

ECONOMIC ANALYSIS ON FOREIGN LABOUR
AND TOTAL FACTOR PRODUCTIVITY GROWTH:
THE CASE OF EUROPE, UNITED STATES,
CANADA AND MALAYSIA

BY

CHUA IONG JIUN
LAU WEE WEE
LIM YI HWEE
TOH ZHEN SIEW
TUNG JIA JUN

A research 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

AUGUST 2016

Copyright @ 2016

ALL RIGHTS RESERVED. No part of this paper may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, graphic, electronic, mechanical, photocopying, recording, scanning, or otherwise, without the prior consent of the authors.

DECLARATION

We hereby declare that:

- (1) This undergraduate research project is the end of result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.
- (2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.
- (3) Equal contribution has been made by each group member in completing the research project.
- (4) The word count of this research report is 16,234 words.

Name of Student	Student ID	Signature
1. CHUA IONG JIUN	14ABB07258	_____
2. LAU WEE WEE	13ABB07171	_____
3. LIM YI HWEE	14ABB06968	_____
4. TOH ZHEN SIEW	13ABB07214	_____
5. TUNG JIA JUN	14ABB00038	_____

Date: 18th August 2016

ACKNOWLEDGEMENT

First and foremost, we would like to take this opportunity to express our gratitude to University Tunku Abdul Rahman (UTAR) by giving us the opportunity to participate in and carry out this final year research project. From this research, we are able to learn and develop an in depth understanding on our research topic. During the progress of this research, we have learned the technique on how to apply the knowledge that we have learned in our field of study in our research. Besides, we also get to learn about the significance of teamwork among group members.

Other than that, we would like to express our deepest and sincere appreciation to those who helped us throughout the completion of our research, especially our respective supervisor, Dr. Wong Chin Yoong for his tremendous support, encouragement and guidance. In this research, we have encountered various difficulties and shortage of knowledge. However, Dr. Wong contributed his valuable time to supervise and guide us with patience so that we are able to solve all the problems and stay on the right track in order to complete this research paper. His willingness to guide us has contributed tremendously to our research. During the progress in completing this research, his guidance and support did inspire us greatly to pursue in this study. In addition, we would also like to convey our gratitude to Ms. Thavamalar a/p Ganapathy who provided us constructive comments and opinions for our research project.

Finally, we would like to thank our family members and our fellow friends for their encouragement, emotional support, consideration and understanding that enable this research to be completed on time. Thank you for being there when we need all of you the most.

TABLE OF CONTENTS

	Page
Copyright Page	II
Declaration	III
Acknowledgement	IV
Table of Contents	V
List of Tables	IX
List of Figures	X
List of Appendices	XI
Abstracts	XII
CHAPTER 1 INTRODUCTION	1
1.0 Introduction	1
1.1 Background of the Study	3
1.1.1 Wage	4
1.1.2 Substitutes or Complement Native Worker	5
1.1.3 Remittances	6
1.1.4 Social Issue	6
1.2 Motivation of the Study	8
1.3 Problem Statement	10
1.4 Research Objectives	10
1.4.1 General Objective	10
1.4.2 Specific Objective	11
1.5 Research Question	11
1.6 Significance of Study	11
1.7 Chapter Layout	12

CHAPTER 2 LITERATURE REVIEW	13
2.0 Introduction	13
2.1 Foreign Labour	13
2.1.1 Foreign Labour and Long-run Economic Growth	13
2.1.2 Foreign Labour and Labour Productivity	15
2.1.3 Foreign Labour and Total Factor Productivity (TFP).....	17
2.2 Total Factor Productivity (TFP) Growth	19
2.2.1 Concept of Productivity	19
2.2.2 Total Factor Productivity (TFP) Growth as Indicator for Sustainable Economic Growth	20
2.3 Other Determinants on Total Factor Productivity (TFP) Growth...	22
2.3.1 Employment	22
2.3.2 Trade	23
2.3.3 Real Gross Domestic Product (Real GDP)	23
2.3.4 Capital	23
2.4 Gaps of the Study	24
CHAPTER 3 METHODOLOGY	26
3.0 Introduction	26
3.1 Theoretical Framework	26
3.1.1 Theoretical Framework: Cobb-Douglas Production Function	26
3.2 Empirical Framework	27
3.2.1 Discussion of Independent Variables	28
3.3 Research Design	30
3.4 Data Collection Methods	31
3.4.1 Data Processing	32

3.4.2	Data Description	33
3.4.3	Individual Trend	34
3.5	Estimators	37
3.5.1	Pooled Ordinary Least Square (POLS)	37
3.5.2	Random Effects Model (REM)	37
3.5.3	Fixed Effects Model (FEM)	39
3.5.4	Model Comparison	40
3.5.5	Deriving Long-run Total Factor Productivity (TFP) Growth	42
3.5.6	Interactive between Foreign Worker and Economy	42
3.6	Conclusion	43
CHAPTER 4 RESULT AND INTEPRETATIONS		44
4.0	Introduction	44
4.1	Pooled Ordinary Least Square (POLS)	44
4.2	Random Effect Model (REM)	47
4.3	Fixed Effect Model (FEM)	47
4.4	Model Comparison	49
4.5	Does Temporary Foreign Worker Growth Affect Total Factor Productivity Growth in Long-run?	51
4.6	Interaction of Independent Variables	52
CHAPTER 5 DISCUSSION, CONCLUSION AND IMPLICATIONS		55
5.0	Introduction	55
5.1	Summary of Result	55
5.2	Policy Implication	56
5.3	Limitation	58
5.4	Recommendation	58

5.5 Conclusion	59
References	60
Appendices	69

LIST OF TABLES

	Page
Table 3.1: Sources of Data	32
Table 3.2: Description of Data in Table Form	33
Table 3.3: Comparison between FEM and REM	40
Table 4.1: Growth Regression using Pooled Ordinary Least Square (POLS)	46
Table 4.2: Estimation of Model POLS, REM, FEM	50
Table 4.3: Estimation of Long-run Coefficient toward Total Factor Productivity Growth	52
Table 4.4: Estimation Result of Interaction of Independent Variables	54

LIST OF FIGURES

	Page
Figure 1.1: Total Factor Productivity (TFP) Growth Trend	9
Figure 3.1: Steps of Dara Processing	32
Figure 3.2: Relationship between DLRTFP and DLTEMP in All Countries	36

LIST OF APPENDICES

	Page
Appendix A: Langrange Multiplier (LM) Test	69
Appendix B: Likelihood Test	70
Appendix C: Hausman Test	71
Appendix D: Estimation of Long-run DLNRK	72
Appendix E: Estimation of Long-run DLEMP	72
Appendix F: Estimation of Long-run DLRGDP	73
Appendix G: Estimation of Long-run DLTEMP	73
Appendix H: Estimation of Long-run DLTRADE	74
Appendix I: Estimation of Interaction between DLTEMP and DLNRK	74
Appendix J: Estimation of Interaction between DLTEMP and DLEMP	75
Appendix K: Estimation of Interaction between DLTEMP and DLRGDP	75
Appendix L: Estimation of Interaction between DLTEMP and DLTRADE	76

ABSTRACT

In this era, influx of foreign labour in any country is an unavoidable case. However, some issues associated with foreign labour have been prevalent in some countries that they are bringing unforeseen impacts which have been significantly affecting the nations. This has raised our interest to look deeply into this matter by studying how the inflow of foreign labour will affect the total factor productivity (TFP) growth.

In our research, we have adopted a panel data ranging from the period of 2007 to 2011 and employed United States, Canada, Malaysia and 27 European Union countries as our sample of study. Based on the findings of our empirical analysis which utilises the best fit Fixed Effect Model (FEM), we found out that there is a negative relationship between the temporary foreign workers and the growth of TFP. Conversely, in the long run, a positive relationship is established. Both distinctive results are further discussed in the research.

CHAPTER 1: INTRODUCTION

1.0 Introduction

Globalisation brings greater interaction among regions, countries, and institutions. Increasing and intensified labour migration is a critical component of the globalization process. The attractiveness of more economically developed places and diseconomies scale of some third world countries has always provided the incentives for some people to migrate. When people moved to the other countries looking for a job or for a better economic condition, they are considered as *labour migrants*. Throughout the history, labour migration has been an important type of input flow, but it has become more crucial today because of the new dynamism of the global economy.

According to Saiman and Jemon (2014), foreign labour can be defined as a person who is employed outside his or her origin of country on a temporary basis. Some researchers state that foreign labours have larger difference in terms of their labour market skills and productive activity. They consist of skilled workers who pursued tertiary education and unskilled workers with secondary or lower level of education, using different skills and taking up different jobs.

Let's look into the labour importation in Taiwan. Flow of foreign workers into Taiwan is caused by the consequences of the changing local, regional, global political economies, various demographics, socioeconomics and cultural factors. Demographic changes include declining birth rate, prolonged schooling of youngsters, women's low labour force participation and the aging of the overall population. These factors have contributed to a decrease in the available workforce. In addition, local workers will tend to avoid labour-intensive occupations as well as 3D jobs which are traditionally considered as dangerous, dirty, demanding and unskilled (Cheng, 2006).

Lee Yuan-Zhen, a well-known Taiwanese feminist points out that foreign workers are desired for various reasons. For example, local workers are paid by piece-rate while foreign workers are paid based on a fixed monthly wage, which is usually the minimum wage in Taiwan. Moreover, foreign workers are willing to work for longer working hours. They work at least 30 hours more than their local counterparts per month in average. As a result, employers will benefit not only from cheap labour but also from coercible workers. Chou Hsin-I, the owner of a recruitment agency in Taiwan explains that *“It is expensive to hire foreign workers, their total costs is not necessarily lower than those of local workers, however, the main reason employer prefer them is because that they can work late and overtime which no local workers would do, not even when you pay them.”*

Late U.S. Secretary of Labour W. Willard Wirtz said that, *“when there is a mismatch of workers and jobs, employers have two options: they can adjust the wages or they can adjust the work force, routinely, they chose the latter.”* This existing option is rarely discussed by employers who argue about "labour shortage", never ending their mind by adding "at the wages we are willing to pay". Yet, the preferable modification of the work force by such employers is to get temporary foreign workers (North, 2013).

Former Labour Secretary, Ray Marshall mentions that foreign worker always *"works hard and scared"*. Foreign workers act consequently and more docile based on the employers' preferences. Migrant labours are stated to be more easily managed due to the enduring nature of their second-rate legal status. Hence, they are selected around the world as they hold a belief that submission to authority is a way of life as a labour.

Most of the U.S.-based employers argue that the other reason to hire temporary foreign workers is that employers are unable to employ the “best and the brightest” without searching elsewhere among the residents and green card workforce. Bill Gates, one of the industry leaders comments that the United States should always own the best and the brightest, and that particular person can be discovered among oversea graduates who received technical educations in America institutions.

On the supply side of labour, the push factors do exist. The absence of sustained economic development, growing population, political uncertainty, low wages, and high unemployment levels continue to compel employer to look for employees abroad (Asis, 2006).

There are many reasons why people left their home country and moved to the other places for a better living. Generally, the main reason of labour immigration has always been economic factors. A poor environmental condition or a low quality of life enforces people to find a better life. It also shows an increasing trend of gap between the third world countries and the developed countries as the years pass by. Hence, people head to industrialized countries to seek for better employment opportunities, stable earnings, and a better quality of living. Political and social convulsions which are related to religious and cultural overtones are other reasons that can force people to move from one location to another location (Muniz, Li and Schleicher, 2010).

1.1 Background of the Study

In order to enhance economic growth, immigrant labour has become an important source of human capital especially in an international arena. A real case of Korea is a good example of requesting the need of foreign labour to fulfil the labour demand by small and medium enterprises since 1990s (Hahn & Choi, 2006). However, there are many issues arrived along with the popularity of importing and exporting foreign labour across the countries. From the studies by Mountford (1999), Vidal (1988), Chander and Thangavelu (2005), and Stark and Wang (2002), they indicate that the influx of skilled workers might raise the return of education and improve the importing countries' economy. For instance, inflow of skilled workers could increase the domestic innovation activities by complementing the domestic human capital.

Several studies highlight that the productive impact of immigrants depends on the skilled characteristics of the foreign and domestic labours in the production

process (Ottaviano and Peri, 2008; Borjas and Hanson, 2008; Peri and Sparber, 2009). Based on the Department for Business Innovation and Skills (2015), the researcher states that the availability of migrants allows the company to pick the best candidate from a wider talent pool which leads to an improvement in business performance and productivity. However, the impact may depend on whether it is in a positive way by business-led or in a negative way by migrant-led. Other studies have also proven that migration of less-skilled workers may cause a shift towards labour-intensive techniques as an effort to complement the less-skilled foreign workers (Peri, 2007; Thangavelu, 2012; Chia, 2007).

1.1.1 Wage

The effect of immigration on wage is still in an unclear position (Borjas, 2003; Borjas, 2006). In the study of Card (2007), Ottaviano and Peri (2006), and Peri (2008), they found that immigration shows an improvement in average domestic wage, while other studies show an overall decline. Besides, some studies have identified that the effect on wage inequality could rely on two types of workers which are skilled and unskilled. If labour is mostly high-skilled, it is found to be alleviated, but it is aggravated if labour is usually low-skilled (Borjas, 2006; Peri, 2008). According to Peri (2010), a case in the United States also shows a positive long-run impact on income per U.S. born worker accumulated over time. Based on a case in Singapore, Thangavelu (2012) states that the skilled wage rate and also the wage gap between unskilled and skilled in the economy have reduced due to the rising share of skilled foreign labours.

The immigration surplus in Singapore is a motivating example to study. The researcher, Thangavelu (2012) found that Singapore allows the entry of both unskilled and skilled foreign workers into the economy. This may allow us to observe the opportunity cost of productivity and wage effects of immigrant workers on the Singapore economy. In his findings, foreign workers did contribute to its economy but it is in a diminishing rate. This is due the complementarity effect between the skilled immigrants and the physical capital is fully exploited.

On the other hand, a case in Malaysia found that the influx of cheap foreign labour suppresses domestic wage growth and reduces the productivity, quality control and improvement of economic welfare of local workers (Rahman, Wang, Wood, & Low, 2012; Athukorala & Devadasan, 2012). According to Serneels (2007), the construction industry in Malaysia has gone through labour shortage and the demand for labour has been continuously snowballing. During the time, employers have chosen to employ foreign workers rather than improving working condition and raising wages to attract domestic workers (Narayanan & Lai, 2005). The main reason is that some employers object to minimum wage level as this would raise their wage payment and increase in overall costs. Thus, the wage rate for domestic workers has remained low and they will lose out in the competition with foreign workers for jobs (Shafii, Musa & Ghazali, 2009). According to a case in Taiwan, it also shows the same negative impact on the wage of domestic workers and at the same time widening the wage gap (Chang, 2002).

1.1.2 Substitutes or Complement Native Worker

When local worker has been defeated in the competition by foreign workers for job, it shows that local workers have been substituted by foreign workers. However, this is still a contentious issue in policy debates in labour importing countries. Some researchers argue that foreign workers are made available only to supplement local workers instead of replacing them (Ducanes & Abella, 2008; Hugo, 2004; Lee, 2002).

In the United States (US), the economy absorbs immigrants by growing job opportunities instead of displacing the US domestic labours. In the short run, immigrants will decrease the capital intensity of the economy if the business has not completely adjusted their productive capacity. However, in medium to long run, this effect occurs when business adjusts their physical capital to take benefits from the labour provided by new immigrants (Peri, 2010). However, a case in Korea, Hahn and Choi (2006) found that only the male semi-skilled workers are likely to be displaced by foreign workers.

1.1.3 Remittances

Remittances have often displayed as a counter-cyclical role when the country is experiencing a domestic stock. This represents a significant portion of foreign exchange earnings for some developing countries such as Nepal, Bangladesh, India, Indonesia, Pakistan, Sri Lanka and Vietnam (Bhattarai, 2005). Therefore, the governments from various developing countries have encouraged international labour migration.

In Nepal, international labour migration has always been ignored by paying minimum attention. Statistics shows that remittance of the migrant workers sent is nearly one hundred billion every year and the amount of remittance has played an essential role to maintain the balance of payment (Bhattarai, 2005). In Sri Lanka, almost 60 percent of remittances are from Middle Eastern region. Over the years, the remittance inflows have increased steadily and contributed to support Sri Lanka's Balance of Payment (BOP). As a result, the country is able to maintain a higher rate of national investment and saving due to the remittance inflows (Ministry of Foreign Employment Promotion and Welfare, 2013).

