hypothesis testing, it will be shown as below:

H_0: Cov (μ_i, X_{it}) = 0 (REM being preferred)

H_1: Cov (μ_i, X_{it}) ≠ 0 (FEM being preferred)

The H_0 as stated above indicates that the covariance between the error term and the independent variables equals zero which means that there is no relationship between these two. This means that REM is being preferred as our model estimation under the null hypothesis. Whereas the H_1 stated the other way round where there is relationship in the covariance between the error term and the independent variables. This showed that FEM is being preferred under this alternative hypothesis.

3.5.3 Breusch-Pagan Lagrange Multiplier Test (BP-LM)

The BP-LM test is being used in determine whether Random Effects Model (REM) or Pooled Ordinary Least Square Model (Pooled OLS) is more suitable for our model estimation. It can be further eLabourated by testing whether the existence of the individual specific variance component inside the model is an appropriate model (Saada, Haniffb, & Alic, 2016).

The test statistic that is going to be used in this model is the LM statistic followed by the Chi-square distribution with a degree of freedom of one which will be shown below:

$$LM = \frac{nT}{2(T-1)}\left[\frac{T^2\bar{e}'\bar{e}}{e`e} - 1\right]^2 \sim X^2\ (1)$$

The $\bar{e}$ indicates the n×1 vector of the group means of the pooled regression residuals, the e`e indicates the goodness-of-fit measure or R-squared of the pooled OLS regression (Saada, Haniffb, & Alic, 2016). After listing out the test statistics, we therefore can develop our hypothesis testing for our BP-LM model which as shown below:

H_0: $\sigma_u^2 = 0$ (Pool OLS is preferable)

H_1: $\sigma_u^2 \neq 0$ (REM is preferable)

The null hypothesis indicates that there is no effect from the variance of the error term which means that the Pool OLS model is preferable. While the alternative hypothesis represents that there is a significant impact from the variance of the individual specific variance of the error term. This means that the REM will be more preferable is the results showed that the alternative hypothesis is correct.

3.5.4 Normality Test: Jarque-Bera Test

Normality test were being used to determine whether the data in the model is normally distributed. The reason that using this normality assumption is that the probability distributions of the OLS estimators can be derived easily since any linear function variables that is normally distributed is usually normally distributed. It also plays a critical role when the sample size for the estimation is small. Under this normality test, Jarque-Bera Test was being chosen for testing the normality of our model estimation. The hypothesis test was shown below:

H_0: The error term is normally distributed

H_1: The error term is not normally distributed

3.5.5 Multicollinearity Test

Multicollinearity problem occurs when there is a correlation between the exogenous variables inside our model. It will result in a high variance which leads to difficulty in estimating an accurate outcome. Multicollinearity will also lead to standard error and coefficients becoming very sensitive to the changes in data. Because of the difficulties on accurate estimation, the confidence intervals tend to be wider which lead to most of the hypothesis results in do does not reject the null (Shristikotaiah, 2021).

To determine the existence of multicollinearity, there are three ways to detect the multicollinearity problem. The first one is the most common one where we can observe regression analysis. Multicollinearities exist when most of the independent variables

are insignificant, but the R-square tends to be very high (usually more than 0.9). The second method is using the **Variance Inflation Factor (VIF).** Where the method for both calculations were being shown below:

$$\text{VIF} = \frac{1}{(1-R^2)}$$

Where if VIF > 10 and the R-square > 0.9, it denotes that there is a high collinearity in our model estimations.

3.6 Chapter Summary

In this Chapter, the discussion of the methodology stated that Cobb-Douglas Production Function would be our prior econometrics model as the model was most suitable for the implications and Labour and capital. Whereas for the model estimation, we are using panel data model for the analysis purpose where it is the most common analysis model for panel dataset. As for the model selection, Poolability test, Hausman test, and BP-LM test was applied on selecting the best model. For the diagnostic test, the research is using the Normality and Multicollinearity test for the determination of an appropriate model.

The computer program that we are going to use in our model estimation will be E-views software. The reason that we choose to use E-views is that E-views is a simpler data analysis program which is suitable for students on doing the research. Besides, the major statistical techniques for our analysis will be hypothesis testing as we are going to determine which model (Pooled OLS, FEM, REM) are more suitable in explaining our model estimation.

