IMPACT OF DIGITAL ECONOMY ON THE EMPLOYMENT: EVIDENCE FROM ASEAN COUNTRIES

By
NURUL ASYIKIN FADZIL

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Universiti Utara Malaysia

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ABSTRACT

The digital economy is an economy based on digital computing technology. The digital economy is also known as the Internet Economy, New Economy, or Web Economy. Increasingly, "digital economies" are interconnected with traditional economies making clear takeovers more difficult. The digital economy has been identified as one of the growth engines that can strengthen the country's economy. With the digital economy in ASEAN, it can significantly improve the competitiveness of the global marketplace. ASEAN countries agree to make digital economics and electronic commerce or e-commerce as the future of the economy in Southeast Asia. However, this digital economy has an impact on the job. Generally there will be job opportunities and also retrenchment due to lack of expertise in technology. Other than that, other effects are broadband and the internet. Broadband plays a very important role in the digital economy. this is because it is a channel or online connection that makes the "digital economy" a reality. This study is aim to examine the impact of digital economy on employment in ASEAN countries. This study period is from 1997-2016 (20 years). This study focuses on the impact of digital economy on employment specifically in 10 ASEAN Countries (Malaysia, Indonesia, Thailand, Cambodia, Laos, Singapore, Brunei, Vietnam, Myanmar and Philippines). Each country is giving different impact because of the economy growths conditions itself. Panel data method has been used to is performed, Ordinary Least Square Regression, Fixed Effect Model, Random Effect Method, Hausman Test and Granger Causality Test to test the variables in this study. This study is using Eviews10. Based on the empirical findings, digital economy have significant effects on the variables that have been used. Broadband subscriptions give significant relationship. So we conclude that broadband subscriptions give a major impact to the digital economy on employment in ASEAN Countries. The study emphasizes in particular aspects relevant to employees and employers. Then the results of the research explain the impact of digital economy to the employment and how it related to the workers. It can also be used as a worker's preparation to go through the era of digital economy by looking at the relationship between the two and the consequences when one is neglected and ignored. In addition, impact of digital economy are also have been discussed to see the real reality of the digital economy in ASEAN countries.

Keywords: *ASEAN, Digital Economy, Employment, Fixed Effect, Random Effect, Panel Data*

ABSTRAK

Ekonomi digital adalah ekonomi yang berdasarkan teknologi pengkomputeran digital. Ekonomi digital juga dikenali sebagai Ekonomi Internet, Ekonomi Baru, atau Ekonomi Web. Ekonomi digital adalah berkait rapat dengan menjadikan ekonomi tradisional persempadanan kelihatan lebih jelas. Ekonomi digital telah dikenalpasti sebagai salah satu enjin pertumbuhan yang dapat memperkuat ekonomi negara. Dengan ekonomi digital di ASEAN, ia dapat meningkatkan daya saing pasaran global dengan ketara. Negara-negara ASEAN bersetuju untuk membuat ekonomi digital dan perdagangan elektronik atau e-dagang sebagai masa depan ekonomi di Asia Tenggara. Bagaimanapun, ekonomi digital ini mempunyai kesan ke atas pekerjaan itu. Secara amnya akan terdapat peluang pekerjaan dan juga pemberhentian kerana kekurangan kepakaran dalam teknologi. Selain itu, kesan lain adalah jalur lebar dan internet. Jalur lebar memainkan peranan yang sangat penting dalam ekonomi digital. ini kerana ia merupakan saluran atau sambungan dalam talian yang menjadikan "ekonomi digital" menjadi realiti. Kajian ini bertujuan untuk mengkaji kesan ekonomi digital terhadap pekerjaan di negara-negara ASEAN. Tempoh kajian ini adalah dari tahun 1997-2016 (20 tahun). Kajian ini memberi tumpuan kepada kesan ekonomi digital terhadap pekerjaan khususnya di 10 Negara ASEAN (Malaysia, Indonesia, Thailand, Kemboja, Laos, Singapura, Brunei, Vietnam, Myanmar dan Filipina). Setiap negara memberikan impak yang berbeza kerana keadaan pertumbuhan ekonomi itu sendiri. Data panel telah digunakan dengan menggunakan kaedah Ordinary Least Square Regression, Fixed Effect Model, Random Effect Method, Hausman Test dan Granger Causality Test untuk menguji pembolehubah dalam kajian ini. Kajian ini menggunakan Eviews10. Berdasarkan penemuan empirikal, ekonomi digital mempunyai kesan yang signifikan terhadap pembolehubah yang telah digunakan. Langganan jalur lebar memberikan hubungan yang signifikan. Oleh itu, kita menyimpulkan bahawa langganan jalur lebar memberi kesan besar kepada ekonomi digital mengenai pekerjaan di Negara-negara ASEAN. Kajian ini menekankan aspek tertentu yang berkaitan dengan pekerja dan majikan. Kemudian hasil penyelidikan menjelaskan kesan ekonomi digital kepada pekerjaan dan bagaimana ia berkaitan dengan pekerja. Ia juga boleh digunakan sebagai persediaan pekerja untuk melalui era ekonomi digital dengan melihat hubungan antara kedua-dua dan akibatnya apabila seseorang diabaikan dan diabaikan. Di samping itu, kesan ekonomi digital juga telah dibincangkan untuk melihat realiti sebenar ekonomi digital di negara-negara ASEAN..

Kata kunci: *ASEAN, Ekonomi Digital, Data Panel, Pekerjaan, Fixed Effect, Random Effect*

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In the Name of Allah, the Most Forgiving, Most Merciful All praise and gratitude be given to Allah, Lord of the Lords, for giving me such a great strength, patience, courage, and ability to complete this study. The completion of this study would not have been possible without the contribution of a number of people that help and guide me to complete this research. To begin with, my highest appreciation goes to Dr. Sabri Bin Nayan, my amazing supervisor who has provided ultimate amount of encouragement and professional support. Thank you to my supervisor, Dr. Sabri Bin Nayan for your time, opinion, constructive suggestions and useful advices. Without your support, this research would not have been come into reality. Secondly, an honest gratitude and special thanks for my family that always give a support and motivation to finish this study. Moreover, I want to express a sincere appreciation to friends and staff of Universiti Malaysia Perlis who always gave a grate support during this research. Last but not lease, I hope this research will be of assistance of someone in the future despite this is the fundamental tool necessary for academic work. May Allah blessing be upon the readers for this research.

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TEMP	Total Employment
BROD	Broadband Subscriptions
WAS	Wages and Salary
GDP	Growth of Gross Domestic Product
USER	Internet Users

CHAPTER 1

INTRODUCTION

1.1 Background

The speedy growth in the economies of the East Asian and South-East Asian regions has happened in the last three decades. As stated by the World Bank (1993), the 23economies of East Asia raised at a closer average rate than all other regions in the world over the 1965-90 periods. The High-Performing Asian Economies (HPAE) such as Japan, the 4 Asian Tigers (South Korea, Taiwan, Hong Kong and Singapore) and the 3 South-East Asian freshly industrializing economies (Indonesia, Thailand, and Malaysia), have grown-up at a rate more than twice as quick as the rest of East Asia since 1960. It has been recommended that the stages of economic development in these eight High-Performing Asian Economies (HPAE) go along flying geese pattern (Kwan, 1994), which started with the miraculous growth of the Japanese economy, followed by Hong Kong, South Korea and Taiwan, and more lately by some countries from South-East Asia. There have been some studies (for example, Young, 1992, 1995; Easterly, 1995; Fukuda and Toya, 1995) which have studied the economic growth of the 4 Asian Tigers. As there has been little research regarding the all countries in the South-East Asian region, this paper focuses on the all the countries of the Association of South-East Asian Nations (ASEAN).

ASEAN's strong and vibrant economy, favorable demographics, ICT investments, and ongoing economic integration have laid the foundation for the region to become a global leader in the digital economy. The 6 largest economies in ASEAN (Indonesia, Thailand, Malaysia, Singapore, Philippines, and Vietnam) contribute 99% of the total ASEAN GDP.

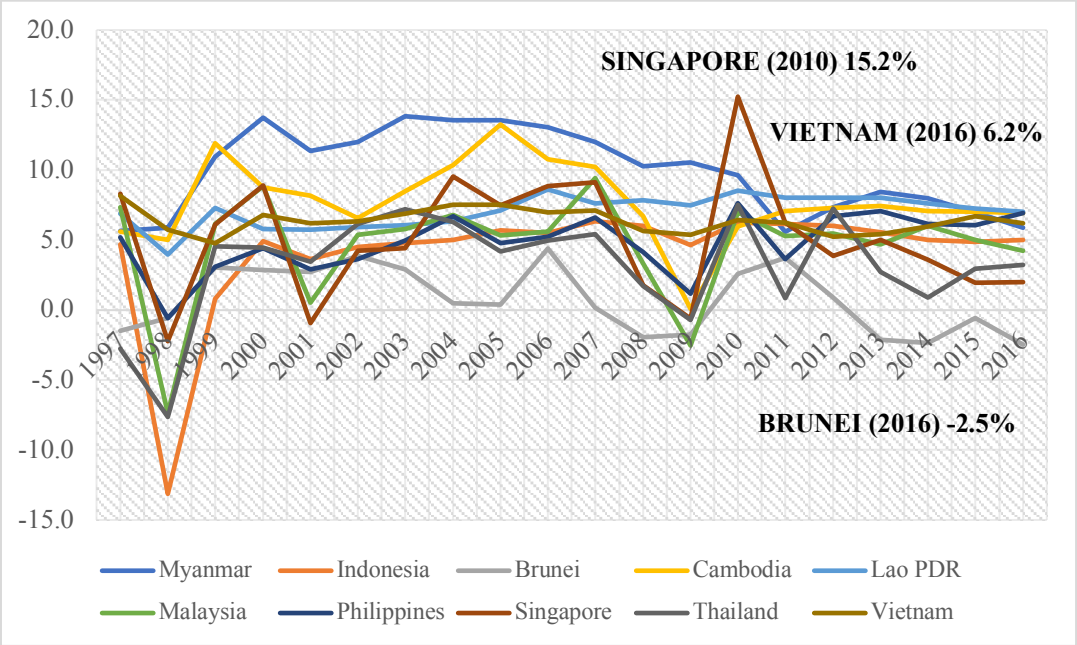

Figure 1.1: GDP Growth **(%)** of ASEAN Countries

The above graph show the GDP Growth (%) of ten (10) ASEAN Countries. It shows that Singapore was the highest percentage of GDP which is 15.2% for the year 2010. Where is the lowest percentage is Indonesia is -13.1% for the year 1998. The latest data (Year 2016) show Vietnam reported 6.2% which is the highest rate of GDP and the lowest is Brunei -2.5%.

The Association of Southeast Asian Nation is a territorial association including 10 Southeast Asian Countries which advances Pan-Asians, intergovernmental participation and encourages financial and political combination among its individuals and Asian states. Since its development on 8 August 1967 by Indonesia, Malaysia, the Philippines, Singapore, and Thailand, the association's enrolment has extended to incorporate Brunei, Cambodia, Laos, Myanmar, and Vietnam.