Furthermore, the International Labour Organization has stated that every year, the remittances send by the migrant workers back to their origin country are usually modest earning that account for US\$ 73 billion. However, the officially registered international labour migrants only represent a small proportion of the actual number and the amount of remittance is not fully recorded in the national account. Thus, the issue of international labour migration should be addressed in terms of the policy level, which could help in promoting a secure migration and operating the labour migration in an effective way as well.

1.1.4 Social Issue

Most Asian migrant workers have failed to secure decent work, and this is seriously affecting the female domestic workers, trafficked persons and irregular

migrant workers (Wickramasekera, 2000). Philippines, Indonesia, and Sri Lanka are the countries that mainly account for sending women as domestic workers for employment in the Middle East region. The common problems faced by the domestic workers are well known such as sexual harassment and long working hours with low wages which often subject to exploitation and abuse (Wickramasekare, 1995; Gulati, 1993).

In Nepal, female migrant workers are willing to work under any circumstances and to accept low wages. This is due to the lack of bargaining power. Female migrant worker does not have training and pre-employment information provided by their government. Therefore, female migrant workers are deprived of knowledge on how to ensure their migration is safe. The researcher, Bhattarai (2005) highlights that Nepali women have low information accessibility about the process of departure, salary and possible risks that they might face during and after their departure. Thus, the level of harassment is also very high in Nepal.

Besides, trafficking of women and children across borders for commercial sex and other exploitative and abusive purposes has increased. Quite often, women and girls are being trafficked for the purpose of prostitution but they do realize and believe that it is legitimate for the recruited. Thailand has become a major hub in this process among the ASEAN countries (Bangkok Post, 2000).

In order to prevent trafficking, there are some countries such as Sri Lanka have implemented the compulsory registration so that all migrants understand the terms of their contracts and it also enables the Sri Lanka Bureau of Foreign Employment (SLBFE) to keep track of the movement of migrants. Furthermore, the government has increased the minimum age for migrant worker and a national policy on labour migration is drafted to prevent trafficking (Ministry of Foreign Employment Promotion and Welfare, 2013).

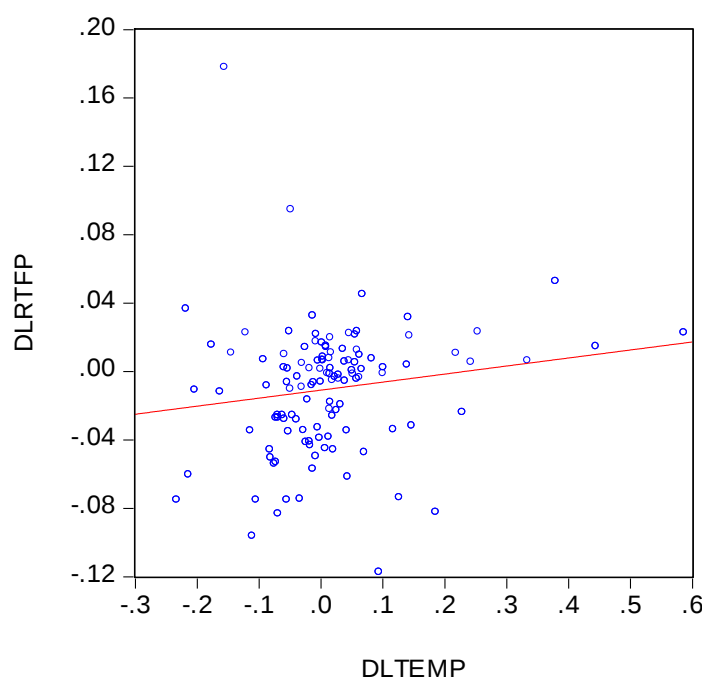
1.2 Motivation of the Study

In recent years, the issue of foreign labours is hotly debated in Malaysia. The presence of foreign workers has already caused panic among the general public. The public views the problem of immigrants with a negative viewpoint. They think that the huge influx of foreign labours has raised critical issues and has significant implications on local communities. In Malaysian manufacturing industry, among 800 000 employment opportunities which contain 8% of total workforce in Malaysia, 69% of them are foreign-born workers. From this data, we may suggest that Malaysia is highly dependent on foreign labours to maintain its economic growth. The common arguments for this issue are the displacement effect of foreign labours to natives which causes the unemployment to get worsen, currency outflow and reduction of average wage level. (Rahman, Wang, Wood & Low, 2012).

The researcher, Tsao (1985) found that the growth of total factor productivity (TFP) is low in Singapore's manufacturing sectors due to the wage policy and the inflow of the low skilled foreign labour. Trade openness which increases the movement of goods and services might also include the transfer of human capital; however, the degree of trade openness has negatively affected the growth of TFP in Bangladesh over the year of 1986 to 2008. (Adhikary, 2011).

According to Woo, Ismail and Yussof (2014), the focus behind the low total factor productivity (TFP) is mainly due to the negative influence from technical efficiency in Malaysia. The level of technology absorption could be improved if the manufacturing sector moves to the production with high value added. Therefore, the use of human capitals is important so that the sophisticated technology can be absorbed optimally. Based on Tsao (1985) analysis, the researcher found that the relationship between the local and foreign low skilled workers to the growth of TFP is negative and statistically significant at 1 percent and 5 percent respectively. In other words, the growth of TFP will decrease by 0.0034 points and 0.0018 points as 1 percent increase in the use of local and foreign low-skilled workers will decrease (see also Tsao, 1985 for the case of Singapore).

Figure 1.1 Total Factor Productivity (TFP) Growth Trend



Note: DLRTFP denotes log of change of total factor productivity; DLTEMP denotes log of change of number of temporary foreign workers

From the graph above, we have collected a panel data sample with 30 countries in total, including the European Unions, the United States, Canada, and Malaysia. The result runs in a time period of 2007-2011. By appointing Y-axis to represent the changes in log of TFP and X-axis to represent the changes in log of the number of temporary foreign workers. Figure 1.1 shows a positive relationship between foreign labours and total factor productivity (TFP) across these 30 countries over the time. This is inferential as it suggests that the presence of foreign-born workers is positively enhancing the economic growth of recipient nations through the TFP.

This is certainly in contrast to the common perception that foreign labours are harmful to the productivity growth. This leaves a gap between our result and the empirical study of other researchers. This drives our keen to study about the reason behind the existing gap and to fill up the difference in between. More studies and tests will be carried out to strengthen the linkage between the two factors (TFP and TEMP) and observe the determinants of TFP which indirectly move the wheel of economic in a faster pace.

1.3 Problem Statement

Over the past decades, the impact of foreign labours on a country's growth is always a debatable issue. It is important to determine the impact of temporary foreign workers on economic growth. Previous researcher studies the impact of foreign workers in different perspectives mainly on economy, social and productivity. In terms of productivity, most of the researchers have applied labour or capital productivity, however depending solely on single factor productivity has encountered several limitations. Therefore, by avoiding these limitations, we have decided to adopt TFP in our study.

Besides, many researchers have used different variables in determining the component of total factor productivity (TFP) growth but no consistent model is found. Consequently, the impact of TFP growth is shown to be consensus. By looking at the previous research, we will be extracting and reassembling the significant variables into our study model such as employment, trade, real gross domestic product (GDP), capital. The construction of our model in this study is to determine the factors affecting TFP and fulfill the purpose of establishing guideline for politicians.

1.4 Research Objectives

1.4.1 General Objective

In our research, we would like to study how foreign labours growth will affect the total factor productivity (TFP) growth in the area of Europe, Canada, United States and Malaysia from year 2007 to 2011.

1.4.2 Specific Objective

More specifically, we would like to:

- (i) Determine the impact of foreign labours growth on total factor productivity growth.
- (ii) Identify the channels through which foreign labours growth influence total factor productivity growth.

1.5 Research Question

There are two research questions to be addressed:

- (i) Does foreign labour growth stimulate total factor productivity growth?
- (ii) What are the mechanisms through which foreign labours growth influence total factor productivity growth?

1.6 Significance of Study

This empirical research intends to contribute to the literature by investigating the relationship between temporary foreign worker growth and total factor productivity (TFP) growth. Previous research has studied about the relationship between temporary foreign worker and total factor productivity instead of growth rate. Therefore, the result might be different as compared to the previous researchers' findings. In order to close the gap, our study focuses on the effect of TFP growth. By providing a better understanding of how temporary foreign worker growth affects TFP growth, the economic growth can be shown clearly and this will help the government and policymaker in their decision making.

Besides, understanding of the interaction between temporary foreign worker and each independent variable is crucial for policymakers in implementing policies.

This study aims to provide a clear picture on how temporary foreign worker will affect the net real capital stock, employment, real gross domestic product (GDP) and trade in a country. The findings of this study will provide an answer on some of the problems stated to cover the respective research topic.

1.7 Chapter Layout

The research proceeds with Chapter 2, reviewing the relevant literature by other researches regarding foreign labours on labour productivity growth, economic growth, and total factor productivity growth. Chapter 3 presents the data, the methodology, and the model that will be applied. Chapter 4 describes about the result and discussion of our findings. Chapter 5 contains the major findings, recommendations and conclusion.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In this chapter, we will be reviewing previous studies that are relevant to our research topic: impact of foreign labours on Total Factor Productivity (TFP) growth. It is useful to help us in developing a relevant theoretical framework as well as formulating a hypothesis for our study.

We have divided this chapter into four sections. The first section focuses on theoretical and empirical findings on the main independent variable in our study, foreign labour while the second section emphasizes on the theoretical and empirical findings on dependent variable, TFP growth. While the third section concerns the theoretical and empirical findings related to the other independent variables that are significant to be included in our study in examining TFP growth as well. Those variables include domestic employment, net capital stock, trade and real Gross Domestic Product (GDP).

2.1 Foreign Labour

2.1.1 Foreign Labour and Long-run Economic Growth

Plenty of literatures have studied on the impacts of foreign workers that have been reviewed in different perspectives, such as economic issues, social issues, labour productivity as well as substitution or complementary relationship between native and foreign workers.

A group of studies have examined on the effect of foreign labour on economic growth. According to Noor, Isa, Said and Jalil (2011), influx of foreign workforce is positively related with economic growth. Immigration is beneficial in

ways of addressing the labour shortage and skill deficiency of the receiving countries, filling the gap in the native labour market and thus, increasing the output of the receiving nations (Ismail and Yuliyusman, 2014). Some studies also tend to agree and support that there is a positive relationship between foreign workforce and economic growth. For instance, Christofides, Clerides, Hadjiyiannis, and Michael (2007) found that there is a significant contribution of foreign employment on Gross Domestic Product (GDP) growth between 1995 and 2005 in Cyprus. Based on their study, the evidence shows that output growth that happened in Cyprus between 1995 and 2005 was mainly due to the substantial and tremendous rise in the number of foreign workers during the period of time. They also suggest that the substantial increase in the foreign worker employment impacts favorably on the wages of the more educated and skilled native workers, especially those with university degrees and are taking high skilled jobs.

Borjas (1995) has also investigated the impact of foreign immigrant on the long run economic growth by considering skill composition of immigrants in his framework. He shows that 10% increase in immigrant workforce is contributed to GDP of the United States by nearly 0.105% during the sample period covered. He further explains that host countries will gain economic benefit from hiring foreign workers mainly due to economic reason that arises from the production complementarities between immigrants and the other factors of production, and these benefits are greater than that of local inputs of production. An evidence shows that the economic benefit gained from foreign employment is \$7 billion annually. Though this evidence shown, it is reasonable to suggest that immigration of skilled labours will generate higher economic benefit due to the complementary relationship between skilled foreign labours and native-owned capital. Therefore, these gains can be considerably increased if the United States government pursues a more aggressive immigration policy that attracts more skilled immigration flow. In addition, net fiscal cost of immigration is larger for unskilled foreign workers. They are more likely to spend more on government services but pay lower taxes.

Furthermore, Drinkwater, Levine, Lotti and Pearlman (2007) revisited the work of Borjas (1995) and developed his analysis by using a general equilibrium endogenous growth model with endogenous capital and several sectors. They

suggest that higher level of research and development (R&D) could be achieved by presence of skilled foreign workforce and thus, resulting in higher level of economic growth in long term. They agree with the study from Borjas (1995), saying that the growth gained will rise as if the skilled labour and physical capital are complementary.

In addition, Thangavelu (2012) studied further on Singapore economy by developing model of Drinkwater et al. (2007). The results from their model show that skilled immigrants do positively affect the native economy, at a diminishing rate. They encourage more R&D and innovative works in economy, and hence boosting the long term economic growth. This result is similar with the work of Drinkwater et al. (2007). They also found that the diminishing return from hiring additional skilled immigrant at a given amount of physical capital stock is due to complementarity effect between skill and physical capital. Thus, study shows that positive impacts of foreign workers, especially skilled foreign workers depend on the innovative activities in native economy. There is always a positive impact of immigrants in innovative sectors.

2.1.2 Foreign Labour and Labour Productivity

A number of authors tried to estimate the impact of immigrants on labour productivity. From the research of Noor et al. (2011), the aim of their study is to analyse the effect of foreign workers on the labour productivity in Malaysian manufacturing sector by using annual time series data during 1972 to 2005. The causal relationship between immigrant and native workers is also being investigated. The result shows that foreign labour has a significant and positive impact on labour productivity in Malaysian manufacturing sector. Further, they have also revealed that there is no causal relationship between foreign workers and natives workers meaning that the foreign workers are neither substitute nor complement for natives. Thus, a reduction in number of foreign labours will not bring any effect to the performance of local workers. In order to reduce the dependency on foreign labours, government should implement policies such as minimum wage as there will be no

wage difference between native and foreign worker. Therefore, this will discourage the employer from hiring foreign worker. However, this will need a long time to achieve their aims.

Several works also draw the same conclusion. According to Aizawa, Ueda, Kadota, Sasaki, Tanaka and Takahashi (2002), acceptance of immigration leads to immigration surplus in the receiving countries in terms of improvement in labour productivity. In general, supply of skilled workers will have a greater positive impact on productivity and growth as compared to unskilled labours. Firstly, the cost intended for skilled labours is much lower than hiring unskilled labours. Secondly, in terms of tax revenue, the tax paid by skilled foreign workers will be much greater than unskilled workers. Therefore, they conclude that expansion in employment of skilled immigrants is more profitable to host countries. Boswell, Stiller and Straubhaar (2004) also suggest that employment of foreign workers positively impacts the labor productivity of host nations. They state that severe labours and skill shortage are faced by many countries in the European Union (EU) mainly due to mismatch problem between labour supply and demand. To tackle this problem, labour migration program is the relevant and effective way. Therefore, we may suggest that the effects of foreign labours on the receiving countries are crucially depending on the skill level of human capital employed (Friedberg and Hunt, 2001).

In contrast, there are some studies show negative results in terms of labour productivity. Nicodemo (2013) estimated the effect of immigration on labour productivity in Spain using the data sources from SABI (for firm's data) and Social Security Records (for individual's data) between 2004 and 2008. In his study, the researcher adds empirical evidence by considering the information at individual and firm levels. This reveals a new result, showing that immigration has a negative impact on labour productivity. By considering the role of immigrant labours on capital investment and labour productivity, Agnoli and Zavodny (2002) have developed a two-sector model of changes in output mix, labour and capital productivity in which the inputs in the production process are skilled and unskilled labour and capital. They found that the immigration appears to lower labour productivity in both high and low-skilled sectors due to acquired language skills. In

another word, this indicates that labour productivity increases more slowly and argues that this may in fact be a short-run effect.

2.1.3 Foreign Labour and Total Factor Productivity (TFP)

In general, most of the studies show positive relationship between foreign labour and TFP growth. As the immigration happened in the United States during 1990's and 2000's has increased the presence of foreign labour in the US, Peri (2012) analysed the impact of immigration on TFP by using production-function approach. He suggests that immigrants had increased TFP but reduce some other factors. The result may due to vary in the geography such as R&D spending, technologies and innovation. Due to the fact that TFP is meaningless without presence of technology and innovation; hence, these two elements have also taken into account to identify the impact of immigrants on TFP. As a result, there is a significant and strong positive relationship between immigration and TFP. From the results obtained, Peri (2012) suggests that immigrants should promote efficient task specialization which will then enhance TFP and promote the adoption of unskilled-biased technology at the same time.