Chapter 4

Empirical Results and Discussion

4.0 Introduction

In this Chapter, the discussion for the panel results was being obtained by applying the methodology that showed from Chapter 3. This panel data results will be presented by using the three types of models which were Pooled Ordinary Least Square (Pooled OLS) model, Fixed Effect Model (FEM), and Random Effect Model (REM). After the discussion of the three models, there are going to be selection of the most appropriate model for the panel data analysis. The selection of model will be through few tests which were Poolability F test, Hausman test, and Breusch-Pagan LM test. With the selection of model, we will be moving on to the determination of the model validity through two types of tests. The tests that were being applied will be Normality test and Multicollinearity test which as the end of our Chapter 4.

4.1 Panel Data Analysis

As being showed in the equation 2 in previous chapter, the linear-log model was being constructed and being demonstrated. The table below shows the result for equation 6 in the three different model that are Pooled OLS model, FEM model, and REM model. Below is the illustration of our equation 6 which derived from the Cobb-Douglas Production Function:

$$LPG_{it} = \beta_0 + \alpha_0 \ln (GE)_{it} + \alpha_1 \ln(CD)_{it} + u_{it} \qquad (6)$$

Table 4.1: Results of Equation (6)

	Pooled OLS	FEM	REM
LNGE	0.543957 [1.302689] (0.2037)	0.903319 [2.063702] (0.0505) *	0.793507 [1.902764] (0.0678) *
LNCD	7.550724 [2.700398] (0.0118) **	10.47870 [1.529390] (0.1398)	8.838921 [2.255448] (0.0324) **

Notes: The rejection of null hypothesis were at 10%, 5%, and 1% significance level which are represented by *, **,*** respectively. The close bracket indicates the test statistic value for each independent variable. While the parentheses value will be indicating the p-value.

From the table 4.1 above, it showed the results that we derived from e-views. The first variable indicates the logarithm of the government efficiencies (LNGE), where it was determined by the number of cases. The reason is that number of cases increase results in the inefficiency of government due to the failure of implementation of the policy (Martinez, Benito, & Garcia-Sánchez, 2021). From the result shown in Pooled OLS model, it showed no relationship in our Pooled-OLS model. For the FEM model, it showed that government efficiencies are having a significant relationship at 10% where the p-value is 0.0505. This means that when the government efficiencies increase by 100%, on average, the Labour productivity growth will be increase by 0.903319%, ceteris paribus. For the REM model, it also showed that government efficiency having a significant relationship with the Labour productivity growth at the significant level of 10% where the p-value was 0.0678. This means that in REM model, when the government efficiency increases by 100%, on average, the Labour productivity growth increase by 0.793507%, ceteris paribus.

On the other hand, the second variable was showing the logarithm of the capital deepening which was the ratio of Labour that we derived from the Cobb-Douglas Production Function (LNCD). Capital deepening meant by the ratio of capital and Labour which initially is the main variable for the Labour productivity (Biddle, 2012). From the result shown from Pooled OLS model, it showed that only capital deepening is having a significant relationship with the Labour productivity growth at the significance level of 10% and 5%. The p-value for the capital deepening was 0.0118. This means that when the capital deepening increase by 100%, on average, the Labour productivity growth increase by 7.550724% ceteris paribus. For the Fixed Effect Model (FEM), it showed that there was no relationship between the capital deepening and the Labour productivity growth. Whereas for Random Effect Model (REM), it showed that capital deepening is having a significant relationship with the Labour productivity growth. This means that the p-value is less than the significance level of 5% and 10% where the value was

0.0324. The significant result showed that when the capital deepening increases by 100%, the Labour productivity growth increases by 8.838921%.

From the analysis above, it showed that Pooled OLS model only having one significant variable with the Labour productivity growth which was the capital deepening. Whereas for FEM model, there was also one variable significant with the Labour productivity growth which was government efficiency that was indicating by the number of cases. Nevertheless, the only model that are having two significant relationship was the REM model where both government efficiency and capital deepening is having a positive relationship with the Labour productivity growth.

4.2 Model Selection

The table 4.2 below showed three tests being applied in our model selection. In our model selection, the test that was being applied was Poolability F-test which determine whether Pooled OLS or FEM model is being preferred. The Hausman test is used to determine whether FEM or REM is being preferred. The third test was the Breusch-Pagan LM test was used to determine whether Pooled OLS model or REM was being preferred.