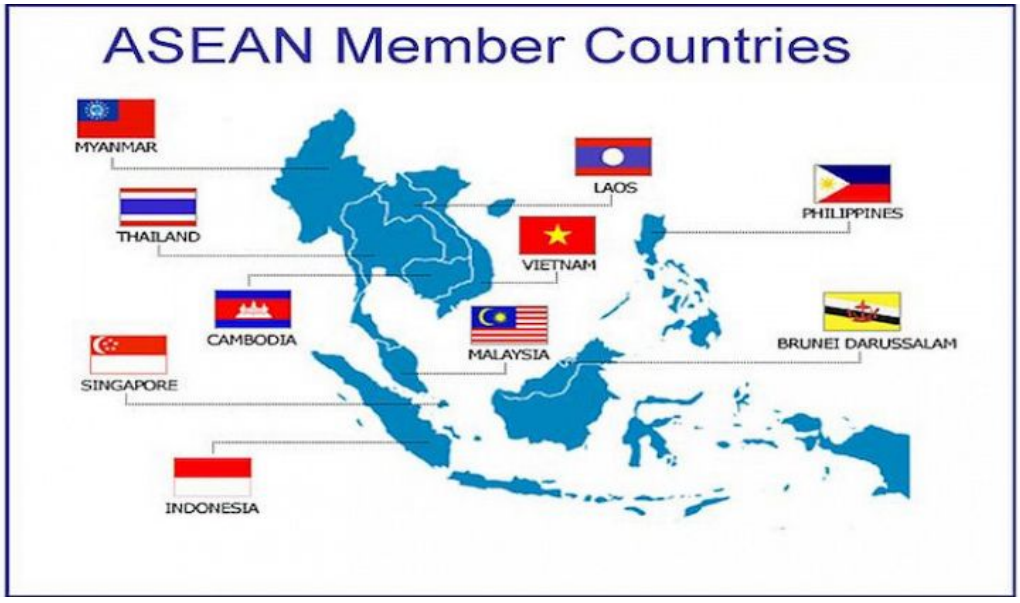

Figure 1: ASEAN Member Countries

1. Malaysia
2. Indonesia
3. Thailand
4. Cambodia
5. Laos
6. Singapore
7. Brunei
8. Vietnam
9. Myanmar
10. Philippines

The digital economy is the universal network of economic commercial transactions, activities and professional interactions that are allowed by information and communications technologies (ICT). It is the economic activity and transaction that consequence from billions of daily online connections among people, businesses, devices, data, and processes. The pillar of the digital economy is hyper connectivity which means rising interconnectedness of machines, organizations, and people that effect from the Internet, mobile technology and the internet of things (IoT).

The number of possible innovations such as opportunity set or state spaces is almost unlimited. Digital economy can be seen as a system containing of components and connections. Greater connectivity among actors and ideas creates more possible combinations through identification of existing opportunities and discovery of new ones.

Digital economy or 4th revolution has severe effects for job creation or destruction. There are, however, largely varying views on the extent to which broader application of Information and Communication Technology (ICT) and new digital technologies such as data analytics, artificial intelligence, 3D printing, cloud computing, the Internet of things (IoT) and robots will lead to the change, eliminate existing jobs, and create new activities, business and jobs. Besides automation, globalisation, economic developments and the changing favourites of procedures and consumers will also change labour demand and supply.

The digital economy also can be referring as economy that based on digital computing technologies. For example, of a digital economy is Amazon. This economy turns around high technology computing and the internet to communicate with consumers. The digital economy switches the traditional retail style financial transaction which is known as creative destruction.

Another example of a popular digital economy is e-Bay. E-Bay is a platform where peoples can purchase and sell goods and services. Peoples can also bid for the good. The website uses PayPal as their medium transaction. PayPal is an American company which drives worldwide and supports online money transfers and services an electronic version to traditional paper methods. Skilled labours are required to cooperatively use their knowledge to create a platform in order to support digital economies. This is showed that the introduction of digital economy decreases the unemployment rate.

The digital economy needs appropriately skilled labours. For example those people who are qualified in the technology sector, these peoples are usually in short supply. This means that the wage price increases as supply is less than demand. As wages increases, it will give people more motivation for them to train under the technology sector, these consequences in lower unemployment due to the many jobs created. This also fixes the problem of unemployment being central for those who are younger.

Increasing rate of the digital economy can also is the reason to the unemployment effect. This is because the traditional methods of retail, such as the shops on the high street, will soon be switch by the internet. The results showed in some workers losing their jobs, which lead to increasing in unemployment rate. Besides that, older workers would most probably impact from this issue. This is because they do not have the skills to move jobs into the digital economy. As we know, although the digital economy does create jobs, it also causes many jobs to be lost as well. As the internet is continuously growing very fast, these impacts should soon be obviously seen to the overall economy.

Digitalisation is also likely to change these usual activities (Marcolin et al., 2016). But new technologies and of Information and Communication Technology (ICT) are now also progressively heading to automation of other activities that have traditionally been considered unusual (Frey & Osborne, 2013).

For example, car navigation, hand-writing recognition, and translation have become regular tasks and automated through the use of data analytics (Veres et al., 2011; Plötz & Fink, 2009). Automation will expose jobs such as office and administrative support as well as transportation and logistics (Frey & Osborne, 2016).

There are also cognitive irregular activities that can be automated. For example, diagnosis of chronic disease and cancer treatments have been partially automated using data analytics on vast numbers of medical records for benchmarking and recognition of patterns (Cohn, 2013).

Many activities those are very hard to automate. In these activities ingenuity and social skills and talents play an important key (management, business, arts, media, education, healthcare, etc.). Digital economy is an innovation in the world economy resulting from technology changes in global investment in which binds new information technology to management activities and business (Wilken, 2003).

1.2 Problem Statement

Understanding the impacts of digital economy on employment in ten (10) ASEAN Countries would be significant to identify the digital economy impact on employment. Each country has different impacts of digital economy because of their geographical and the economic condition. These SMEs enterprises employed around 67% of all employees; generate 58% of the total turnover in EU and they are the engine of the economy (Calogirou et al. 2010). Digital economy creates potentials of better connections and network with employees and employer. While the companies leading driver for digital or new technology adoption, it can be expected improved in labour efficiency, the companies can have different motives – customer demands or to improve competitiveness and it also lead to the impact on employment (Xu & Quaddus 2009).

There is a significant positive association between broadband deployment and economic growth in the panel of OECD countries since the mid-1990s (Comin, Hobijn, and Rovito, 2008). There is a significant positive impact of broadband on employment growth in the US at *zip-code* level, there was no significant impact in their *state*-level regressions (Gillett et al. (2006). Broadband itself would have different type of capacity.

It depends to demand and supply. Some area is not support the broadband. The argument is would broadband give an impact on the employment. Both of these studies provide different results. Broadband should have a good impact on the job as it facilitates and launches all activities and tasks. Broadband capacity plays a role in affecting the work. The higher the bandwidth capacity, the greater the impact on the job. The location also plays a role in the provision of broadband services.

Such activities result in negative consequences for both the company and its employees (Lee, Yoon, & Kim, 2008). Chandran (2000), the result shows that respondents used the Internet for communication and information gathering. Internet user actually cannot determine the actual purpose usage of internet either they use of economic purpose or anything else. However, internet users have an impact on the job because in today's technology era, all the information is just at the fingertips. employees will get information via the internet. They also communicate through existing technology facilities such as email, video calls and another online medium.

In the investigation of India's aggregate growth profile, the findings showed a negative relationship (Ahsan Et Al., 2010). There is positive relationship between employment and growth of gross domestic product (Sodipe and Ogunrinola, 2011). In general, the digital economy will have a positive impact on a country's GDP. However, there is research that showed negative results to GDP and employment. Digital economy basically should have positive impacts on employment. It is because digital economy is a trending or new technology approach in economy. Therefore, a high technology may lead to positive economies development.

Classical Theory, believed that a cut in money wages and salary would increase employment and help in eliminating unemployment. Contradictory, (Hyslop and Stillman, 2007) difficult to explain, positive effects and the effects of minimum wages on labor supply, unemployment and inactivity of the economy. Logically, when a worker has a high level of technological skills, employer will pay higher compared a worker who have low skills or expertise in technology.

Employment rates will also decline due to digital economy because there will be a job destruction. Branham (2005) studies, employees have a feeling that it is not fair to get the same pay wages and salary as those who contribute far less to the organization or company and most importantly, workers or employees end up feeling completely neglected than.

Consequently, they start to reduce and decrease their working abilities and passion, pace and feeling based on the fact that they are earning the same wages and salary and are on the same level as their colleagues. Very important for the companies is the ability to benefit from that new strategy. If they do not have any benefits to the employee or employer are not being able to realize and estimate them properly, the incentives for future improvements and reaching more sophisticated levels of digital economy are low. All these lead to the impacts of digital economy on employment.

Latest issue of the impacts of Information Communication Technology (ICT) on total employment has become a major source of debate among both academics and policy makers. The study by Frey and Osborne (2013) showed that US jobs at risk due to the ability of machines to substitute humans in routine tasks the Information Communication Technology (ICT) revolution.

I decided to concentrate my research paper on ASEAN Countries because as we know currently the economy growth is highly developed in ICT. The rapid development on Internet and new technologies presumes continuously monitoring the changing conditions. Furthermore, I would like to focus on employment, because employees and employers relatively in between of the process of digital implementation and application now all the problems and benefits which have already faced and solved.

1.3 Research Objectives

The research objectives of this study are as follows:

i. To identify the impacts between broadband and employment in ASEAN country.
ii. To analyse the impacts between wages & salary[1] and employment ASEAN country.
iii. To justify the impacts between internet user and employment in ASEAN country.
iv. To justify the impacts between economy growth and employment in ASEAN country.

1.4 Research Question

The four main research questions to be answered in this study are as follows:

i. Does broadband give positive impact towards employment in ASEAN country?
ii. Does wages & salary give positive impact to employment ASEAN country?
iii. Does internet users significantly impacts to employment in ASEAN country?
iv. Does economy growth positively influence employment in ASEAN country?

[1] Wage and salaried workers (employees) are those workers who hold the type of jobs defined as "paid employment jobs," where the incumbents hold explicit (written or oral) or implicit employment contracts that give them a basic remuneration that is not directly dependent upon the revenue of the unit for which they work. (Source: World Bank Indicator)

1.5 Significant of the study

Due to the speedy development of the technology which plays the important role in today's economy, the research based on the impact of digital economy is clearly meaningful. There are some factors that influence the digital economy, for instance, GDP, technology & infrastructure, broadband, wages & salary and many more. Because the impact of economic growth on a country is great, good economic growth means that the country is moving in the right direction, and it is closely related to people's lives (Soares, 2004). If it is found that technology has important contribution to economic growth, the government should increase the scope of network business encouragement and the corresponding preferential policies, and vigorously develop network commerce. At the same time, the relevant company should strengthen legal supervision and improve their workers skills area, strengthen the protection of information security and property safety, to maintain the sustained and healthy development of the new economy. It is the complementary study for the regarding area at some extent.