Another study from France by Mitaritonna, Orefice and Peri (2014) also suggest that foreign labours have a significant positive impact on TFP growth. Immigrants may complement to domestic labours, increase productivity and allow specialisation by skill. Their presence could be beneficial to firms who are hiring them by lowering their cost of production and thus, profit-gaining. Besides, they also found that the productivity effect of immigrants is positively linked with rapid growth of capital and improved export performance of the firms.

Furthermore, Woo, Ismail and Yussof (2014) revealed that it is essential to look into the TFP growth in Malaysia's manufacturing industries as it is one of the measurements to identify the sustainable output growth, given the diminishing returns nature of input growth in the long-run. This reason had become a motivation for them to examine the impact of foreign labour as well as other determinants on

the TFP in Malaysia's manufacturing sector. Data Envelopment Analysis (DEA) is employed in their study to calculate the values of TFP to capture the long-run and short run relationship. The result shows that the aggregate number of the foreign labours and natives have a positive impact on the TFP growth in the long-run. Besides, both skilled and unskilled foreign labours show a significantly positive and negative impact on the TFP growth in a long run. Based on this findings, researchers conclude that the employment of human capital, especially the skilled natives or foreign labours are essential to absorb the invested technology more efficiently.

By focusing more on how skill composition of foreign workers impacts on TFP growth, several studies are drawn from the consistent findings. Zhi, Goh, Wang and Ofori (2003) also found that large number of unskilled foreign workers are not only affecting the labour productivity but also resulting in a decline in the TFP in the construction industry. Evidence has proven that heavy reliance on unskilled foreign labour has been regarded as a primary cause for low productivity in the construction industry. For instance, when the growth of foreign worker's proportion increases by 1%, it will cause growth of TFP to fall by 0.111%. But the growth of TFP is low in manufacturing sectors due to the wage policy and inflow of low skilled foreign labours in Singapore while the skilled foreign labours in Denmark shows a positive relationship in the TFP growth (Woo et al., 2014)

In addition, Fassio, Kalantaryan and Venturini (2015) aim to investigate the role of foreign labours in innovation level in Europe during 1994-2007. They emphasise their study more on the complementarity among sectors rather than the contribution of different national skills. They employ TFP as an indicator for innovation level and focus more on the three largest European countries; they are France, Germany and United Kingdom. Their findings show that overall immigrants are relevant in native market. Well-educated labours have positive relationship in high-tech industries while low or unskilled workers are more relevant to work in low-tech sectors such as manufacturing sector. This is due to low-tech industries do not require much knowledge and skill to perform.

Moller, Munch and Skaksen (2011) have concluded that there are very limited studies of the importance of immigrants on domestic industries even though

most of the nations are welcoming the entry of foreign workers into their markets. Based on their findings, strong complementarities between knowledge (skill) of foreign experts and native workers exist and hence, it is hard to say that immigrants replace local labours. Evidence shows that presence of foreign experts increases the probability of exporting the following year by 2.7% and the intensity of exports rises by 1.3%-1.6% in the three following years. One of the reasons to explain the positive effects of immigration surplus is foreign expert possesses their special skill and knowledge about foreign market in domestic market.

From the previous studies, we may conclude that there are limited studies on the relationship between foreign labours and TFP growth. Besides, the results from previous researches are also inconsistent, either positive or negative, by taking into account of other elements, such as capital intensity, technology level, skill composition and education level of immigrants. Therefore, this has become our motivation for further study on this issue.

2.2 Total Factor Productivity (TFP) Growth

2.2.1 Concept of Productivity

At the most basic level, concept of productivity can be defined as the ratio of output to input for a specified production situation, with all the other inputs held constant (Owyong, 2000; Rogers, 1998). For example, labour productivity is measured as value added per worker or working hour, while capital productivity is measured as value added per machine (Organisation for Economic Co-Operation and Development [OECD], 2001).

Gain in productivity determines that either more output is being produced by using same level of input, or less input is required to produce same amount of output. Thus, it is easy and straightforward to conclude that gain in productivity is linked closely to the issue of efficiency. Equally, productivity growth indicates an increase in efficiency level of a firm or a nation.

There are some assumptions in calculating the growth rate of output based on growth in either labour or capital. They are: (1) constant returns to scale in production and (2) competitive factor market. Based on these assumptions, such single factor productivity analysis has encountered obvious shortcomings. There may be more than one input or factor of production used in most industries or sectors. Second, the relative importance of the input employed might be varied over the time. To prevent the limitations of single-factor productivity analysis, Total Factor Productivity (TFP) analysis is more preferable to be employed in measuring productivity (Owyong, 2000).

2.2.2 Total Factor Productivity (TFP) Growth as Indicator for Sustainable Economic Growth

Total Factor Productivity (TFP) is the combined productivity of all factors of production. According to Shackleton (2013), economists have found that only a portion of economic growth that can be explained by the growth in inputs, either labour (number of working hour) or capital (amount of capital used). However, the unexplained portion or residual implies advancement in production technology and process. We called the residual as Total Factor Productivity growth (TFP growth). Comin (2008) states that TFP level is determined by how efficiently and intensely the factors of production are utilized, and it is usually used to measure the long-term change or dynamism in technology that has brought to the factors such as technical innovation.

Moreover, the significance of TFP in indicating long-run economic growth is emphasised by Kim (2002). According to the neoclassical economic growth model, since rate of growth is determined by the productivity growth rate in the long run, the growth that is solely based on physical capital accumulation is destined to remain stagnant as it reaches the steady state. Thus, TFP growth is critical for the long-term economic growth of an economy. The main theoretical results of neoclassical growth model as well as new growth theory show that the economic growth with rapid accumulation of factors will decelerate if TFP growth is not taken

into account. Abramovitz (1955) and Solow (1957) also state that the TFP growth is associated with economic growth. From their studies, we found that 90% of output per capita growth in United States from 1869-78 to 1944-53 can be explained by TFP growth. However, only 10% of output growth is related to the growth in factors of production.

Besides, the growth in TFP, reflecting more efficiency on utility of inputs, has long been recognised as a significant indicator for improvements in income and welfare of a country. Wealth of a nation is indirectly determined by its productivity level. Study found out that cross-country which differs in income levels and growth rates is mostly due to the differences in productivity level. Hence, the TFP growth seems to have a significant effect on country's output growth. (World Bank, 2000). Study of Krugman (as cited in Nachega and Fontaine, 2006) suggests that unsustainable East Asian economies growth is mainly driven by capital accumulation and labour quality improvement rather than the growth in productivity. It is found that disappointing growth in output per capita during the sample period covered is due to the negative growth of both TFP and physical capital per capita.

There are several approaches to measure TFP growth, the traditional way to measure TFP growth is the Solow residual. It is measured under a set of very restrictive assumptions: constant returns to scale and perfect competition, costless adjustment and consequently, full utilisation of production factors (Benkovskis, Fadejeva, Stehrer and Worz, 2013). Another best alternative to derive both direct and indirect effects of the TFP growth in the industry level at macro level is through the use of the input-output tables, as they provide important information on the use of intermediate products. Another advanced method to measure TFP growth is Data Envelopment Analysis (DEA). To access efficiency and productivity, TFP growth is a special mathematical linear programming model which allows the use of panel data. The changes in TFP can be divided into two components which are Technological Change (TECHCH) and technical Efficiency Change (EFFCH). According to the DEA analysis and stochastic frontier, two important components contributing to the growth in TFP are technical efficiency change and technological change.

However, estimation of TFP is very sensitive to the time period and country chosen for the study. Many studies found that developed economies and developing economies might cause different estimation of TFP. For developed economies, it is usually asserted that there are under-adjustments in the quality adjustments to factor of production in the developed economies. As a result, the TFP becomes greater than what it should have been. On the other hand, it is also possible that over-adjustments are made in the developing economies. TFP is smaller than what it should have been. For instance, TFP explains that 60% of Japan's output growth. In the period 1955-70, 51% of Japan's economic growth was due to TFP. In most studies, the role of TFP in economic growth is less significant in the developing economies if compared with the developed economies (Chen, 2002). The reason behind might be the accumulation of intangible capitals in developed economy has achieved significant TFP growth in the post-war period since early 20th century. For developing economics, physical capital-using technological progress may be the rationale for the low contribution of TFP growth.

2.3 Other Determinants on TFP Growth

2.3.1 Employment

Employment is expected to have a negative impact on TFP growth. Based on the research of Pissarides and Vallanti (2004), employment does negatively affect TFP growth in the short run (less than 1 year), but it turns out to be a positive effect when it is continuously present in the long-run (after 1 year) with the presence of additional forces in their observation. The situation of short term effect is probably due to the fact that job destruction reacts faster to shock than job creation does (Ladu, 2005), but this is not the case in long run. This statement is also proven by Greasley and Madsen (2006) as they found that the negative externalities are associated with higher employment and thus, dominated the diminishing TFP gap.

2.3.2 Trade

It is straightforward to be understood that the purpose of trade is for profit-gaining, therefore trade is expected positively influence on TFP growth. Based on Ferreira and Trejos (2011), most of the trades arise due to comparative advantage with no consideration of any condition barrier of trade. Another example from India states that, the removal of tariff barriers and other trade restrictions have improved in terms of trade and gradually improved its economic environment in fruit industry. Even its effect in short term is very minimal, but it significantly enhances the TFP growth in the long term (Saha, 2012). The long term effect of trade is also proven by a previous researcher named Danzinge (2000). He found that trade openness is in long-run equilibrium with both investment and TFP.

2.3.3 Real Gross Domestic Product (Real GDP)

To study the relationship between real GDP and TFP growth, we use market size as proxy for real GDP. Larger market size reflects higher real GDP level. In general, larger market size often refers to larger population or greater trade openness of a country. Larger population or greater trade openness will encourage more variety of goods available and more substitutes for the same good in the economy. This will cause a rise in the price elasticity of demand. Thus, this will lead to tight competition in the larger market and make the firms in the larger market to be more productive and innovative for survival in the marketplace. Based on this, we may expect that the real GDP (market size) has significant impacts on TFP growth (Desmet and Parente, 2010).

2.3.4 Capital

Based on Jajri (2007), the study on Malaysia has proven that the physical and human capital accumulation has become the major driver for the growth. There are three elements in the growth accounting method that contribute to the

production of output which are labour, capital and technology. Technology also refers as total factor productivity which enables labour and capital to produce goods or services more quickly and more efficiently. Malaysia adopts input driven growth associated with capital accumulation where these sources of growth bring effect only in the short run. The high rate of growth is not sustainable in the long run as the returns of capital are subject to diminishing returns. Hence, an increase in capital at a constant technology level will improve growth rate for short run, yet it will slow down the TFP as the limited amount of labour with excessive amount of capital will create inefficient production.

2.4 Gaps of the Study

Impacts of foreign labours have been investigated by previous researchers in a few different perspectives, such as economic issues, social issues, labour productivity as well as the substitution or complementary relationship between the natives and the immigrants. In order to measure the effects of foreign labours on the long run economic growth, we have decided to apply Total Factor Productivity (TFP) as TFP is the best indicator of long run growth in an economy (Kim, 2002). Besides, there are limited studies of foreign labours on TFP (Moller et al., 2011). Based on these two strong reasons, we are motivated to study or investigate further on how foreign labour impacts on TFP growth.

By reviewing previous studies, the empirical findings of Peri (2012), Mitaritonna et al. (2014), Woo et al. (2014) and Fassio et al. (2015) have showed a consistent conclusion that there is a significant positive relationship between foreign labours and TFP. Based on these previous findings, there is a sufficient evidence to conclude that the role of immigrants is beneficial in ways of addressing labour shortage and skill deficiency in the domestic labour market, filling the gaps in the native labour market and thus, it enhances the TFP performance of the receiving countries.

However, we also found out that the positive impacts of foreign labour influx will not be consistent and it will be varied across the previous studies; the result obtained from previous studies will be negative sometimes. We may suggest that the inconsistent results are mostly due to different elements are taken into consideration in determining TFP. They include capital intensity, technology level, skill composition and education level. Besides, the time period taken in studies will also determine the result of TFP; either the researchers concern about the short run or the long run.

Another study gap that we found from previous literature is most of the studies have discussed the impacts of foreign labours on TFP growth solely in their respective countries, such as Malaysia, Singapore, Denmark and the United State (Woo, et al., 2014; Moller, et al., 2011; Zhi, et al., 2003; Peri, 2012) or in the geographical region level, such as Europe (Fassio, et al., 2015).

Therefore, we have planned to fill up the study gaps by studying the issue via a worldwide perspective and considering other significant determinants of TFP growth in our study model to make our result more reliable and sound.

CHAPTER 3: METHODOLOGY

3.0 Introduction

In this chapter, we will introduce the theoretical background of our study and the empirical framework of our analysis to carry out the process of all tests. Regarding the research methodology, it consists of the research design, data collection methods, data processing, data description, and data analysis. To prevent misleading results, it is important to choose an appropriate methodology.

3.1 Theoretical Framework

The original model used in the empirical analysis is a simple Solow growth in Cobb-Douglas function. As shown below, the transformation from the Cobb-Douglas production function to the function used in this study.

3.1.1 Theoretical Framework: Cobb-Douglas Production Function

First, to investigate the relation between total factor productivity growth and temporary foreign worker growth, Cobb-Douglas production function is used in this study. Based on Cobb-Douglas production function, total production is determined by the amount of labour input and the amount of physical capital input (Tan, 2008). The production model is formed as:

$$Y = AK^{\alpha}L^{1-\alpha} \quad (1)$$

Where Y denotes total output, A denotes total factor productivity, K denotes physical capital input, and L denotes labour input.

By rearranging the equation in (1), the following equation is applied for the estimation of TFP.

$$TFP \equiv A = \frac{Y}{K^{\alpha}L^{1-\alpha}} \quad (2)$$

3.2 Empirical Framework

To enable the estimation of parameters, equation (2) is modified into a linear form by converting it into natural logarithm form:

$$\ln TFP = \ln Y - \alpha \ln K - (1 - \alpha) \ln L \quad (3)$$

Since our objective is to measure the growth of total factor productivity, thus we have used the changes of the variable instead of the level form. Equation (4) is formed by adding changes to both sides of the equations:

$$\Delta \ln A = \Delta \ln Y - \alpha \Delta \ln K - (1 - \alpha) \Delta \ln L \quad (4)$$

$$\Delta \ln A = \alpha_0 + \beta_1 \Delta \ln Y + \beta_2 \Delta \ln K + \beta_3 \Delta \ln L + \mu_{it} \quad (5)$$

Where, $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 < 0$, μ_{it} refers to trade openness, foreign direct investment FDI, real GDP and temporary worker effects.

In equation (5), the model shows the effect of labour growth, capital growth and economic growth on total factor productivity growth. However, in today's economic situation, there are many other variables that may contribute to the factors of productivity. If we only consider the standard model, biased result might be obtained. Thus, some other impactful variables must be added into this equation in order to get an accurate estimation. Another key element that is being ignored in this equation is the error term, μ . Error term refers to the other variables that may be omitted during the empirical process. Without taking care of other outside factors, the result of estimation is probably varied from the real one. Hence, equation (4) is

still insufficient to measure the overall impacts on the total factor productivity. We have then rearranged and used new equation which is suitable to be used in our model and transformed the variables into logarithmic form in order to reduce the skewness of data, making the results more appropriate in the equation (6) shown below.

$$\Delta \ln RTFP_{it} = \alpha_{it} + \beta_1 \Delta \ln NRK_{it} + \beta_2 \Delta \ln EMP_{it} + \beta_3 \Delta \ln RGDP_{it} + \beta_4 \Delta \ln TRADE_{it} + \beta_5 \Delta \ln TEMP_{it} + \beta_6 \Delta \ln RTFP_{it-1} + \mu_{it} \quad (6)$$

The expected model now has included international trade (TRADE), real GDP (RGDP), and most importantly, foreign workers. Where $\Delta \ln RTFP_{it}$ = natural log of Total Factor Productivity growth, $\Delta \ln NRK_{it}$ = natural log of Net Real Capital Stock growth, $\Delta \ln EMP_{it}$ = natural log of Employment growth, $\Delta \ln RGDP_{it}$ = natural log of Real GDP growth, $\Delta \ln TRADE_{it}$ = natural log of Trade growth, $\Delta \ln TEMP_{it}$ = natural log of Temporary Worker growth, $\Delta \ln RTFP_{it-1}$ = lag of natural log of TFP growth, β_0 = intercept, μ_{it} = error term, i = countries, t = time trend.