Table 4.2: Model Selection Result

Poolability F-test	3.659604 (0.039234) **
Hausman Test	0.950372 (0.6218)
Breusch-Pagan LM test	25.42586 (0.0046) ***

Notes: The rejection of null hypothesis were at 10%, 5%, and 1% significance level which are represented by *, **,*** respectively. The parentheses value will be indicating the p-value.

From the table 4.2 above, the Poolability F-test showed a result that we reject the null hypothesis due to the p-value was 0.039234 which was less than the significance level of 10%

and 5%. This means that there was no common intercept across all the countries. Thus, the FEM was being preferred with the two-significance level at 10% and 5%.

For the Hausman test, table 4.2 showed with the result that the p-value was greater than the three-significance level. This indicates that we do not reject the null hypothesis since there is no covariance between the error terms and the independent variable. Since we do not reject the null hypothesis, this means that REM is being preferred rather than FEM.

Moreover, for the Breusch-Pagan LM test, it is to determine whether Pooled OLS model of REM was being preferred. Since the p-value was 0.0046 which less than the three-significance level of 10%, 5%, and 1%, we will reject the null hypothesis. As a result, REM will be our preference from the result of this BP-LM test. This mean that there is an effect from the variance of the error term.

As a conclusion, from three of these tests, it showed that REM model would be more preferable than FEM and Pooled OLS model for interpreting our results.

4.3 Diagnostic Testing

4.3.1 Normality Test

Table 4.3 Normality Results

Jarque Bera Statistic	8.258704 (0.016093) **

Notes: The rejection of null hypothesis were at 10%, 5%, and 1% significance level which represented by *, **, *** respectively. The parentheses value represents the p -value for the data set.

From the result showed in table 4.3 above, it showed the value of Jarque-Bera statistic as a indication on whether the overall data being chosen was normally distributed. From the p-value as being shown in the parenthesis, the result showed that we reject the null hypothesis at the significance level of 10% and 5% (0.016093 < 0.1/0.05). This means that our data is not normally distributed.

The reason that our data set was not normally distributed was due to some of the number observation was close to zero and the natural limitation which ended up causing the data set was skew to the right or left side (Buthmann, 2021). In our data analysis, the data set was being linearized by using the natural logarithm. Also, our data set for the government efficiency which indicated by number of cases consist of the zero value which ended up the model become not normally distributed.

4.3.2 Multicollinearity test

Table 4.4 Multicollinearity Results

Variable	VIF
LNGE	1.132882
LNCD	1.132882

From table 4.4 above, it shows that two of the variables are showing the same results. According to Corporate Finance Institute (n.d.), the optimal VIF for no detection of Multicollinearity problem is that the VIF is less than 10 (1.132882 < 10). In the table above, both VIF for LNGE and LNCD were having less than 10 which indicates that there is no existence of Multicollinearity. Thus, there was no multicollinearity problem in our model estimation.

4.4 Chapter Summary

From the analysis above, the three model that were being computed from e-views showed a significant result. However, only the Random Effect Model (REM) match with the expectation

of our study. The result showed in REM where both government efficiency and the capital deepening (the ratio of capital input per Labour input). Whereas while looking at the model selection part, the result showed that FEM model will be chosen and a more appropriate model on estimating our results through different test. Also, the diagnostic test eliminates the concern of normality and multicollinearity problem that may arise from our model.

Chapter 5

Conclusion, Limitations, and Recommendations

5.0 Introduction

With the previous study from the first four chapter, it comes to an end in this chapter. In this chapter, the discussion will be mainly focus on the main findings of our study, the implications of who will be benefited, the limitations of our study, and the recommendations for further research which were based on our results shown in the previous chapter.

5.1 Major Findings

For our study on this analysis of the labour productivity along with its independent variables, it is aimed to contribute on how the great impact of COVID-19 pandemic affects the Labour productivity in the ASEAN countries. The independent variable that was being chosen to study the relationship with the Labour productivity are capital deepening which derived from the data sets of gross fixed capital formation (GFCF) and the employed person in these 5 countries, and the government efficiency which derived from the data set of the number of COVID-19 cases. While for the Labour productivity, we are using the Labour productivity growth to act as an indication on the changes in the Labour productivity during the COVID-19 period. With the done selection of dependent and independent variables, the methodology applied were Cobb-Douglas production function and panel data mode which include the three main models like Pooled OLS model, Fixed Effect Model (FEM), and Random Effect Model (REM).