Meanwhile, the study also explore more on the impact of digital economy on employment in ASEAN Countries such as GDP, technology & infrastructure, broadband, wages & salary. This study also can help to identify how the employees and the employers face the latest issues on digital economic pressure in the current situation. Should the workers treat the changes in technology as a personal problem towards the organization or economy.

This study would help to identify how workers can cope and adapt with the changes in technology. In some company or organizations, new methods of working and introduction of new technology is important in order to adapt up with the current economy and market trend. At the end of the study, I wish to determine whether those employees who are not ready for the challenges will be unskilled in their work and causes conflict in their job area. Finally this study also helps to whether digital economy significantly affect the employment.

1.6 Scope and Limitation of the Study

The main limitation of this study is the collection of data, which some of data in certain countries cannot be found in World Bank data. However the situation in these ten ASEAN countries can partly reflect the impact of digital economy on employment.

As we know, literature review is the most important part of any study because it helps to identify the scope of works that have been done so far in study area. In my study, there may be not much literature review on digital economy because this is consider as new area of study. If any, prior research on this area or slightly related to the technology or innovation can be consider as related topic as well. The main tool needed in this study was Eview10. I need to study on myself and from my friends. So far the latest version of this software was good and friendly.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter discussed about literature reviews from prior research to support this study where it separate into two parts:

2.1 Theoretical Review

The purpose of this form is to concretely examine the corpus of theory that has accumulated in regard to an issue, concept, theory, or phenomena. The theoretical review helps establish what theories already exist, the relationship between them, to what degree the existing theories have been investigated, and to develop new hypotheses to be tested. Often, this form is used to help establish a lack of appropriate theories or reveal that current theories are inadequate for explaining new or emerging research problems. The unit of analysis can focus on a theoretical concept or a whole theory or framework (Fink 2005).

2.2 Empirical Review

This form consists of an overview of existing evidence, pertinent to a clearly formulated research question which uses pre-specified and standardized methods to the identity and critically appraise relevant research and to collect, report, and analyse data from the studies that are included in the review. Typically, it focuses that on a very specific empirical question, often posed in a cause -and-effect form such as; “To what extent does variable contribute to another variable”.

2.1 Theoretical Review

The employment theories are broadly classified into two (2):

2.1.1 Classical Theory of Employment

Classical theory is a full-time job. The 'Great Depression' from 1929 to 1934, over the world in widespread unemployment, low spending and low national income, for about 5 years, disrupted classical theorists. This gave growth to the Keynesian work theory. The term classical economist was first used by Karl Marx to describe Ricardo's economic thinking and his predecessors including Adam Smith.

Classical economist, Keynes means followers of David Ricardo including John Stuart Mill, Alfred Marshal and Pigou. According to Keynes, the classical economy implies traditional or orthodox economic principles, which have been accepted, by and by renowned economists at that time. As Marshal's followers, Keynes himself has accepted and taught these classic principles. But he was aware of the laissez-faire doctrine. Both types of theoretical work are:

(a) The presumption of full employment and other productive resources, and

(b) Price easing and wages to bring full employment

2.1.2 Keynesian Theory of Employment

According to classical experts, there will be full employment in the free enterprise capitalist economy due to the Law Say operation and the wage price flexibility. This classic theory began under severe attacks during the Great Depression years of 1930 in the hands of J. M. Keynes. In this theory, he denied the notion of full employment and full employment suggest otherwise as a special case and not the general case.

Full employment is a temporary phenomenon, incidentally astrology. He thought of his theory is the 'public', that is, to use at any time. Then he baptized his book of creation: The General Theory of Work, Benefits and Money (1936).

Therefore, Keynes's theory can be classified as "general". Wages of the person working are equal to the price that will be lost if the work is reduced by one unit (after removing any other costs that will cause the decrease of this output); the subject, however, for the same eligibility can be disturbed, in accordance with certain principles, if competition and market break. The actual pay of one who works is just enough in the budget of a self-employed person to encourage the actual number of labour used to approach; subject to the requirement that equality for each labour unit may be interrupted by a combination of units that can work equally with the imperfections of competition that qualify the first postulate.

Destruction must be understood here to protect every kind of cause that may cause a man, or male body, to withhold their labour from receiving wages that give them utilities under certain minimum. Pigou's unemployment theory argues that unemployment is largely due to the wage policy that fails to adequately adapt to changing real demand for the workforce. When considering his own wage rates, he argued against the appeals of real salary reductions in advance by claiming that the theory he had developed so far indicated that they did not benefit, and the second was along the lines of 'no way to get a uniform wage reduction'. He kept the second argument 'in reserve' in a word credited to Schumpeter by W. H. Hutt.

2.1.3 Compensation Theory

Referring to Vivarelli and Pianta (1995, 2000, and 2004), this theory consists of different market compensation mechanism is triggered by changes in the technology itself and can offset the effects of trade on the initiation of the process of innovation. The mechanism of compensation through the new

machine is the same process innovation that replaces workers in the consumer industry, create new jobs in sectors where capital can be generated new machine.

2.1.4 Neoclassical Growth Theory

The neoclassical growth theory is an economic theory that explains how strong economic growth rates can be achieved with the right amount through three drivers such as labour, capital and technology. This theory also states that by changing the amount of labour and capital in the production function then the balance can be achieved. This theory also assumes that technological change has a huge impact on the economy, and economic growth cannot last without progress and improvements in technology.

2.1.5 Rogers' diffusion theory

This theory is the breakthrough or dissemination of technological innovation following the pattern of normal distribution. In this theory, it can be distinguished between five (5) segments of adapters, in which the theory holds fixed assumptions on the size, profiles and determinants of ad choice. According to Rogers (2003), the innovation or timing of a person's decision is assumed to be determined by the subjective perception of a set of product characteristics (relative advantages, complexity, compatibility, trial capability and observation). Innovators and early adopters, for example, are assumed to have higher perceptions.

2.2 Empirical Review

2.2.1 Employment

In a digital economy, employer or worker employment relationships have been reversed. Employees no longer live with single companies for their entire career. The key to ensuring occupational safety and earnings for new economic workers is to ensure that they are prepared with the skill base to move from one work to the next. The business shifts to smaller core employees, equipped with workers who depend on the skills that can be seen at the time.

Bryn Jolfsson and McAfee (2015) imply that jobs in the future will be superior to jobs in the present. Progress in digital technologies, they suggest, will mean 'less need to work doing boring, repetitive tasks and more opportunity for creative and interactive work'. Good jobs in the future will include creative writer, digital scientist and entrepreneur. While other less good jobs such as gardener and carer may persist (at least until digital technologies eliminate them), the economy will tend towards the creation of 'new and better' quality jobs. The latter out- come, in essence, will result from workers finding ways to complement digital technologies. The idea of society 'racing with machines, instead of against them as a route to economic and social progress.

As argued by Bergvall-Kåreborn and Howcroft (2014), however, Mechanical Turk (and other similar crowd employment platforms) has clear negative effects on the quality of work. Not only does it mean workers are assigned to dull and repetitive tasks, it also entails they are paid at rates well below the minimum wage and with no social protection. The platform enables firms to bypass normal labour standards, and by rendering workers as less visible and more remote, leads firms to ignore their moral responsibilities.

Mechanical Turk as a technology 'leveraged by capital to capture and alienate labour power'. It represents, in other words, a means to exploitation and profit.

World Employment Report in 2001 and 2002, many countries, the informal sector in the digital economy increasingly demanding labour and able to provide jobs for specialized workers only. By using the internet to run a business, fewer people are needed because of automated or dated works.

Few studies have investigated the relationship between different ICT applications and employment. The majority of these studies investigate the link between employment and broadband access or use using data at the municipality/county level (Crandall et al. 2007; Kolko 2012; Atasoy 2013). For instance, using county level data for the US for the period 1999-2007, Atasoy (2013) finds that broadband access is significantly positively associated with an increase in the employment rate.

The Future of Jobs, (2016) published by the World Economic Forum at Davos, covered 15 economies involving 1.86 billion workers grouped into 20 job families. The authors predict "a net employment impact of more than 5.1 million jobs lost to disruptive labour market changes over the period 2015–2020, with a total loss of 7.1 million jobs which is 2/3 of which are concentrated in the Office and Administrative job family and a total gain of 2 million jobs, in several smaller job families".

Whitley and Wilson (1982 and 1987), it examines multispectral dynamic models that are strictly aimed at study the effects of technological change on the compensation framework. In their first study, both authors predicted levels of work in 1990 for most British economic sectors and in their simulation compensation mechanisms could be more than compensate for the loss of early work due to the innovation process.

Boltho and Glyn (1995) describing data on OECD countries during the period of 1960-93. Their primary outcome of collecting estimates suggests that work or growth relationships are not so strictly from the standpoint of descriptive, but is supported by a simple econometric estimates (univariate and contemporary).

The positive correlation between GDP growth and employment growth has also been confirmed throughout the 1990-1993 contrary to the impression of unemployment growth due to the spread of ICT in the OECD economy.

Frey and Osborne's (2015) methodology and applied it to the UK economy. The Bank found that up to 15 million jobs are at risk of automation here in the UK. Occupations most at risk include – but are by no means limited to administrative, clerical and production tasks. Dons, Carl Benedikt Frey and Michael Osborne (2013) they suggest that "about 47% of total US employment is at risk" over the next decade or two, affecting routine and middle- income jobs, many of which are currently filled by graduates who did not take a technical degree.

The McKinsey Report on Disruptive Technologies (2014) suggests that applications of the 12 technologies discussed in the report could have a potential economic impact between $14 and $33 trillion a year in 2025. The authors conclude that as a result, "The nature of work will change, and millions of people will require new skills".

Berman, Bound, & Machin, (1998) arguments about the impact of technological change jobs almost as economic studies. It has taken on an "Information Communication Technology flavour in the last 20 years. Specifically, economists started in the early 1990s to explore the "skill-tendency technological change" hypothesis.

Refer to Autor (2013) they then moved on to the “polarizing” effects of ICT, recognizing that the effects the demand and applying for labour through its impact work composition.

However, in studied of Kroft and the Pope (2014) cannot prove that the rapid introduction of Craigslist's workplaces between the years 2005-2007 has reduced local unemployment rates over the same period.

The debate has been fuelled by a recent series of ‘future of work’ studies according to which up to half of the workforce faces a high risk of automation in coming decades (Frey and Osborne, 2017). Although the economic literature suggests that these recent risk assessments may be largely overstating the automation potential (Autor, 2015; Arntz et al., 2016), so far only few studies address the aggregate labour market consequences of modern automation technologies.