In equation (5) & (6), α, β are the partial coefficients, and μ represents the error term (white noise) that is independent and identically distributed. Besides, running logarithm at both sides of the equations ensures that the input can be split into linear form easily and it makes the estimation process to be clearer. The model in the estimated is a dynamic model as the lagged dependent is also included.

3.2.1 Discussion of Independent Variables

Besides, the reason that we have chosen these independent variables in our model will be showed. According to Jajri (2007), capital refers to the goods such as machines, buildings, and vehicles that are being used in production. Capital amount will determine the capacity of the economy whether it is able to absorb and work complementally with labour and other inputs. The amount of capital should always be considered well enough to interact in economy as it can be beneficial or harmful.

One of the other independent variables would be employment. Based on Greasley and Madsen (2006), the higher employment is appeared to lead the diminishing total factor productivity gaps. It can be categorised into job creation and job destruction. When job destruction reacts faster to shock than job creation, it will negatively affect total factor productivity growth.

For real GDP growth, it reflects the value of all goods and services produced by an economy in a stated period when taking inflation into account. In many countries, the economic growth is mainly contributed by human capital and foreign direct investment. Total factor productivity growth might be affected by them as well. Thus, when both human capital and foreign direct investment (FDI) increase, Real GDP will improve TFP growth (Arazmuradov, Martini and Scotti, 2014).

Moreover, trade growth is important to a country's total factor productivity growth as it carries a big role in explaining growth, trade growth in general in increasing the international transaction and it can also be a source of learning. Trade growth covers a wide range of factors which include the technology transfer, knowledge transfer through human capital and FDI which bring a positive effect to TFP growth. They argue that trade growth is a knowledge courier and it focuses on imports as a way of introducing the foreign technology which is relatively advance into domestic production, which in turn has a positive effect on TFP growth.

Then, the main variables that we have concerned much will be foreign temporary worker growth. Foreign temporary worker can be defined as a person who work on a temporary basis in a country out of his origin country. (Mohamed, Ramendran & Yacob, 2012). They might, for one, improve the level of innovativeness through the supply of specific skills and competences. A more extensive measure of innovation used in the literature is the growth of Total Factor Productivity (TFP). Based on Alesina, Harnoss and Rapoport (2013), they have found in their country-level analysis that the diversity of temporary foreign workers regarding their country of birth is positively associated with TFP growth and it has a more noticeable effect for the diversity of highly-skilled temporary foreign workers.

The relationship between temporary foreign worker growth and TFP growth might show in an adverse way in terms of skill and unskilled. Recent empirical evidence has, indeed, found a positive effect for skilled migration on innovative outcomes in some European countries (Gagliardi, 2011; Bosetti, Cattaneo and Verdolini, 2015) while the unskilled performed the opposite effect. In addition, the use of the foreign temporary workers will only bring a negative impact to the growth of TFP growth in the short-run. This is because the foreign temporary workers tend to need some time to adapt to the new environment when they have entered the new country or new labour market. However, the growth of TFP will increase once the adaption has been completed in a long-run (Herowitz et al., 1999).

Temporary foreign workers will also tend to exert higher effort as they have a perception that firms will proceed to convert their fixed-term contracts into permanent contracts and this will increase their productivity. Temporary workers carry their own different skill levels and the skill levels of workers in a particular country cause an increase in the TFP growth. Countries as well as some industries with higher level of education and skills have higher TFP growth as these workers are able to produce better outputs.

3.3 Research Design

Our research objective could be meet by using quantitative research. In our study, quantitative methods are particularly useful when researchers seek to study a larger scale of behaviour pattern as they can be quantified and measured easily than a smaller scale of behaviour pattern. This study seeks to identify the impact of inflow immigrant on the determinants of TFP growth like net real capital stock growth, employment growth, temporary workers growth, real GDP growth and trade growth. Data has been collected and analysed by using mathematical methods and in the form of numerical way.

3.4 Data Collection Methods

In this research, we have used a panel data which stretches from 2007-2011, a period of 5 years in the countries of Malaysia, Canada, the United States and the area of European countries, which include Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Germany, Hungary, Latvia, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, Turkey and United Kingdom.

Moreover, Canada is one of the countries in our study due to the fact that Canada is popular in Temporary Foreign Worker Program (TFWP) that is not found in most parts of the country. The United States is also important in our study because the United States is an economy benchmark. Then, Malaysia is also selected in our study because it is an issue-arising country and the most important thing would be, as a Malaysian we can see the growth has dropped dramatically so it would be our interest to study it. Also, for the 27 selected European countries, they are mostly developed countries and labour importing countries which might be different from developing countries; thus, we would like to examine those impacts on the selected countries.

Other than that, we have chosen the time period ranging from 2007-2011 because of the missing data. The first few years selected would be from 2001 to 2011, but there is not much of data for us to carry out, thus we have shorten our time period to five years. Secondary data has been selected to carry out this research. In order to determine the impact of TFP growth on the variables on real capital stock growth, real GDP growth, we have obtained the data sources from Penn World Table, employment growth data from International labour organization (ILO), and trade growth from World Bank database table. But, there are different sources used from different countries for the foreign temporary worker growth' data where Canada has obtained data from Citizenship and Immigration Canada (CIC), Eurostat for European Countries, Malaysia has obtained from MEF and U.S Department of Homeland Security for United States. As for the dependent variables, total factor productivity growth is obtained from Penn World Table as shown in table 3.1.

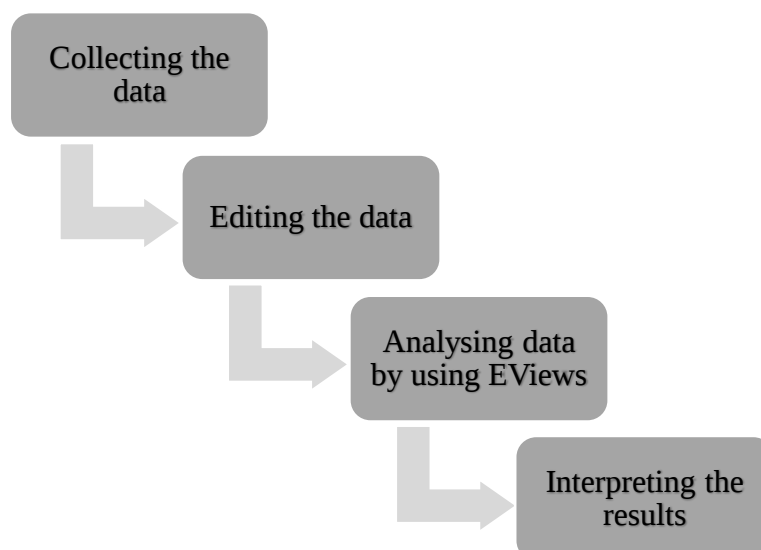
Table 3.1: Sources of Data

Independent variables	Sources
Net Real Capital Stock (NRK)	Penn World Table (PWT)
Employment (EMP)	International labour organization (ILO)
Real GDP (RGDP)	Penn World Table (PWT)
Trade Growth (TRADE)	World bank database table
Temporary foreign workers (TEMP)	Canada: Citizenship and Immigration Canada (CIC) Euro countries: Eurostat Malaysia: Malaysian Employers Federation (MEF) United States: U.S Department of Homeland Security
Total Factor Productivity (RTFP)	Penn World Table (PWT)

3.4.1 Data Processing

There are few steps involved in the data processing part. First, we obtained the data from some of the available sources. After obtaining the data, we have then edited and rearranged the data before running an empirical analysis on EViews 9, a popular econometric software to carry out and estimate time series data. After the empirical analysis has been carried out, we interpreted and analysed the finding related to the research objective.

Figure 3.1: Steps of Data Processing



3.4.2 Data Description

Based on the model in our study, the unit measurement of each independent variables is different. Table 3.2 shows that net real capital stock growth is measured in $[(1-\delta)*rkna]$ whereby δ is the average depreciation rate of the capital stock and $rkna$ refers to a constant capital stock in 2005 national price (in mil. 2005US\$), and the expected sign for capital is negative as well. Then, the expected sign for employment growth is negative, the higher employment is shown to have dominated the diminishing total factor productivity gaps (Greasley & Madsen, 2006).

Other than that, real GDP growth is measured via constant 2005 national prices which has the value of million, 2005US\$. According to Arazmuradov, Martini and Scotti (2014), the expected sign for real GDP growth is positive when human capital and foreign direct investment (FDI) increases, thus total factor productivity growth will enhance real GDP growth. Besides, the trade is measured by the sum of exports and imports of goods and services, it is measured in the percentage of GDP (World Bank, n.d). According to Ismail, Sulaiman and Jajri (2014), the expected sign for trade growth is positive. Lastly, unit measurement for temporary foreign worker growth is in thousand and the expected sign for temporary foreign worker growth is negative.

Table 3.2: Description of Data in Table Form

Independent variables	Unit measurement	Expected relationship with TFP
Net Real Capital Stock (NRK)	In mil. 2005US\$	negative
Employment (EMP)	Thousand	negative
Real GDP (RDGP)	In mil.2005US\$	positive
Trade (TRADE)	% of GDP	positive
Temporary workers (TEMP)	Thousand	negative
Total Factor Productivity (RTFP)	2005=1	-

3.4.3 Individual Trend

Figure 3.2 shows the relationships between temporary foreign worker growth and Total Factor Productivity (TFP) growth for 30 countries in our study. Each graph below represents one country which includes Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, Turkey, United Kingdom, Canada, Malaysia and United States respectively.

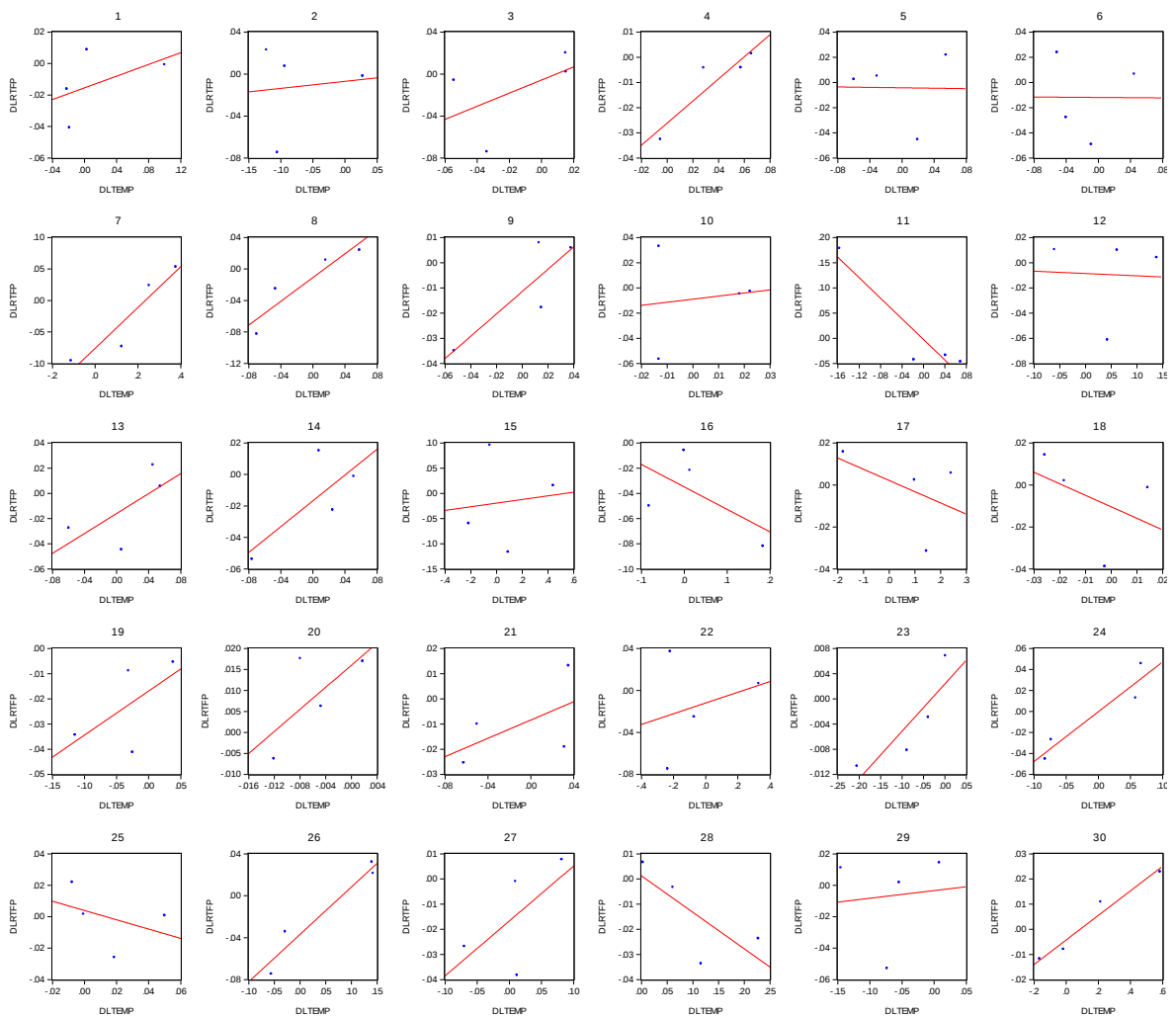
21 out of 30 countries show an upward sloping trend which means there is a positive relationship between temporary foreign worker growth and TFP growth, 6 countries and 2 countries show a negative trend and neutral trend respectively. Based on the different results we obtained from these 30 graphs, this makes us keen to study and suggest the potential reason. The effect of immigration on the labour market depends critically on the skills of migrants, existing native workers and the characteristics of the recipient countries. The research evidence has proven that the effect of immigration on labour market is always specific in terms of time and place (Ruhs & Silva, 2015).

Therefore, we strongly believe that different effects will be created due to the variance skills of temporary foreign workers employed in each country, skills of existing native labours and their own characteristics. Regarding the 30 countries we have studied, the majority is developed countries and they have common characteristics in implementing their immigration policy or common preferences in hiring immigrants by demanding high-skilled immigrants in order to address labour shortage. In order to encourage skilled migrants seeking jobs in developed economies, certain attractive offers like good wages and employment conditions, better recruitment prerequisite, and cheaper transportation are commonly offered by the developed countries.

Positive total factor productivity growth (TFP) is the result of innovations that create new products and production processes. For instance, the previous

improvements in living standards of American households have been largely affected by the growth in the productivity of capital and labour (Jones 1995 as cited in Hanson, 2012). There are many multinational companies in recent decades have appeared to raise the level of national welfare like Intel, Apple Inc., Lipitor and other cholesterol reducing drugs, fuel-efficient automobiles, safe. A binding constraint in developing innovations is the supply of highly talented scientists, engineers, and other technical personnel while the immigrations help in reducing this constraint. This shows that the high-skilled foreign labours promote innovation. Furthermore, additional benefit of high-skilled immigrants is likely to pay far more taxes than they use in public services which is able to generate a positive net contribution to government fiscal accounts.

Figure 3.2: Relationship between DLRTFP and DLTEMP in All Countries



Note: The observed countries are represented by the numbers where:

- | | | |
|--------------------|-----------------|-------------------|
| 21. Belgium | 11. Greece | 1. Portugal |
| 22. Bulgaria | 12. Hungary | 2. Romania |
| 23. Croatia | 13. Ireland | 3. Spain |
| 24. Cyprus | 14. Italy | 4. Sweden |
| 25. Czech Republic | 15. Latvia | 5. Switzerland |
| 26. Denmark | 16. Luxembourg | 6. Turkey |
| 27. Estonia | 17. Malta | 7. United Kingdom |
| 28. Finland | 18. Netherlands | 8. Canada |
| 29. France | 19. Norway | 9. Malaysia |
| 30. Germany | 20. Poland | 10. United States |

While DLRTFP denotes total factor productivity growth and DLTEMP denotes temporary foreign worker growth.

3.5 Estimators

In our study, to estimate the model in our equation, there are basically three types of model which are pooled ordinary least square model (OLS), fixed effect model (FEM) and random effect model (REM). Each model will be explained briefly before we begin utilising our methodology.