The construction of the Cobb-Douglas production function was then being modified by using the natural logarithm method which turns our model into linear-logarithm model (lin-log model). After the re-modification of the model, the data set were being applied into our panel data analysis. From the result shown from the panel data analysis, the first independent variable, which was capital deepening showed a significant result in the Pooled OLS model and REM. The result showed that the relationship between the capital deepening and the Labour productivity is positive where increase in capital deepening result in increase in the Labour

productivity. As capital deepening act as an indicator for both employed person and the gross fixed capital formation (GFCF), this means that both variables did play an important role to determine the Labour productivity. Whereas from the result shown in FEM, it showed no relationship between the capital deepening and Labour productivity. However, since we selected REM as the most appropriate model, this means that the relationship between these two still valid. According to Dua & Garg (2019), the study's results also showed that capital deepening was one of the significant variables that affecting the Labour productivity. With the support of the derivation of the model in the other study, it also makes our capital deepening (K/L) being valid in the determination of the Labour productivity (Madsen, 2010). Thus, the findings from our study match with the previous study as well as our expectation.

Furthermore, the second independent variable in our result estimation was the government efficiency. The government efficiency in our data estimation was being applied by using the number of COVID-19 cases. The panel data results showed that government efficiency played an important role in estimated the relationship with the Labour productivity growth under the FEM and REM. Whereas for the Pooled OLS model, it showed that there was no relationship between the Labour productivity growth and government efficiency. Since we are selecting REM as our appropriate model estimation, this means that government efficiency does have a significant relationship with our study. The results showed that an increase in the government efficiency will also increase the Labour productivity. This means that there is a positive relationship between the government efficiency and Labour productivity growth. According to Moser & Yared (2021), government implementation played an important role in improving the productivity which the statement match with our study. Therefore, government efficiency and Labour productivity are significantly related to each other.

From our study, there was another major finding where came from our diagnostic test. In our study, it showed that our model is not normally distributed. The reason is that our data set were using the natural limitation as well as some of the data set was using the value of zero which ended up our model not normally distributed. While according to Boomsma (1983), sample size also making the non-normality distribution occurred which also one of our problems in our selected observation. For another major findings, there was no correlation between our independent variables where makes our variables more reliable.

5.2 Implications of Study

This research aims to benefit the policy makers from ASEAN countries, employers as well as employees which was related to this study. From the analysis of the study, the policy makers would be able to determine which factor was being affected the most and focus on the policy to be implemented which helps to cope with the factor during this COVID-19 pandemic. For instance, the number of cases which results in increasing of people facing sickness an affecting the Labour productivity. As the problems being discovered, the policy makers could implement some policy to protect their citizens health which could ensure their productivity was maintained. For instance, the New Zealand government implemented the lockdown which leads to 40% of the citizens to work at home to prevent the further outbreak in their country (Carroll, 2020). Thus, by focusing on the right policy to improve, the policy maker would be able to ensure the stability of the Labour productivity in their own country.

Whereas for the employers, this research also be able to benefit them as it is the way that they checked on the current Labour market during the COVID-19 pandemic. As the analysis was for the countries of ASEAN, the research therefore will be more favorable under the employer in the ASEAN countries and for those multinational company's employer which decided to invest in the ASEAN countries. Inside the research, there are two main studies that showed a significant relationship that can be applied for the employers which was the number of cases impact on the Labour productivity. The employers itself could base on the number of cases in their countries and decided to adjust on their production line. This would be able to ensure that the employers itself are having the output that they targeted and preventing on the COVID-19 virus inside their plant or industry.

Whereas from the perspective of the employees, they could be based on the results shown from the analysis and adjusting on their employment status and mode. The reason is that the employees itself should always focusing on government implementation which will affect their working mode. This would be a good reason for the employees to check on this study which they can based on the relationship and get to know how government efficiency affect their source of income, which is to work.

5.3 Limitations of Study

There is always a space for improvement. In our study, there are few limitations that could be further discuss and modified. The first limitations will be the non-normality distribution as being discussed in the major findings. The reason is that the number of observations for our study was just slightly more than the 30-sample size which based on the quarterly data. While non-normality data always occurred in small sample size data as the test statistic result from small data sample are always too small and therefore rejecting the null hypothesis. Thus, this could be one of the concerns to for future research.

