THE JOINT IMPACT OF TECHNOLOGY INNOVATION AND TOURIST ARRIVALS ON JAPAN'S ECONOMIC GROWTH

BY

ANG EE ZHERN
CHERYL LUAH JING NING
CHONG POH FANG
TEOH YEE CHE
WAN WAI KIT

A final year project submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF ECONOMICS (HONS)
FINANCIAL ECONOMICS

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF BUSINESS AND FINANCE
DEPARTMENT OF ECONOMICS

APRIL 2019

DECLARATION

We hereby declare that:

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

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

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

(4) The word count of this research report is 13551.

Name of Student:	Student ID:	Signature:
1. ANG EE ZHERN	1503281	_____
2. CHERYL LUAH JING NING	1501911	_____
3. CHONG POH FANG	1504840	_____
4. TEOH YEE CHE	1503232	_____
5. WAN WAI KIT	1503214	_____

Date: _____

ACKNOWLEDGEMENT

First and foremost, we would like to thank Universiti Tunku Abdul Rahman (UTAR) for giving us this opportunity to carry out this research and also providing us the sufficient reading materials for us to refer while doing our research. We are honored to be given the precious opportunity to carry out this research project and acknowledge the presence of UBEZ3026 Undergraduate Project.

We would also like to express our sincere gratitude to our research supervisor, Mr Ng Cheong Fatt for his patient guidance, enthusiastic encouragement and useful critiques of this research. Despite his packed schedule, he is always available for consultation and we are grateful for his great sense of responsibility. Besides, he has also been generous to share his knowledge in the field of statistics and has been supportive throughout our research. This research would not be completed without his constant encouragement and guidance. Apart from that, we would also like to thank our FYP coordinator, Mr Kuar Lok Sin for providing us the guidelines for our FYP. We also appreciate him for being patient in listening and answering our questions regarding the guidelines.

Besides, we would also like to thank Ms Kalai Vani a/p Kalimuthu, our second examiner for spending her time in reading our research and giving us precious advices to improve our research.

We are also appreciative for all the hard works and efforts contributed by every member in completing this Final Year Project. The times that we shared in completing this research together will be the most memorable moment in our university life. Lastly, we would like to extend our special thanks to our families for their support both mentally and financially throughout the research.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

GDP	Gross Domestic Product
UNWTO	United Nations World Tourism Organization
WTO	World Tourism Organization
SPSS	Statistical Package for Social Science
OECD	Organisations for Economic Cooperation and Development
WEF	World Economic Forum
GCI	Global Competitiveness Index
R&D	Research and Development
DRR	Disaster Risk Reduction
EWS	Early Warning System
JNTO	Japan National Tourism Organization

CES	Constant Elasticity of Substitution
VAR	Vector Auto Regression
ECT	Error-Correction Term
ARDL	Autoregressive Distributed Lag
DOLS	Dynamic Ordinary Least Square
FMOLS	Fully Modified Ordinary Least Square
FDI	Foreign Direct Investment
EGARCH-M	Exponential Generalized Autoregressive Conditional Heteroscedasticity in Mean
VEC	Vector Error Correction
GMM	Generalized Method of Moments
TFP	Total Factor Production
FRED	Federal Reserve Bank of St.Louis
IMF	International Monetary Fund
WDI	World Development indicators, World Bank

ADF	Augmented Dickey-Fuller
PP	Philips-Perron
ARCH	Autoregressive Conditional Heteroscedasticity
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Squares

LIST OF APPENDICES

ABSTRACT

Japan is a vulnerable country to natural disaster and this is a significant issue as it diminishes the confidence level of tourists toward Japan. The aim of this research is to examine the joint impact of technology innovation and tourist arrivals on Japan's economic growth. By using time series data ranging from 1986 to 2016, we applied autoregressive distributed lag (ARDL) model to test the relationship between dependent variable, economic growth and independent variables namely technology innovation, tourist arrivals, labor, capital and an interaction term between technology innovation and tourist arrivals. The results of our study showed that there is long run positive relationship between technology innovation, tourist arrivals, capital and Japan's economic growth respectively. Meanwhile, there is long run negative relationship between labor and Japan's economic growth. The joint impact effect for the interaction term between technology innovation and tourist arrivals is substitute effect. Therefore, Japan government could focus on policies to promote R&D innovation to reduce the risks and consequences resulting from natural disaster in order to boost the confidence level of tourists toward Japan and this could lead to economic growth.

DECLARATION

We hereby declare that:

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

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

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

(4) The word count of this research report is 13551.

Name of Student:	Student ID:	Signature:
1. ANG EE ZHERN	1503281	_____
2. CHERYL LUAH JING NING	1501911	_____
3. CHONG POH FANG	1504840	_____
4. TEOH YEE CHE	1503232	_____
5. WAN WAI KIT	1503214	_____

Date: _____

ACKNOWLEDGEMENT

First and foremost, we would like to thank Universiti Tunku Abdul Rahman (UTAR) for giving us this opportunity to carry out this research and also providing us the sufficient reading materials for us to refer while doing our research. We are honored to be given the precious opportunity to carry out this research project and acknowledge the presence of UBEZ3026 Undergraduate Project.

We would also like to express our sincere gratitude to our research supervisor, Mr Ng Cheong Fatt for his patient guidance, enthusiastic encouragement and useful critiques of this research. Despite his packed schedule, he is always available for consultation and we are grateful for his great sense of responsibility. Besides, he has also been generous to share his knowledge in the field of statistics and has been supportive throughout our research. This research would not be completed without his constant encouragement and guidance. Apart from that, we would also like to thank our FYP coordinator, Mr Kuar Lok Sin for providing us the guidelines for our FYP. We also appreciate him for being patient in listening and answering our questions regarding the guidelines.

Besides, we would also like to thank Ms Kalai Vani a/p Kalimuthu, our second examiner for spending her time in reading our research and giving us precious advices to improve our research.

We are also appreciative for all the hard works and efforts contributed by every member in completing this Final Year Project. The times that we shared in completing this research together will be the most memorable moment in our university life. Lastly, we would like to extend our special thanks to our families for their support both mentally and financially throughout the research.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

GDP	Gross Domestic Product
UNWTO	United Nations World Tourism Organization
WTO	World Tourism Organization
SPSS	Statistical Package for Social Science
OECD	Organisations for Economic Cooperation and Development
WEF	World Economic Forum
GCI	Global Competitiveness Index
R&D	Research and Development
DRR	Disaster Risk Reduction
EWS	Early Warning System
JNTO	Japan National Tourism Organization

CES	Constant Elasticity of Substitution
VAR	Vector Auto Regression
ECT	Error-Correction Term
ARDL	Autoregressive Distributed Lag
DOLS	Dynamic Ordinary Least Square
FMOLS	Fully Modified Ordinary Least Square
FDI	Foreign Direct Investment
EGARCH-M	Exponential Generalized Autoregressive Conditional Heteroscedasticity in Mean
VEC	Vector Error Correction
GMM	Generalized Method of Moments
TFP	Total Factor Production
FRED	Federal Reserve Bank of St.Louis
IMF	International Monetary Fund
WDI	World Development indicators, World Bank

ADF	Augmented Dickey-Fuller
PP	Philips-Perron
ARCH	Autoregressive Conditional Heteroscedasticity
CUSUM	Cumulative Sum
CUSUMSQ	Cumulative Sum of Squares

LIST OF APPENDICES

ABSTRACT

Japan is a vulnerable country to natural disaster and this is a significant issue as it diminishes the confidence level of tourists toward Japan. The aim of this research is to examine the joint impact of technology innovation and tourist arrivals on Japan's economic growth. By using time series data ranging from 1986 to 2016, we applied Autoregressive Distributed Lag (ARDL) model to test the relationship between dependent variable, economic growth and independent variables namely technology innovation, tourist arrivals, labor, capital and an interaction term between technology innovation and tourist arrivals. The results of our study showed that there is long run positive relationship between technology innovation, tourist arrivals, capital and Japan's economic growth respectively. Meanwhile, there is long run negative relationship between labor and Japan's economic growth. The joint impact effect for the interaction term between technology innovation and tourist arrivals is substitute effect. Therefore, Japan government could focus on policies to promote R&D innovation to reduce the risks and consequences resulting from natural disaster in order to boost the confidence level of tourists toward Japan and this could lead to economic growth.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

An ordinary introduction to Japan's economic and demographic background as well as research background on growth, tourism and technological innovation is presented. A problem statement is formed to discuss about the issues revolve around technological innovation and tourist arrivals. Research objectives and questions were then formulated. Last but not least, the significance of study and outline of each chapter are presented in this chapter.

1.1 Research Background

In the measure of nominal Gross Domestic Product (GDP), Japan is the third largest economy in the world. It experienced the economic miracle after World War II and quickly become one of the largest economy entities in the world. Japanese is especially famous for their electronics and automotive industries because of their reputation of high quality in the field of technological innovations and production. Despite of the fame of Japanese manufacturing industry, it only accounted for 27.5 percent of Japanese GDP in 2012, with service sector being the largest contributor, with a whopping share of 71.4 percent. This shows that Japan, like other advanced economies, has been diverting from manufacturing sector to service sector. Tourism industry is one of the industries in Japan's service sector that has remarkably great performance in recent years. Japan is ranked 4th out of 141 countries in terms of

health and hygiene, safety and security, cultural resources and business travel in the Travel and Tourism Competitiveness Report 2017 by World Economic Forum.

Japanese has an aging population pyramid, with 27% of the population aged above 65, it is concerned that it would slow down the economic growth (Bloom, Canning & Fink, 2010). The Japanese government has been searching for ways to maintain and improve the country's GDP despite the ageing population. After Tokyo successfully won the bid for hosting 2020 Olympic games in 2013, Japan's Prime Minister Shinzo Abe escalate the government's goal of doubling the number of foreign visitors to reap further benefits from inbound tourism. Boosting tourism is also one of the Prime Minister's reform agenda, as boosting the number of foreign visitors also brings benefits to retailers. A notable step that the government took was relaxing the visa requirements for Asian countries.

Although Japan has a high ranking in terms of tourism competitiveness, natural disaster remains a topic of discussion as it could be a drawback for Japan's effort in promoting their tourism industry. Japan is extremely vulnerable to many natural disasters like earthquake and volcanic eruption because it is located on the Ring of Fire. The Ring of Fire is a horseshoe-shaped zone with high frequency of volcanic and seismic activity associated with volcanic belt and plate movements. The Great East Japan Earthquake with a magnitude of 9.0 followed by tsunami has caused significant damage to Tohoku district that housed 17.7% of Japan's population. Three Fukushima Daiichi reactors' power supply have been disabled due to tsunami which cause overheating and nuclear meltdown. The incident on 11 March 2011 placed a downward pressure on the tourism industry, causing the tourist arrivals to decline sharply (Chiou, Huang, Tsai, Lin & Yu, 2013). Despite the incident of 2011, Japan quickly recovered and maintained its position as the world's third largest economy. This is because Japan as a country that has experienced many natural disasters has been consistently achieving technological innovation and advancement in dealing with them. However, the incident of 2011 has profoundly reduced the confidence of tourists as the affected area reported 15,896 deaths and

vast amount of people injured and missing. Therefore, Japanese government is industriously seeking for technological innovation in natural disasters to cope and handle future disasters in a better way.

1.1.1 Growth

Growth of Economy in a country is measured by real Gross Domestic Product (GDP) which represents the country's production level. An increase in GDP indicates a greater expansion in the market value of products produced by using the resources of economy over time. It is significantly to determine the economy's health. In order to analyze growth, growth production function is used to determine contribution of factor of productions namely capital and labor to the economy of a country. Capital is one of the important components on determined the economy growth. The indicator of capital is gross fixed capital formation that including investment in both tangible goods namely equipment, machinery and plats and intangible goods such as education and training (Ongo & Vukenkeng, 2014). Gross fixed capital formation included three components which are gross fixed capital formation not only in private sector, but also public and government sector. Even though investing in capital will lead to rise in market value of products and assets, but it separated formation of new assets from gross fixed capital formation. An adequate level of capital will improve the productivity of every sector and industry of a country by gaining advantages through specialization and large scale production, hence increase the economic growth.

Moreover, labor is also one of the determinants of growth production function and labor participation as the indicator of labor. Labor participation

showed the total amount of people who are being employed or are in the labor force. In an economy within a country, a relatively greater population rate tend to expect higher labor participation and economic development (Kargi, 2014). It is because the economy can expect increase in both consumption and production when population rise. In the end, this will create job opportunity and improve labor participation in the economy. A growing labor force is said to provide an uplifting potential to the rate of expansion in the economy. However, Japanese has an aging population pyramid with 27% of the population aged above 65 which posed a threat to the labor force. This situation raised concern that it would slow down the economic growth (Bloom, Canning & Fink, 2010). In the fields of labor economics, an underutilized of labor resources will cause the adverse effects on the growth potential and development of the countries (Yasemin, 2013). Labor underutilization can be measured by unemployment rate which looked as main indicator of labor performance in the economy. Higher unemployment rate showed lower labor participation rate, it will hurt the economy such as lower down consumer spending and then diminish the economy growth.

1.1.2 Tourism

United Nations World Tourism Organization (UNWTO) states that activities of individual travels to and stays in where located out of their regular accommodation for not over a consecutive year for the purposes of business, leisure and others is defined as tourism. International tourists are people who are not residents of a country that staying at least 24 hours in that particular country (Naudé & Saayman, 2005). Tourism will not only bring impacts to the host county but the source country as well. Therefore, many researchers and economists are interested in considering tourism as a

major factor of economic growth (Munir, Kogid & Mifli, n.d.). According to Japan Tourism Statistics (2018), the total visitor arrivals in May 2018 has reached 2,675,000. In rank order, the top four tourist destinations in Japan include Tokyo, Chiba prefecture, Osaka and Kyoto.

Since 1960s, tourism industry has became one of the world's largest industries from being a trivial activity and rapid developing international economic sector (Mishra, Rout & Mohapatra, 2011). According to World Tourism Organization (WTO), the number of tourist arrivals in the Pacific and Asia was 181 million while the tourism receipt was 204 million US dollar. Lean et al. (2014) stated that there are four hypotheses which are tourism-led growth, bidirectional causal relationship, growth-led tourism and no absolute connection between tourism and economic growth can be determined with relative to the tourism-economic growth relationship.

Tourism industry can bring in jobs and help to reduce poverty by being a feasible export-oriented growth strategy (Fayissa, Nsiah & Tadasse, 2007). Other than that, it will create more job opportunities, increase domestic demand, positively make contributes to the balance of payments and allow a well reallocation of wealth (Selimi, Sadiku & Sadiku, 2017). According to Fayissa et al. (2007), tourism industry provides a significant amount of foreign exchange incomes. These contribution may ameliorate a country's budget deficit through improvement in tax revenues as tourism industry is a major contributor in economy (Savas, Beskaya & Samiloglu, 2010).