3.5.1 Pooled Ordinary Least Square (POLs)

Firstly, the most restrictive model is the pooled model. This model has underlain the usual assumptions for the cross section analysis. It is assumed to be no unobserved individual heterogeneity. It can fulfil the assumption of linear, unbiased result and consistency if the model is appropriate. Pooled OLS is the best model which has no heteroscedasticity problem, no serial correlation, and no multicollinearity problem as well. The equation below shows (7) the pooled OLS.

$$Y_{it} = \alpha + \beta X_{it} + \mu_{it}, i= 1, \dots, N, t= 1, \dots, T \quad (7)$$

Based on equation (7), assuming there are K regressors (covariates), such that $\dim(\beta) = K$. Panel models mainly differ in their assumptions on μ . μ independently across i and t which indicates that the regressors are strictly exogenous (it does not depends on current, past and future values of the error term.). $E_{\mu} = 0$, $\mu_i = 0$ and $Var_{\mu} = \sigma^2$, it is also assumed that the error term is independently and identically distributed with zero mean and constant variance. It is efficiently estimated by least squares (OLS).

3.5.2 Random Effects Model (REM)

Then, we have a look at the second model which is random effect model. REM treats error term to be independently distributed with the regressors. RE estimator measures variation over time and over cross sections. In the random

effects model, the individual-specific effect is a random variable that is uncorrelated with the explanatory variables of all time periods which is in the past, current, and future of the same individual.

For the REM, the pooled OLS estimator is unbiased under the small samples, but we cannot establish the properties of small sample for the RE estimator. The RE estimator is asymptotically and normally distributed and consistent when the number of individual is more than one and even if time is fixed. REM is usually examined by the Lagrange Multiplier (LM) test which is different from the FEM. We assume REM has same intercepts and slopes in which the error term should not correlate to any regressor. This is because the difference among the groups does not lie in their intercepts but it lies in their variance of the error term. REM is then used in generalized least squares when the variance structure among groups is known. REM equation is then shown below.

$$Y_{it} = \alpha + \beta' X_{it} + \mu_{it},$$

$$\mu_{it} = \mu_i + v_{it} , \tag{8}$$

$$\mu_i \sim (0, \sigma_\mu^2)$$

$$v_{it} \sim (0, \sigma_v^2)$$

For $i = 1, \dots, N$, and $t = 1, \dots, T$. μ and v are mutually independent.

In equation (8), we assume that the intercept of an individual unit is randomly drawn from a much larger population with a constant mean value. The individual intercept is then expressed as a deviation from this constant mean value. It is appropriate in situations where the (random) intercept of each cross sectional unit is uncorrelated with the regressors.

3.5.3 Fixed Effects Model (FEM)

Fixed effect model (FEM) treats error term as a variable that is partially correlated with the observed regressors. We assumed that the time-varying explanatory variables in the FEM are not perfectly collinear as they have non-zero within-variance (i.e. variation over time for a given individual) and not too many extreme values. Hence, explanatory variables cannot include a constant or any time-invariant variables. (Schmidheiny, K., 2015)

Furthermore, FEM also examines group differences in the intercepts, assuming that the same slopes and constant variance across entities group has considered the error is allowed to be correlated to other regressors. FEM uses least square dummy variable (LSDV) and within effect estimation methods. Besides, FEM is tested by the incremental F test, variances of the error term is constant and intercept is varied across groups and/ or times. There are also some pros and cons in FEM. The advantages would be, if the unobserved heterogeneity is correlated with regressors, there will be a consistent estimation. FE estimators will solve the omitted variable bias. The drawbacks are the time invariant regressors fall out the tremendous loss of information and this will lead to less degree of freedom; hence, FE estimators should not be used unless it is necessary.

Fixed effect model consists of incidental parameters. Most authors call a parameter incidental when its dimension increases with the sample size. The nuisance is due to such a parameter is worse than a typical nuisance parameter which its dimension may be constant. In FEM, it is appropriate in situations where the (random) intercept of each cross sectional unit is correlated with the regressors.

$$\text{Cor}(\mu_i, X_{it}) \neq 0$$

Let $Z_{\mu, it}^{(j)}$ denote a dummy variable that is 0 for all observations it with $i \neq j$ and 1 for $i = j$.

Then, convening $Z_{\mu, it} = (Z_{\mu, it}^{(1)}, \dots, Z_{\mu, it}^{(N)})'$ and $\mu = (\mu_1, \dots, \mu_N)'$,

$$Y_{it} = \alpha + \beta' X_{it} + \mu' Z_{\mu, it} + v_{it}, \quad i = 1, \dots, N, t = 1, \dots, T \quad (9)$$

Equation (9) shows the LSDV (least-squares dummy variables), the within, or the FE estimator. The regression fulfils all conditions of the Gauss-Markov Theorem. Assuming X as non-stochastic, LSDV is unbiased, consistent, and linear efficient (BLUE). The table below shows a comparison between FEM and REM.

Table 3.3: Comparison between FEM and REM

	FEM	REM
Intercepts	Varying across groups	Constant
Slopes	Constant	Constant
Variance of error term	Constant	Varying across groups
Estimation	LSDV, within effect method	GLS
Hypothesis testing	Incremental F test	Breusch-Pagan LM test
LM test (compare between Pooled OLS and REM)	-	Reject null hypothesis, REM is preferable.
Likelihood test (compare between Pooled OLS and FEM)	Reject null hypothesis, FEM is preferable.	-
Hausman test (compare between FEM and REM)	Reject null hypothesis, FEM is preferable.	Do not reject null hypothesis, REM is preferable.

3.5.4 Model Comparison

Thus, we would compare between 3 models to justify which is the best model in the equation. To compare Pooled OLS and REM, we use LM test. REM is preferable if we reject null hypothesis. Then, Likelihood test is used to test between the comparison of pooled OLS and FEM, if we reject null hypothesis, FEM is preferable. The last pair of comparison would be FEM and REM. This is usually tested by Hausman test. If the null hypothesis is that the individual effects are

uncorrelated with the other regressors in the model is rejected, a FEM model is better than REM. However, the time fixed effect cannot be included in Hausman test and it is only valid under homoscedasticity (Schmidheiny, 2015).

Pooled vs REM (LM test)

To compare the preference between Pooled OLS and REM, we carry out Langrange Multiplier (LM) test. We denote

$$“H_0 : \mu_i = 0” \text{ and } “H_1 : \mu_i \neq 0”$$

By assuming our significant level (α) to be 0.01/0.05/0.1. We reject H_0 if the test statistics is greater than critical value, otherwise, we do not reject H_0 . There is another way to carry out the test which is to reject H_0 if the P-value is smaller than α .

Pooled vs FEM (Likelihood test)

To compare the preference between **Pooled OLS and FEM**, likelihood test is applied. We denote

$$“H_0 : \mu_i = 0” \text{ and } “H_1 : \mu_i \neq 0”$$

By assuming our significant level to be 0.01/0.05/0.1. H_0 will be rejected if the test statistics is found to be greater than critical value, otherwise, we do not reject H_0 . Same as the case above, we will reject H_0 if the P-value is smaller than α .

FEM vs REM (Hausman test)

Hausman test is applied to compare the preference between **FEM and REM**, We denote

$$“H_0 : Cor(\mu_i, X_{it}) = 0” \text{ and } “H_1 : Cor(\mu_i, X_{it}) \neq 0”$$

By assuming our significant level to be 0.01/0.05/0.1. . We reject H_0 if the test statistics is greater than critical value, otherwise, we do not reject H_0 . If test statistics is not given, we can stick to another decision rule to reject H_0 if the P-value is smaller than α .

3.5.5 Deriving Long-run TFP Growth

In our study, we have used lagged variable which is DLRTFP(-1) to improve the effectiveness of the model. However, this has restricted our model to examine only the short run effect of temporary foreign worker growth towards total factor productivity growth. In order to get a more accurate study, further steps are taken in the estimation procedure to obtain the long-run effect of our model. The transformation is conducted by following steps:

$$\Delta Y_{it} = \alpha_0 + \beta_1 \Delta X_{1it} + \beta_2 \Delta X_{2it} + \beta_3 \Delta X_{3it} + \beta_4 \Delta X_{4it} + \beta_5 \Delta X_{5it} + \beta_6 \Delta Y_{it-1} + \mu_{it} \quad (10)$$

$$\Delta Y_i = \alpha_0 + \beta_1 \Delta X_{1i} + \beta_2 \Delta X_{2i} + \beta_3 \Delta X_{3i} + \beta_4 \Delta X_{4i} + \beta_5 \Delta X_{5i} + \beta_6 \Delta Y_i + \mu_{it} \quad (11)$$

$$(1 - \beta_6) \Delta Y_i = \alpha_0 + \beta_1 \Delta X_{1i} + \beta_2 \Delta X_{2i} + \beta_3 \Delta X_{3i} + \beta_4 \Delta X_{4i} + \beta_5 \Delta X_{5i} + \mu_{it} \quad (12)$$

$$\Delta Y_i = \frac{\alpha}{1 - \beta_6} + \frac{\beta_1}{1 - \beta_6} \Delta X_{1i} + \frac{\beta_2}{1 - \beta_6} \Delta X_{2i} + \frac{\beta_3}{1 - \beta_6} \Delta X_{3i} + \frac{\beta_4}{1 - \beta_6} \Delta X_{4i} + \frac{\beta_5}{1 - \beta_6} \Delta X_{5i} + \mu_{it} \quad (13)$$

Equation (13) shows the transformation from short-run coefficient to long-run coefficient of each variable by eliminating the lagged variable. The final long-run model is built as shown in equation (14).

$$\Delta \ln RTFP_i = \frac{\alpha}{1 - \beta_6} + \frac{\beta_1}{1 - \beta_6} \Delta \ln NRK_i + \frac{\beta_2}{1 - \beta_6} \Delta \ln EMP_i + \frac{\beta_3}{1 - \beta_6} \Delta \ln RGDP_i + \frac{\beta_4}{1 - \beta_6} \Delta \ln TEMP_i + \frac{\beta_5}{1 - \beta_6} \Delta \ln TRADE_i + \mu_{it} \quad (14)$$

3.5.6 Interactive between Foreign Worker and Economy

$$\Delta Y_{it} = \alpha_0 + \beta_1 \Delta X_{1it} + \beta_2 \Delta X_{2it} + \beta_3 \Delta X_{3it} + \beta_4 \Delta X_{4it} + \beta_5 \Delta X_{5it} + \beta_6 \Delta Y_{it-1} + \mu_{it} + \beta_7 \Delta X_{4it} \Delta X_{jit} \quad (15)$$

Based on the equation above, j denotes as real GDP growth, trade growth and employment growth. There is a complement effect between foreign worker and TFP growth. When the foreign labour increases, employment will rise essentially, then it will affect the TFP growth to rise as well. According to the Department for Business, Innovation & Skills (2015), immigrant workers work as a team with local workers in skill training, innovation and knowledge sharing. If foreign worker possesses skills and knowledge that are not found in the natives workers, it will become complementary effect between foreign workers and local worker.

3.6 Conclusion

In short, this chapter discusses the data collection, data description, data processing and also the methodologies to be used in next chapter. The methodologies that we have chosen are pooled OLS, fixed effect model and random effect model. Besides, we also focus on the Solow growth model and Cobb-Douglas function that are used in our study. We have also interpreted the long-run effect of TFP on the economy and the interaction between the independent variables. The following chapter would be the data analysis where the results have been mentioned above to elaborate and interpret more details.

CHAPTER 4: RESULT AND INTERPRETATIONS

4.0 Introduction

In this chapter, the results of empirical study are revealed and reported accordingly. We have first conducted Pooled Ordinary Least Square (POLS) to select the best independent variables based on Cobb-Douglas Production Function. Random Effect Model (REM) and Fixed Effect Model (FEM) were then added to compare to the POLS to select the most efficient model for total factor productivity (TFP). Langrange Multiplier (LM) test was applied to compare POLS and REM while Likelihood test was conducted for POLS and FEM. The final model was then formulated by using Hausman test to select the best model between FEM and REM. After that, we have also examined the long-run effect of independent variables towards TFP by taking transformation on the model. Lastly, the result of interaction of independent variables are discovered.

4.1 Pooled Ordinary Least Square (POLS)

To find the best fit equation that explains the relationship between the dependent and independent variables, we have adopted multi-stage regressions by fitting the initial model with lagged of dependent and additional independent variables.

Table 4.1 indicates the growth regression results with the total factor productivity growth (DLRTFP) as dependent variable for each stage. We begin with Equation (1) where only net real capital stock growth stock (DLNRK) and employment growth (DLEMP) are on the right hand side of the equation based on the production function. Equation (1) has a low R^2 of 0.1084, indicating a poor goodness of fit and only DLEMP is found to be significant. As the R^2 being too low, we proceed to the next stage, forming Equation (2) according to Cobb-Douglas production function by including one additional variable which is real gross

domestic product growth (DLGDP). All of the independent variables show a statistical significant result with an improved R^2 0.5966. The sign of the coefficient of DLEMP has changed from negative to positive.

However, the most important factor which is our focus of study, temporary foreign worker growth (DLTEMP), is not included in the equation yet. So, in the following Equation (3), we introduce DLTEMP as the additional factor. R^2 has improved slightly in Equation (3), but DLTEMP appears to be insignificant in the equation. Another variable, education growth (DLHC) is introduced in Equation (4), R^2 remains the same which means the introduction of this variable does not increase the goodness of fit in the model as it also appears to be statistically insignificant together with DLTEMP.

By moving forward to Equation (5), we include trade growth (DLTRADE) in the equation which it has been proven to be statistically significant where DLTEMP becomes significant at 10% with the changes of sign from positive to negative. In Equation (6), the lagged of the TFP growth variable DLRTFP (-1) is next introduced into the model in order to improve the goodness of fit marginally. As a result, the significance of temporary foreign worker has improved from 10% to 5% significant level. While, the goodness of fit has improved from 0.6985 to 0.7717. Nonetheless, DLHC shows insignificant result in both Equations (5) and (6), so we decide to remove this variable in Equation (7). In Equation (7), all the variables become statistically significant and the R^2 achieved is considered high throughout the equations.

After numerous stages of testing with different variables, Equation (7) appears to be the most ideal equation to explain the relationship between temporary foreign labour growth and total factor productivity growth with all of the variables statistically significant at 1% level of significance and DLTEMP is statistically significant at 5% significance level. Without taking consideration of countries' characteristics, DLTEMP is found to have negatively relationship with TFP growth.

Table 4.1: Growth Regression using Pooled Ordinary Least Square (POLS)

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>C</i>	-0.0022 (0.0062)	0.0127*** (0.0044)	0.0124*** (0.0045)	0.0122** (0.0048)	0.0065* (0.0043)	0.0098* (0.0050)	0.0099** (0.0048)
<i>DLNRK</i>	-0.3131 (0.2045)	-0.8474*** (0.1453)	-0.8386*** (0.1499)	-0.8395*** (0.1507)	-0.6756*** (0.1336)	-0.7535*** (0.1843)	-0.7536*** (0.1832)
<i>DLEMP</i>	-0.0372*** (0.0113)	0.3950*** (0.0373)	0.3927*** (0.0385)	0.3915*** (0.0398)	0.3066*** (0.0372)	0.3008*** (0.0435)	0.3015*** (0.0407)
<i>DLGDP</i>	--	0.4012*** (0.0339)	0.3993*** (0.0348)	0.4004*** (0.0361)	0.3225*** (0.0338)	0.3107*** (0.0372)	0.3104*** (0.0365)
<i>DLTEMP</i>	--	--	0.0049 (0.0193)	0.0051 (0.0194)	-0.0301* (0.0178)	-0.0440** (0.0194)	-0.0441** (0.0191)
<i>DLHC</i>	--	--	--	0.0682 (0.5449)	0.1447 (0.4735)	0.0265 (0.5745)	--
<i>DLTRADE</i>	--	--	--	--	0.1412*** (0.0229)	0.1627*** (0.0236)	0.1626*** (0.0233)
<i>DLRTFP (-1)</i>	--	--	--	--	--	-0.0573 (0.0744)	-0.0584 (0.0700)
<i>R²</i>	0.1084	0.5966	0.5969	0.5969	0.6985	0.7717	0.7717
<i>Adjusted R²</i>	0.0931	0.5862	0.5828	0.5792	0.6825	0.7522	0.7552
<i>F-statistic</i>	7.1107***	57.1899***	42.5635***	33.7625***	43.6373***	39.5929***	46.7534***
<i>D-W test stat</i>	2.2184	1.5668	1.5681	1.5636	1.6509	1.7289	1.7278

Note: The asterisks *, **, *** indicate rejection of the null hypothesis at 10%, 5% and 1% level of significance respectively. Standard Error in parentheses.

4.2 Random Effect Model (REM)

By comparing POLS and REM, they have consistent results in sign and they are significant in each independent variable, as well as the goodness of fit (R^2).