A more recent strand of the literature focuses on the effects of robots on the labor market. Graetz and Michaels (2015) show that industrial robots had no detrimental effect on aggregate employment in developed countries. A somewhat different result has recently been put forward for the US suggesting that regions using more robots experienced a negative effect on employment (Acemoglu and Restrepo, 2017).

Moreover, most studies so far rely on occupation-, industry- or region-level data. As has been recently highlighted by Acemoglu (2017), more firm-level evidence is necessary to take into account how firms deal with these new technologies. Among the few exceptions is Cortes and Salvatori (2015) who find no employment losses in firms specialized in routine tasks. However, they rely on routine intensity measures which again only capture technological change indirectly.

While most of this literature focuses on changing task- and occupational structures, Dorn et al. (2015) find that US local labour markets specialized in routine tasks did not experience employment declines whereas Gregory et al. (2016) document even a net positive impact on labor demand of RRTC across European regions. Studies on RRTC typically rely on the initial routine task intensity of occupations, industries or regions to estimate the effects of RRTC.

Refer to Abassi & Hollman (2000) employee turnover is the turn of the worker around the labour market between firm, job and work and between work and unemployment.

2.2.2 Broadband

Broadband can help people find jobs in a many ways. They can explore and searching for opening at the job announcement site, submit an application and resume online, and communicate with potential employers via e-mail. The existence of search methods has improved since the introduction of the Internet. Broadband is not just infrastructure. This is a common purpose of technology that can basically restructure the economy situation.

The impact of digital economics is a way of assessing the implications of broadband dissemination as it requires a more comprehensive view than just seeing the impact on individuals, firms or communities. The country level stage generation on previous broadband appears before technology has been implemented significantly even in developed countries.

Broadband can give an impacts to the way the organization's operate. There is a prove that shown on skilled-biased technological can change and Information and Communication Technology (ICT) developments are conservatively placed in this category because it needs certain skills to be employed.

Broadband can make workers to do systematic tasks more productive and efficient by providing access to resources and information. Those features reduce require for routine low skill worker tasks. As an Information and Communication Technology (ICT), broadband will accompaniment some high skilled tasks and alternate some low skilled tasks.

Study of Röller & Waverman (2001) concluded that telecommunications and infrastructure is the main key drivers to the economic growth. Other study shows very similar findings, representatives the strength of Röller & Waverman's empirical findings across time as well as across countries and regions.

Greenstein and McDevitt (2011) study, prior to the extensive availability of audio and video streaming, broadband Internet contributed about $ 28 billion in U.S. GDP. Almost half of this was due to the increase in households from dial-up services to broadband.

Choi (2011), Bagues and Labini (2009) show a positive impact on the impact of the Internet on individual employee market outcomes.

The empirical literature on the impact of broadband on individual productivity, which induces the macroeconomic growth effects has been effectively summarized in more detail by Cardona, Kretschmer & Strobel (2013).

Qiang, Rossotto & Kimura (2009) have suggested that the effect of better broadband penetration is even bigger. According to this study, each additional percentage point of broadband penetration results shows increase in the Gross Domestic Product (GDP) growth rate in high-income countries and even low- and middle-income countries.

Czernich et al. (2011); Kolko (2012); Holt and Jamison (2009) find that the relationship between broadband and economic growth, with some evidence

linking broadband infrastructure and the application of a higher increase in economic output.

Lehr et al. (2005) show that the effect of broadband on productivity or economic gain. One previous study concluded that the growth of broadband support in the areas of employment, business, and the intensity of the business in the IT sector is intense.

Gillett et al. (2006) discovered that broadband could generate job growth and business growth particularly the growth of Information & Communication Technology and anything related to business. In addition, they have no relationship with wage levels.

Wieck and Vidal (2001), studies have shown that there is a positive relationship between broadband investment and economic growth and employment.

Middleton and Chang (2008) study, research shows positive economic evidence about broadband usage is early and that there is little evidence to justify the benefits claimed. Middleton (2009) argues that the use of bandwidth may have a negative consequence in terms of increasing energy consumption through increased use of broadband devices.

It is also believed that broadband could increase the attractiveness of the nation to the "creative class" of informal workers and concentrate on human capital in enhancing global competition for talented workers (Dutta and Mia 2008).

2.2.3 Wages and Salary

The direct impact of labour-saving technology may be compensated in the labour market. Actually, in the neoclassical structure - with free competition and full reimbursement between labour and capital - technological unemployment showed a decline in wages and this will lead to a reversal of the change to more labour-intensive technology.

Workforce demand is not affected by some groups, work rates can be sustained only at lower costs (OECD 1996, pf 10 ff.). Therefore, technology may not radically decrease the labour demand as a whole, but it may alter the composition of the job or the type of workforce being requested.

Katz and Murphy (1992), Krueger (1993), Berman, Bound, and Griliches (1994), Danziger and Gottschalk (1995) and Autor, Katz, and Krueger (1998) wages and salary are inequality has raised dramatically over the past 20 years, and many economists believe that computer technology has played an important role in this process by dropping the demand for skilled workers, partly evident in reducing skilled work.

Hyslop and Stillman (2007) have proven the potential impact and impact of the introduction of teenage minimum wages in New Zealand on 16 to 19 working hours. It shows in parallel the Card and Krueger decisions in the U.S.

However, this decision is quite different. Hyslop and Stillman estimate the negative elasticity of work for teens, but these effects and impacts are more than offset by hourly work after the massive growth of teenage minimum wages began in 2000. They also found tremendous, and difficult to explain, positive effects and the effects of minimum adolescent wages on labour supply, unemployment and inactivity of the economy.

As we all know, today's technology has led to different jobs across the country in developed countries. In the early 1980s, employment was removed from middle-salary jobs towards both high-salary and low-pay jobs. Mid-salary distribution has been broadly known for the United States.

Referring to the World Bank Reported (2016) shows that the labour market has become more opposed to various developing countries since the mid-90s, with the skilled employment sections are reduced.

Studied by Hannan (2005) have found that there is a relationship between higher wages and employee work and turnover. The result shows that workers use higher efforts when their employer chooses to pay higher wages. Thus it will lead to the productive works and good company performance.

2.2.4 Technology and Infrastructure

Elmer (1999) shows digital economy can be obtain indicators in four areas: technology used, supply, demand and macroeconomic variables. Figuera (1999) develops a series of indicators related to aspects of infrastructure, number of Internet hosts, electronic technology and numbers of computers, modems and mobile phones.

According to Ipsos Insight (2006) clear change in the use of Internet is predicted for developing countries, where mobile phones are the primary way to access the Internet. The entire infrastructure of the Internet will be different there, and infrastructure should be built to provide the best user experience with the resources available. Internet access can affect the development of the whole community.

Kuo and Yen (2008) have reviewed the mobile internet users acceptance in Taiwan. Research findings suggest that users with high personal power of innovation who are willing to accept new technologies seem to be easier to

use than other users. It also shows that the key factor in improving consumer behavioural intentions to use mobile 3G value-added services is attitude, followed by friendly and easy-to-use, cost-effective and clear cost.

Different in developing countries. These factors will determine the rate of acceptance and or failure of the cellular services especially in relation to financial transactions. Mobile phones are equipped with support facilities in connecting the physical world to mobile internet. According to Browne (2007) device features such as camera read barcodes and pre-installation applications allow users to get live content and services online.

2.2.5 Growth of Gross Domestic Product (GDP)

Ahsan et al. (2010) argues that higher jobs are usually not associated with higher per capita GDP. In their investigation of India's aggregate growth profile, the findings showed a negative relationship. This study was conducted on the rate of poverty, employment, and working age population and observed over a ten year period corresponding to 1983-1993 and 1993-2003.

Hull (2009), in her study of the relationship between economic growth, employment and poverty reduction, identifying sectors as 'productive' and 'unproductive', so growth in the sector will not directly bring common benefits to all sectors of the economy.

The World Bank (2005), in its study of 14 countries, states that the three countries experiencing pro-poor growth have seen more labour-intensive growth. In the analysis of other country-specific panel data for the manufacturing industry carried out in eight Central and Eastern European countries, work is fully linked to output, mostly in the medium and low sectors (Onaran 2008).

The structure of economic integration also has a major impact on the employment index and wages. Reinert and Kattel (2004) stated that the European qualitative change from Listian symmetry Listian integration to integrative and asymmetric integration leads to structural change in direction to the wider distribution of wages and wages as a GDP percentage in favour of subsidized finance, insurance, and property.

The World Bank (2006) reports that the effects of volatility in economic growth on employment growth in Turkey have been investigated suggesting no significant relationship between economic and employment uncertainties. Copying monetary and fiscal policy implications on work also results in the adjustment of the labour market through pay adjustments rather than jobs.

Taymaz (1998) indicating that the elasticity of wages found to enable the economy to react to changes in macroeconomic conditions. The results are also obtained using the economic model for the manufacturing industry, an important macroeconomic variable for job generation. Studies show that real interest rates and high real exchange rates are an important indicator of capital inflows and real wage increases have an important impact on the performance of the manufacturing industry.

As more and more energy in an open economy, it can also be linked to economic and social development. Despite the increase in energy prices, foreign exchange rates (Agenor & Monteil, 1996), in sufficient global forecasts (Harrop, 2000), while increased import costs, it may reflect inflation in producing countries or exporters to importing countries (Kibritcioglu & Kibritcioglu, 1999).

2.2.6 Internet User

Over the years, many studies have shown steady growth in adapting computers. Providing inspiration from government and reasonable

computer availability has resulted in an increase in computer penetration among peoples growing steadily. Their use of computers has been used for the basic use of internet browsing, finding documents, doing tasks, discovery materials and using computers for entertainment such as playing games, watching movies, online shopping and so on.

An increase in Internet penetration is important for increased broadband penetration. Overall showed a decrease in cost due to the overwhelming competition among service providers. Broadband penetration also increased due to continued efforts.

Individuals who use laptops consistently increase steadily, this is not automatically translated to out-of-home use because its use is still widely used at home. Over the years, many studies have shown steady growth in adapting computers. Providing inspiration from government and reasonable computer availability has resulted in an increase in computer penetration among peoples growing steadily. Their use of computers has been used for the basic use of internet browsing, finding documents, doing tasks, discovery materials and using computers for entertainment such as playing games, watching movies, online shopping and so on.

An increase in Internet penetration is important for increased broadband penetration. Overall showed a decrease in cost due to the overwhelming competition among service providers. Broadband penetration also increased due to continued efforts. Individuals who use laptops consistently increase steadily, this is not automatically translated to out-of-home use because its use is still widely used at home.

Internet users are psychological communication theories that emphasize how people use the internet. It explains how internet users use mass media to meet their needs and wants. They seek to determine the key motives for the use of individual media and to identify the positive and negative effects of individual media use (Katz et al 1974).

The primary basis of internet users is the individual social and psychological needs and intentions to communicate, their communications, and the importance of the show (Rubin 2002). Katz et al. (1974) describes the internet user approach to media research as a social and psychological root, desire, generating, potential, mass media and other sources, leading to, the difference in media exposure patterns, resulting in, requiring satisfaction and other consequences, perhaps most undesirable.