According to Selimi et al. (2017), people who visit a particular country will stimulate the country's economy and create a "tourism market" by utilizing the accommodation, transportation, food and recreation services. The tourism market can be known as an untypical market because a product

is not delivered, but there is right to use goods or services that available in a different location. Since many countries have experienced the improvement and sustainable of their national economy through tourism industry, therefore tourism has potential to contribute for the development of a country. The globalized and developed tourism industry provides employment and economic advantages to construction, agriculture and telecommunications sector (Dinu, 2012). Mishra et al. (2011) found out that tourism in India can provide the opportunity of infrastructure expansion as it can be emerged as one of the largest foreign exchange beneficiaries. Household and government earnings can be directly and indirectly enhanced by the rapid development of tourism industry through multiplier effect, therefore strengthen the country's balance of payment and provoke government policies that focus on promoting tourism (Akan, Isik & Arslan, 2009). A study by Martin, Morales and Scarpa (2004) stated that since the tourism sector tends to be labor-intensive, therefore improvement in production is on the basis of increasing in employment. Hence, it can help those country with high unemployment rate. In Turkey, tourism industry has been considered as a supplementary income source for GDP (Savas et al., 2010).

1.1.3 Technological Innovation

Technological innovation refers to a continuous process of invention, realization and implementation of a new idea generated based on technology, knowledge or capability (Vaughan, 2013). Technological innovation acts a crucial role in the economic development process. According to (Shang, Wang, Li, Chen & Li, 2018), one significant stage in modernizing economy is innovation led development. It enhances worldwide competitiveness, at the same time the long-run growth is achievable and sustainable in a country.

In the Cobb-Douglas model, the link between growth rate of technological innovations and economic growth is highlighted (Pecea, Simonab & Salisteanu, 2015). Innovation of technology has led to sixth generation which include technology push, market pull, coupling, cross-functioning, and integration or networking (Goi, 2017). The potency of environmental stewardship, social development, and economic progress can be enhance through technology innovation. Other than road management system, building management system and public facilities management, solid waste management also one of the concern in technological innovation. The problem of solid waste management include the rapid expansion of urban areas, funding issues, rapid technological advancement, and limited energy and raw materials (Goi, 2017).

Other than that, science-technology innovation also have effect on sustaining the competitiveness and growth in long run. In agreement with Organisation for Economic Co-operation and Development (OECD) and Eurostat, science-technology innovation defined as an idea that implementing a new or slightly improved products, or process, or a new marketing method or trend, or new organisational method in business practices, workplace organisation or external relations (Sener & Saridogan, 2011). Moreover, technological innovation can be triggered by increasing research and development (R&D) expenditures, researchers on science and development, qualified human capital and information and communication technologies. According to the World Economic Forum (WEF)-Global Competitiveness Index (GCI) 2010-2011 results, it stated that science-technology innovation have great impact on the development of a country therefore improving wealth and welfare of it (Sener & Saridogan, 2011).

The elements that drive technological innovation are improving the production of ideas, knowledge and information. According to the OECD 2006, the process of technological innovation will influence the innovation

activities to the firms such as knowledge, technologies, human resources, financial and business practises, and information (Bujari & Mart´ınez, 2016). The innovation activities include investment in research and development (R&D), production in marketing, and the generation and knowledge acquisition. The process of technological process are consider long term and risky process because the investment in R&D or the innovation of the product in marketing may not always obtained the expected return. Aghion and Howitt (1992) presented a model of economic growth, the technological coefficient, it shows that the engine of economy growth is the production of technology innovations. One of the Science and technology was implemented in some countries is disaster risk reduction (DRR). Early Warning System (EWS), in term of disaster risk reduction which can identify the risk at dimensions and construction techniques that strengthen the resilience of buildings and infrastructure to confront different types of natural disasters (Shaw, Izumu & Shi, 2016).

According to McCallum, Liu, See, Mechler, Keating, Hochrainer-Stigler, Mochizuki, Fritz, Dugar, Arestegui, Szoenyi, Bayas, Burek, French and Moorthy (2016), improving in technologies available to aid flood disaster risk reduction through the disaster management cycle which included the steps for post-disaster response and pre-disaster response. In Europe, flood resistance and resilience technologies play an important role to reduce the destruction from flooding, it is able to drain water out quickly and shorten the recovery period of individuals, communities and buildings (White, Connelly, Garvin & Lawson, 2016). After the tsunami disaster and earthquake in year 2011, the resilient community has been highlighted and the transportation planning process also became the concern for Japan (Nakanishi, Black & Matsuo, 2014). Innovation activity is the engine of economy growth and it should be the main goals of analysis in future (Zalewski & Skswinska, 2009).

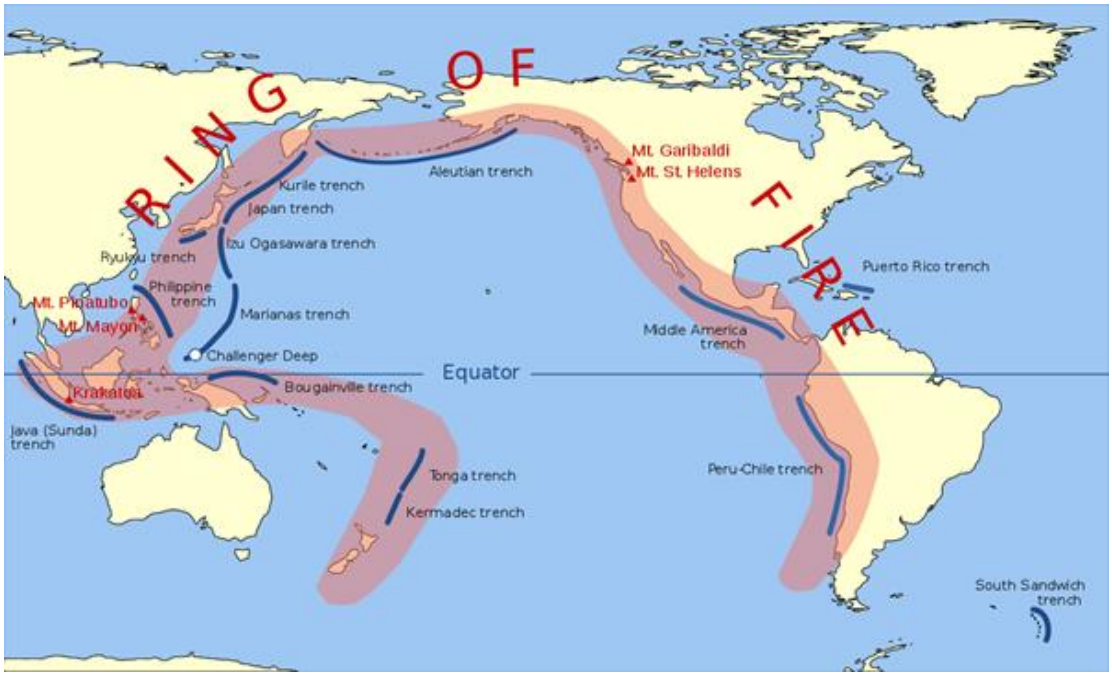
1.2 Problem Statement

As Japan is located on the Ring of Fire (Figure 1.1), it is one of the active sites for earthquakes and volcanoes. Parwanto and Oryama (2014) found that the inter-occurrence times of earthquakes and tsunami for Japan throughout the period of 1900 to 2013 is 186.23 days and 273.31 days on average. The natural disaster exerts a downward pressure on Japan's tourism and economic growth. When Japan suffers from natural disasters, the negative impact on number of tourists is obvious as natural disasters will push tourists away from the tourist attractions. It would also have an obvious impact on the GDP if the number of tourist arrivals falls tremendously. According to Walters, Mair and Ritchie (2014), a crisis or disaster in a tourist destination have significant impacts on downturn in visitor numbers and on resulting tourist destination choice behaviour. For example, due to tsunami and Fukushima nuclear power plant meltdown, total number of international tourism arrivals to Japan in 2011 drop by 28% according to statistic form Japan National Tourism Organization (JNTO). It shows a significant short term impact on domestic tourism. Johnson, Donnelly and Cooper (2011) stated that Japan occupied about half of the net impact of natural disasters which is 0.5 percentage point on reduction of global GDP.

Tourism industry is one of the potential industries for further economic growth. Japan's Prime Minister also make boosting tourism as one of the country's reform agenda. The tourism-led growth model believed that tourism could directly and indirectly make contribution to sustaining economic growth (Munir, Kogid & Mifli, n.d.; Čerović, Knežević, Matović & Brdar, 2015). The consequences on tourism economy is crucially alludes to one of the components of nation GDP which is tourism consumption and it commits a dominant effect on the economy of country. Makochekanwa (2013) stated that tourism industry has been known as a significant instrument to promote economic growth, reduce poverty and improve food security. Tourism industry is predominantly important for some rural parts of Japan that rely

on agriculture and tourism for livelihood. It provides extra income and promotes income stability to the household that otherwise can only rely on agriculture and other primary industries.

Figure 1.1 Ring of Fire



Source: National Geographic

Tourist's confidence towards a country that is prone to natural disasters can be increased by expeditious recovery in those affected areas (United Nations, 2005). Innovation in technologies for disaster management such as the UNESCO-led Indian Ocean Early Warning System is a essential tool to reinforce preparedness, speed up recovery and rebuild tourist confidence (United Nations, 2005; Calgaro & Lloyd, 2008).

Therefore, technological innovation and advancement that could mitigate the impact of natural disaster whether through pre-disaster preparedness or post-disaster recovery have a place in reassuring tourists and ultimately achieve Japanese government's goal of promoting economic growth through tourism. Throughout the

history, Japan has experienced many natural disasters, and it has been accumulating advanced technology in dealing with them. In the past decade, the estimated serious damages caused by major earthquakes have been effectively halved by innovation of technology (Nishikawa, 2015). For instance, the innovation of Early Earthquake Detection System equipped with Japanese Shinkansen Bullet Trains successfully worked and saved the life of passengers during the 2004 Niigata-Chuetsu Earthquake at Joetsu Shinkansen. If there is any detection of earthquake via this system, the power supply of bullet train will be cut down automatically and the emergency brake will be activated at the same time as well. However, the extent of the effect of current technological stage on tourist arrivals remains a gap. Therefore, it is important for Japan to continuously work for the magnitude of technology innovation and tourist arrivals in jointly affecting GDP.

1.3 Objectives

1.3.1 General Objective

The general objective of this study is to analyze the joint impact of technological innovation and tourist arrivals of Japan's economic growth for the period of 1986 - 2016.

1.3.2 Specific Objectives

Our research particularly aim to:

1. Identify the joint impact of technological innovation and tourist arrivals on the economic growth in Japan and how do each of these variables affecting the GDP accordingly.
2. Identify the causal nexus between tourist arrival and economic growth (GDP) in Japan.
3. Study the relationship between technological innovation and economic growth (GDP) in Japan.
4. Determine the effect of capital and labor on economic growth (GDP) in Japan.

1.4 Research Questions

There are few questions to be investigated in this study:

1. What is the joint impact of technological innovation and tourist arrivals on the economic growth of Japan and how do each of these variables affecting the GDP accordingly?
2. What is the relationship between tourist arrivals and economic growth (GDP) in Japan?
3. How does technology innovation affect the economic growth (GDP) of Japan?

4. Do capital and labor have significant effect on the economic growth (GDP) of Japan?

1.5 Significance of Study

Most of the empirical researches and studies solely focused on either effect of tourist arrival or technological innovation on the economic growth of Japan. However, there was no past study that the impact of these two variables namely tourist arrivals and technological innovation jointly towards the economic growth. Moreover, those researchers investigated the combined effect only based on theories. There is lack of empirical analysis and research on the combined effect of the two factors. Therefore, it is important to determine and focus on the joint impact of these two factors and the relationship between them whether they are complement effect or substitute effect. The purpose of this research is to study the importance of technology innovation in dealing with natural disasters to boost confidence level of tourisms towards Japan.

Other than that, we have to examine the significance of independent variables included tourist arrivals, technology innovation, capital and labor in order to know whether it is an important factor of a country's economic growth. With the study of coefficient sign, we can know whether the result reaches our expectation and discover whether there is a negative or positive nexus between the endogenous and exogenous variables.

1.6 Chapter Layout

The layout of chapters for this study is ordered into the following sequences. This study is continue with Chapter 2 which is literature review that discuss the relevant studies by past researchers. The data sources and methodology of study will be presented in Chapter 3 following by Chapter 4 which the empirical results will be discussed and interpreted. Lastly, this study or paper will be ended with Chapter 5. Discussion, recommendations, policies implication and conclusion will be shown in this chapter.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

Previous studies on technology innovation, tourist arrivals and economic growth will be reviewed in chapter 2. Chapter 2 aims to study the intellectual evolution of these fields and some major debates on them. Theories and concepts used by past researchers are mainly reviewed in this chapter to assist in constructing a sound theoretical framework for this research.

2.1 Theoretical Framework

2.1.1 Cobb-Douglas Production Function

Economic researchers are not paying too much attention to the mathematical modelling of the relationship between input and output in the 19th century. The physiocrats, who believe land development is the only wealth of nations admit that labor as a factor of production. But, they not believed in value added by the manufacturing sector so they treated capital as non- productive factors. Due to the effort from somewhere, they could not reason that the price difference between processed and unprocessed goods was made possible. Moreover, classical researchers found that factor intensities and factor intensity reversal in the factor proportion theory can be benefit from the international trade. Other than that, they also found that the importance of labor and capital in production and they argued that the price difference in the value added by labor and capital between two countries can be from the basis for specialization in the production (Amuka, Asogwa, Ugwu, & Ugwu, 2018).

The Cobb-Douglas production function is based on empirical study of Paul .H. Douglas and C.D. Cobb for the American manufacturing industry. It is a linear homogeneous production function of the first degree. It considers only two inputs which are labour and capital for output. Capital includes equipments and plants. A production function can be used to describe the relationship between output and the inputs or to study tradeoffs by using the two inputs factors.

A typical and well-known Cobb-Douglas production function has the form:

$$Q=f(K,L) =AK^{\alpha}L^{\beta}$$

Where Q = the total output, L = units of labor, K = units of capital, and α and β are elasticity of labor and capital, and f is an efficiency parameter. When the factor inputs are increased by 1%, the output will also equally increase by 1%, which follows the constant return to scale. According to Ongo and Vukenkeng (2014), Ugochukwu and Chinyere (2013) and Ali (2015), it stated that capital (K) is significantly and positively associated with output, and it also related to the development of infrastructure and advancement of technology. For labor, Zhu, Wu and Wang (2011), Paudel and Perera (2009) and Kargi (2014) mentioned that positive relationship of labor force with economic growth contribute to major portion of GDP and drive economic growth.

The Cobb-Douglas production function able to help governments for rational decision making as to maximize profit or minimize loss, so that an adjustments for an optimal input combination. According to Amuka, Asogwa, Ugwu, and Ugwu (2018) stated that there are two major critique from academic of economies for the Cobb-Douglas mode which are the assumption of constant returns to scale and the omission of technical change, which assuming that the technology remained unchanged within the period.