From the REM results of table 4.2, temporary foreign worker growth (DLTEMP) is statistically significant at 5% significance level. The net real capital stock growth (DLNRK), employment growth (DLEMP), real gross domestic product growth (DLRGDP) and trade growth (DLTRADE) are statistically significant at 1% significance level.

Total factor productivity growth (DLRTFP), in average will decrease by 0.0441 percentage point for each additional percentage point of temporary foreign worker growth rate, *ceteris paribus*. If net real capital stock increases by 1 percentage point, on average, the TFP growth will decrease by 0.7536 percentage point, *ceteris paribus*. For each additional percentage point increases in employment, it will lead to a total of 0.3015 percentage point increase in TFP growth. Besides, if real GDP growth increases by 1 percentage point, in average, the TFP growth will increase by 0.3104 percentage point, *ceteris paribus*. If trade growth increases by 1 percentage point, on average, the TFP growth will increase by 0.1626 percentage, *ceteris paribus*.

4.3 Fixed Effect Model (FEM)

By comparing POLS and FEM, most of the findings are similar except net real capital stock growth (DLNRK) and temporary foreign worker growth (DLTEMP). Net real capital stock growth turned out to be insignificant in FEM. While the significance level of temporary foreign workers has increased from 5% to 1%. The goodness of fit has improved from 0.7717 to 0.8826.

From the FEM results of table 4.2, employment growth (DLEMP), real gross domestic product growth (DLRGDP), temporary foreign worker growth (DLTEMP) and trade growth (DLTRADE) are statistically significant at 1%

significance level. Net real capital stock growth (DLNRK) is insignificant at 10% significance level.

TFP growth, in average will increase by 0.4642 percentage point for each additional percent point of employment growth, *ceteris paribus*. This result is inconsistent with our expected relationship as stated by Pissarides and Vallanti, (2004) and Greasley and Madsen (2006) who suggest negative relationship between employment and TFP growth. However, the possible reason for this situation is that foreign immigrants might act as a complementary to work with domestic workers. According to Department for Business, Innovation & Skills (2015), immigrant workers may work as team with local workers in term of skills, innovation, knowledge sharing, training, and migrant's connections.

Besides, every 1 percentage point increases in real GDP growth, it will lead to 0.4592 percentage point increase in TFP growth. This is consistent with our theoretical expectation. Real GDP is expected to have a positive impact on TFP growth (Baier, Dwyer and Tamura, 2006; Arazmuradov, Martini and Scotti, 2004). Most of the countries, their economic growth is mainly associated with physical and human capital accumulation through FDI and domestic investment. The cost of production can be reduced when there is an efficiency in the usage of input. Thus, this will increase the production and improve the economic growth as well.

After countries' characteristics had been taken into consideration, DLTEMP is still negatively affect TFP growth. When temporary foreign worker growth increases by 1 percentage point, in average, the TFP growth will decrease by 0.0597 percentage point, *ceteris paribus*. This result shows that it has an inconsistent relationship with previous studies of Peri (2012) and Mitaritonna et al. (2014) in which they found that foreign labours have a significant positive impact on TFP growth. However, the contrast of findings are explainable. From the previous studies, researchers are concerned about the TFP level instead of TFP growth, and our study is focusing on TFP growth, thus the result might still show an increase in the TFP level; however, it is in a decreasing or diminishing rate. This situation has previously proven by Borjas (1995), Drinkwater et al. (2007) and Thangavelu (2012), stating that skilled foreign labours do have a positive effect on the domestic

economy, at a diminishing rate. Generally, the effect on TFP growth can be categorized into 2 patterns which are TFP level increases at an increasing rate (positive relationship), and another one will be TFP level increases at a decreasing rate (negative relationship). By applying this concept, we may suggest that negative relationship in our finding explains that foreign workers are enhancing the TFP level at a diminishing rate. In another word, the consent is still achieved in our study with the previous stands.

For each additional percent point increases in trade growth, the TFP growth will increase by 0.1085 percentage point, *ceteris paribus*. It is very obvious that with the presence of trade, most of the countries that participate in the trade will prefer to produce and specialise in the commodities that are relatively low cost. With specialisation, countries will optimise the production with the availability of inputs which increases the total factor productivity.

4.4 Model Comparison

To select the best model to explain the relationship between temporary foreign worker growth and total factor productivity growth, several additional tests were conducted. We have first performed the Langrange Multiplier test to compare the pooled OLS model with random effect model (REM). The result from table 4.2 states that test statistics value of 0.2441 which is smaller than the critical value of 7.28/4.321/2.952 at a significant level (α) 0.01/0.05/0.1 respectively. The null hypothesis is not rejected and it shows that pooled OLS is preferable as compared to REM. After that, we continued to find out the comparison between pooled OLS model and fixed effect model (FEM) by using Likelihood test. From the result, we obtained P-value of 0.0006 which led us to reject the null hypothesis since the P-value is smaller than the α value at either significance level of 0.01/0.05/0.1. Thus, FEM is preferable as compared to pooled OLS model. Lastly, Hausman test was carried out to determine the best model between FEM and REM. Based on the result from table 4.2, the P-value of 0.0001 indicates that FEM is more appropriate as compared to REM as null hypothesis is rejected at 1%, 5% and 10% significance level.

Table 4.2: Estimation of Model POLS, REM, FEM

Model	POLS	REM	FEM
C	0.0099** (0.0048)	0.0099** (0.0043)	-0.0074 (0.0096)
DLNRK	-0.7536*** (0.1832)	-0.7536*** (0.1629)	-0.6189 (0.4077)
DLEMP	0.3015*** (0.0407)	0.3015*** (0.0362)	0.4642*** (0.0501)
DLRGDP	0.3104*** (0.0365)	0.3104*** (0.0325)	0.4592*** (0.0449)
DLTEMP	-0.0441** (0.0191)	-0.0441** (0.0170)	-0.0597*** (0.0214)
DLTRADE	0.1626*** (0.0233)	0.1626*** (0.0207)	0.1085*** (0.0250)
DLRTFP (-1)	-0.0584 (0.0700)	-0.0584 (0.0623)	-0.1659** (0.0694)
R²	0.7717	0.7717	0.8826
Adjusted R²	0.7552	0.7552	0.8064
F-statistic	46.7534***	46.7534***	11.5938***
D-W test stat	1.7278	1.7278	2.6709
L-M test	0.2441	--	--
Hausman test (P-value)	--	0.0001	--
Likelihood test (P-value)	--	--	0.0006

Note: The asterisks *, **, *** indicate rejection of the null hypothesis at 10%, 5% and 1% level of significance respectively. Standard Error in parentheses.

4.5 Does Temporary Foreign Worker Growth Affect Total Factor Productivity Growth in Long-run?

Long-run impact of temporary foreign worker growth was estimated using the methodology used in previous chapter. The long-run coefficients can be obtained by using this equation:

$$DLRTP_i = \frac{\alpha}{1 - \beta_6} + \frac{\beta_1}{1 - \beta_6} DLNRK_i + \frac{\beta_2}{1 - \beta_6} DLEMP_i + \frac{\beta_3}{1 - \beta_6} DLRGDP_i \\ + \frac{\beta_4}{1 - \beta_6} DLTEMP_i + \frac{\beta_5}{1 - \beta_6} DLTRADE_i + \mu_{it}$$

From results obtained from table 4.3, net real capital stock growth (DLNRK) still remains insignificant at 10% significance level in the long-run. While employment growth (DLEMP), real gross domestic product growth (DLRGDP), temporary foreign worker growth (DLTEMP) and trade growth (DLTRADE) have remained statistically significant at 1% significance level if compared to short-run effect.

However, the employment growth is estimated to have negative effect on TFP growth while the growth in trade has less benefits on TFP growth in the long-run. Another essential finding in the long-run is that the effect of temporary foreign worker growth face a total opposite result compare to the short-run, which become positive towards TFP growth in a large magnitude from decreasing 0.0597 percentage point to increasing 0.0931 percentage point when immigrant workers are increased by 1 percentage point. This finding will probably suggest that more foreign workers are imported will actually benefit productivity at the cost of time.

**Table 4.3: Estimation of Long-run Coefficient toward Total Factor
Productivity Growth**

	Long-run Coefficient	Coefficient	T- statistic	F-statistic	Chi-square
<i>C</i>	--	--	--	--	--
<i>DLNRK</i>	$\frac{\beta_1}{1 - \beta_6}$	-0.5308 (0.3548)	-1.4960	2.2379	2.2379
<i>DLEMP</i>	$\frac{\beta_2}{1 - \beta_6}$	-0.3981*** (0.0404)	9.8437	96.8987***	96.8987***
<i>DLRGDP</i>	$\frac{\beta_3}{1 - \beta_6}$	0.3938*** (0.0370)	10.6356	113.1153***	113.1153***
<i>DLTEMP</i>	$\frac{\beta_4}{1 - \beta_6}$	0.0931*** (0.0234)	3.9767	15.8139***	15.8139***
<i>DLTRADE</i>	$\frac{\beta_5}{1 - \beta_6}$	-0.0512*** (0.0180)	-2.8530	8.1395***	8.1395***

Note: The asterisks *, **, *** indicate rejection of the null hypothesis at 10%, 5% and 1% level of significance respectively. Standard Error in parentheses.

4.6 Interaction of Independent Variables

Based on the results from table 4.4 for testing the interaction between temporary workers with other independent variables, we found that there are no any interactive relationships for DLTEMP to DLNRK and DLTRADE. However, there are significant interactive relationships between temporary workers growth with DLEMP and DLRGDP at 1% of significance level.

Based on some of the previous studies, there is a positive relationship between DLNRK and DLTEMP. This is due to influx of temporary worker could increase demand for food and services in destination countries which leads to an increase of investment and capital accumulation (Greenwood & McDowell, 1986). Meanwhile, for the DLTRADE and DLTEMP, one of the recent Centre for Economic Performance discussion papers conducted by Ottaviano, Peri & Wright,

2015 discovered that immigrants promote exports of final services as well as reduce imports of some types of intermediate services to their origin countries. Unfortunately, these studies are not consistent with our result which shows no relationship between them.

For DLEMP, we found out our testing results are consistent with some previous studies findings. The relationship between foreign workers and native workers can be either complementary or substitutable. If foreign workers possess skills and knowledge that the natives do not have, it is possible to have complementary effect between the foreign labours and the local workers. On the other hand, if the foreign workers possess same skills and knowledge as the native workers, the foreign and local employees will become rivals but not complementary. From our results, we may suggest a possible reason that among our samples, most of the countries are recruiting high-skilled immigrants that will complement with local workers and thus, it enhances the TFP growth (OECD, 2001). Another essential information has been provided by the result is that by observing the ratio between the temporary foreign worker growth and the employment growth, it is possible to offset the negative impact of foreign workers towards total factor productivity. This can be done by adjusting the ratio in which doubling up the employment growth, for example from 10% to 20% [$10\% \times 2$] can actually cause 0.0665 [$0.10 \times 0.3325 \times 2$], an increase in percentage point that will offset and recover the negative impact on TFP growth by temporary workers growth since $0.0665 - 0.0405 = 0.026$.

In addition, the significant interactive relationship between DLRGDP and temporary workers can be explained that a high RGDP growth of host countries will attract an influx of immigrants. High RGDP growth of a country indicates that the country is in good economic conditions and has a higher wage level. This will become the main reason for foreign workers immigrants to migrate to the host countries to earn higher wage. However, the interaction seems to be giving a negative impact to the TFP growth which is offsetting the benefits from real GDP growth.

Table 4.4 Estimation Result of Interaction of Independent Variables

Model	(1)	(2)	(3)	(4)	(5)
C	-0.0074 (0.0096)	0.0081 (0.0096)	-0.0003 (0.0083)	-0.0020 (0.0082)	0.0081 (0.0096)
DLNRK	-0.6189 (0.4077)	-0.6481 (0.4104)	-0.4003 (0.3497)	-0.2780 (0.3488)	-0.6696 (0.4125)
DLEMP	0.4642*** (0.0501)	0.4574*** (0.0509)	0.4511*** (0.0426)	0.4621*** (0.0420)	0.4626*** (0.0502)
DLRGDP	0.4592*** (0.0449)	0.4522*** (0.0458)	0.4265*** (0.0388)	0.4361*** (0.0379)	0.4575*** (0.0450)
DLTEMP	-0.0597*** (0.0214)	-0.0796** (0.0322)	-0.0405** (0.0186)	-0.0471** (0.0181)	-0.0701*** (0.0244)
DLTRADE	0.1085*** (0.0250)	0.1089*** (0.0251)	0.1053*** (0.0213)	0.1017*** (0.0210)	0.1117*** (0.0253)
DLRTFP (-1)	-0.1659** (0.0694)	-0.1698** (0.0697)	-0.2054*** (0.0596)	-0.2012*** (0.0586)	-0.1560** (0.0704)
DLTEMP x DLNRK	--	1.2394 (1.5040)	--	--	--
DLTEMP x DLEMP	--	--	0.3325*** (0.0713)	--	--
DLTEMP x DLRGDP	--	--	--	-0.3105*** (0.0636)	--
DLTEMP x DLTRADE	--	--	--	--	0.1429 (0.1617)
R²	0.8826	0.8840	0.9167	0.9190	0.8843
Adjusted R²	0.8064	0.8053	0.8601	0.8640	0.8056
F-statistic	11.5938***	11.2236***	16.2045***	16.7032***	11.2477***
D-W test stat	2.6709	2.7212	2.8113	2.7717	2.7182

Note: The asterisks *, **, *** indicate rejection of the null hypothesis at 10%, 5% and 1% level of significance respectively. Standard Error in parentheses.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

Our objective of this paper aims to investigate the impact of foreign workers on the economic growth. By using the data from 2007 to 2011 and taking the United States, Canada, Malaysia and 27 European Union countries as our sample of study, we would like to investigate the outcome of the influx of temporary foreign workers on the Total Factor Productivity (TFP) of the origin country by considering the other factors such as Trade, Real GDP, Net Capital and employment as well. Hence, in this chapter, we will summarise the findings of the study, and a few policy implications will be suggested based on the result of the study. As for the latter part, we will discuss the limitations of our research and make some recommendations for future research in order to improve the further analysis.

5.1 Summary of Result

Based on the different tests that we have conducted in methodology and empirical findings, our study has managed to answer the research questions which we have set in chapter one. After performing Langrange Multiplier (LM) test, Likelihood test and Hausman test among POLS, FEM and REM. FEM, the best model is then selected to explain the effect of temporary foreign worker growth on the total factor productivity growth. Utilising the best model FEM, we found out that the role of temporary foreign worker growth is statistically significant at 1% significance level in this model. In addition, the coefficient for employment growth, real gross domestic product growth and trade growth are all proven to be positive and significant at 1% significance level. However, net real capital stock is statistically insignificant although the sign is expected.

In previous chapter, our tested result has shown a contrast finding in the sign of temporary foreign worker growth. From our result, we found out that there is a negative relationship between the temporary foreign worker growth and the total factor productivity growth which is differ from the findings of previous researcher. Furthermore, the effect of temporary workers growth in the long-run has also been revealed. We have observed that temporary foreign workers bring different effect in both long run and short run. Temporary foreign workers do increase the TFP growth at an increasing rate in long-run but it shows a contrast in the short run where the TFP growth is increasing at a diminishing rate. Moreover, trade growth and employment growth experience a reverse relationship in the long-run while the real gross domestic product growth and the net real capital stock remain the same effects in both long run and short run.

Another key to mention is the interactive term, the interaction of independent variables is determined. The interactive term is very crucial to study how the connection between independent variables is formed and to examine the effect towards the TFP growth. The significant results have clearly showed that the interaction between the temporary worker growth and the employment growth as well as the temporary worker growth with the real gross domestic growth bring a favorable effect to TFP growth as compared to the interaction of temporary worker growth with both net real capital growth and trade growth which are revealed to be insignificant. From that, we can assume that the positive relationship between employment growth and TFP growth can be explained by the complementary effect, which means the inflow of foreign workers is to complement the native workers and next, bringing a positive effect towards TFP growth.

5.2 Policy Implication

The inflow of foreign workers in the overall economic growth seems to have a disparate effect on different countries regarding the characteristics of the foreign workers itself and the respective policies hold by every country. By considering not only the welfare of the native labour in terms of employment but also the growth of economy, policy maker is playing an important role in their actions.