Tsai and Lin (2003) study showed that teenagers shown most of the sign of Internet addiction. They state that they are addicted to the message and activities on the Internet, but not the Internet as a medium as the Internet helps them to release their emotions. Refer to Asemi (2005) study information search habits of Internet users at the University of Medical Sciences, Isfahan, Iran, and the findings show that people get quality information through the Internet.

Oyedun (2007) pointed out the use of Internet research at the Federal University of Technology Library, Minna, and detected that many respondents demanded that through Internet services in libraries, they had improved significantly in their academic performance. Chandran (2000) shows that, in S.V University, Tirupathi, shows that most respondents use Web services and Internet e-mails. Additionally, the study also found that more than 25% of respondents used the Internet for 2 to 3 times a week, while they were using the Internet for communication and information gathering. The finding by Kaur (2000) concludes that slow internet connection is a the main problem faced by internet users. However, he agreed with Kumar and Kaur (2005).

2.2.7 Digital Economy and Employment

After discussing the classification of new economic jobs, and employment relationships, eventually turning to the relationship between the two variables. Digital economic growth may have direct and indirect impact on the labour market as well as the composition of the work.

Digital economy can produce or create more knowledge-based products, it may lead to broad changes in the labour market, changing the composition of the labour needed to produce and deliver a product or service. There will be changes in the type of skills required.

A study by Harris and Krueger (2015) on working of online intermediaries in the “gig economy” identifies about 600,000 "independent workers" in the USA, which is about 0.4% of US employment. This number is estimated to be growing rapidly.

Another study that Hall and Krueger did in conjunction with Uber’s research chief was on the income of crowd workers in the US. The study reveals that an Uber driver’s gross income is $17.50 an hour on average. That study of gross earnings was based on October 2014 data, before Uber further lowered fares in 48 cities. But after subtracting the cost of gasoline, insurance, and auto maintenance, many drivers say they earn net just $10, $11, or $12 an hour.

As a result of rising digitalisation which provides a shared new communication as well as collaboration infrastructure and crowd- sourcing as an alternative concept of organising, a novel form of digital work has emerged; i.e. crowd work. Due to the fact that crowd work describes a new form of work, it is located at the inter- section of digital and paid work. On the one hand, paid work is the cornerstone of any economy or labour market (Kittur, Nickerson et al. 2013) and therefore in focus of Crowd Work as well. On the other hand, the vast majority of people enter any kind of

employment for their own subsistence. Likewise, people perform crowd work to earn monetary rewards. The intrinsic motivation to participate usually plays a minor role.

More recently, based on aggregate data for 27 EU countries, Evangelista et al. (2014) find that ICT usage has a positive and significant impact on labour productivity. At the same time several other dimensions of digitalization lead to an increase in manufacturing employment. So far there is no consensus about the effects of different types of ICT on employment and labour productivity.

The findings of Sharma and Gupta (2001 and 2003) show that faster rate of innovation and dissemination can also be attributed to higher job earnings. This can create more aggression as employees need to improve their skills over time. This may result in a redistribution of labour to the change of economic needs.

Another important change is that Information and Communication Technology (ICT) takes place in jobs in the economic sector. Changes occur due to salary separation around skills, demand for special capabilities. Businesses will cover the cost of Information and Communication Technology (ICT) including the new application costs, developer time, software license, hardware or software, support and maintenance costs, and business costs related to the transition to the new system and so on.

The challenge is still to predict the cost of support and maintenance for new technologies, business costs associated with making the transition to the new system and other hidden costs. According to Penbera (1999) the rapid development of technology changes, it is increasingly difficult to determine the long-term impact of any technological options.

CHAPTER 3

METHODOLOGY

3.0 Introduction

This chapter presents the data and methodology used in this study. The discussion is divided into 5 sub-sections such as Research Framework, Data Descriptions, Hypotheses development, Variable specification and Research Design.

3.1 Research Framework

This section identifies the independent and dependent variables for this study. The research framework is constructed as follows:

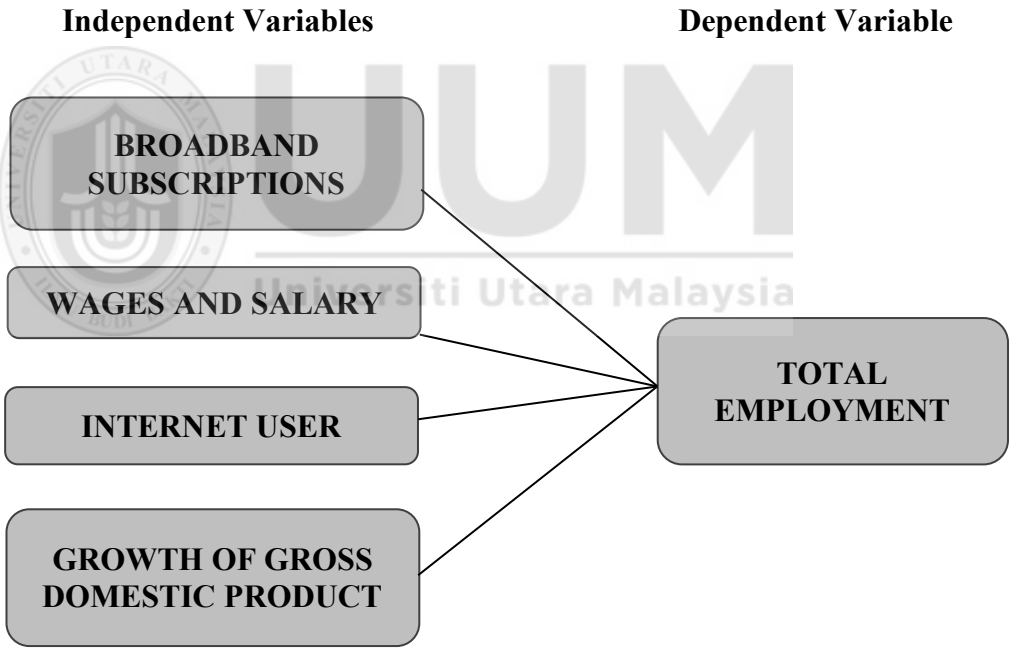

Figure 2: Theoretical Framework

3.2 Data Descriptions

3.2.1 Data Sources

In this study I used secondary data. This study examines the impact of digital economy on work. Therefore, all data is obtained from World Development Indicators and Indicators from World Bank Data. For secondary data for research, information is collected through an online review journal article related to research topics. These data are mostly obtained online, academic reference books, magazines and newspapers.

3.2.2 Data Collection

All the data collected from 10 ASEAN Countries which is Malaysia, Indonesia, Thailand, Cambodia, Laos, Singapore, Brunei, Vietnam, Myanmar and Philippines. The data is from 1997 – 2016, 20 years observations. The data & information are collected from World Bank Indicators and Jobs, such as Total Employment and other variables include Growth of Gross Domestic Product, Broadband Subscriptions, Wages & Salary & Internet User. The study used a comparative approach. The analysis involves Descriptive Analysis, Ordinary Least Squares (OLS) regression, Fixed Effect Model, Random Effect Model, Hausman Test & Granger Causality Test. Our computational device is the E-view software (version 10+).

3.3 Hypotheses Statement

Refer to the Creswell hypothesis (1994) is the official statement that shows the possible relationship between dependent and independent variables. Referring to Macleod Clark J and Hockey L (1981), the hypothesis is a statement or explanation recommended by the study or observation but has not been proven or rejected.

3.3.1 Relationship between Broadband Subscriptions and Employment

Kolko's (2012) study on broadband contribution to local economic development studied broadband causal relationship to employment, and specific industries likely to be affected by the presence of faster networks. The reason why broadband could have the impact of dropping communication costs. Study also hypothesized that effects on employment could be either positive in terms of the need to hire more labours, or negative in terms of using technology to replace workers. It also contain an important discussion of how the relationship between broadband subscriptions and employment could different by countries and how it could hypothetically have a negative impact as technology is used as a substitute for labour.

H_0 : There is no relationship between broadband subscriptions and employment.

H_1: There is significant relationship between broadband subscriptions and employment.

3.3.2 Relationship between GDP and Employment

Sodipe and Ogunrinola (2011) who observe that there is positive relationship between employment and growth of gross domestic product. But while their study finds that this relationship is significant, our own conclusion is that the relationship is not significant, the foreign private capital has negative and significant impact on employment. The public expenditure variable is positive and significantly related to employment in Nigeria. This is against Olapade and Olapade (2010) who observe that there is no significant relationship between employment and growth of gross domestic product.

H_0 : There is no relationship between GDP and employment.
H_1: There is significant relationship between GDP and employment.

3.3.3 Relationship between Wages & Salary and Employment

The relationship between wages & salary and employment has been a great argument between Keynes and classical economist's theory. Classical economists believed that a cut in money wages and salary would increase employment and help in eliminating unemployment. Keynes stress-out that labours would strongly struggle any trial to reduce wages and salary, though they might be ready to agree to reduce in real wages & salary due to increase in prices.

H_0 : There is no relationship between wages & salary and employment.
H_1: There is significant relationship between wages & salary and employment.

3.3.4 Relationship between Internet User and Employment

Rogers (2003) argues that the implement of one new idea may cause the adoption of several others in a cluster which consists of one or more distinguishable elements of technology that are perceived as being interrelated". The technology cluster concept has been used to examine the adoption of videotext (La Rose and Atkin 1992), Digital (Eastin 2002) and Mobile Commerce (Yang, 2005). This concept posits that consumers are likely to adopt a technology offering the same functions as those already adopted. Mobile commerce is a technology developed from computers and communication technologies so consumers who adopt cell phones, PDA, notebook computer or on-line shopping, should be more likely to adopt M-Commerce.

H_0 : There is no relationship between internet user and employment.

H_1: There is significant relationship between internet user and employment.

3.3.5 Alternate Hypotheses

i. There is significant relationship between broadband and employment
ii. There is significant relationship between GPD and employment.
iii. There is significant relationship between wages & salary and employment.
iv. There is significant relationship between internet user and employment.

3.4 Variable Specification

3.4.1 Dependent Variable

Employment may be defined as an aged person engaged in any activity to produce goods or provide services for pay or profits, whether at work during the reference period or not working due to temporary absence from work, or working hours of arrangement. The dependent variables on this research are the number of jobs indicating the amount used in the 10 ASEAN Countries.

Dependent Variable for this study is TEMP which is Total Employment for 10 ASEAN Countries (Malaysia, Indonesia, Thailand, Cambodia, Laos, Singapore, Brunei, Vietnam, Myanmar and Philippines) from year 1997-2016 (20 years). The data sources is from International Labour Organization, ILOSTAT database, using World Bank population estimates. Labour data retrieved in March 2017.