According to Mishra (2007), there are some production functions has been introduced to solve the limitations of Cobb-Douglas model. One of them is constant elasticity of substitution (CES), a model similar to Cobb-Douglas model which allows any goods that produced with only two factor inputs, and it assumes CES between the two factor inputs. However, the difficulties of the CES model are it will break down when the production of goods consists of more than two inputs and the assumption of CES between the two factors of inputs is difficult to obtain. Other than that, Wassily Leontief stated that the simplest of the production function that developed to explain the relationship between input and output is the input-output model that based on factor proportion. When there are two non-substitutable inputs are combined in a fixed proportion to produce a given output of good, an increase in one of the inputs while holding other constant will not affect the level of output.

2.2 Review of Literature

2.2.1 Tourism-led Growth

To enhance our knowledge, Obadiah, Odhiambo and Njuguna (2012), Jayathilake (2013), Carrera and Risso (2008), Akan et al. (2009), Lau, Oh and Hu (2008), Shih and Do (2016), Brida, Pereyra, Risso, Devesa, Aguirre (2008) mentioned the tourism-led growth which is derived from the export-led growth model analyzes a possible single directional causal nexus from tourism development to GDP in the short run and long run. In this hypothesis, international tourism is a potential drivers of economic growth and non-traditional export to improve a country's economy growth. Government policies that emphasize in promoting tourism may raise the country's income level.

According to Obadiah, Odhiambo and Njuguna (2012), they used ARDL model approach in Kenya to investigate the relationship between tourism development and economic growth. The results reveal that tourism development unidirectionally causes economic growth in short and long run. The study by Brida, Carrera and Risso (2008) showed that the economic growth in Mexico was positively affected by the international tourism expenditure. Therefore, tourism is a crucial factor in Mexican economy since tourism-led growth hypothesis was applied.

According to Akan et al. (2009), they carried out a recent study for Turkey between year 1985 to 2007 by implementing Phillips–Perron test, Johansen cointegration test, Granger causality approach and a Vector Autoregression (VAR) model. Their results indicated that tourism sector in Turkey is positively related with its economic growth in the long run. Hence, it also shows the evidence of supporting the tourism-led growth hypothesis in Turkey.

The study by Lau, Oh and Hu (2008) showed there is a presence of long term comovement nexus between tourist arrival and GDP in Sarawak. Granger causality approach indicated that an improvement in economic growth lead by continuous tourism expansion. The empirical results showed that both GDP and tourist arrivals do not have short run causality. However, Error-Correction term (ECT) significantly reveals there is long run causal relationship from tourist arrivals to Malaysia's economic growth. Therefore, tourism-led economic growth happens in Sarawak.

In order to identify the short and long-run movements of the relationship between the two variables namely tourism and economic growth from 1967 to 2011 in Sri Lanka, Jayathilake (2013) carried out a testing on real GDP, global tourist arrivals and real effective exchange rate. The cointegration test shows a positive long run relationship between the variables. Meanwhile, Granger causality test indicates the existence of unidirectional causal relationship running from tourist arrivals to real GDP

in Sri Lanka. Their empirical results concludes the model of tourism-led growth and positive effect of tourism development on economic growth.

Savas et al. (2010) founded out one of the siginificant determinants for Turkey's long run growth is tourism. The researchers used Autoregressive Distributed Lag (ARDL) cointegration method as well as error correction model to determine the relationship between real exchange rate,correction model to investigate the relationship between real exchange rate, international tourist expenditures, international tourist arrivals and real GDP in the long run. Evidently, there is a long run unidirectional causal nexus from both the tourist expenditures and tourist arrivals and real exchange rate to the real GDP. Therefore, it concluded that Turkey economy applies tourism-led growth hypothesis.

Shih and Do (2016) explained that there is a significant long term relationship between tourist arrivals and Vietnam's economic growth from 1995-2013. In other words, tourist arrivals and GDP are significantly cointegrated by applying Johansen cointegration test. The researchers observed that the coefficient of tourist arrivals is positive which means that the number of tourist arrivals increases will lead to an increases in GDP. The empirical results shows the existence of tourism-led growth hypothesis in Vietnam. The Granger causality has been further used to ensure the effectiveness of tourism-led growth hypothesis in Vietnam. Besides, this study also establishes its stability over 10 years.

According to Lean and Tang (2010), a study for the causality relationship is valid and stable over the sample period by using the Granger causality test in Malaysia. The results conclude that the tourism-led hypothesis in Malaysia is stable and valid. According to Lean, Chong and Hooy (2014) examined the impact of tourism to economic growth from the year 1980 to 2009 in Malaysia and Singapore. By using the Granger causality, the results suggest that tourism-led economic growth in Singapore in the long run.

The study of Terzi (2015) performed the causality relationship between international tourism revenue and economic growth from the period 1963 to 2013 in Turkish by using Granger causality, unrestricted VAR and Toda-Yamamoto VAR analysis. The findings from the research showed there is valid of tourism-led growth hypothesis in Turkey and government suggest to invest in tourism sector.

2.2.2 Growth-led Tourism

Growth-led Tourism indicates tourism development and economic grwoth have an one way causal relationship. Development in economy may improve the tourism receipts (Jayathilake, 2013). Furthermore, the study by Lee (2008) showed evidence to support single directional Granger causality between GDP and tourism in short-run. Therefore economic-driven tourism expansion is preferable than tourism-led growth.

Kum, Aslan and Gungor (2015) examined the relationship between tourism arrivals and GDP in N-11 countries from 1995 to 2013 by using panel cointegration techniques. They applied dynamic ordinary least square (DOLS) and fully modified ordinary least square (FMOLS) to estimate the model. Meanwhile, the methods proposed that tourism arrival is positively related to GDP. In simple word, 0.06% increase in GDP is stimulated by 1% increase in tourism arrivals as a result of FMOLS while GDP increase to 0.08% by applying DOLS. Moreover, the results indicate growth-led tourism happens in N-11 countries as there is a unidirectional causal relationship from economic growth to tourism.

Rajapakse (2016) studied the causality relationship between international tourist arrivals, foreign direct investment (FDI) and GDP for Sri Lanka with annual data from 1985-2014. The study applied conventional test such as unit root test, Johansen cointegration test, Vector

Autoregression (VAR) and Granger causality test. The empirical outcome provide non-cointegration between GDP, international tourist arrivals and FDI. Besides, Granger causality test reveals the short run impact of GDP on FDI and international tourist arrivals. In other words, FDI has one way influence over international tourist arrivals. Apparently, there is an existence of economic-driven tourism growth in Sri Lanka.

Brida, Pereyra, Risso, Devesa, Aguirre (2008) studied that the causality from tourism expenditures and real exchange rate to real GDP per capita in Colombia by using Granger Causality Test. Tourism plays a crucial role in Colombia's economy and tourism brings positive influence to Colombia's GDP in long run.

Chen and Chiou-Wei (2009) studied that the causal relationship between the variables which are tourism expansion and economic growth in Taiwan and South Korea by using EGARCH-M model. The results found that the tourism-led growth happended in Taiwan is significant. Meanwhile, South Korea showed a bi-directional causality.

2.2.3 Bi-directional / Reciprocal Causal Relationship

Tang (2011) found out that the real output, real effective exchange rate and tourist arrivals in Malaysia from 1989 to 2010 have reciprocal causality relationship in the long run. The empirical result of the study by Demiroz and Ongan (2005) indicated that GDP contributes to the tourism sector while tourism also contribute to the GDP. In other words, there is a bi-directional causal relationship between the tourism receipts and economic growth in the short run and long run. Sak and Karymshakov (2012) examined the relationship between tourism revenue and economic growth by using the panel data of 11 group of countries which consists of 135 countries from year 1995–2008. The results show there is a bi-directional causality relationship between the two variables in Europe countries. In

addition, Lee and Chang (2008) examine the relationship between tourism and economic growth for a number of OECD and non-OECD nations. The result suggest a unidirectional causality from tourism to economic development in OECD nations, but bidirectional causality relationships in non OECD nations.

Shan and Wilson (2010) indicated that previous studies excluded and failed to take the possibility of feedback effect tourism and economic growth into account. Therefore, they considered the two ways causality effect in their study and found out that bi-directional effect is existed between tourism and economic growth of China.

The study of Sung (2018) showed that the relationship between international tourist disbursement and real GDP is bidirectional when testing in both models of bivariate and trivariate. According to Seghir, Mostéfa, Abbes and Zakarya (2015), they applied co-integration and Granger causality approach to examine the relationship between economic growth and tourism expenditure in 49 countries. Their results indicated that there is a bi-directional causality relationship between the two variables. Kim and Chen (2006) applied cointegration and Granger causality test to examine the causality relationship between economic growth and tourism expansion in Taiwan. The results showed tourism expansion and economic growth reinforce each other. In other words, there is a reciprocal relationship between them. According to Aslan (2013) examined that the causality between tourism development and GDP by using the panel Granger causality tests in the Mediterranean countries from the year 1995 to 2010. The study showed a bi-directional causal relationship found in Portugal.

Shahbaz, Kuma, Ivanov, and Loganathan (2016) studied about the causality between tourism and Malaysia's GDP between 1975 and 2013. They proved that the relationship between two variables shows a bi-directional causation by applying the ARDL and augmented Solow production model. Othman, Salleh and Sarmidi (2012) also performed

ARDL methodology to test bi-directional relationship between these two variables for 18 countries. They also found out tourism activities and economy growth has bi-directional relationship in some countries such as Malaysia, Singapore, Canada and UK.

The study of Samimi, Sadeghi and Sadeghi (2011) examines the causality between economic growth and tourism development by using P-VAR approach during the year 1996 to 2009 in developing countries. The results found that there is a bilateral causality and bring positive effect between the economic growth and tourism development. Kadir, Nayan and Abdullah (2010) conducted the causal relationship between tourism receipts and real growth though the period 1994 to 2004 in Malaysia. By using the multivariate causality test, the growth in the national economy might be bidirectional and has a significantly leading growth in tourism industry in Malaysia because of the improvements in the quality and quantity of tourism product, facilities and services.

From the empirical results of study by Park and Kim (2017), it showed that there is bi-directional relationship between the variables namely tourism and economic growth of Korea. Even though there is bi-directional causality, they found out any activities or development from tourism sector could lead to growth of economy in Korea strongly but the effect of economic growth on tourism is significant yet less stronger than tourism activities caused economic growth. The study of Wu and Wu (2018) examined the causal relationship between the real international tourism receipts and economic growth from the year 1995 to 2015 in 11 Asian regions by using the multivariate panel Granger causality test and the results that there is a reciprocal causal relationship was found in Macau and Singapore.

2.2.4 No Causality Relationship between Tourism and Economic Growth

Mishra, Rout and Mohapatra (2011) found out that in these recent few years, India's tourism industry is growing and become a potential sector comparing with other sectors. Therefore they have examined on causality between tourism and economic growth by applying time series models. However, the evidence from their study showed that there is indirect causality relationship between tourism activities and economy growth in the short run for India within the year 1978 to 2009. The study by Katircioglu (2009) applied bound tests and cointegration test to examine the validity of tourism-led growth hypothesis. The results indicates the hypothesis cannot be implied for Turkey as both approaches not able to confirm the existence of long term equilibrium and cointegration relationship between international tourism and real GDP. Hence, Granger causality approach not able to be applied for further steps.

Ozturk and Acaravci (2009) found out the same result as Katircioglu (2009), their ARDL model test indicates that the real GDP and international tourism have no long term or equilibrium relationship. For the tourism-led growth hypothesis, it can be tested by using vector error correction model (VEC) and autoregressive distributed lag model (ARDL). While the tourism-led growth hypothesis cannot be inferred since no existence of cointegration between the two variables. Hence, Granger causality approach cannot be carried out further. In addition, panel data analysis has also been established to explore this argument. In the case of Asia, Middle East and North Africa, Sak and Karymshakov (2012) stated that there is no causal relationship between tourism revenue and GDP. The importance of tourism for economic can be depending on level of income and trade openness and investment rate but low and middle income countries will not strongly display this relationship. They also stated that small share of tourism sector in an economy may result in non-existence of causality for some countries.

Tugcu (2014) also found that no causality between tourist development and economic growth. If the resources allocated for tourist is limited to its contribute to economic growth, it is not possible to perform a causal connection to economic growth and tourism. Moreover, Ekanayake and Long (2012) argue that tourist does not boost economic in developing nation, developing nation focus their development on other sector such as service and manufacture, therefore, there are insufficient resources allocated for tourist. Based on result of Granger causality test under research of Ekanayake and Long (2012), it state there is no evidence to prove the tourism-led growth hypothesis.

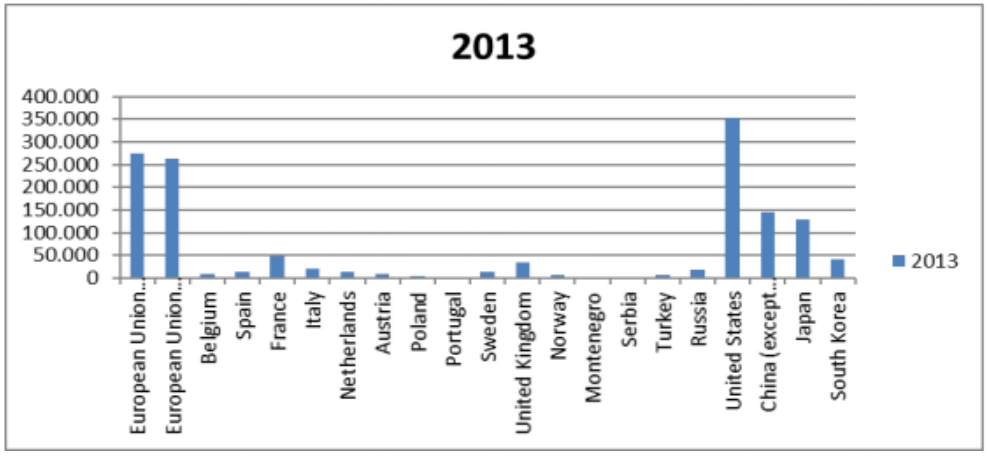
Ozcan, Aslan and Nazlioglu (2017) stated that there is a neutrality hypothesis between economic freedom and foreign tourist arrivals during from the year 1996 to 2012 in 17 post-socialist transition countries by using the panel Granger causality approach. In other words, an increase in tourism arrivals will not boost the income level directly or an increase in the economy growth will not bring any impacts to to attract more tourists.

2.2.5 Technological Innovation and Economic Growth

The research conducted by Bujari and Martínez (2016) examines the relationship between the technology variables such as number of patents, high-technology exports, investment in Research and Development (R&D) and economic growth in Latin America countries from 1996 to 2008. They applied Generalized Method of Moments (GMM) system to determine and study the panel data model. Their empirical results reveal that investment in R&D has a significant positive relationship on economic growth. In other words, a greater investment in R&D will stimulate increase in total factor production (TFP) and thereby enhance economic growth.