From our findings, we observe that temporary worker growth has a negative relationship with TFP growth in the short run, it means that the fasten expansion of temporary foreign workers slow down the TFP growth without mentioning that foreign workers are harmful to the economy. From this findings, we would suggest the policy maker to focus more on the labour immigration law. In order to strike a balance between labour shortage and the employment opportunity of native workers, a restriction on the quantity of foreign labour import is necessary. Before the import of foreign labours, the government should carefully analyse the actual need for foreign workforce in the country and fully utilised its own existing formal local employees. Policy maker should also strengthen their screening process in order to bring in the foreign workers with better qualification and contribute higher value to our productivity.

Immigration of foreign workers is unavoidable; however, when the inflows of foreign workers are complement to the local employment, then the positive impact will be larger than the negative one, in this case, restricting the number of foreign labour is no longer suitable and effective. When the influx of foreign labour is complementary to the native workers, the government should put effort in the selection of appropriate foreign workers by identifying the foreign labours' skill in order to fill the gap of the local needs. For instance, bringing in the foreign labours who possess a higher technological knowledge and skill which the local workers are lack of so that the complementary effect can be maximised and a higher TFP growth can be achieved.

Whereas in the long run, to sustain the economic growth, trainings and developments should be given to both local and foreign workers in order to enhance their absorptive capacity and hence, contributing a higher value to the productivity. The government could support the employers by providing the trainings and developments through subsidies that help to cover certain amount of expenses. All these practices should rely on a professional and regulated body instead of completely leaving it to the employers.

Foreign labour is not doing any harm, it is all depending on how the government handles it. When the foreign workers are brought here to meet the local

employers' specific requirements in various fields, the specific needs must be stated very clearly in order to avoid any mismatch of labour force in the country (Teh, 2015).

5.3 Limitations

Although our research has achieved its objectives but there are still some unavoidable limitations that we need to spell out. First, there is a major limitation in our study which we have only obtained 5 years in our model from 2005-2011. It is typically insufficient where we are unable to take period effect into account and it might cause difficulty to access a significant result.

Secondly, we have data limitation on foreign workers. It is impossible for us to get an actual figure of foreign workers as in most of the countries, illegal number of foreign workers is unable to be considered due to the country's policy. The country immigration department is unable to track the number of illegal labours without any registration and biography records. Those illegal workers may work under a company without permit licence and these workers might account for a huge amount that may cause our observation and result to be inappropriate.

5.4 Recommendation

Since there are some limitations in our study, we would like to suggest future researchers to take a longer period of time for their model in order to enhance the consistency and accuracy of the data. For instance, selecting around 10 to test the significance of model and the variables that might give us more accurate results.

Besides, future studies can also focus on other factors that contribute to TFP such as research and development (R&D), education level, training provided and duration of work. There might be difficulties in obtaining the data of these variables;

however, future researchers would focus more on this as it will lead to a broader view and deeper perspective.

Furthermore, lack of diversity in this study is also another limitation we have encountered. In our study, our sample mainly involving the developed countries. We would recommend future researchers to involve a more diversified sample, for example, by including more developing countries using the primary data as some data is limited in developing countries.

5.5 Conclusion

By understanding the dynamics between the variables, the objectives of the study can be fulfilled. In the past, there are very few researches done regarding this topic, even though there might be difficulties in conducting a perfect research, yet we proceed further to find out the possible answers and reasons behind that move this big wheel of the growth of the economy. Although our research may suffer from several limitations, it serves as a framework and guideline for future researchers with similar area of interest. In conclusion, this study sheds light on the determinants of the TFP growth in relation with the effect of temporary foreign workers brought which may inspire the government or the policy makers to make it into consideration.

REFERENCE

- Abramovitz, M. (1993). The search for the source of growth: Areas of ignorance, old and new. *The Journal of Economic History*, 53(2), 217-243.
- Adhikary, B. K. (2011). FDI, trade openness, capital formation, and economic growth in Bangladesh: A linkage analysis. *International Journal of Business and Management*, 6(1), 16-28.
- Agnoli, M. Q., & Zavodny, M. (2002). The effect of immigration on output mix, capital and productivity. *Federal Reserve Bank of Atlanta Economic Review*, First Quarter, 1-11.
- Aizawa, N., Ueda, T., Kadota, Y., Sasaki, K., Tanaka, T., & Takahashi, S. (2002). *Economic and social analysis of foreign workers problems*. Paper presented at Haruo Shimada Seminar 26th, Keio University, Minato, Japan.
- Amagan, G., & Ozden, A. (2007). Determinations of total factor productivity with Cobb-Douglas production function in agriculture: The case of Aydin-Turkey. *Journal of Applied Sciences*, 7(4), 499-502.
- Arazmuradov, A., Martini, G., & Scotti, D. (2014). Determinants of total factor productivity in former Soviet Union economies: A stochastic frontier approach. *Economic System*, 38(1), 115-135.
- Asis, M. M. B. (2006). *The Philippines' culture of migration*. Retrieved from <http://www.migrationpolicy.org/article/philippines-culture-migration>
- Athukorala, P. C., & Devadason, E. S. (2012). The impact of foreign labor on host country wages: The experience of a Southern host, Malaysia. *World Development*, 40(8), 1497-1510.
- Baier, S. L., Dwyer, G. P., & Tamura, R. (2006). How important are capital and total factor productivity for economic growth? *Economic Inquiry*, 44(1), 23-49.
- Barro, R. J., Mankiw, N. G., & Martin, X. S. (2001). Capital mobility in neoclassical models of growth. *The American Economic Review*, 103-115.

Benkovskis, K., Fadejeva, L., Stehrer, R., & Worz, J. (2013). How important is total factor productivity for growth in central, eastern, and southeastern European countries? *Focus on European Economic Integration*, 1, 8-27.

Bhattarai, P. (2005). *Migration of Nepalese youth for foreign employment: Problems and prospects*. Retrieved from <http://www.youthaction.org.np/userfiles/file/Research%20Report%20on%20Labor%20Migration.pdf>

Borjas, G. J. (1995). The economic benefits from immigration. *Journal of Economic Perspectives*, 9(2), 3-22.

Borjas, G. J. (2006). Native internal migration and the labor market impact of immigration. *Journal of Human Resources*, 41(2), 221-258.

Borjas, G. J., Grogger, J & Hanson, G. H. (2008). *Imperfect Substitution between Immigrants and Natives: A Reappraisal* (NBER Working Paper No. 13887). Retrieved from National Bureau of Economic Research website: <http://www.nber.org/papers/w13887.pdf>

Boswell, C., Stiller, S., & Straubhaar, T. (2004). *Forecasting labour and skills shortages: How can projections better inform labour migration policies?* Hamburg: Hamburg Institute of International Economics (HWWA).

Card, D. (2005). Is the new immigration really so bad? *The Economic Journal*, 115(507), 300-323.

Chander, P., & Thangavelu, S. M. (2004). Technology adoption, education and immigration policy. *Journal of Development Economics*, 75(1), 79-94.

Chang, H. C. (2002). *Do Foreign Workers Have an Adverse Effect on the Native Unskilled Labour in Taiwan?* (Research Paper Number 837). Retrieved from The University of Melbourne, Department of Economics website: http://fbe.unimelb.edu.au/__data/assets/pdf_file/0004/805864/837.pdf

Chen, E. K. Y. (2002). The total factor productivity debate: Determinants of economic growth in East Asia. *Asian-pacific Economic Literature*, 11(1), 18-38.

- Cheng, S. A. (2006). *Serving the household and the nation: Filipina domestic and politics of identity in Taiwan*. Lexington, United States: Lexington Books United States.
- Chia, S. Y. (2006). Labor mobility and East Asian integration. *Asian Economic Policy Review*, 1(2), 349-367.
- Christofides, L. N., Clerides, S., Hadjiyiannis, C., & Michael, M. S. (2007). The impact of foreign workers on the labour market of Cyprus. *Cyprus Economic Policy Review*, 1(2), 37-49.
- Comin, D. (2008). *Total factor productivity* (2nd ed.). Hampshire, U.K: Palgrave Macmillan.
- Danzinge, F. N. L. (2000). Trade policy and its impact on economic growth: Can openness speed up output growth? (Volume 75 of Discussion Papers No. ISSN 1431-181X). Retrieved from Ibero-America Institute for Economic Research website: <https://www.uni-goettingen.de/de/document/download/b26b6be5f0dfabe52c6a4612e8c78a68.pdf/iai-75db.pdf>
- Desmet, K., & Parente, S. L. (2010). Bigger is better: Market size, demand elasticity, and innovation. *International Economic Review*, 51(2), 319-333.
- Department for Business Innovation & Skills. (2015). *The impacts of migrant workers on UK businesses*. (BIS Research Paper No. 217). Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/406760/bis-15-153-impacts-of-migrant-workers-on-uk-business.pdf
- Drinkwater, S., Levine, P., Lotti, E., & Pearlman, J. (2007). The immigration surplus revisited in a general equilibrium model with endogenous growth. *Journal of Regional Science*, 47(3), 569-601.
- Ducanes, G., & Abella, M. (2008). *Labour Shortage Responses in Japan, Korea, Singapore, Hong Kong and Malaysia: A Review and Evaluation* (ILO Asian Regional Programme on Governance of Labour Migration Working Paper No.2). Retrieved from Cornell University ILR School website: <http://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?article=1054&context=intl>

- Fassio, C., Kalantaryan, S., & Venturini, A. (2015). *Human resources and innovation: Total factor productivity and foreign human capital* (EUI Working Paper RSCAS 2015/43). Retrieved from Robert Schuman Centre for Advanced Studies Migration Policy Centre website: <http://hdl.handle.net/1814/36236>
- Ferreira, P. C., & Trejos, A. (2011). Gains from trade and measured total factor productivity. *Review of Economic Dynamics*, 14(1), 496-510.
- Filho, M. B., Silva, R. G., & Diniz, E. M. (2004). The empirics of the Solow growth model: Long term evidence. *Journal of Applied Economics*, 8(1), 31-51.
- Friedberg, R. M., & Hunt, J. (2001). The impact of immigrants on host country wages, employment and growth. *The Journal of Economic Perspective*, 9(2), 23-44.
- Gagliardi, L. (2015). Does skilled migration foster innovative performance? Evidence from British local areas. *Paper in Regional Science*, 94(4), 773-794.
- Greasley, D., & Madsen, J. B. (2006). Employment and total factor productivity convergence. *KYKLOS*, 59(4), 527-555.
- Greenwood, M. J. & McDowell, J. M. (1986). The factor market consequences of U.S. immigration. *Journal of Economic Literature*, 24(4), 1773-1785
- Hahn, C. H., & Choi, Y. S. (2006, July). *The effects of temporary foreign worker program in Korea: Overview and empirical assessment*. Paper presented at the World Economy Conference, Seoul, Korea. Retrieved from <http://faculty.washington.edu/karyiu/confer/seoul06/papers/hahn-choi.pdf>
- Hajkova, D., & Hurnik, J. (2007). Cobb-Douglas production function: The case of a converging economy. *Czech Journal of Economics and Finance*, 57(9), 465-476.
- Hanson, G. H. (2012). Immigration and economic growth. *Cato Journal*, 32(1), 25-34.
- Hercowitz, Z., Lavi, Y., & Melnick, R. (1999). The impact of macroeconomic factors on productivity in Israel, 1960-96. *Bank of Israel Economic Review*, 72, 103-124.

- Hugo, G. (2005, September). *Migration in the Asia-Pacific Region*. Paper presented for the Policy Analysis and Research Programme of the Global Commission on International Migration, Geneva, Switzerland. Retrieved from https://www.iom.int/jahia/webdav/site/myjahiasite/shared/shared/mainsite/policy_and_research/gcim/rs/RS2.pdf
- Ismail, R., & Yuliyusman, F. (2014). Foreign labour on Malaysian growth. *Journal of Economic Integration*, 29(4), 657-675.
- Ismail, R., Sulaiman, N., & Jajri, I. (2014). Total factor productivity and its contribution to Malaysia's economic growth. *Research Journal of Applied Sciences, Engineering and Technology*, 7(23), 4999-5005.
- Jajri, I. (2007). Determinants of total factor productivity growth in Malaysia. *Journal of Economic Cooperation*, 28(3), 41-58.
- Kim, J. (2002). Total factor productivity growth in East Asia: Implications for future growth. *Asian Economic Papers*, 1(2), 50-70.
- Ladu, M. G. (2005). *Total factor productivity growth and employment: A simultaneous equations model estimate* (CRENOS Working Paper 2005/06). Retrieved from Centro Ricerche Economiche Nord Sud website: <http://crenos.unica.it/crenos/sites/default/files/wp/05-06.pdf>
- Lee, J. S. (2002). The role of low-skilled foreign workers in Taiwan's economic development. *Asia Pacific Business Review*, 8(4), 41-66.
- Ministry of Foreign Employment Promotion and Welfare. (2013). *Migration Profile: Sri Lanka*. Retrieved from http://www.ips.lk/ips_migration/publication/migration_profile/migration_profile_ips.pdf.
- Mitaritonna, C., Orefice, G., & Peri, G. (2014). *Immigrants and firm's productivity: Evidence from France* (CEPII Working Paper No. 2014-09). Retrieved from CEPII website: <http://www.cepii.fr/CEPII/en/publications/wp/abstract.asp?NoDoc=6672>
- Mohamed, R. K. M. H., Ramendran, C. SPR., & Yacob, P. (2012). The impact of employment of foreign workers: Local employability and trade union roles in Malaysia. *International Journal of Academic Research in Business and Social Sciences*, 2(10), 530-541.

- Moller, N. M., Munch, J. R., & Skaksen, J. R. (2011). *Do foreign experts increase the productivity of domestic firms?* (IZA Discussion Paper No. 6001). Retrieved from Institute for the Study of Labor (IZA) website: <http://ftp.iza.org/dp6001.pdf>
- Mountford, A. (1997). Can a brain drain be good for growth in the source economy? *Journal of Development Economics*, 53(2), 287-303.
- Muniz, O., Li, W., & Schleicher, Y. (2010). *Migration conceptual framework: Why do people move to work in another place or country?* Retrieved from http://cgge.aag.org/Migration1e/ConceptualFramework_Jan10/ConceptualFramework_Jan10_print.html
- Nachega, J., & Fontaine, T. (2006). *Economic growth and total factor productivity in Niger* (IMF Working Paper No. 06/208). Retrieved from International Monetary Fund website: <https://www.imf.org/external/pubs/ft/wp/2006/wp06208.pdf>
- Narayanan, S., & Lai, Y. W. (2005). The causes and consequences of immigrant labour in the construction sector in Malaysia. *International Migration*, 43(5), 31-57.
- Nicodemo, C. (2013). *Immigration and labor productivity: New empirical evidence for Spain* (IZA Discussion Paper No. 7297). Retrieved from Institute for the Study of Labor (IZA) website: <http://ftp.iza.org/dp7297.pdf>
- Noor, Z. M., Isa, N., Said, R., & Jalil, S. A. (2011). The impact of foreign workers on labour productivity in Malaysian manufacturing sector. *Journal of Economics and Management*, 5(1), 169-178.
- North, D. (2013). *Motivation for hiring alien Workers?* Retrieved from <http://cis.org/labor-shortage-not-reason-employers-want-alien-workers>
- Organisation for Economic Co-operation and Development (OECD) (2001). *International mobility of the highly skilled*. OECD Publishing, Paris.
- OECD (2001). *Measuring Productivity - OECD Manual: Measurement of Aggregate and Industry-level Productivity Growth*. OECD Publishing, Paris.
- Orhant, M. (2000). *Human trafficking: Gangs make Thailand a regional hub: Yakuza operating with local mafia*. Retrieved from <http://www.friends-partners.org/lists/stop-traffic/1999/1130.html>