3.4.2 Independent Variables

Digital economics can be measured through various variables, all of which are relatively relevant to one another. To analyse the effects of digital economy, the relative impact of some independent variables. The independent variables are also from 10 ASEAN Countries from 1997-2016 (20 years); (1) BROAD (Broadband Subscriptions) refers to fixed broadband subscriptions to high speed access to the public Internet. (2) USER (Internet Users) refers to Internet users who have used the Internet (from any location) within the last 3 months. The internet can be used via computers, cell phones, personal digital assistants, game machines and digital TVs. The sources of both independent variable data are from the International Telecommunication Union, the World Telecommunication Telecommunications Report and the database.

Another free variable is (3) WAS (Wages & Salary). It refers to the workers who pay the job. Data sources are from ILOSTAT International Labour Organization, a database obtained in November 2017. (4) GDP (Growth of Gross Domestic Product) is another independent variable in this study. It can be defined as a percentage of GDP growth rate at market prices based on fixed local currency. Data sources from World Bank Country Account Data and OECD Country Account data files.

3.5 Research Design

3.5.1 Descriptive Analysis

In this study, I used descriptive analysis to explain the basic characteristics of the data. It will show a brief summary of the samples and the steps. In addition, descriptive analysis illustrates the data required to determine the normalization of distribution, data descriptions are required because the nature of the technique used to analyse the data analysis depends on the characteristics of the data.

Mean

The Mean is the most commonly used methods of describing a central tendency. It represents the centre of gravity of distribution. Each score in a distribution contributes to the determination of mean. It is also known as arithmetic average. Refer to Krishnaswamy & Ranganathan (2006), mean is the average of all values in a distribution.

Standard Deviation

Standard deviation shows the correlation between the mean score and the sample mean. The standard deviation is expressed as a positive square root of the sum of the squared aberration from the mean divided by the sum of the minus one. This is the average difference between the observed value

and the mean. Standard deviation is used when declaring deployment in the same unit as the original measurement. It is set as (σ).

Standard deviation can be calculated using the following formula:

$$\sigma = \frac{i\sqrt{\Sigma fx^2}}{N}$$

Where,

σ = Standard Deviation (S.D.)

i = length of class interval

Σ = sum of

x^2= squares of the deviations of scores from the assumed mean

f = frequency of class interval

c^2 = square of correction

N = total number of scores

3.5.2 Panel Ordinary Least Square (POLS)

This study uses regression of the Panel Ordinary Least Square Panel (POLS) that is aligned to a steady standard error since countries have both cross-sectional data and time series. Panel Ordinary Least Square Panel (POLS) is a common linear modelling technique that can be used to model a single response variable that has logged in at least interval scale. However, panel data is unstable as some data in certain countries and year observations are lost. The minimum regular regression model (POLS) can be interpreted by inserting multiple variables to easily add independent variables to the equation.

This study uses the Panel Ordinary Least Square Panel (POLS) model because the normal normalized estimator (POLS) is approximately equal to the large sample even if it is not suitable for errors (Vijverberg and Hasebe, 2015).

To illustrate how the study was structure into a statistical model, we begin by examining econometric models.

$$\boldsymbol{Log = Log\beta X_0 + Log\beta X_1 + Log\beta X_2 + Log\beta X_3 + Log\beta X_4}$$

The empirical model of this study is written as:

LogY= ***Log*βX0 [TEMP]** + **[BROAD]** ***Log*** βX1 + **[WAS]** ***Log***βX2 + **[GDP]** ***Log***βX3 + **[USER]** ***Log***βX4

Where:

TEMP : Total Employment

BROAD : Broadband

WAS : Wages and Salary

GDP : Growth of Gross Domestic Product

USER : Internet Users

3.5.3 Fixed and Random Effect Model

There are three (3) methods to reject unobservable heterogeneity, fixed effects model, random effects model and finally use Hausman Test. The effect regression model is still used to reduce the tendency of selection in estimating causal effects in observation data by removing most of the variations that are deemed to contain misleading factors. Refer to (Wooldridge (2010), Allison (2009), the units in the panel data set it thinks vary systematically from one another in an unknown way that affects the resulting interest, the fixed effect of the units is often used as they removes all of the variation units, creating the estimated average of the effect of variables in units over time.

In Fixed Effect Model, $Yit = \alpha i + \beta Xit + \varepsilon it$ $i=1,2,....n$ $t=1,2,....T$

Where:

Xit = observable variables that changes across i only, across t only or across i and t.

αi = the unknown intercept (the individual effect) for each entity (so there are n entity- specific intercepts).

εit = the idiosyncratic errors and change both across entity (i) and time (t)

With time varying covariates, fixed effect is stable in any case whether it is correlated or not. Even though the impact of βXit which is the time invariant observed variables and their coefficient at least the effects can be controlled by including εit. Time invariant variables is allowed to correlate with the time fluctuating variables

The random effects model assumption made by the fixed impact model (Hunter & Schmidt, 2000). Estimates of certain parameters will differ from others. Impression models are basically chosen for their convenience in handling and normalizing heterogeneity in error terms. In other words, we can classify the random effects model is different from the fixed effects model. This country is seen as a random variable that forms part of the larger nation population. Otherwise, Random Effects is not, until Permanent Effect is usually known as a larger tool in economic analysis to estimate all other variables remain the same.In Random Effect Model,

$Yit = \beta Xit + uit,$ where $uit = \alpha i + \varepsilon it$

Where:

αi = assumed to be uncorrelated with Xit , the between-entities component of the error term

εit = the within-entity component of errors

By using random effects the variance can design together between cross-sectional entities by allowing the intercept to change. In fixed effects model, it discovers differences in error variances. In other word, random effects model estimates that the effects of *X*it and *uit* on *Y*it are constant. $uit = \alpha i + \varepsilon it$, so that indicates equivalent assumption of the model of the error variance εit .

3.5.5 Hausman Test

In this study, the Hausman test is used to make comparisons between two estimators of different model parameter parameters. The Hausman test describes the test for model exclusions. In panel data, the Hausman test is used to choose between fixed effect models and random effects models. The zero hypothesis is the preferred model is a random effect. The alternative hypothesis is that the model is a constant impression. Basically, the test will show whether there is a correlation between unique error and regression in the model or not. The zero hypothesis is that there is no correlation between the two.

Allow δRE to represent RE estimation vectors without coefficients on time variable or aggregate time variables and let δFE show FE convention vector.

In Hausman Test Regression,

$H = (\delta RE - \delta FE) [\text{AVAR} (\delta RE) - \text{AVAR} (\delta FE)]^{-1} (\delta RE - \delta FE)$

It has chi² with *M* degrees of freedom asymptotic distribution. Where *M* is the number of coefficients that creates statistical substantiation in that failed to reject the exogeneity (articulated in such a way that a variable or variables is exogenous for parameter α) of undetected individual effect in random effect model. Conversely, fixed effect model reject the exogeneity assumption.

3.5.6 Granger Causality Test

Granger Causality is a method for studying casual links between random variables (Granger, 1969). *Causality* is closely related to the idea of cause-and-effect, although it isn't exactly the same. A variable X is causal to variable Y if X is the cause of Y *or* Y is the cause of X.

However, with Granger causality, it can be testing a true cause-and-effect relationship; What you want to know is if a particular variable comes before another in the time series. In other words, if you find Granger causality in your data there isn't a causal link in the true sense of the word. When econometricians say "cause," what they mean is "Granger-cause," although a more appropriate word might be "precedence" (Leamer, 1985).

Granger causality (G-causality) analysis provides a powerful method for achieving this, by identifying directed functional ("causal") interactions from time-series data. G-causality implements a statistical, predictive notion of causality whereby causes precede, and help predict, their effects. It is defined in both the time and frequency domains, and it allows for the conditioning out of common causal influences (Seth, Barrett, and Barnett, 2015).

CHAPTER 4

DATA ANALYSIS AND FINDINGS

4.0 Introduction

This chapter discusses the results of the relationship between impacts of digital economy on employment in 10 ASEAN Countries for 20 years (1997-2016) observations. The empirical results and discussion are divided into the following subsection such as Panel Data, Descriptive Analysis, Ordinary Least Square (OLS), Fixed & Random Effect Model, Hausman Test and Granger Causality Test.

4.1 Panel Data

The panel data set is one where there is frequent observation on the same unit (Gujarati 2003). Refer to MaCurdy (1981) the advantages of panel data compared to other models including its ability to control the effect of the wrong variable. Hsiao, Mountain & Ho Illman (1995) flexibility to enable accurate parameter adjustment, as well as reduction of measurement errors (Hsiao 2006) and flexibility to focus on the specific effects of their respective countries (Gujarati 2003).

First, the descriptive and dependent variable analysis is shown. Results and findings are divided into three (3); which is a panel data model, the Regular Regular Regression (OLS), Fixed Effects Model and Random Effect Model and Hausman Test were explored in this study to get results and study the relationship model.

4.2 Descriptive Analysis

The descriptive analysis are presented in Table 4.2. This table shows the overall mean, standard deviation, maximum and minimum values for all the variables used in the analysis.

Table 4.2: Descriptive Analysis Result

Variables	Mean	Standard Deviation	Minimum	Maximum	N
TEMP	7.098043	0.734834	5.186295	8.080395	140
WAS	1.565190	0.299254	0.732394	1.977724	140
USER	0.984076	0.809834	-1.618629	1.908485	140
BROAD	5.133099	1.312200	1.397940	6.970123	140
GDP	0.716010	0.323336	-1.061996	1.141261	140

As shown in table 4.2 descriptive analysis that variable have 140 observations. TEMP (Total Employment) has mean value of 7.098043 while the maximum is 8.080395and minimum is 5.186295. The standard deviation of TEMP (Total Employment) is 0.734834. The mean for WAS (Wages & Salary) & USER (Internet User) are 1.565190 and 10.984076 and their standard deviations are 0.299254 and 0.809834 respectively. GDP (Growth of Gross Domestic Product) has 0.716010 mean and the standard deviation is 0.323336. The mean value for BROAD (Broadband Subscriptions) is 5.133099 while maximum value is 6.970123 and minimum value is 1.397940 where standard deviation is 1.312200.

The standard deviation measures how concentrated the data are around the mean; the more concentrated, the smaller the standard deviation. The result shows that BROAD shows the highest standard deviation (1.312200) while WAS shows the lowest standard deviation (0.299254).