Mladenović, Cvetanović and Mladenović (2016) found out that investment in R&D activities is significantly related to the GDP growth in European Union from 2002 to 2012. The multiple regression model results obviously indicate that 1% raise in the R&D expenditure as a share of GDP will lead to 2.2% increase in real GDP growth rate. Bilbao and Roudriguez (2004), state that R&D expenditure plays an importance role in economic growth which introduce new advanced technology to enhance competitiveness of a nation. Bilbao and Roudriguez (2004) stated R&D expenditure plays an important role in economic growth which introduce new advanced technology to enhance competitiveness of a nation.

Gumus and Celikay (2015) conducted a study about the relationship between R&D spending and economic growth for total of 52 developed and developing countries during 1996 to 2010. The results show that there is a significant and positive relationship between R&D spending and economic growth in both long and short run for developed countries. Meanwhile, the R&D spending has a powerful and positive relationship on GDP in the long run but weak in the short run for developing countries. According to figure 2.1, developed countries such as China, US, Japan and European countries which contribute more in research and development have lead a rapid growth in economic while low research and development in middle east countries lead to a limit growth in the economic. It is consistent with the research of Goel and Ram (1994), degree of development of a nation create a difference by boost up its economic growth form R&D expenditure.



Source form: Eurostat

Figure 2.1 R&D Expenditure of the World (Billion).

According to Tari and Alabas (2017), R&D spending on technological innovation is important in developing growth models. After 1980, the models emphasize the significance of R&D activity in driving the economic growth of a country as there is a short run and long run cointegration relationship between GDP growth and R&D spending on technology. In their study, they examined this relationship by performing ARDL bound test and1 they found that the relationship between these two factors are positive and significantly.

According to Bozkurt (2014), he carried out a study of the relationship between technological developments, innovation, R&D activities, and economic growth with Johansen cointegration tests and vector error correction model in Turkey between years 1998 to 2013. The results showed that there is causality from economic growth and R&D which mean that an increase in R&D, economic growth also will increase for sustainability.

CHAPTER 3: METHODOLOGY

3.0 Introduction

Chapter 3 introduces theoretical framework and economic model by focusing on the relationship between the GDP per capita and gross fixed capital formation, employment population ratio, tourist arrivals and gross domestic spending on research and development. On the other hand, we would also describe the way in which this research will be carried out including design of research, collection of data, description of data as well as methods of data processing. In addition, the overview of the research methodology in this study will be further explained.

3.1 Model Specification

The theoretical framework applied to determine both short and long run relationship among the variables is Solow's growth model. Robert (2010) used capital (K), labor (L), and technical progress (A) to determine national production (Y) and the production function is shown as below:

$$Y_t = \mathrm{A} f(K_t, L_t) \quad (1)$$

It also known as Cobb- Douglas production function in most cases, the function is expressed in following form:

$$Y_t = \mathrm{A} K_t^{\alpha} + L_t^{1-\alpha} \quad (2)$$

Constant return to scale representing by $\alpha = [0,1]$.

Therefore, let technical progress (A) be represented by other macroeconomic determinants such as technology innovation and tourist arrival. Thus, A term in equation (2) can be rewritten as equation (3).

$$A=\theta+ R\&D_t+ Tourist_t \quad (3)$$

Where θ refers to time-invariant constant, $R\&D_t$ indicates technology innovation and $\alpha Tourist_t$ refers to tourist arrival. Then, substitute Equation (3) into Equation (2) to provide Equation (4).

$$Y_t = \theta+K_t+ L_t+ R\&D_t+ Tourist_t \quad (4)$$

To let equation (4) in linear form, logarithmic function is implemented and error term (ε) is introduced. Since all statistic for the variables are in different measurements such as dollar form, percentage, population, we expressed the variable into natural logarithmic form for the purpose of reducing the skewness of data and raising the normality of distribution, to make an interpretable result.

The equation report in following form:

$$lnY_t = \beta_0 + \beta_1 lnK_t+ \beta_2 lnL_t+\beta_3 lnR\&D_t + \beta_4 lnTourist_t + \varepsilon_t \quad (5)$$

In order to expand the understanding of the joint impact of R&D and tourist arrival to Japan`s economic growth in the model, We add the interaction term into our regression model.

$$lnY_t = \beta_0 + \beta_1 lnK_t+ \beta_2 lnL_t+\beta_3 lnR\&D_t + \beta_4 lnTourist_t + \beta_5 lnR\&D_t Tourist_t + \varepsilon_t \quad (6)$$

Where, the notations would indicate:

lnY_t = Natural Logarithm of Gross Domestic Product Per Capita (constant 2010 US $)

lnK_t= Natural Logarithm of Gross Fixed Capital Formation, Nominal, Domestic Currency (Yen ¥)

lnL_t= Natural Logarithm of Labor Force Participation Rate (percentage)

$lnR\&D_t$= Natural Logarithm of Gross Domestic Spending on R&D (% of GDP)

$lnTourist_t$= Natural Logarithm of Tourist Arrival Population (million)

$lnR\&D_tTourist_t$= Natural Logarithm of Interaction between R&D and Tourist Arrival

Based on the hypothesis, K, Gross Capital Formation is significantly and positively associated with Y, GDP due to the development of infrastructure of technical (Ongo & Vukenkeng, 2014). L, Labor Force Participation Rate have a positive relationship and act as major portion of GDP and drive the economic growth in Sri Lanka (Paudel & Perera, 2009). According to Mladenović, Cvetanović and Mladenović (2016), they found out that Research & Development spending is positively related to GDP in long run but weak in short run for developing countries. Besides that, the higher spending on R&D may also increase employment and real capital. Shih and Do (2016) found that the relationship in long run between tourist arrival and economic growth are positive and significant. In other words, a raise in GDP is led by a raise in tourist arrivals. We expect that the interaction term for R&D and tourist arrivals will have a positive sign, which refers to complement effect. A joint impact may occur when there is an increase in R&D which means improvement in resistance to natural disaster may increase the confidence level of tourist and enhance economic growth.

3.2 Data Collection

All data applied in this research are annual observations of Japan, within the period from 1986 to 2016. The Gross Domestic Product per capita (constant 2010 USD) is measured by annual time series data by refering to the World Bank's World Development Indicators. The labor force participation rate in Japan is sourced from the Economic research Federal Reserve Bank of St.Louis (FRED). However, gross fixed capital formation data was retrieved from the International monetary fund (IMF). Besides, the data of gross domestic spending on research and development was retrieved from the Organisation for Economic Co-operation and Development (OECD), and the data of tourist arrivals was obtained from Japan National Tourism Organization (JNTO). All these variables were transformed to log.

The variable GDP per capita is indicated by constant 2010 in million US dollar. The employment and gross domestic spending on research and development are explained in terms of rates. Last but not least, tourist arrivals and gross fixed capital formation are explained in terms of population, million. The descriptive study of all our variables is summarized in Table 3.

Table 3.1. Data sources and variables definition.

Variables	Description	Unit Measurement	Data Sources
GDP per capita	Gross Domestic Product per capita (constant 2010 US $)	Current USD	World Development indicators, World Bank WDI
Labor	Labor Force Participation Rate	Participation Rate %	Economic Research Federal Reserve Bank of St.Louis (FRED)
Capital	Gross Fixed capital formation,nominal, domestic currency	Current LCU	International monetary fund (IMF)

Tourist arrivals	Tourist arrivals population	Population, Million	Japan National Tourism Organization (JNTO)
R&D	Gross domestic spending on R&D (% of GDP)	Percentage Of GDP	Organisation for Economic Co-operation and Development (OECD)

Notes: The availability of Japan's data can be used to determine the descriptive study from 1986-2016. Sources: World Development indicators, World Bank, Economic Research Federal Reserve Bank of St.Louis (FRED), International Monetary Fund (IMF), Japan National Tourism Organization (JNTO), Co-operation and Development (OECD).

3.3 Data Description

3.3.1 Gross Fixed Capital Formation

According to Kanu and Nwaimo (2015), macroeconomic theory applied in official governmental accounts is the defination of Gross Fixed Capital Formation. The "gross" means that it will not have any reconciliation on fixed capital such as depreciation of fixed capital, and also excluded land purchases. Gross fixed capital is measuring net addition value to fixed capital, which is not total investment because it excluded all types of financial asset, for instance inventories and other costs of operation. Gross fixed capital formation is also one of the components of expenditures to calculate GDP.

3.3.2 Labor Force Participation Rate

Juhn and Potter (2006) stated that labor force participation rate is the proportion of the population who are either working or not working but looking for jobs aggressively. Labor force participation rate is computed by

one times civilian non-institutionalized population divided by labor force while the labor force equal to the people who has job and who do not has job in a country. People who are 16 years old or older can be consider as civilian non-institutional population, but excluding people who are prisoners or those on activity duty in Armed Forces.

3.3.3 Gross Domestic Spending on Research & Development

Gross domestic spending on Research & development (R&D) refers to the total of gross domestic spending on scientific research and experimental development. According to Bayarcelik and Tasel (2012), the components of R&D are the creativity on a organized basis to improve the knowledge that able to develop a brand new applications. The firms who get new innovation will enjoy the monopoly benefits but it will be destroyed until next innovation occurs (Khan & Khattak, 2014).

3.3.4 Tourist Arrivals Population

Tourist arrivals defined as tourists who stay at least one night in the country, while those who does not cross the frontier will not be considered as tourist arrival (Perera, 2017). Catudan (2016) explained that tourism will lead positive and significant effect to GDP and foreign direct investments. Peace and order, good health facilities and services and infrastructures are the concerns that may influence and convince the tourists to visit their destination of interest.

3.3.5 Interaction between R&D and Tourist Arrival

As there is no any priori conclusion about the interaction term, the sign of the coefficient of interaction is uncertain, and no hypothesis is posited. If R&D and tourist arrival happens to be complement and interact to support growth, the sign of the interaction term would be positive and significant. In contrast, if the sign is negative and significant, the interpretation would be R&D and tourist arrival are substitutes. However, if the interaction term has non significant coefficient, the results would be two of the variable are independent of each other in their contribution to economic growth.

3.4 Data Processing

The study includes several steps in data processing. It is started by obtaining the relevant data needed for this study. The data for dependent and independent variables includes GDP per capita, labor, gross fixed capital, gross domestic spending on R&D, and tourist arrival are sourced from World Bank Indicator, Economic Research Federal Reserve Bank of St.Louis (FRED), International monetary fund (IMF),Organisation for Economic Co-operation and Development (OECD) and Japan National Tourism Organization (JNTO) accordingly. Next, we extract all relevant statistic into Microsoft Excel in an adapted manner and convert them into the logarithm form. After that, we used the log-form- variables to carry out empirical tests by using a statistical tool- EViews 9 software, follow by analyzing and interpreting the results and findings based on the methodology that the study have test subjected to the objective and hypothesis.

3.5 Methodology

3.5.1 ARDL Model

The concept of ARDL approach was suggested by Pesaran, Shin and Smith (1996) and revised by Pesaran, Shin and Smith (2001) by implementing the bounds test. In fact, the ARDL approach posits a number of advantages in our research. According to Ifa & Guetat (2018), the ARDL model can effectively identify both short and long-term relationships between the variables with different order of integration which indicated that these variables are stationary in level I(0) or in first difference, I(1). Futhermore, ARDL approach can be use to delete the errors such as variables that being omitted and correlated. Last but not least, ARDL approach is applicable and effective for sample size that is small (Ifa & Guetat, 2018).

An ARDL model for equation (7) is express as below:

$$Y_t = \alpha + \sum_{i=1}^{p} \gamma_i \, y_{t-1} + \sum_{j=1}^{k} \sum_{i=0}^{qi} X_{i,t-i} \, \beta_{j,i} + \varepsilon_t \quad (7)$$

Where: P= number of lags of dependent variable, q_i is the number of lags of the first explanatory variable, and q_k is the number of lags of the k-th explanatory variable.

We express our ARDL regression without interaction term between tourist arrival and technology innovation in equation 8 and it also called as Model 1 in further discussion:

$$\Delta \ln Y_t = \alpha_0 + \beta_0 \ln Y_{t-1} + \beta_1 \ln K_{t-1} + \beta_2 \ln L_{t-1} + \beta_3 \ln R\&D_{t-1} + \beta_4 \ln Tourist_{t-1} + \sum_{i=1}^{p} \beta_{0i} \, \Delta \ln y_{t-i} + \sum_{i=0}^{p} \beta_{1i} \, \Delta \ln K_{t-i} + \sum_{i=0}^{p} \beta_{2i} \, \Delta \ln L_{t-i} + \sum_{i=0}^{p} \beta_{3i} \, \Delta \ln R\&D_{t-i} + \sum_{i=0}^{p} \beta_{4i} \, \Delta \ln Tourist_{t-i} + \mu_t \quad (8)$$

Since our focus is on joint impact of tourist arrivals and technology innovation, we add on the coefficient namely $lnR\&D_{t-1}Tourist_{t-1}$ also known as INT, and form equation 9 and it also called as Model 2 in further discussion.

$$\Delta \ln Y_t = \alpha_0 + \beta_0 \ln Y_{t-1} + \beta_1 \ln K_{t-1} + \beta_2 \ln L_{t-1} + \beta_3 \ln R\&D_{t-1} + \beta_4 \ln Tourist_{t-1} + \beta_5 lnR\&D_{t-1}Tourist_{t-1} + \sum_{i=1}^{p} \beta_{0i} \Delta \ln y_{t-i} + \sum_{i=0}^{p} \beta_{1i} \Delta \ln K_{t-i} + \sum_{i=0}^{p} \beta_{2i} \Delta \ln L_{t-i} + \sum_{i=0}^{p} \beta_{3i} \Delta \ln R\&D_{t-i} + \sum_{i=0}^{p} \beta_{4i} \Delta \ln Tourist_{t-i} + \sum_{i=0}^{p} \beta_{5i} \Delta \ln R\&D_{t-i}Tourist_{t-i} + \mu_t \quad (9)$$

Where, the notations would indicate:

lnY_t = Natural Logarithm of Gross Domestic Product per capita (constant 2010 US $)

lnK_t= Natural Logarithm of Gross Fixed Capital Formation, Nominal, Domestic Currency (Yen ¥)

lnL_t= Natural Logarithm of Labor Force Participation Rate

$lnR\&D_t$= Natural Logarithm of Gross Domestic Spending on R&D (% of GDP)

$lnTourist_t$= Natural Logarithm of Tourist Arrivals Population, million

$lnR\&D_tTourist_t$= Natural Logarithm of Interaction between R&D and Tourist Arrivals

In some cases, explanatory variables, X_i may not consists of lagged terms in the model ($q_i = 0$). These kind of variables are named as static or fixed regressors. In contrast, dynamic regressors is known as exogenous variables with more the one lagged term.

We determine the number of lags of each variable to specify an ARDL model. Simple model selection procedures are able to determine these lag lengths. Since an ARDL model can be estimated in least squares regression, therefore, standard Akalke, Schwarz and Hannan-Qutnn information criteria can be used for model selection.