- Ottaviano, G. I. P., & Peri, G. (2008). *Immigration and national wages: Clarifying the theory and the empirics* (NBER Worker Paper No. 14188). Retrieved from National Bureau of Economic Research website: <http://www.nber.org/papers/w14188>
- Ottaviano, G. I. P., Peri, G., & Wright, G. C. (2015). *Immigration, trade and productivity in services: Evidence from UK Firms*. (CEP Discussion Paper No. 1353). Retrieved from Centre for Economic website: <http://cep.lse.ac.uk/pubs/download/dp1353.pdf>
- Owyong, D. T. (2000). Productivity growth: Theory and measurement. *APO Productivity Journal*, 19-29.
- Peri, G. (2008). *Immigration Accounting: U.S. States 1960-2006* (CReAM Discussion Paper No. 05/08). Retrieved from Centre for Research and Analysis of Migration website: <http://www.dagliano.unimi.it/media/14-Peri-2008.pdf>
- Peri, G. (2010). *The Effects of Immigrants on U.S. Employment and Productivity*. Federal Reserve Bank of San Francisco (FRBSF) Economic Letter. Retrieved from <http://www.frbsf.org/publications/economics/letter/2010/el2010-26.pdf>.
- Peri, G. (2012). The effect of immigration on productivity: Evidence from U.S. States. *The Review of Economics and Statistics*, 94(1), 348-358.
- Pissarides, C. A., & Vallanti, G. (2004). *Productivity growth and employment: Theory and panel estimates* (CEP Discussion Paper No. 633). Retrieved from Centre for Economic website: <http://cep.lse.ac.uk/pubs/download/dp0663.pdf>
- Rahman, H. A., Wang, C., Wood, L. C., & Low, S. F. (2012). Negative impact induced by foreign workers: Evidence in Malaysian construction sector. *Habitat International*, 36(4), 433-443.
- Rogers, M. (1998). *The definition and measurement of productivity* (Melbourne Institute Working Paper No.9/98). Retrieved from https://www.melbourneinstitute.com/downloads/working_paper_series/wp1998n09.pdf

- Ruhs, M., & Silva, C. V. (2015). *Briefing: The labour market effects of immigration*. Paper presented at The Migration Observatory, University of Oxford, Oxford, England.
- Saha, S. (2012). Productivity and openness in Indian economy. *Journal of Applied Economics and Business Research*, 2(2), 91-102.
- Saiman, M. S., & Jemon, S. (2014). Social security: Case of foreign workers in Sabah, Malaysia. *Malaysian Journal of Business and Economics*, 1(1), 87-102.
- Schmidheiny, K. (2015). *Panel Data: Fixed and Random Effects*. Retrieved from: <http://www.schmidheiny.name/teaching/panel2up.pdf>
- Serneels, P. (2007). The nature of unemployment among young men in urban Ethiopia. *Review of Development Economics*, 11(1), 170-186.
- Shackleton, R. (2013). *Total factor productivity growth in historical perspective*. (Congressional Budget Office Working Paper 2013-01). Retrieved from Congressional Budget Office (CBO) website: https://www.cbo.gov/sites/default/files/113th-congress-2013-2014/workingpaper/44002_TFP_Growth_03-18-2013_1.pdf
- Shafii, H., Musa, S. M. S., & Ghazali, N. M. (2009). The Problem of Foreign Workers in the Industry from the Perspective of Pembinaan Contractors: A Case Study in Johor Bahru, Johor. *Malaysia Labor Review*, 3(1), 163-191.
- Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, 70(1), 65-94.
- Solow, R. M. (1956). Technical change and the aggregate production function. *Review of Economics and Statistics*, 39(3), 312-20.
- Stark, O., & Wang, Y. (2002). Inducing human capital formation: Migration as a substitute for subsidies. *Journal of Public Economics*, 86(1), 29-46.
- Tan, B. H. (2008). *Cobb-Douglas production function*. Retrieved from <http://docentes.fe.unl.pt/~jamador/Macro/cobb-douglas.pdf>

- Teh, W. S. (2015, July 16). Bringing in another 1.5 million foreign workers? We ask stakeholders whether this is really necessary. *Malaysian Digest*. Retrieved from <http://malaysiandigest.com/frontpage/282-main-tile/561792-bringing-in-another-1-5-million-foreign-workers-we-ask-stakeholders-whether-this-is-really-necessary.html>
- Thangavelu, S. M. (2012). *Economic Growth, Welfare and Foreign Workers: Case of Singapore*. Paper presented at the International Conference on Trade, Investment and Production Networks in Asia Leverhulme Centre for Research on Globalisation and Economic Policy (GEP), University of Nottingham, United Kingdom. Retrieved from <https://www.nottingham.ac.uk/gep/documents/conferences/2012/malaysia-conference/shandre-thangavelu.pdf>
- Tsao, Y. (1985). Growth without productivity: Singapore manufacturing in the 1970s. *Journal of Development Economics* 9(1-2), 25-38.
- Vidal, J. P. (1998). The effect of emigration on human capital formation. *Journal of Population Economics*, 11(4), 589-600.
- Wickramasekera, P. (1995). *Female migrant workers in Asia: Emerging issues and national and international responses*. Paper presented at International Seminar on International Female Migration and Japan: Networking, Settlement and Human Rights, International Peace Research Institute, Meiji-Gakuin University, Tokyo, Japan.
- Wickramasekera, P. (2000). Asian labour migration: Issues and challenges in an era of globalization (International Migration Working Paper No. 57) Retrieved from International Labour Organization website: http://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/publication/wcms_160632.pdf
- Woo, V. M. W., Ismail, R., & Yussof, I. (2014). Foreign labours and total factor productivity in Malaysia's manufacturing. *Persidangan Kebangsaan Ekonomi Malaysia (PERKEM ke-9)*, 117-124.
- Zhi, M., Goh, B. H., Wang, S. Q., & Ofori, G. (2003). Total factor productivity growth accounting in the construction industry of Singapore. *Construction Management and Economics*, 21(7), 707-718.

Appendix A

Langrange Multiplier (LM) Test

Lagrange Multiplier Tests for Random Effects

Null hypotheses: No effects

Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided
(all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	0.244115 (0.6212)	0.440679 (0.5068)	0.684794 (0.4079)
Honda	0.494080 (0.3106)	-0.663837 --	-0.120036 --
King-Wu	0.494080 (0.3106)	-0.663837 --	-0.516569 --
Standardized Honda	0.647486 (0.2587)	0.988542 (0.1614)	-4.925296 --
Standardized King-Wu	0.647486 (0.2587)	0.988542 (0.1614)	-5.181639 --
Gourierieux, et al.*	--	--	0.244115 (>= 0.10)
*Mixed chi-square asymptotic critical values:			
	1%	7.289	
	5%	4.321	
	10%	2.952	

Appendix B

Likelihood Test

Redundant Fixed Effects Tests
Equation: MODEL7_FE
Test cross-section fixed effects

Effects Test	Statistic	df	Prob.
Cross-section F	1.757897	(29,54)	0.0365
Cross-section Chi-square	59.829878	29	0.0006

Cross-section fixed effects test equation:
Dependent Variable: DLRTFP
Method: Panel Least Squares
Date: 06/26/16 Time: 21:42
Sample (adjusted): 2009 2011
Periods included: 3
Cross-sections included: 30
Total panel (balanced) observations: 90

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNRK	-0.753636	0.183183	-4.114108	0.0001
DLEMP	0.301457	0.040686	7.409337	0.0000
DLRGDP	0.310446	0.036527	8.498973	0.0000
DLTEMP	-0.044075	0.019140	-2.302816	0.0238
DLTRADE	0.162617	0.023334	6.969119	0.0000
DLRTFP(-1)	-0.058389	0.070027	-0.833815	0.4068
C	0.009863	0.004811	2.050366	0.0435

R-squared	0.771677	Mean dependent var	-0.008040
Adjusted R-squared	0.755172	S.D. dependent var	0.040370
S.E. of regression	0.019975	Akaike info criterion	-4.914082
Sum squared resid	0.033117	Schwarz criterion	-4.719653
Log likelihood	228.1337	Hannan-Quinn criter.	-4.835677
F-statistic	46.75342	Durbin-Watson stat	1.727773
Prob(F-statistic)	0.000000		

Appendix C

Hausman Test

Correlated Random Effects - Hausman Test

Equation: MODEL7_RE

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	28.973218	6	0.0001

** WARNING: estimated cross-section random effects variance is zero.

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
DLNRK	-0.618859	-0.753636	0.139667	0.7184
DLEMP	0.464167	0.301457	0.001198	0.0000
DLRGDP	0.459172	0.310446	0.000958	0.0000
DLTRADE	0.108497	0.162617	0.000194	0.0001
DLTEMP	-0.059728	-0.044075	0.000166	0.2250
DLRTP(-1)	-0.165897	-0.058389	0.000934	0.0004

Cross-section random effects test equation:

Dependent Variable: DLRTP

Method: Panel Least Squares

Date: 06/26/16 Time: 21:45

Sample (adjusted): 2009 2011

Periods included: 3

Cross-sections included: 30

Total panel (balanced) observations: 90

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.007440	0.009553	0.778800	0.4395
DLNRK	-0.618859	0.407674	-1.518026	0.1348
DLEMP	0.464167	0.050065	9.271243	0.0000
DLRGDP	0.459172	0.044861	10.23535	0.0000
DLTRADE	0.108497	0.024993	4.341028	0.0001
DLTEMP	-0.059728	0.021356	-2.796760	0.0071
DLRTP(-1)	-0.165897	0.069365	-2.391670	0.0203

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.882553	Mean dependent var	-0.008040
Adjusted R-squared	0.806431	S.D. dependent var	0.040370
S.E. of regression	0.017761	Akaike info criterion	-4.934414
Sum squared resid	0.017035	Schwarz criterion	-3.934491
Log likelihood	258.0486	Hannan-Quinn criter.	-4.531186
F-statistic	11.59381	Durbin-Watson stat	2.670892
Prob(F-statistic)	0.000000		

Appendix D

Estimation of Long-run DLNRK

Wald Test:

Equation: MODEL7_FE

Test Statistic	Value	df	Probability
t-statistic	-1.495974	54	0.1405
F-statistic	2.237937	(1, 54)	0.1405
Chi-square	2.237937	1	0.1347

Null Hypothesis: $C(1)/(1-C(6))=0$

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
$C(1) / (1 - C(6))$	-0.530801	0.354819

Delta method computed using analytic derivatives.

Appendix E

Estimation of Long-run DLEMP

Wald Test:

Equation: MODEL7_FE

Test Statistic	Value	df	Probability
t-statistic	9.843711	54	0.0000
F-statistic	96.89865	(1, 54)	0.0000
Chi-square	96.89865	1	0.0000

Null Hypothesis: $C(2)/(1-C(6))=0$

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
$C(2) / (1 - C(6))$	0.398120	0.040444

Delta method computed using analytic derivatives.

Appendix F

Estimation of Long-run DLRGDP

Wald Test:

Equation: MODEL7_FE

Test Statistic	Value	df	Probability
t-statistic	10.63557	54	0.0000
F-statistic	113.1153	(1, 54)	0.0000
Chi-square	113.1153	1	0.0000

Null Hypothesis: $C(3)/(1-C(6))=0$

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
$C(3) / (1 - C(6))$	0.393836	0.037030

Delta method computed using analytic derivatives.

Appendix G

Estimation of Long-run DLTEMP

Wald Test:

Equation: MODEL7_FE

Test Statistic	Value	df	Probability
t-statistic	-2.852978	54	0.0061
F-statistic	8.139481	(1, 54)	0.0061
Chi-square	8.139481	1	0.0043

Null Hypothesis: $C(4)/(1-C(6))=0$

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
$C(4) / (1 - C(6))$	-0.051229	0.017956

Delta method computed using analytic derivatives.

Appendix H

Estimation of Long-run DLTRADE

Wald Test:

Equation: MODEL7_FE

Test Statistic	Value	df	Probability
t-statistic	3.976663	54	0.0002
F-statistic	15.81385	(1, 54)	0.0002
Chi-square	15.81385	1	0.0001

Null Hypothesis: $C(5)/(1-C(6))=0$

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
$C(5) / (1 - C(6))$	0.093059	0.023401

Delta method computed using analytic derivatives.

Appendix I

Estimation of Interaction between DLTEMP and DLNRK

Dependent Variable: DLRTFP

Method: Panel Least Squares

Date: 06/24/16 Time: 21:49

Sample (adjusted): 2009 2011

Periods included: 3

Cross-sections included: 30

Total panel (balanced) observations: 90

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNRK	-0.648121	0.410429	-1.579129	0.1203
DLEMP	0.457362	0.050889	8.987440	0.0000
DLRGDP	0.452182	0.045788	9.875583	0.0000
DLTEMP	-0.079586	0.032242	-2.468411	0.0168
DLTRADE	0.108851	0.025072	4.341586	0.0001
DLRTFP(-1)	-0.169768	0.069730	-2.434649	0.0183
DLTEMP*DLNRK	1.239368	1.503994	0.824051	0.4136
C	0.008080	0.009613	0.840492	0.4044

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.884039	Mean dependent var	-0.008040
Adjusted R-squared	0.805273	S.D. dependent var	0.040370
S.E. of regression	0.017814	Akaike info criterion	-4.924923
Sum squared resid	0.016820	Schwarz criterion	-3.897224
Log likelihood	258.6215	Hannan-Quinn criter.	-4.510494
F-statistic	11.22363	Durbin-Watson stat	2.721231
Prob(F-statistic)	0.000000		

Appendix J

Estimation of Interaction between DLTEMP and DLEMP

Dependent Variable: DLRTFP
Method: Panel Least Squares
Date: 06/24/16 Time: 21:35
Sample (adjusted): 2009 2011
Periods included: 3
Cross-sections included: 30
Total panel (balanced) observations: 90

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNRK	-0.400333	0.349682	-1.144848	0.2574
DLEMP	0.451071	0.042649	10.57646	0.0000
DLRGDP	0.426467	0.038772	10.99922	0.0000
DLTEMP	-0.040452	0.018618	-2.172794	0.0343
DLTRADE	0.105255	0.021256	4.951809	0.0000
DLRTFP(-1)	-0.205428	0.059567	-3.448673	0.0011
DLTEMP*DLEMP	0.332523	0.071319	4.662468	0.0000
C	-0.000257	0.008286	-0.031012	0.9754

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.916714	Mean dependent var	-0.008040
Adjusted R-squared	0.860143	S.D. dependent var	0.040370
S.E. of regression	0.015097	Akaike info criterion	-5.255897
Sum squared resid	0.012080	Schwarz criterion	-4.228198
Log likelihood	273.5154	Hannan-Quinn criter.	-4.841468
F-statistic	16.20452	Durbin-Watson stat	2.811255
Prob(F-statistic)	0.000000		

Appendix K

Estimation of Interaction between DLTEMP and DLRGDP

Dependent Variable: DLRTFP
Method: Panel Least Squares
Date: 06/24/16 Time: 21:49
Sample (adjusted): 2009 2011
Periods included: 3
Cross-sections included: 30
Total panel (balanced) observations: 90

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNRK	-0.277968	0.348797	-0.796934	0.4290
DLEMP	0.462093	0.041970	11.00999	0.0000
DLRGDP	0.436057	0.037903	11.50466	0.0000
DLTEMP	-0.047130	0.018087	-2.605722	0.0119
DLTRADE	0.101665	0.020998	4.841711	0.0000
DLRTFP(-1)	-0.201174	0.058593	-3.433403	0.0012
DLTEMP*DLRGDP	-0.310509	0.063586	-4.883328	0.0000
C	-0.002019	0.008239	-0.245104	0.8073

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.918999	Mean dependent var	-0.008040
Adjusted R-squared	0.863980	S.D. dependent var	0.040370
S.E. of regression	0.014889	Akaike info criterion	-5.283715
Sum squared resid	0.011749	Schwarz criterion	-4.256016
Log likelihood	274.7672	Hannan-Quinn criter.	-4.869286
F-statistic	16.70315	Durbin-Watson stat	2.771713
Prob(F-statistic)	0.000000		

Appendix L

Estimation of Interaction between DLTEMP and DLTRADE

Dependent Variable: DLRTFP
Method: Panel Least Squares
Date: 06/24/16 Time: 22:00
Sample (adjusted): 2009 2011
Periods included: 3
Cross-sections included: 30
Total panel (balanced) observations: 90

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLNRK	-0.669639	0.412525	-1.623269	0.1105
DLEMP	0.462633	0.050197	9.216330	0.0000
DLRGDP	0.457465	0.044994	10.16722	0.0000
DLTEMP	-0.070061	0.024386	-2.873019	0.0058
DLTRADE	0.111740	0.025312	4.414562	0.0001
DLRTFP(-1)	-0.155968	0.070408	-2.215203	0.0311
DLTEMP*DLTRADE	0.142898	0.161705	0.883690	0.3809
C	0.008087	0.009600	0.842328	0.4034

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.884259	Mean dependent var	-0.008040
Adjusted R-squared	0.805642	S.D. dependent var	0.040370
S.E. of regression	0.017797	Akaike info criterion	-4.926819
Sum squared resid	0.016788	Schwarz criterion	-3.899119
Log likelihood	258.7068	Hannan-Quinn criter.	-4.512390
F-statistic	11.24772	Durbin-Watson stat	2.718217
Prob(F-statistic)	0.000000		