4.3 Panel Ordinary Least Square (POLS)

Table 4.3: Panel Ordinary Least Square (POLS) Regression

Variables	Coefficient	Std. Error	T-Stat	Prob.	N
WAS	-0.851110	0.198401	-4.289851	0.0000	140
USER	-0.182799	0.088858	-3.013986	0.0031	140
BROAD	0.182799	0.054912	3.328980	0.0011	140
GDP	0.366718	0.176195	2.081314	0.0393	140
C	7.492844	0.478172	15.66975	0.0000	140
$R^2 = 0.337012$	Adjusted $R^2 = 0.317368$				

Multiple linear regression result obtained as follow:

$$\boldsymbol{Log}\mathbf{Y} = \boldsymbol{Log}\boldsymbol{\beta}\mathbf{X0} + \boldsymbol{Log}\boldsymbol{\beta}\mathbf{X1} + \boldsymbol{Log}\boldsymbol{\beta}\mathbf{X2} + \boldsymbol{Log}\boldsymbol{\beta}\mathbf{X3} + \boldsymbol{Log}\boldsymbol{\beta}\mathbf{X4}$$

LogY = [TEPM] *In*βX0 + [BROAD] *In*βX1+[WAS] *In*βX2+[GDP] *In*βX3+[USER] *In*βX4

Y = 15.66975 (TEMP) + 3.328980 (BROAD) + 2.081314 (GDP) -3.013986 (USER) - 4.289851 (WAS)

Se = (0.478172) (0.176195) (0.054912) (0.088858) (0.198401)

t-Stat = (15.66975) (3.328980) (2.081314) (-3.013986) (-4.289851)

Prob. (0.0000) (0.0031) (0.0011) (0.0393) (0.0000)

N = 140

From the table 4.3 POLS the t-stat showed how extreme a statistical can be estimated. t-Stat is used in a t-test to decide whether to accept or reject the null hypothesis. To find the degree of freedom from the observation the formula is N-K-1

Where, N =No. of units in the sample K = Independent Variables

Thus, $d.f = 140 - 4 - 1$ and $d.f = 135$

In this study, degree of freedom is 135. As a results, due to the value of t-statistic for the variables is +/- 1.9777 critical value based on 0.05 (5% confidence level for 2 tails), internet user, wages & salary, broadband subscriptions and gross domestic product have a significant relationship with employment. So, all variables resulted 0.05 levels of probability and it can be considered for testing the hypothesis. The coefficients show that many dependent variables are expected to increase or decrease. If the coefficients show a positive value it means an increase and decrease if the coefficients show a negative value when the independent variable increases or decreases by one. The coefficients also show how much dependent variables are expected to rise when independent variables increase by one, holding all other independent variables.

4.3.1 Relationship between Broadband Subscriptions and Employment

The result shown in Table 4.3 POLS Regression, reflect that broadband subscriptions has positive relationship with employment of 10 ASEAN Countries. This indicate that 1% increase in broadband subscriptions causes 0.18% increase in employment with the economic assumption of the other variables are remain constant. Based on the significant level 5%, the null hypothesis that broadband subscriptions has an insignificant relationship is rejected. As a results, broadband subscriptions has significant relationship with the employment in 10 ASEAN Countries.

4.3.2 Relationship between Wages & Salary and Employment

Refer to the result shown in Table 4.3 POLS Regression reflect that wages & salary has negative relationship with employment of 10 ASEAN Countries. This indicate that 1% increase in wages & salary causes 0.85% decrease in employment with the economic assumption of the other variables are remain constant. Based on the significant level 5%, the null hypothesis that broadband subscribers has an insignificant relationship is rejected. As a results, wages & salary has significant negative relationship with the employment in 10 ASEAN Countries.

4.3.3 Relationship between GDP and Employment

Table 4.3 POLS Regression show the result reflect that GDP (Growth of Gross Domestic Product) has positive relationship with employment of 10 ASEAN Countries. This indicate that 1% increase in GDP (Growth of Gross Domestic Product) causes 0.37% increase in employment with the economic assumption of the other variables are remain constant. Based on the significant level 5%, the null hypothesis that GDP (Growth of Gross Domestic Product) has an insignificant relationship is rejected. As a results, GDP (Growth of Gross Domestic Product) has significant positive relationship with the employment in 10 ASEAN Countries.

4.3.4 Relationship between Internet User and Employment

The results shown in Table 4.3 POLS Regression reflect that Internet User has negative relationship with employment of 10 ASEAN Countries. This indicate that 1% increase in Internet User causes 0.27% decrease in employment with the economic assumption of the other variables are remain constant. Based on the significant level 5%, the null hypothesis that Internet User has an insignificant relationship is rejected. As a results, Internet User has significant positive relationship with the employment in 10 ASEAN Countries.

4.4 Fixed & Random Effect Model

Table 4.4 (a) Fixed Effect Model Result

Variable	Coefficient	t-Statistic	Prob.
WAS	0.087435	4.158761	0.0001
USER	0.005991	0.916915	0.3609
BROAD	0.032418	6.946344	0.0000
GDP	-0.013896	-1.767500	0.0796
C	6.798841	245.8851	0.0000
R^2	0.999081		

From the Table 4.4 (a) Fixed Effect Model shows that BROAD (Broadband Subscriptions) and WAS (Wages & Salary) are statistically 0.0000 significant level for BROAD (Broadband Subscriptions) and 0.0001 significant level for WAS (Wages & Salary) unlike the rest of other independent variables USER (Internet User) and GDP (Growth of Gross Domestic Product). R^2 for Fixed Effect Model is 0.99081 which is 99.08% explain the dependent variable and 0.92% is explained by other factors which are exclude in this study.

Table 4.4 (b) Random Effect Model Result

Variable	Coefficient	t-Statistic	Prob.
WAS	0.086321	4.107621	0.0001
USER	0.005768	0.882838	0.3789
BROAD	0.032650	6.998696	0.0000
GDP	-0.013725	-1.747129	0.0829
C	6.733028	27.44866	0.0000
R^2	0.738587		

From the Table 4.4 (b) Random Effect Model shows that BROAD and WAS are statistically 0.0000 significant level for BROAD and 0.0001 significant level for WAS unlike the rest of other independent variables USER and GDP. R^2 for Fixed Effect Model is 0.738587 which is 73.86% explain the dependent variable and 26.14% is explained by other factors which are exclude in this study.

Two tails p-value test the hypothesis that each coefficient must different from 0. To reject this, the p-value has to be lower than 0.05 (95% we could also choose α =0.10). This results shows that BROAD and WAS has significant positive relationship with the TEMP. Conversely, GDP and USER shows insignificant relationship on TEMP.

4.5 Hausman Test

The purpose of Hausman test is used to choose between Fixed Effect and Random Effect Model. If p-value is a significant (Prob. < chi² lower than 0.05) then fixed effects is suitable to run the regression model. While if p-values is insignificant (Prob. > chi² higher than 0.05 then random effect is appropriate to run the regression model.

Table 4.5 Hausman Test Result

Test Summary	chi² Statistic	chi² d.f	Prob.
Hausman Test	5.544835	4	0.2358

From the Table 4.5 Hausman Test Result it shows that random effect has been chosen in this study due to the Prob. > chi² in this case is greater than 0.05 significant level respectively. In order that, Prob. > chi² = 0.2358 is insignificant. Fixed effects rejected (inconsistent) in favour of random effects (consistent but not efficient). Therefore Random Effect Model is more appropriate over Fixed Effect Model.

4.6 Granger Causality Test

Table 4.6 Granger Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
BROAD does not Granger Cause TEMP	126	3.22230	0.0433
TEMP does not Granger Cause BROAD		0.88643	0.4148
GDP does not Granger Cause TEMP	148	2.95041	0.0555
TEMP does not Granger Cause GDP		8.08957	0.0005
USER does not Granger Cause TEMP	175	1.28980	0.2780
TEMP does not Granger Cause USER		0.11423	0.8921
WAS does not Granger Cause TEMP	180	3.05431	0.0497
TEMP does not Granger Cause WAS		4.11453	0.0179
GDP does not Granger Cause BROAD	109	7.84498	0.0007
BROAD does not Granger Cause GDP		1.93356	0.1498
USER does not Granger Cause BROAD	126	3.32397	0.0393
BROAD does not Granger Cause USER		0.71362	0.4919
WAS does not Granger Cause BROAD	126	2.55972	0.0815
BROAD does not Granger Cause WAS		0.28900	0.7495
USER does not Granger Cause GDP	146	1.64853	0.1960
GDP does not Granger Cause USER		4.32455	0.0150
WAS does not Granger Cause GDP	148	10.6293	5.E-05
GDP does not Granger Cause WAS		0.87189	0.4204
WAS does not Granger Cause USER	175	2.13630	0.1213
USER does not Granger Cause WAS		0.12629	0.8814

Note: Significant at 0.01 and 0.05 levels respectively

Table 4.6 represents the empirical results of the Granger Causality Test between employment and impact of digital economy variables. Result of WAS (Wages & Salary) and BROAD (Broadband Subscriptions) with TEMP (Total Employment) show that the null hypothesis for WAS (Wages & Salary) and BROAD (Broadband Subscriptions) does not granger cause TEMP (Total Employment) is rejected at 0.05 significance level, which is 0.0497 significant level for WAS (Wages & Salary) and 0.0433 significant level for BROAD (Broadband Subscriptions). Thus, it can be conclude that WAS (Wages & Salary) and BROAD (Broadband Subscriptions) has a significant influence on TEMP (Total Employment).

Null hypothesis is going to be rejected which means WAS does not Cause TEMPT. Hence this proves that WAS and TEMP have cause and effect relationship is bidirectional. So, we reject the null hypothesis that BROAD does not Granger cause TEMP, but we do ACCEPT null hypothesis that BROAD does not Granger cause GDP. Therefore, it appears that Granger causality runs one-way from BROAD to TEMP and not the other way. We accept null hypothesis that USER does not Granger Cause TEPM, which means USER and TEMP have no cause between the variables.

The other variables are USER (Internet User) and GDP (Growth of Gross Domestic Product). The Granger Causality Tests shows that null hypothesis are failed to rejected for these variable at 0.2780 significant level for USER (Internet User), 0.0555 significant level for GDP (Growth of Gross Domestic Product) since p-value greater than the significance level (0.01 and 0.05), so it can be concluded that there is no relationship between USER (Internet User) and GDP (Growth of Gross Domestic Product) and TEMP (Total Employment).

CHAPTER 5

DISCUSSION AND CONCLUSION

5.0 Introduction

Main conclusion can be summarize the significant results and findings from this study. The limitation of this study and some useful recommendations for future research also stated in this chapter.

5.1 Summary of the Study

From this study on Panel Ordinary Least Square (POLS) test, it shows the independent variables [BROAD (Broadband Subscriptions) & GDP (Growth of Gross Domestic Product)] have positive significant relationship impact of digital economy on employment. Hausman Test also shown that Random Effect is appropriate to run the regression model. It show BROAD (Broadband Subscriptions) and WAS (Wages & Salary) have significant relationship on employment. The WAS (Wages & Salary) is found to Granger cause the TEMP (Total Employment) at 5% significance level. Meanwhile, BROAD (Broadband Subscriptions) and TEMP (Total Employment) are found to Granger cause inflation at 5% significance levels respectively. So we can conclude that these 3 tests show BROD (Broadband Subscriptions) show significant relationship. The results shows, Broadband Subscriptions give a major impact to the digital economy on employment in ASEAN Countries.