3.5.2 Unit Root Test

A unit root test allow us to verify a series is stationary or non-stationary. Ensuring the stationarity of series is important because if the series is non-stationary, it will suffer from spurious regression problem. It happened when we regress one non-stationary variable with other non-stationary variable, the statistic result will suggest a high T-statistic (a significant explanatory variable) with high R square even if the two variable are totally unrelated.

We applied Augmented Dickey-Fuller (ADF) as well as Phillips-Perron test in our study to identify variables' stationary and integration order.

3.5.2.1 Augmented Dickey-Fuller (ADF)

Augmented Dickey-Fuller (ADF) test is the most common method to test for unit root. The ADF model used for testing as below:

$$\Delta Y_t = \mu + \delta y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-i} + e_t \quad (10)$$

Where,

$\delta = \alpha - 1$

α=coefficient of y_{-1}

Δy_t= first difference of y_t , for example: $y_t - y_{t-1}$

The null hypothesis of ADF is H_0 against the alternative hypothesis of $H_1 < 0$. Reject null hyphothesis if the series is stationary. Otherwise, do not reject null hyphothesis.

3.5.2.2 Philips-Perron (PP)

In time series model, the other approach that can be used to examine the existence of unit root is called Philips-Perron (PP) test. The model test written as following form:

$$\Delta y_t = \pi y_{t-1} + \beta_i D_{t-i} + e_t \quad (11)$$

Where,

e_t stands for I(0) with zero mean while D_{t-i} is a deterministic trend component.

The hypothesis is tested for $\pi = 0$. In the basic of null hypothesis, PP test is non-parametric and does not require the specification of the serial correlation form of Δy_t .Thus, there is different in computation method of t-ratio to obtain π value. On the other hand, Shrestha and Bhatta (2017) stated that PP test rectifies the statistics by taking into account the autocorrelation and heteroskedasticity problems.

Although ADF test is more trustable compared to PP test, the test will be less helpful due to the distortion of size and when the power of test is not high. PP test is suggested to used for large volume financial data.

3.5.3 Bounds Test

To identify the long-run relationships among the GDP, K, L, R&D, TOURIST, R&D*TOURIST, we perform bound test under Pesaran et

al.(2001) by using the cointegrating relationship form in equation (8) and equation (9). The procedure of bound test is based on F-test. It is carried out to determine the hypothesis that the variable is cointegrated and non-cointegrated.

The null hypothesis is formed as H_0: $\beta_1=\beta_2=\beta_3=\beta_4=\beta_5=0$, shows the variables are not cointegrated. Whereas the alternative hypothesis is form as $H_{1:}$ At least one of the β_i is not equal to 0, where i = (1,2,3...), there is cointegration among the variables. Wald-test, also known as F-statistic is refered by ARDL bounds test. In the cointegration test, Pesaran et al. (2001) explained that if all variables are I(0) under lower critical bound estimation ,the variables are not cointegrated. In contrast, if all variables are I(1) under upper bound estimation, the variables are cointegrated. As the estimated F-statistic is larger than upper bound critical value, then we do not reject the H_0 which means there is no cointegration among the variables.

3.6 Diagnostic Checking

3.6.1 Autocorrelation

Correlation between series of observations ordered in time is defined as autocorrelation problem. Autocorrelation arises when the error term correlated. In other words, two error terms are dependent. Therefore, Breusch-Godfrey Serial Correlation LM test will be applied to identify the autocorrelation issues. Reject null hypothesis if p-value is less than significance level at 1%, 5% and 10% percent. Otherwise, do not reject null hypothesis.

3.6.2 Normality Test

We apply Jarque-Bera test to identify the error term's normality. By using Jarque-Bera tests, we can identify whether the skewness and kurtosis of error term is normally distributed. The null hypothesis of Jarque- Bera test indicate the error term is normally distributed. The decision rule will be reject null hypothesis if p-value is less than significance level at 1%, 5% and 10%. Otherwise, do not reject null hypothesis.

3.6.3 Heteroskedasticity

Another important regression analysis is heteroskedasticity test. When heteroskedasticity occur, variance of the error term in not constant. Besides, heteroskedasticity may occur due to omission of some important variables from the model, distribution of one or more regressors is uneven, incorrect data transformation and incorrect functional form. Hence, we use Autoregressive Conditional Heteroscedasticity (ARCH) to check this issue. The null hypothesis of ARCH test indicates the model has no heteroscedasticity problem. We will reject the null hypothesis if p-value is less than significance level at 1 percent, 5 percent and 10 percent. Otherwise, do not reject null hypothesis.

3.6.4 Ramsey Reset Test

In general, a functional form misspecification shows that the model included irrelavant explanatory variable, omitting important variable and adopt wrong functional form (Gujarati & Porter, 2009). In short, the remaining parameter estimators bias is cause by misspecification of the functional form. In RESET test statistic, the Auxiliary regression is presented by equation 12.

$$y = \beta_0 + \beta_1 + \beta_2 x_2 + \cdots + \beta_n x_n + \delta_2 \, y\hat{}2 + \, \delta_2 y\hat{}3 \mu \quad (12)$$

The null hypothesis of RESET test indicates that the model is correctly specified. We will reject the null hypothesis if p-value is lower than significance level at 0.10, 0.05, 0.01. Otherwise, do not reject null hypothesis.

3.6.5 CUSUM & CUSUMSQ Test

CUSUM and CUSUMSQ tests are used to check the long-run stability of the model (Pesaran & Pesaran,1996). The tests is apply on the first observations and plotted against breaking point. The coefficients are stable when the plot stays within the range of 5 percent significance level.

Chapter 4 Data Analysis

4.0 Introduction

Analysis is make on the several methodology that was discussed in previous chapter. Hence, we conduct diagnostic test such us Unit Root test by using Augmented Dickey Fuller (ADF) test and Philips Perron (PP) test to test the stationarity among all variable. Bound test will also be applied in this study to examine the long run relationship among the variable. Lastly, diagnostic test such as serial correlation LM test, Jarque-Bera test ,ARCH test, Ramsey Reset test and stability test will be applied.

4.1 Descriptive Statistics

Table 4.1. Descriptive Statistics (1986-2016)

Variable	GDP (Million)	L (percentage)	K (In million)	R&D (percentage)	Tourist (Million)
Mean	5.28	61.63	1.32	2.94	6.49
Standard Deviation	5.77	1.71	1.76	0.30	4.89
Maximum	6.05	64.00	1.60	3.40	2.40
Minimum	3.82	59.10	1.01	2.44	2.06

This study is based on annual data of Japan`s gross domestic product (GDP), labor (L), capital (K), technology innovation (R&D), and tourist arrived (TOURIST). Based on the table, average change in labor is highest with the mean value of 61.63, followed by TOURIST(6.49), GDP(5.28), R&D(2.94) and K (1.32). Furthermore, R&D was founded to have largest difference between maximum value and minimum value. The largest value of R&D was 1.60 while lowest was 1.01 over the period of year 1986-2016. Besides, GDP founded to have highest standard deviation which was 5.77 followed by the Tourist, L, K, and R&D with the value of 4.89, 1.71, 1.76 and 0.30 respectively.

4.2 Unit root test

Table 4.2. Unit test result

Variable	ADF		Phillips- Perron	
	Level (Constant trend)	First Difference (Constant without Trend)	Level (Constant trend)	First Difference (Constant without Trend)
Ln GDP	-2.9282	-3.8347 ***	-4.4311***	-3.7764***
	(0.1704)	(0.0069)	(0.0073)	(0.0079)
	{4}	{0}	{3}	{1}
Ln K	--3.0767	-3.412***	-3.4554*	2.1782**
	(0.1310)	(0.0191)	(0.0630)	(0.0305)
	{2}	{1}	{1}	{9}
Ln L	-2.9078	-2.2205***	-1.8892	-1.9760**
	(0.1747)	(0.0279)	(0.6351)	(0.0174)
	{1}	{2}	{3}	{1}
Ln RD	-1.0513	-3.3502 **	-1.5580	-3.2642**
	(0.9208)	(0.0216)	(0.7856)	(0.0262)
	{0}	{0}	{2}	{3}

Ln TOURIST	-3.5644*	4.0567***	-1.3062	-5.3874***
	(0.0524)	(0.0046)	(0.8669)	(0.0001)
	{3}	{4}	{3}	{3}
INT	-0.6376	-5.1224***	-2.0221	-2.2537**
	(0.8454)	(0.0003)	(0.5661)	(0.0257)
	{1}	{3}	{4}	{5}

Notes:The maximum lag length allowed for ADF test is 7 on basic of AIC. Newey-West and Bartlett Kernel method is use to select the bandwidth and estimate the spectral in PP test. ( ) represent p-value and { } refer to maximum lag length. The value in brackets represent p-value. The symbol *,** and *** represent significance at 10%, 5% and 1% respectively.

Clearly, based on the results from table 4.2, the series in level are not stationary. When comes to first difference, all series are stationary under ADF test and PP test. We imply that all series are rejecting the null hypothesis at first order of integration. Since the result fulfill the requirements, we will proceed to bound testing procedure.

4.3 Autoregressive Distributed Lag (ARDL)

Model I is the estimated results without interaction term between tourist arrival and technology innovation refer to equation 8. Model II is estimation results with interaction term between tourist arrival and technology innovation refer to equation 9.

Table 4.3. Bounds testing results, & results of Linear ARDL models estimation.

	Model (I)	**Model (II)**
Selected Model	ARDL(1,0,0,0)	ARDL(1,0,0,0)
Bounds test F-statistic	6.9035	6.0055
95 % lower bound	2.86	2.62

95% upper bound	4.01	3.79
Conclusion	Cointegrated	Cointegrated

Independent Variable	**Dependent Variable, In Y**	
In K	0.7319 *** (0.1830) {0.0005}	0.5596*** (0.1498) {0.0011}
In L	-5.4653*** (1.7146) {0.0040}	-4.2573*** (1.3206) {0.0038}
In R&D	-0.2502 (0.2986) {0.4103}	5.7127** (2.6218) {0.0398}
In TOURIST	0.0278 (0.0275) {0.3225}	0.4797** (0.2009) {0.0256}
INT	- - -	-0.3829** (0.1705) {0.0346}
ECT_{-1}	-0.3554*** (0.0626) {0.0000}	-0.4493*** (0.0781) {0.0000}

Notes: Numbers inside parentheses are lag lengths. K—Gross capital formation, L—Labor force participation rate, R&D—Gross domestic spending of R&D (total % of GDP), TOURIST –Tourists arrived. . ( ) represent T-statistic and { } refer to p-value. The value in brackets represent p-value. The symbol *,** and *** represent significance at 10%, 5% and 1% respectively. Model I refer to equation 8 and Model II refer to equation 9.

Table 4.3 shows the bound test result for model I and model II as well as relationship level estimation. The bound F-statistic for model I (6.9035) over the 5% upper bound 4.01, therefore do not accept the null. Besides, for model II, the bound testing F-statistic (6.0055) over the 5% upper bound (3.79), therefore do not accept null.

Table 4.3 confirmed the existence of long run relationship between GDP growth and its macroeconomics variables. There are two non-identical fashions to estimate Equation (5). Model I is for estimating results without interaction term of tourist arrivals and technology innovation, model II is for estimating results with interaction term of tourist arrival and technology innovation. All level estimates expect for In L have the sign as expected and highly significant. The coefficient of ECT in model I is 35.54 percent and is statistically significant at 1% significant level. The result reveals that gross domestic spending converges on its long-run equilibrium with the adjustment speed of 35.54 percent. For model II, coefficient of ECT is 44.93 percent and statistically significant at 1% significant level. The result indicate that gross domestic spending converges on its long-run equilibrium with the adjustment speed of 44.93 percent.

Model I and Model II indicate the presence of cointegration when Δln Y is the endogeneous variable. Δln K in model I and model II have significant expected signs. 1 % raise in GDP growth associated with 0.7319 percent increase in capital formation, ceteris paribus in model I. On the other side, 1 % increase in GDP growth associated with 0.5596 percent increase in capital formation, ceteris paribus. For the capital to GDP, the result shows that is consistent with some studies in this field, there is a positively correlated between fixed capital formation and GDP in the long run in Pakistan (Ali, 2015). Ongo and Vukenkeng (2014) stated that gross fixed capital formation is significantly and positively associated with GDP, and it also related to the development of infrastructure and advancement of technology. According to Ugochukwu and Chinyere (2013), capital formation and economic growth has a significant positive relationship in the long run and Nigeria government was suggested to emphasize on accumulating capital in order to stimulate development and economic growth.

For labor, based on discussion on previous study, we estimated that there is a positive sign between labor and GDP growth. However, the coefficient sign of

labor is negative but significant to the GDP growth, which oppose the production function assumption. An additional 1percent GDP growth will lead to a lower labor participation rate by 5.47 percent in model I, ceteris paribus; A 1 percent increase in GDP growth will decrease labor participation rate by 4.26 percent in model II, ceteris paribus. Several empirical studies have stated the reason of the reducing in Japan's productivity. According to Nakumura, Kaihatsu and Yagi (2019), the major factor of reducing Japan's productivity growth is the slowdown in total factor productivity (TFP). The study considered the crucral reason for productivity growth: new labor skills, way of working, and the flexibility in reallocating the resources of management. For instance, capital and labor. Based on the result of Corrado, Haskel, Jona, and Lommi (2012), it shows that investing insufficiently in software, human and organization capital have led to slow down in Japan's productivity growth. Next, the reason of low labor participation rate is lack of internal practice chance and contemporaneous employ new graduates. In manufacturing sector, the downsloping trend of 'regular worker' share is also a reason of low labor participation rate (Nakumura et al, 2019).

While there are different results in Δln R&D in both model I and model II. In model I, coefficient of Δln R&D is negative sign and insignificant to the GDP growth. An additional 1 percent GDP growth will lead to lower gross domestic spending of R&D by 0.2502 percent, ceteris paribus which contradicts with the assumption of study before. However, in model II, coefficient of Δln R&D is expected sign which positive and significant to the GDP growth. Specifically, a 1percent increase in GDP growth promotes 5.71 percent increase in gross domestic spending of R&D, ceteris paribus. The result is line with Bujari and Martínez (2016) for the case in Latin, showed that investment in R&D has a significant positive relationship associated with GDP, which means a greater investment in R&D will also increase in total factor production and in order to enhance economic growth. According to Gumus and Celikay (2015), R&D expenditure and GDP have significantly positive relationship for total of 52 developed countries.

For Δln tourist, result show sign of coefficient of tourist arrived is positive and insignificant in Model I but significant in Model II. A 1% increase in tourists arrived will lead to higher GDP growth for 0.48%, ceteris paribus. For the tourist arrivals, the result can be supported by several empirical studies, Jayathilake (2013) stated that a positive relationship between tourism and economic growth, which can concludes that the model of tourism-led growth and positive effect of tourism development on economic growth. According to Kum, Aslan and Gungor (2015), a studies examined the relationship between tourist arrivals and GDP showed a positive relationship and also indicate that economic-driven tourism growth happens in N-11 countries. A positively correlated between tourist arrivals and economic growth and the empirical results showed the tourism-led growth hypothesis in Vietnam (Shih & Do, 2016).