On the other hand, the other limitation of this study is that we do not know whether our panel data analysis having a constant error term. The reason is that the shortcoming of the application on determining the panel data. In the proposed analysis tools, the software that being applied do not have the heteroscedasticity test for panel data. Therefore, the future research should be advisable for using others analysis tools on determining a greater model for analyzing the Labour productivity in the ASEAN countries.

5.4 Recommendations for Research

For the future research on this study, it is advisable that the future researchers will be able to add on some additional factors which could improve the current model analysis. The additional factors could be the number of vaccination rate. The reason is that vaccination rate could be a better off determination on government efficiency. Vaccination rate could also be able to show more clearly on how vaccination plays an important role in improving the Labour productivity. Besides, with the less observation of our study, it is advisable for future study to add more period in the research as the COVID-19 cases was still significantly impacted many countries. Thus, with these two recommendations, it will further improve the validity of our study on the Labour productivity in ASEAN countries.

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Appendix

Dependent Variable: LABOUR_PRODUCTIVITY____
Method: Panel Least Squares
Date: 04/11/22 Time: 17:49
Sample (adjusted): 2020Q1 2021Q2
Periods included: 6
Cross-sections included: 5
Total panel (balanced) observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNKL	7.550724	2.796152	2.700398	0.0118
LNNOC	0.543957	0.417565	1.302689	0.2037
C	-56.99332	21.49988	-2.650867	0.0133

Root MSE	5.010222	R-squared	0.213269
Mean dependent var	-0.419700	Adjusted R-squared	0.154992
S.D. dependent var	5.745203	S.E. of regression	5.281238
Akaike info criterion	6.260838	Sum squared resid	753.0698
Schwarz criterion	6.400957	Log likelihood	-90.91256
Hannan-Quinn criter.	6.305663	F-statistic	3.659604
Durbin-Watson stat	1.157118	Prob(F-statistic)	0.039234

Appendix 1: Results for Pooled OLS Model

Dependent Variable: LABOUR_PRODUCTIVITY____
Method: Panel Least Squares
Date: 04/11/22 Time: 17:50
Sample (adjusted): 2020Q1 2021Q2
Periods included: 6
Cross-sections included: 5
Total panel (balanced) observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNKL	10.47870	6.851551	1.529390	0.1398
LNNOC	0.903319	0.437718	2.063702	0.0505
C	-80.45361	47.04568	-1.710117	0.1007

Effects Specification

Cross-section fixed (dummy variables)

Root MSE	4.146197	R-squared	0.461219
Mean dependent var	-0.419700	Adjusted R-squared	0.320667
S.D. dependent var	5.745203	S.E. of regression	4.735291
Akaike info criterion	6.148927	Sum squared resid	515.7286
Schwarz criterion	6.475873	Log likelihood	-85.23390
Hannan-Quinn criter.	6.253520	F-statistic	3.281490
Durbin-Watson stat	1.681374	Prob(F-statistic)	0.017602

Appendix 2: Results for FEM

Dependent Variable: LABOUR_PRODUCTIVITY____
Method: Panel EGLS (Cross-section random effects)
Date: 04/11/22 Time: 17:50
Sample (adjusted): 2020Q1 2021Q2
Periods included: 6
Cross-sections included: 5
Total panel (balanced) observations: 30
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNKL	8.838921	3.918919	2.255448	0.0324
LNNOC	0.793507	0.417028	1.902764	0.0678
C	-68.25295	28.27018	-2.414309	0.0228

Effects Specification		
	S.D.	Rho
Cross-section random	3.265584	0.3223
Idiosyncratic random	4.735291	0.6777

Weighted Statistics

Root MSE	4.404107	R-squared	0.201153
Mean dependent var	-0.213801	Adjusted R-squared	0.141979
S.D. dependent var	5.011730	S.E. of regression	4.642336
Sum squared resid	581.8847	F-statistic	3.399357
Durbin-Watson stat	1.500473	Prob(F-statistic)	0.048223

Unweighted Statistics

R-squared	0.202044	Mean dependent var	-0.419700
Sum squared resid	763.8140	Durbin-Watson stat	1.143082

Appendix 3: Results for REM

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 6
Cross-sections included: 5
Total panel observations: 30
Note: non-zero cross-section means detected in data
Cross-section means were removed during computation of correlations