BROAD (Broadband Subscriptions) is one of the impact of digital economy on employment. Broadband subscription rates are becoming more and more enhanced by the existence of this digital economy. Employees will choose the broadest and most powerful bandwidth in carrying out their tasks. In this context, employers play an important role in providing the best broadband services for their employees to perform their duties more productively and efficiently. The

impact of this broadband is also huge for the country's economic growth. It can see how the country is moving along with the latest technology.

Besides that, broadband will enable employees to become informants and countries capable of competing in the world is the main goal of the government when introducing various high-tech projects in the country. With broadband, professional workers can work from home. For example, there are a handful of workers who get permission from employers to work from home for reasonable reasons. This high-speed broadband subscription has to be offered to employers and needs to be implemented in their respective countries. The government did not ignore it, but it should be remembered that investment in technology should be continued for the present and future generations. With this broadband subscription, economic opportunities including job offers will increase due to investment interest either from within or outside the country. When employers provide high-speed broadband infrastructure facilities enable employees to work productively and efficiently.

In the era of this unlimited telecommunications and multimedia technology revolution, the internet has become an important part of employees in the organization. The Internet is the fundamental technology in the development of information technology. Nowadays, the internet is one of the world's leading network connectivity channels that has shrunk the world. It also provides a lot of benefits to the community due to its widespread use and borderless information. Everything can be done with the internet.

As a worker, they cannot miss the internet with fast and fast news access and from anywhere and abroad or within the country especially in their daily business. The community should use it as best as possible and avoid being a frog under the shell. With the presence of the internet, society is becoming more advanced and knowledgeable. The Internet helps them in our daily business.

Internet usage certainly gives us a thousand benefits or benefits. Therefore, as a first-class society, we have to utilize the internet in gaining special knowledge. In this modern era, we should not miss such a shell under the frog as the use of the internet seems inseparable with the progress of the country now. So the government has to educate the public on the internet to produce IT literate generation and to compete with other developed countries to achieve their goals.

5.2 Limitation of the Study

This study was limited to certain data in certain countries. Such as data for BROAD (Broadband Subscriptions) for certain countries ware missing for several years. Besides that, data for GDP (Growth of Gross Domestic Product) also missing for several years in some countries.

Another limitation is on this study is the data in year 2017. Some of the data on Jobs Data such as TEMP (Total Employment) and WAS (Wages & Salary) cannot be found in the Word Bank Indicators. So that in this study we insist to use overall data variables from year 1997-2016 (20 years) observations.

Besides that, there are not many references to the digital economy as it is the latest issue. The last few studies did not focus on all ASEAN countries. Many studied before focus on developed countries or several selected countries.

5.3 Recommendations for Future Research

Given the limitation for current study, it can be recommend that, future research can focus on employment in the top leading develop ASEAN Country. The findings should be more accurate because we can focus more on the impacts on the digital economy on employment at that country. Besides that, another recommendation is, future research can consider other variables on the impact of digital economy. There must be more other variables can be taken as the impact to the digital economy because of the rapid changes in the technology. As we know technology keep changing over time. So the impact must be many more in the future. Due to the Granger Causality test result, its shows that the between

independent variable are also show cause and effect relationship. Future research may expend the study focusing on that independent variables. Future research can find and expend the source of the missing data. Not only at World Bank Indicator. It can be the data be more reliable and accurate. Beside that researcher can make a comparison between them. So that this can solve some problems of missing data for some countries.

5.4 Conclusion

In conclusion, this study sought to determine the impact of digital economy on employment in ASEAN Countries. It is important to know the impact of digital economy on employment and how this impact to the economy. All the ASEAN should take the opportunities to enhance their technology innovation as a mechanism of economic growth.

Finally, as workers we must be prepared in facing the era of digital economy is now growing. Back again with the economic need to live, workers must be able to adapt to the economic development that is currently in the digital age. Otherwise, the risk of being replaced can be enlarged. Continue the development of digital economy must be followed by the increase of competence for the actors of industrial activity of digital economy itself. Otherwise, what happens is a decrease in the quality of workers who cannot ad apt to the ongoing conditions. As the digital economy grows, it must increase competence. So that workers can always follow or adapt to the economic development that is happening. The thing to remember is to never stop learning. When there is economic development.

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APPENDIX A

DESCRIPTIVE ANALYSIS

Date: 06/07/18 Time: 14:27
Sample: 1997 2016

	TEMP	USER	WAS	BROAD	GDP
Mean	7.098043	0.984076	1.565190	5.133099	0.716010
Median	7.404339	1.234273	1.601516	5.305446	0.782958
Maximum	8.080395	1.908485	1.977724	6.970123	1.141261
Minimum	5.186295	-1.618629	0.732394	1.397940	-1.061996
Std. Dev.	0.734834	0.809834	0.299254	1.312200	0.323336
Skewness	-0.990753	-1.126709	-0.689645	-0.577871	-2.760933
Kurtosis	3.576151	3.616898	2.944262	2.509867	13.13388
Jarque-Bera	24.84018	31.84098	11.11570	9.193161	776.9218
Probability	0.000004	0.000000	0.003857	0.010086	0.000000
Sum	993.7261	137.7707	219.1266	718.6338	100.2414

APPENDIX B

PANEL ORDINARY LEAST SQUARES

Dependent Variable: TEMP
Method: Panel Least Squares
Date: 06/07/18 Time: 14:28
Sample (adjusted): 1999 2016
Periods included: 18
Cross-sections included: 10
Total panel (unbalanced) observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
USER	-0.267818	0.088858	-3.013986	0.0031
WAS	-0.851110	0.198401	-4.289851	0.0000
BROAD	0.182799	0.054912	3.328980	0.0011
GDP	0.366718	0.176195	2.081314	0.0393
C	7.492844	0.478172	15.66975	0.0000

R-squared	0.337012	Mean dependent var	7.098043
Adjusted R-squared	0.317368	S.D. dependent var	0.734834
S.E. of regression	0.607132	Akaike info criterion	1.874918
Sum squared resid	49.76218	Schwarz criterion	1.979977
Log likelihood	-126.2443	Hannan-Quinn criter.	1.917611
F-statistic	17.15588	Durbin-Watson stat	0.054660
Prob(F-statistic)	0.000000		

APPENDIX C

FIXED EFFECT MODEL

Dependent Variable: TEMP
Method: Panel Least Squares
Date: 06/07/18 Time: 14:31
Sample (adjusted): 1999 2016
Periods included: 18
Cross-sections included: 10
Total panel (unbalanced) observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
USER	0.005991	0.006534	0.916915	0.3609
WAS	0.087435	0.021024	4.158761	0.0001
BROAD	0.032418	0.004667	6.946344	0.0000
GDP	-0.013896	0.007862	-1.767500	0.0796
C	6.798841	0.027650	245.8851	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.999081	Mean dependent var	7.098043
Adjusted R-squared	0.998986	S.D. dependent var	0.734834
S.E. of regression	0.023401	Akaike info criterion	-4.577401
Sum squared resid	0.069001	Schwarz criterion	-4.283237
Log likelihood	334.4181	Hannan-Quinn criter.	-4.457862
F-statistic	10533.35	Durbin-Watson stat	0.257007
Prob(F-statistic)	0.000000		

APPENDIX D

RANDOM EFFECT MODEL

Dependent Variable: TEMP
Method: Panel EGLS (Cross-section random effects)
Date: 06/07/18 Time: 14:32
Sample (adjusted): 1999 2016
Periods included: 18
Cross-sections included: 10
Total panel (unbalanced) observations: 140
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
USER	0.005768	0.006533	0.882838	0.3789
WAS	0.086321	0.021015	4.107621	0.0001
BROAD	0.032650	0.004665	6.998696	0.0000
GDP	-0.013735	0.007862	-1.747129	0.0829
C	6.733028	0.245295	27.44866	0.0000

Effects Specification	S.D.	Rho
Cross-section random	0.770577	0.9991
Idiosyncratic random	0.023401	0.0009

Weighted Statistics

R-squared	0.738587	Mean dependent var	0.057068
Adjusted R-squared	0.730841	S.D. dependent var	0.045368
S.E. of regression	0.023539	Sum squared resid	0.074802
F-statistic	95.35584	Durbin-Watson stat	0.237222
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	-0.031695	Mean dependent var	7.098043
Sum squared resid	77.43633	Durbin-Watson stat	0.000229

APPENDIX E

HAUSMAN 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	5.544835	4	0.2358

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
USER	0.005991	0.005768	0.000000	0.0694
WAS	0.087435	0.086321	0.000000	0.0744
BROAD	0.032418	0.032650	0.000000	0.0698
GDP	-0.013896	-0.013735	0.000000	0.0285

Cross-section random effects test equation:
Dependent Variable: TEMP
Method: Panel Least Squares
Date: 06/07/18 Time: 14:33
Sample (adjusted): 1999 2016
Periods included: 18
Cross-sections included: 10
Total panel (unbalanced) observations: 140

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.798841	0.027650	245.8851	0.0000
USER	0.005991	0.006534	0.916915	0.3609
WAS	0.087435	0.021024	4.158761	0.0001
BROAD	0.032418	0.004667	6.946344	0.0000
GDP	-0.013896	0.007862	-1.767500	0.0796

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.999081	Mean dependent var	7.098043
Adjusted R-squared	0.998986	S.D. dependent var	0.734834
S.E. of regression	0.023401	Akaike info criterion	-4.577401
Sum squared resid	0.069001	Schwarz criterion	-4.283237
Log likelihood	334.4181	Hannan-Quinn criter.	-4.457862
F-statistic	10533.35	Durbin-Watson stat	0.257007
Prob(F-statistic)	0.000000		

APPENDIX F

GRANGER CAUSALITY TEST

Pairwise Granger Causality Tests
Date: 06/07/18 Time: 14:34
Sample: 1997 2016
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
BROAD does not Granger Cause TEMP	126	3.22230	0.0433
TEMP does not Granger Cause BROAD		0.88643	0.4148
GDP does not Granger Cause TEMP	148	2.95041	0.0555
TEMP does not Granger Cause GDP		8.08957	0.0005
USER does not Granger Cause TEMP	175	1.28980	0.2780
TEMP does not Granger Cause USER		0.11423	0.8921
WAS does not Granger Cause TEMP	180	3.05431	0.0497
TEMP does not Granger Cause WAS		4.11453	0.0179
GDP does not Granger Cause BROAD	109	7.84498	0.0007
BROAD does not Granger Cause GDP		1.93356	0.1498
USER does not Granger Cause BROAD	126	3.32397	0.0393
BROAD does not Granger Cause USER		0.71362	0.4919
WAS does not Granger Cause BROAD	126	2.55972	0.0815
BROAD does not Granger Cause WAS		0.28900	0.7495
USER does not Granger Cause GDP	146	1.64853	0.1960
GDP does not Granger Cause USER		4.32455	0.0150
WAS does not Granger Cause GDP	148	10.6293	5.E-05
GDP does not Granger Cause WAS		0.87189	0.4204
WAS does not Granger Cause USER	175	2.13630	0.1213
USER does not Granger Cause WAS		0.12629	0.8814