For the interaction term between technology innovation and tourist arrivals, shows -0.3829 at the 0.05 significant level, which suggest that there is substitution effect between them. Mokhtari (2018) defines substitution as one macroeconomic determinants might be substituted for another alternate determinants, and still boost the economic growth. Based on view of Mokhtari's finding, economic growth can achieve with help of either technology innovation and tourist arrivals. According to the result of table 4.3, tourist arrivals and technology innovation are positive significantly to economic growth, which mean both variable will lead to economic growth when two variable is independent. Concerning substitution effect, increase investment in technology innovation and travel sector will consume large amount of financial funds under a limited budget, the results suggest that government should choose to invest in either one macroeconomic determinants to boost the economic growth since they have the same impact on GDP growth and both variable are substitute.

4.4 Diagnostic Checking

Table 4.4. Diagnostic Checking result

Jarque-Bera	10.1222***	3.2111
	[0.0063]	[0.2008]
BGLM	1.0284	0.6321
	[0.3741]	[0.5413]
ARCH	4.2214**	3.5439
	[0.0399]	[0.1700]
RESET	1.4578	0.1777
	[0.1584]	[0.8606]
CUSUM	S	S
CUSUMSQ	U	S

Notes : [ ] represent p-value. ‘ S’ denotes stable estimates while ‘U’ denote unstable estimates from CUSUM and CUSUMSQ tests. The symbol *,** and *** represent significance at 10%, 5% and 1% respectively.

Before further inferences, we assess all the models’ sufficiency of the dynamic specification according to different diagnostic tests such as Jarque-Bera test for error normality, RESET test for the misspecification of the model, LM test for serial correlation, the ARCH test for autoregressive conditional heteroskedasticity. Lastly, we test stability of the estimated model’s coefficients by applying cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ). In the sample period, the plots of CUSUM and CUSUMSQ statistics shown in Table 4.5 which are within 95% and 90% critical bounds respectively represents the estimated model’s coefficients are stable.

It seems that Model I and Model II do not pass all diagnostic tests, namely Jarque- Bera, ARCH tests and CUSUMSQ stability tests. Model 1 failed the functional form Jarque-Bera, which suggest that the model is not normal distributed. Besides, Model 1 also did not pass ARCH test, which indicates that model suffer

from Autoregressive Conditional Heteroskedasticity (ARCH) effect, and it also failed the CUSUMSQ test which shows that the parameters is unstable over the sample periods. On the other hand, model 2 have pass all diagnostic tests. The model is adequately specified for ARDL estimation because it did not violate the critical assumption of no parameter instability and no serial correlation.

Table 4.5. Plots of CUSUM and CUSUMSQ for the estimated Model I and Model II

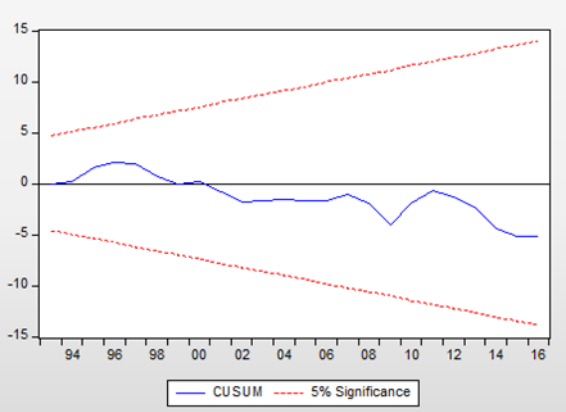


Figure 4.1. Plots of CUSUM for Model 1

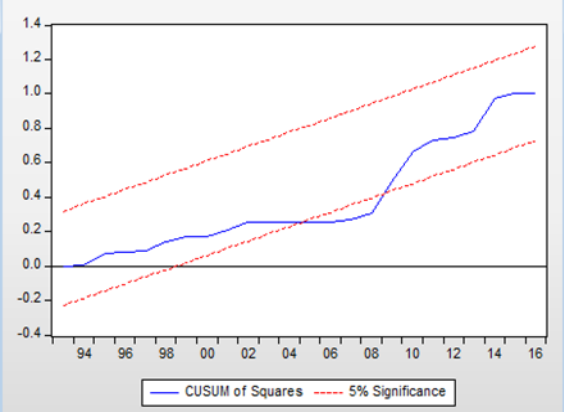


Figure 4.2.Plots of CUSUMSQ for Model 1

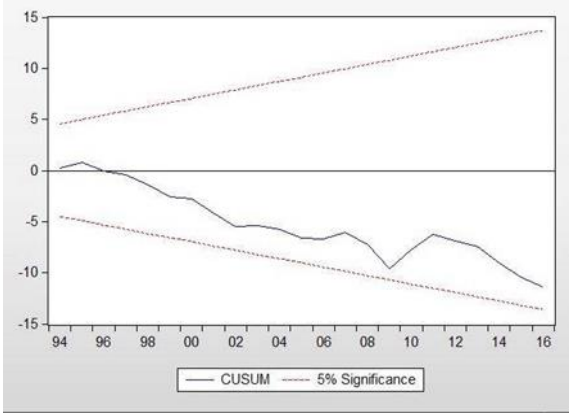


Figure 4.3. Plots of CUSUM for Model 2

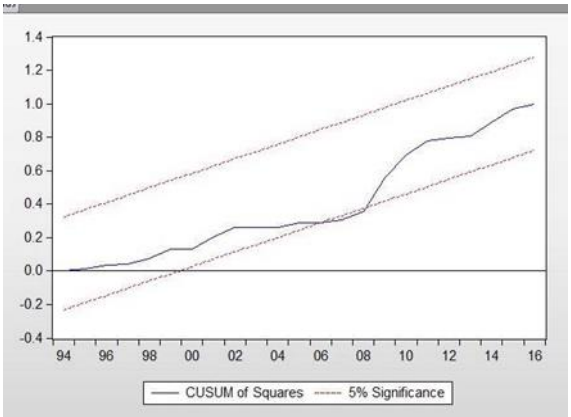


Figure 4.4. Plots of CUSUMSQ for Model 2

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

This chapter summarizes our studies. The results indicated that there is a significant relationship and substitute effect between the tourist arrivals and technological innovation. Besides, this chapter concludes the policy recommendations, limitations and recommendations of our studies for future references.

5.1 Summary

Natural disasters will bring a negative impact on the number of tourists and it will push tourist arrivals away from the tourist attractions. The inter-occurrence times of earthquakes and tsunami for Japan is 186.23 days and 273.31 days on average from the years 1900 to 2013 (Parwanto & Oryama, 2014). Makochekanwa (2013) found that tourism industry has been known as a significant instrument to promote the economy growth, reduce poverty and improve food security. Therefore, technological innovation and advancement able to reduce the damage of natural disaster by pre-disaster preparedness or post-disaster recovery have a place in reassuring tourists and ultimately achieve Japanese government's goals of promoting economic growth through tourism. With technological innovation, Japanese Shinkansen Bullet Trains successfully worked and saved the life of passengers during the year 2004 Niigata-Chuetsu Earthquake at Joetsu Shinkansen.

The aim of this research is to study the importance of technology innovation in dealing with natural disaster to boost the confidence level of tourisms towards Japan. To test the relationship between dependent variable, economy growth with independent variables, tourist arrivals, technology innovation, capital, labor and an interaction term between tourist arrivals and technology innovation by applying the Autoregressive Distributed Lag (ARDL) methodology.

According to the results in Chapter 4, it showed a positive effect of capital, tourist arrivals and technological innovation on economic growth while negative effect of labor on economic growth. For the joint impact, it showed a negative sign which mean there is substitute effect between the technology innovation and tourist arrivals.

Based on our study, there is a positively significant effect on economic growth. The firm-level productivity will increase when there is an installation of new capital equipment productivity increase. The result is consistent with Ali (2015) and Ongo and Vukenkeng (2014). Technical progress led by capital formation thus an increase in production and specialization within the economy. When there is an adequate exploitation of natural resources, capital formation able to establishment of level of income which allow the needs and wants can be satisfied.

For the relationship between labor and economy growth, the study found there is negative and significant between the variables. Based on previous discussion in Chapter 3, a prediction that labor will bring positive effect on economy growth while the results showed a negative sign. There are some empirical research, Nakumura, Kaihatsu and Yagi (2009) and Corrado, Haskel, Jona, Lommi (2012) supported that reason for the decline in Japan productivity. An insufficient and inefficient on investment, human and organization capital which led to slow down in Japan productivity. Other than that, lack of internal training opportunities and simultaneous hiring of new graduates which led to a declining trend of ‘regular worker’ share in manufacturing sector thus reducing productivity.

A positive and significantly relationship between R&D and economic growth has been found on this research. An increase in public R&D investment will increase the total factor productivity of the R&D sector thus boost the R&D production. Moreover, the productivity in the finals goods production sector and household consumption will increase when there is an increase in public R&D. The study's findings line with Bujari and Martínez (2016) and Gumus and Celikay (2015). R&D spending will bring a strong and positive impact on economic growth in long run but weak in short run for developing countries.

Other than that, the results showed tourist arrivals is positive and significant on economy growth.The result supported by Jayathilake (2013) and Shih and Do (2016). The tourism-led growth hypothesis is to analyze a possible unidirectional causal relationship from tourism development to economic growth in short run and long run. Tourism development link with wide range of industries and it bring positive impact to society which are household income, government revenue and balance of payment. Therefore, the international tourism act as a potential strategic factor for economic growth. Brida , Carrera and Risso (2008) pointed out that the international tourism expenditure was positively associated with economy growth.

The joint impact effect for the interaction term between technology innovation and tourist arrivals is substitute effect. Substitute effect define as the one variables might be substituted by another variable, yet still boost the economic growth. Within a limited budget, policy maker is suggested to focus on either investment since both investment also will bring a positive and significant impact on economy growth.

5.2 Policy Implications

In this study, we found that there is substitute effect between technology innovation and tourism arrival on influencing economic growth of Japan. The results also presented technology innovation has dominant relationship with Japan's GDP. Japan as a vulnerable country to natural disasters such as earthquake is a significant issue affecting the tourism industry. As natural disaster cannot be totally eliminated, Japan government could focus on policies to promote R&D innovations to diminish the risks and consequences of natural disaster. The confidence level of tourists towards Japan can be enhanced if policies are well implemented. Great policy is not an easy journey but it will lead to a great difference. Therefore, government and policy makers of Japan act as a crucial position and role to develop policies regarding R&D to cope with natural disaster.

In order to promote a sound policy on promoting R&D innovation to cope with natural disaster, a strong cooperation between policy maker, technical and scientist is needed (United Nations, 2009). A well-performed policy based on technology innovation area required commitment from all levels of a country not only government but also from international and local. Japan is a country that has great awareness and advance in disaster hazard reduction. However, there is still remained a question on engaging technology with policies so that disaster hazard reduction policies can be developed based on technology. Japan could invest on technology and science expertises to strengthen knowledge and effort on disaster resilience. Those professionals and expertises would help Japan to innovate effective equipments or technologies to prevent serious effect from disaster. Japan also could focus on policy to attract more technology professionals in this area from foreign countries.

Moreover, government could focus on policy minimizing the consequences of natural disaster such as investing and developing on infrastructure which can

accurately predict the weather and hazard. A system with strong and effectual advance-warning signal is a main component on lowering risk of natural disaster (Rosa & Murisic, 2018). When there is a sign of natural disaster, this system can perform issuance of warnings to public timely and effectively. This allow advanced prevention work to be carried out productively to minimize the risk and loss associated with natural disaster. Hence, the tourism sector will not be affected significantly as the recovery process and period after natural disaster will not take too long time. The monitoring job of advance-warning system is part of the components that cannot be ignored. Japan could keep observing and updating on vary change of trends and threats of natural disaster from time to time.

Japan also could form a legislative framework on R&D innovation area for minimizing disaster risk to improve growth of tourism sector. Under the framework, government could focus on few actions and targets such as improving their various technologies to reinforce preparedness towards disasters, continuously developing and investing in disaster resilience and access to technology knowledges of other countries. In order to enhance and make the framework stronger to achieve the targets as well as action plans, a country contingency plan could be adapted to deal with the uncertainty of climate change.

5.3 Limitations

In our studies, we have faced a few of limitations as well. One of the crucial shortcomings is the insufficient of data. We are unable to obtain the data set as the data sources available in Japan is only from 1986 to 2016, a total of 31 years only which is comparatively less than other time series model research. The larger the sample size, the more precise the result would be. Therefore, we may not precisely examine the joint impact between tourists arrivals and technological innovation based on the recent data. We trusted that the joint impact between tourist arrivals

and technological innovation can be well interpreted if there is sufficient of recent data.

Last but not least, our paper employed capital, labor, R&D innovations and tourists arrivals as the exogenous variables to examine their relationship towards economic growth (GDP). However, there are still a lot of exogenous variables may affect the GDP such as foreign direct investment, public spending, inflation rate and other more. A high degree of freedom will lead to a more significant results. However, the degree of freedom will be reduced if we include more exogenous variables. Furthermore, the probability of exogenous variables correlated each other will increase if we include more variables.

5.4 Recommendations

The limitations identified and discussed in the above section provided areas that can be further enhanced in future studies. First and foremost, the period studied for our research is comparative less than the other time series model research due to insufficiency of data in Gross domestic spending on R&D. We recommended that alternatives of technological innovation indicator that have data available in longer time period could be used to obtain more accurate results. If future researchers could obtain a longer and more updated time period of data range for Gross domestic spending on R&D, the consistency and accuracy could be improved and the findings will be more credible. The data used for studying the impact of technological innovation have to be more updated and recent to reduce the deviation between estimates and the actual situation.

Last but not least, the future extension of current study may employ panel data models for their research to overcome omitted variables bias. The joint impact

of technological innovation and tourist arrival examined by our study is limited to Japan. Future researchers could expand their area of study to group of developed countries and developing countries for more in-depth analysis in examining the joint impact. For illustration, an empirical study that involves a group of developing countries enables the data to be analyzed in a broader horizon and the evaluation based on these results can be more accurate. The evaluations that are credible can be used tentatively with other information to form a strategy for spurring economic growth.

REFERENCES

Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica, 60*(2) , 323-351.

Akan, Y., Isik, C., & Arslan, I. (2009). The impact of tourism on economic growth: The case of Turkey. *Journal of Tourism, 9*.

Ali, G. (2015). Gross fixed capital formation & economic growth of Pakistan. IMPACT: *Journal of Research in Humanities, Arts and Literature, 1*(2), 21-30.

Amuka, J.I., Asogwa, F.O., Ugwu, C.C., & Ugwu, K.C. (2018). Testing the fit of Cobb- Douglass production function within unrestricted least squares. *International Journal of Economics and Financial Issues, 8*(3), 142-147.