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	25.42586	10	0.0046
Pesaran scaled LM	3.449327		0.0006
Pesaran CD	2.777033		0.0055

Appendix 4: Results for Breusch-Pagan LM Test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.950372	2	0.6218

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LNKL	10.478696	8.838921	31.585827	0.7705
LNNOC	0.903319	0.793507	0.017684	0.4089

Cross-section random effects test equation:
Dependent Variable: LABOUR_PRODUCTIVITY____
Method: Panel Least Squares
Date: 04/11/22 Time: 17:50
Sample (adjusted): 2020Q1 2021Q2
Periods included: 6
Cross-sections included: 5
Total panel (balanced) observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-80.45361	47.04568	-1.710117	0.1007
LNKL	10.47870	6.851551	1.529390	0.1398
LNNOC	0.903319	0.437718	2.063702	0.0505

Effects Specification
Cross-section fixed (dummy variables)

Root MSE	4.146197	R-squared	0.461219
Mean dependent var	-0.419700	Adjusted R-squared	0.320667
S.D. dependent var	5.745203	S.E. of regression	4.735291
Akaike info criterion	6.148927	Sum squared resid	515.7286
Schwarz criterion	6.475873	Log likelihood	-85.23390
Hannan-Quinn criter.	6.253520	F-statistic	3.281490
Durbin-Watson stat	1.681374	Prob(F-statistic)	0.017602

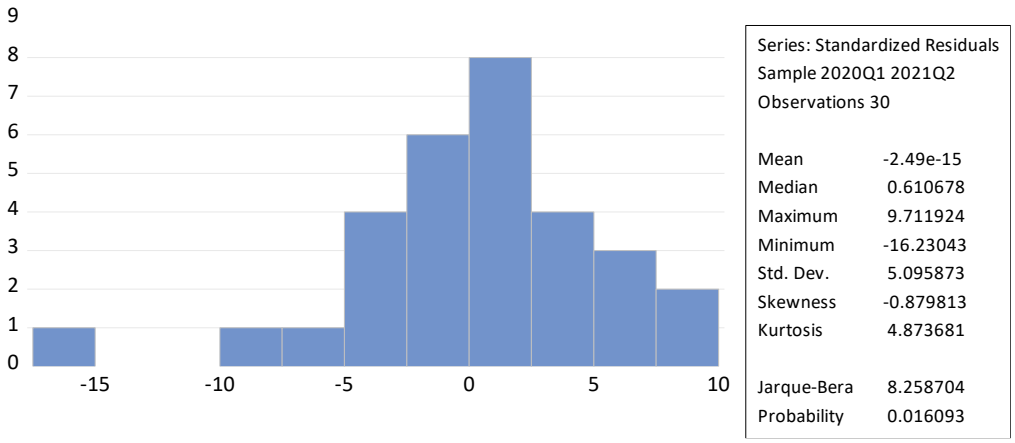
Appendix 5: Results for Hausman Test

Dependent Variable: LABOUR_PRODUCTIVITY____
Method: Panel Least Squares
Date: 04/11/22 Time: 17:51
Sample (adjusted): 2020Q1 2021Q2
Periods included: 6
Cross-sections included: 5
Total panel (balanced) observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNKL	7.550724	2.796152	2.700398	0.0118
LNNOC	0.543957	0.417565	1.302689	0.2037
C	-56.99332	21.49988	-2.650867	0.0133

Root MSE	5.010222	R-squared	0.213269
Mean dependent var	-0.419700	Adjusted R-squared	0.154992
S.D. dependent var	5.745203	S.E. of regression	5.281238
Akaike info criterion	6.260838	Sum squared resid	753.0698
Schwarz criterion	6.400957	Log likelihood	-90.91256
Hannan-Quinn criter.	6.305663	F-statistic	3.659604
Durbin-Watson stat	1.157118	Prob(F-statistic)	0.039234

Appendix 6: Results for Poolability F-Test



Appendix 7: Results for Normality Test

Variance Inflation Factors
Date: 04/11/22 Time: 17:54
Sample: 2019Q4 2021Q2
Included observations: 30

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LNKL	15.35793	244.3328	1.132882
LNNOC	0.173913	7.486113	1.132882
C	799.2028	277.4778	NA

Appendix 8: Results for Multicollinearity Test