Aslan, A. (2013). Tourism development and economic growth in the Mediterranean countries: evidence from panel Granger causality tests. *Current Issues in Tourism, 17*(40), 363-372.

Bayarcelik, E. B., & Taşel, F. (2012). Research and development: source of economic growth. *Procedia-Social and Behavioral Sciences, 58*, 744-753.

Bilbao, B.O., & Rodriquez, P.A. (2004). From R&D to innovation and economic growth in the EU. *Growth and Change: A Journal of Urban and Regional Policy, 35*(4), 434-455.

Bloom, D.E., Canning, D., & Fink, G. (2010). Implications of population ageing for economic growth. *Oxford Review of Economic Policy, 26*(4), 583–612.

Bozkurt, C. (2014). R&D expenditures and economic growth relationship in Turkey. *International Journal of Economics and Financial Issues, 5*(1), 188-198.

Brida, J.G., Pereyra, J.S., Risso, W.A., Devesa, M.J.S., & Aguirre S.Z. (2008). The tourism-led growth hypothesis: Empirical evidence from Colombia. *An international Multidisciplinary Journal of Tourism, 4*(2), 13-27.

Brida J.G., Carrera E.S., & Risso W.A. (2008). Tourism's impact on long-run Mexican economic growth. *Economics Bulletin, 3*(21), 1-8.

Bujari, A. A., & Mart´ınez, F. V. (2016). Technological innovation and economic growth in Latin America. *Revista Mexicana de Econom´ıa y Finanzas, 11*(2), 77-89.

Calgaro, E., & Lloyd, K. (2008). Sun, sea, sand and tsunami: examining disaster vulnerability in the tourism community of Khao Lak, Thailand. *Singapore Journal of Tropical Geography, 29*(3), 288-306.

Catudan, J. M. J. (2016). The impact of tourist arrivals, physical infrastructures, and employment, on regional output Growth. *Procedia-Social and Behavioral Sciences, 219*, 175-184.

Čerović,S., Knežević, M., Matović, V., & Brdar, I. (2015). The contribution of tourism industry on the GDP growth of Western Balkan countries. *Industrija, 43*(3).

Chen, C., & Song, Z. C. W. (2009). Tourism expansion, tourism uncertainty and economic growth: New evidence from Taiwan and Korea. *Tourism Management, 30*(6), 812-818.

Chiou, C. R., Huang, M. Y., Tsai, W. L., Lin, L. C., & Yu, C. P. (2013). Assessing impact of natural disasters on tourist arrivals: The case of Xitou Nature Education Area (XNEA), Taiwan. *International Journal of Tourism Sciences, 13*(1), 47-64.

Corrado. C., Haskel. J., Jona-Lasinio C., & Lommi. M. (2012). Intangible capital and growth in advanced economies: Measurement methods and comparative results. *INTAN Investment Working Paper*.

Demiroz, D. M., & Ongan, S. (2005). The contribution of tourism to the long-run Turkish economic growth. *Ekonomický časopis*, *9*, 880-894.

Dinu, A. M. (2012). The importance of tourism and touristic services in GDP. *Quaestus Multidisciplinary Research Journal.*

Ekanayake, E. M., & Long, A. E. (2012). Tourism development and economic growth in developing countries. *The International Journal of Business and Finance Research*, *6*(1), 51-63.

Eugenio-Martin, J. L., Morales, N. M., & Scarpa, R. (2004). Tourism and economic growth in Latin American Countries: A panel data approach. *Social Science Research Network Electronic Journal.*

Fayissa, B., Nsiah, C., & Tadasse, B. (2007). The impact of tourism on economic growth and development in Africa. *Department of Economics and Finance Working Paper Series.*

Goel, R. K., & Ram, R. (1994). Research and development expenditures and Economic growth: A cross-country study. *Economic Development and Cultural Change*, *42*(2), 403–411.

Goi, C. L. (2017). The impact of technological innovation on building a sustainable city. *International Journal of Quality Innovation*, *3*(6).

Gumus, E., & Celikay, F. (2015). R&D expenditure and economic growth: New empirical evidence. *Margin The Journal of Applied Economic Research, 9*(3), 205-217.

Gujarati, D. N., & Porter, D. C. (2009). *Basic Econometrics*. Americans, NY: McGraw−Hill Companies.

Ifa, A., & Guatat, I. (2018). Does public expenditure on education promote Tunisian and Moroccan GDP per capita? ARDL approach. *The Journal of Finance and Data Science, 4*(4), 234-246.

Jayathilake, P. M. B. (2013). Tourism and economic growth in Sri Lanka: Evidence from cointegration and causality analysis. *International Journal of Business, Economics and Law, 2*(2), 22-27.

Johnson, R., Donnelly, J. M., & Cooper, W. H. (2011). Japan's 2011 earthquake and tsunami: Economic effects and implications for the United States. *Congressional Research Service Report for Congress.*

Juhn, C., & Potter, S. (2006). Changes in labor force participation in the United States. *Journal of Economic Perspectives, 20*(3), 27-46.

Kadir, N., Nayan, S., & Abdullah, M. S. (2010). The causal relationship between tourism and economic growth in Malaysia: Evidence from multivariate causality tests. *Encontros Científicos, 6*, 16-24.

Kanu, S. I., & Nwaimo, C. E. (2015). Capital expenditures and gross fixed capital formation in Nigeria. *Research Journal of Finance and Accounting, 6*(12), 188-197.

Kargi, B. (2014). Labor force participation rate and economic growth: Observations for Turkey. *Universal Journal of Management and Social Scien*ces, *4*(4), 46-54.

Katircioglu, S. T. (2009). Revisiting the tourism-led-growth hypothesis for Turkey using the bounds test and Johansen approach for cointegration. *Tourism Management, 30*(1), 17-20.

Khan, J., & Khattak, R. N. U. (2014). The significance of research and development for economic growth: The case of Pakistan. *MPRA Paper No.56005*.

Kim, H. J., & Chen, M. H. (2006). Tourism expansion and economic development: The case of Taiwan. *Tourism management, 27*(5), 925-933.

Kum, H., Aslan, A., & Gungor, M. (2015). Tourism and economic growth: The case of next-11 countries. *International Journal of Economics and Financial Issues, 5*(4), 1075-1081.

Lau, E., Oh, S. L., & Hu, S. S. (2008). Tourist arrivals and economic growth in Sarawak. *Munich Personal RePEc Archive (MPRA) Paper No. 9888.*

Lean, H. H., & Tang, C. F. (2010). Is the tourism-led growth hypothesis stable for Malaysia? A note. *International Journal of Tourism Research, 12*, 375-378.

Lean, H. H., Chong, S. H., & Hooy, C. W. (2014). Tourism and economic growth: Comparing Malaysia and Singapore. *International Journal of Economics and Management, 8*(1), 139 – 157.

Lee, C. C., & Chang, C. P. (2008). Tourism development and economic growth: A closer look at panels. *Tourism Management, 29*(1), 180-192.

Lee, C. G. (2008). Tourism and economic growth: the case of Singapore. *Regional and Sectoral Economic Studies*, *8*(1), 89-98.

Makochekanwa, A. (2013). An analysis of tourism contribution to economic growth in SADC Countries. *Botswana Journal of Economics, 11*(15), 42-56.

McCallum, I., Liu, W., See, L., Mechler, R., Keating, A., Hochrainer-Stigler, S., Mochizuki, J., Fritz, S., Dugar, S., Arestegui, M., Szoenyi, M., Bayas, J. L., Burek, P., French, A., & Moorthy, I. (2016). Technologies to support community flood disaster risk reduction. *International Journal Disaster Risk Science, 7*, 198-204.

Mishra, P. K., Rout, H. B., & Mohapatra, S. S. (2011). Causality between tourism and economic growth: Empirical evidence from India. *European Journal of Social Sciences*, *18*(4), 518-527.

Mishra, S. K. (2007). A brief history of production functions.*The IUP Journal of Managerial Economics*, *7*(4), 6-34.

Mladenović, S. S., Cvetanović, S., & Mladenović, I. (2016). R&D expenditure and economic growth: EU28 evidence for the period 2002–2012. *Economic research-Ekonomska istraživanja*, *29*(1), 1005-1020.

Mokhtari, H. (2018). Economic order quantity for joint complementary and substitutable items. *Mathematics and Computers in Simulation*, *154*, 34-47.

Munir, Q., Kogid, M., & Mifli, M. (n.d.). Tourism and economic growth in Malaysia: Cointegration and causality analysis. Retrieved from https://www.ums.edu.my/fpep/files/ECO_Others_1.pdf

Nakamura, K., Kaihatsu, S., & Yagi, T. (2019). Productivity improvement and economic growth: lessons from Japan. *Economic Analysis and Policy*, *62*, 57-79.

Nakanishi, H., Black, J., & Matsuo, K. (2014). Disaster resilience in transportation: Japan earthquake and tsunami 2011. *International Journal of Law in the Built Environment, 5*(4), 341-361.

Naudé, W., & Saayman, A. (2005). The determinants of tourist arrivals in Africa: A panel data regression analysis. *Tourism Economics, 11*(3), 365–391.

Nishikawa, S. (2015). Incorporating science and technology for disaster risk reduction The Japanese experience. *Planet@Risk, 3*(1), 95-106.

Obadiah, N. K., Odhiambo, N. M., & Njuguna, J. M. (2012). Tourism and economic growth in Kenya: An empirical investigation. *International Business & Economics Research Journal*, *11*(5), 517-528.

Ongo, E. N., & Vukenkeng, A. W. (2014). Does gross capital formation matter for economic growth in the CEMAC sub-region?. *EuroEconomica*, *33*(2).

Othman, R., Salleh, N. M. H., & Sarmidi, T. (2012). Analysis of causal relationship between tourism development, economic growth and foreign direct investment: An ARDL Approach. *Journal of Applied Sciences, 12*(12), 1245-1254.

Ozcan, C. C., Aslan, M., & Nazlioglu, S. (2017). Economic freedom, economic growth and international tourism for post-communist (transition) countries: A panel causality analysis. *Theoretical and Applied Economics, 2017*(2), 75-98.

Ozturk, I., & Acaravci, A. (2009). On the causality between tourism growth and economic growth: Empirical evidence from Turkey. *Transylvanian Review of Administrative Sciences, 5*(25), 73-81.

Park, S. Y., & Kim, S. H. (2017). Tourism development and economic growth in Korea: Causal relationship in tails. *Tourism Analysis, 2*(2), 149-165.

Parwanto, N. B., & Oryama, T. (2014). A statistical analysis and comparison of historical earthquake and tsunami disasters in Japan and Indonesia. *International Journal of Disaster Risk Reduction, 7*, 122-141.

Paudel, R., & Perera, N. (2009). Foreign debt, trade openness, labor force and economic growth: Evidence from Sri Lanka. *The ICFAI Journal of Applied Economics*, *8*(1), 57-64.

Pecea, A. M., Simonab, O. E. O., & Salisteanu, F. (2015).Innovation and economic growth: An empirical analysis for CEE countries. *Procedia Economics and Finance, 26*, 461 – 467.

Pesaran, M. H., & Shin, Y. (1999). Econometrics and economic theory in the 20th century: The Ragnar Frisch Centennial Symposium. In S.Strom (Ed.), *An autoregressive distributed lag modelling approach to cointegration analysis* (pp. 371-413). Cambridge: Cambridge University Press

Pesaran, M. H., Shin, Y., & Smith, R. J. (1996).Testing for the existence of a long-run relationship. *Cambridge Working Papers in Economics 9622.*

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16*, 289-326.

Rajapakse, R. P. C. R. (2016). The relationship among FDI, GDP and international tourist arrivals for Sri Lanka: An analysis of granger causality. *International Journal of Research in Economics and Social Sciences*, *6*(5), 183-193.

Robert, M. S.(2010). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics, 70*(1), 65-94.

Rosa, D. D., & Murisic, M. (2018). Romania: Good policies and institutions can limit the impact of natural disasters. Retrieved from https://www.preventionweb.net/news/view/61858

Sak, N., & Karymshakov, K. (2012). Relationship between tourism and economic growth: A panel Granger causality approach. *Asian Economic and Financial Review*, *2*(5), 591-602.

Samimi, A. J., Sadeghi, S. S., & Sadeghi, S. (2011). Tourism and economic growth in developing countries: P-VAR approach tourism and economic growth in developing countries: P-VAR approach. *Middle-East Journal of Scientific Research*, *10*(1), 28-32.

Savas, B., Beskaya, A., & Samiloglu, F. (2010). Analyzing the impact of international tourism on economic growth in Turkey. *ZKU Journal of Social Sciences*, *6*(12), 121-136.

Seghir, G. M., Mostéfa, B., Abbes, S. M., & Zakarya, G. Y. (2015). Tourism spending-economic growth causality in 49 countries: A dynamic panel data approach. *Procedia Economics and Finance*, *23*, 1613-1623.

Selimi, N., Sadiku, L., & Sadiku, M. (2017). The impact of tourism on economic growth in the Western Balkan countries: An empirical analysis. *International Journal of Business and Economic Sciences Applied Research, 10*(2), 19-25.

Sener, S., & Saridogan, E. (2011). The effects of science-technology-innovation on competitiveness and economic growth. *Procedia Social and Behavioral Sciences*, *24*, 815–828.

Shahbaz, M., Kuma, R. R., Ivanov, S., & Loganathan, N. (2017). The nexus between tourism demand and output per capita, with the relative importance of trade openness and financial development: A study of Malaysia. *Tourism Economics*, *23*(1), 168-186.

Shan, J., & Wilson, K. (2010). Causality between trade and tourism: Empirical evidence from China. *Applied Economics Letters*, *8*(4), 279-283.

Shang, J., Wang, Z., Li, L., Chen, Y., & Li, P. (2018). A study on the correlation between technology innovation and the new-type urbanization in Shaanxi Province. *Technological Forecasting and Social Change*, *135*, 266-273.

Shaw, R., Izumi, T., & Shi, P. (2016). Perspectives of science and technology in disaster risk reduction of Asia. *International Journal of Disaster Risk Science*, *7*(4), 329-342.

Shih, W., & Do, N. (2016). Impact of tourism on long-run economic growth of Vietnam. *Modern Economy*, *7*, 371-376.

Shrestha, M. B., & Bhatta, G. R. (2017). Selecting appropriate methodological framework for time series data analysis. *The Journal of Finance and Data Science*, *4*(2), 71-89.

Sung, Y. C. (2018). Revisiting the tourism-led growth hypothesis in a dual model using Mwald Granger causality analysis. *Asian Economic and Financial Review*, *8*(8), 1102-1110.

Tang, C. F. (2011). Tourism, real output and real effective exchange rate in Malaysia: a view from rolling sub-samples. *Munich Personal RePEc Archive (MPRA) Paper No. 29379.*

Tari, R., & Alabas, M. M. (2017). The relationship between R&D expenditures and economic growth: The case of Turkey (1990-2014). *Abant İzzet Baysal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*.

Terzi, H. (2015). Is the tourism-led growth hypothesis (TLGH) valid for Turkey?. *Doğuş Üniversitesi Dergisi*, *16*(2), 165-178.

Tugcu, C. T. (2014). Tourism and economic growth nexus revisited: A panel causality analysis for the case of the Mediterranean region. *Tourism Management*, *42*, 207-212.

Ugochukwu, U. S., & Chinyere, U. P. (2013). The impact of capital formation on the growth of Nigerian economy. *Research Journal of Finance and Accounting*, *4*(9), 36-42.

United Nations. (2005). *Tsunami Thailand one year later: National responses and contribution of international partners.* UN, Bangkok.

United Nations. (2009). *Reducing disaster risks through science: Issues and actions.* UN, Switzerland.

Vaughan, J. (2013, October). Technological innovation: Perceptions and definitions. *Library Technology Reports, 49*(7).

Walters, G., Mair, J., & Ritchie, B. (2014). Understanding the tourist's response to natural disasters. *The case of the 2011 Queensland floods*, *21*(1), 101-113.

White, L., Connelly, A., Garvin, S., & Lawson, N. (2016). Flood resilience technology in Europe: Identifying barriers and co-producing best practice. *Journal of Flood Risk Management.*

Wu, T., & Wu, H. (2018). Tourism and economy growth in Asia: A bootstrap multivariate panel Granger causality. *International Journal of Tourism Research*, *21*(1).

Yasemi, O. (2013). Unemployment and labor force participation: A panel cointegration analysis for European countries. *Applied Econometrics and International Development*, *13*(1), 67-76.

Zalewski, R., & Skawinska, E. (2009). Impact of technological innovations on economic growth of nations. *Systemics, Cybernetics And Informatics*, *7*(6), 35-40.

Zhu, S., Wu, Q. J., & Wang, Y. (2011). Impact of labor force on China's economic growth based on grey metabolic GM (1, 1) model. *In Grey Systems and Intelligent Services (GSIS), 2011 IEEE International Conference*, 262-265.

APPENDICES

Appendix 1: Augmented Dickey-Fuller Test

Level form: Intercept with trend

Null Hypothesis: LN_GDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.928154	0.1704
Test critical values:	1% level	-4.356068	
	5% level	-3.595026	
	10% level	-3.233456	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_K has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.076702	0.1310
Test critical values:	1% level	-4.323979	
	5% level	-3.580623	
	10% level	-3.225334	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_LABOR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.907779	0.1747
Test critical values:	1% level	-4.309824	
	5% level	-3.574244	
	10% level	-3.221728	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_R_D has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.051331	0.9208
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_TOURIST has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.564368	0.0524
Test critical values:	1% level	-4.339330	
	5% level	-3.587527	
	10% level	-3.229230	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INT has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.637630	0.8454
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

First Different : Intercept

Null Hypothesis: D(LN_GDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.834658	0.0069
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LN_K) has a unit root
Exogenous: Constant
Lag Length: 1 (Fixed)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.412087	0.0191
Test critical values:	1% level	-3.689194	
	5% level	-2.971853	
	10% level	-2.625121	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LN_VISITOR) has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.056689	0.0046
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LN_R_D) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.350199	0.0216
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(INT) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=7)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.122375	0.0003
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

*MacKinnon (1996) one-sided p-values.

Phillips-Perron test

Level form: Intercept with trend

Null Hypothesis: LN_GDP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.431683	0.0073
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_K has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.455473	0.0630
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_LABOR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.889174	0.6351
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LN_R_D has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.557960	0.7856
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

Null Hypothesis: LN_TOURIST has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.306170	0.8669
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INT has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.022140	0.5661
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

First Different : Intercept

Null Hypothesis: D(LN_GDP) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.776359	0.0079
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000434
HAC corrected variance (Bartlett kernel)	0.000384

Null Hypothesis: D(LN_K) has a unit root
Exogenous: None
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.178210	0.0305
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.001552
HAC corrected variance (Bartlett kernel)	0.000747

Null Hypothesis: D(LN_LABOR) has a unit root
Exogenous: None
Bandwidth: 1 (Used-specified) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.042464	0.0412
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	1.30E-05
HAC corrected variance (Bartlett kernel)	1.42E-05

Null Hypothesis: D(LN_R_D) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.264151	0.0262
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000592
HAC corrected variance (Bartlett kernel)	0.000544

Null Hypothesis: D(LN_VISITOR) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.387412	0.0001
Test critical values:	1% level	-3.679322	
	5% level	-2.967767	
	10% level	-2.622989	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.019706
HAC corrected variance (Bartlett kernel)	0.026510

Null Hypothesis: D(INT) has a unit root
Exogenous: None
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.253742	0.0257
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.134815
HAC corrected variance (Bartlett kernel)	0.085300

Appendix 2: ARDL (Equation 8)

ARDL Cointegrating And Long Run Form
Dependent Variable: LN_GDP
Selected Model: ARDL(1, 0, 0, 0, 0)
Date: 04/04/19 Time: 14:02
Sample: 1986 2016
Included observations: 30

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_K)	0.260146	0.063399	4.103336	0.0004
D(LN_LABOR)	-1.942505	0.522534	-3.717474	0.0011
D(LN_R_D)	-0.088941	0.096876	-0.918092	0.3677
D(LN_TOURIST)	0.009868	0.010302	0.957855	0.3477
CointEq(-1)	-0.355428	0.062613	-5.676564	0.0000

Cointeq = LN_GDP - (0.7319*LN_K -5.4653*LN_LABOR -0.2502*LN_R_D + 0.0278*LN_TOURIST + 37.9963)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_K	0.731925	0.182957	4.000523	0.0005
LN_LABOR	-5.465257	1.714644	-3.187401	0.0040
LN_R_D	-0.250236	0.298582	-0.838079	0.4103
LN_TOURIST	0.027764	0.027482	1.010241	0.3225
C	37.996284	4.610571	8.241122	0.0000

Bounds Test

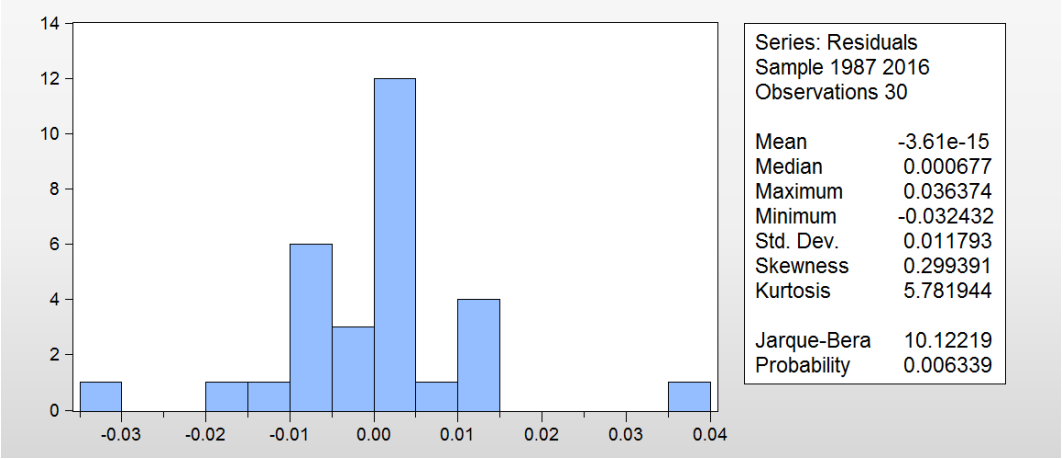
ARDL Bounds Test
Date: 04/04/19 Time: 14:03
Sample: 1987 2016
Included observations: 30
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	6.903489	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Jarque Bera Normality Test



Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.028391	Prob. F(2,22)	0.3741
Obs*R-squared	2.564909	Prob. Chi-Square(2)	0.2774

ARCH Test

Heteroskedasticity Test: ARCH

F-statistic	4.599787	Prob. F(1,27)	0.0411
Obs*R-squared	4.221352	Prob. Chi-Square(1)	0.0399

Ramsey RESET Test

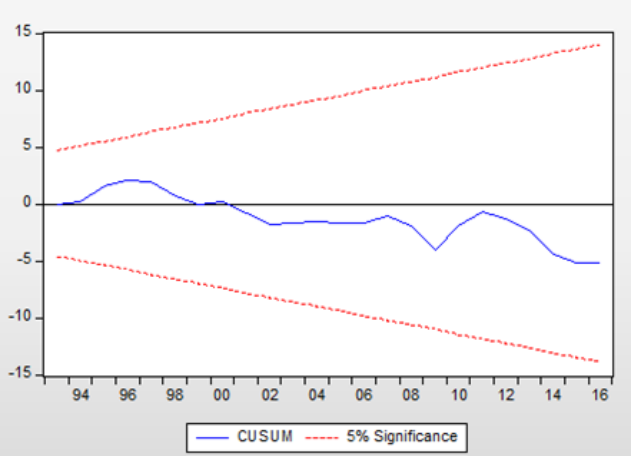
Ramsey RESET Test
Equation: UNTITLED
Specification: LN_GDP LN_GDP(-1) LN_K LN_LABOR LN_R_D LN_TOURIST C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.457782	23	0.1584
F-statistic	2.125130	(1, 23)	0.1584

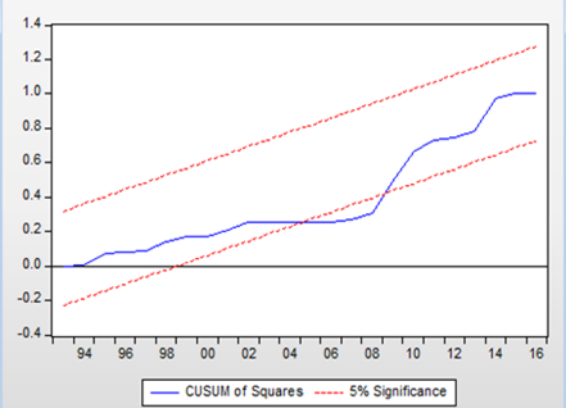
F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.000341	1	0.000341
Restricted SSR	0.004033	24	0.000168
Unrestricted SSR	0.003692	23	0.000161

CUSUM



CUSUMSQ



Appendix 3: ARDL (Equation 9)

ARDL Cointegrating And Long Run Form
Dependent Variable: LN_GDP
Selected Model: ARDL(1, 0, 0, 0, 0, 0)
Date: 04/04/19 Time: 13:14
Sample: 1986 2016
Included observations: 30

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_K)	0.251428	0.060557	4.151900	0.0004
D(LN_LABOR)	-1.912836	0.497874	-3.842005	0.0008
D(LN_R_D)	2.566716	1.429969	1.794945	0.0858
D(LN_VISITOR)	0.215535	0.110948	1.942672	0.0644
D(INT)	-0.172032	0.092440	-1.861020	0.0756
CointEq(-1)	-0.449304	0.078103	-5.752745	0.0000

Cointeq = LN_GDP - (0.5596*LN_K -4.2573*LN_LABOR + 5.7127*LN_R_D + 0.4797*LN_VISITOR -0.3829*INT + 29.2148)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_K	0.559595	0.149811	3.735348	0.0011
LN_LABOR	-4.257333	1.320579	-3.223837	0.0038
LN_R_D	5.712651	2.621825	2.178883	0.0398
LN_VISITOR	0.479708	0.200919	2.387571	0.0256
INT	-0.382886	0.170501	-2.245651	0.0346
C	29.214796	4.767713	6.127633	0.0000

Bounds Test

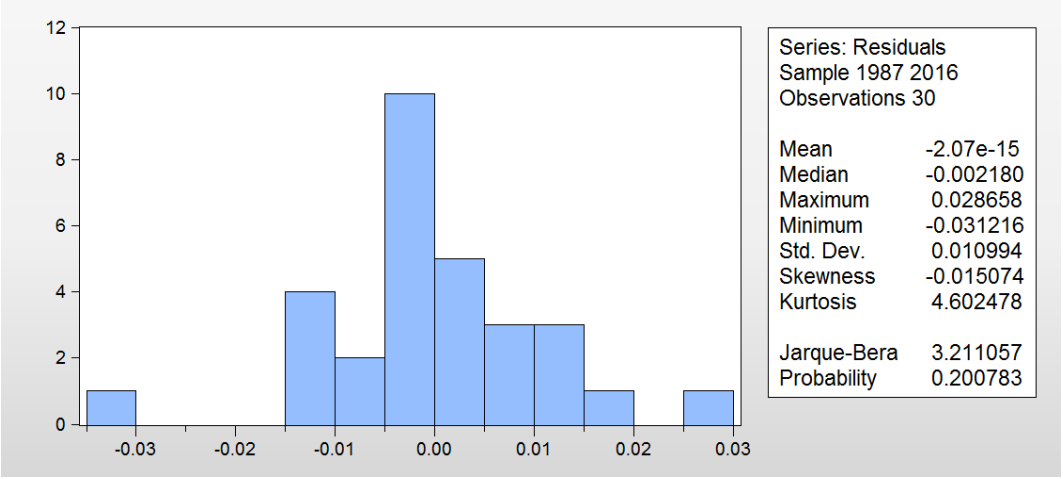
ARDL Bounds Test
Date: 04/04/19 Time: 13:18
Sample: 1987 2016
Included observations: 30
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	6.005505	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Jarque Bera Normality Test



Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.632124	Prob. F(2,21)	0.5413
Obs*R-squared	1.703513	Prob. Chi-Square(2)	0.4267

ARCH Test

Heteroskedasticity Test: ARCH

F-statistic	1.811378	Prob. F(2,25)	0.1842
Obs*R-squared	3.543934	Prob. Chi-Square(2)	0.1700

Ramsey RESET Test

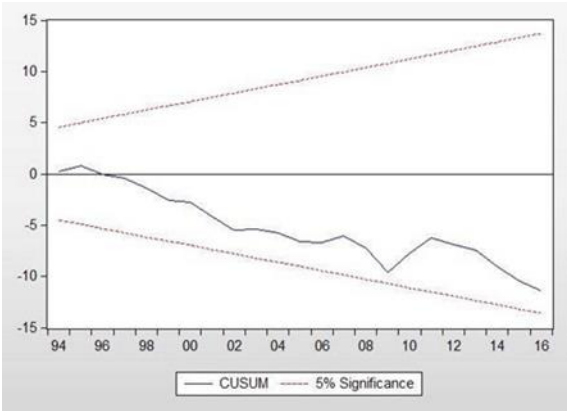
Ramsey RESET Test
Equation: ARDL1
Specification: LN_GDP LN_GDP(-1) LN_K LN_LABOR LN_R_D LN_VISITOR INT C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.177701	22	0.8606
F-statistic	0.031578	(1, 22)	0.8606

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	5.02E-06	1	5.02E-06
Restricted SSR	0.003505	23	0.000152
Unrestricted SSR	0.003500	22	0.000159

CUSUM



CUSUMSQ