HOW THE FDI, INFLATION, EXCHANGE RATE AND HUMAN CAPITAL AFFECT THE LABOR PRODUCTIVITY IN FINLAND

BY

CHONG PUI YEE
KHOR JIA YI
LEE YEW HONG
LEONG YONG YIN
LYON LAU YEE ONN

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

APRIL 2015

DECLARATION

We hereby declare that:

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

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

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

(4) The word count of this research report is 16884.

Name of Student:	Student ID:	Signature:
1. Chong Pui Yee	11ABB00781	_____
2. Khor Jia Yi	11ABB04810	_____
3. Lee Yew Hong	11ABB05465	_____
4. Leong Yong Yin	11ABB01970	_____
5. Lyon Lau Yee Onn	11ABB02708	_____

Date: April 17, 2015

ACKNOWLEDGEMENT

The completion of this thesis required the help of various individuals. Without them, we might not meet our objectives in doing this study. Therefore, we would like to give gratitude to the people for their invaluable help and support in our research.

First and foremost, we would like to express our sincere thanks of gratitude to our supervisor, Mr. Kuar Lok Sin who helped us all the time of research and writing of this thesis. Our research project could not have been completed without his guidance because of his patience, motivation, enthusiasm, and immense knowledge. We are greatly indebted to him for supervising our group when we have encountered numerous obstacles from data collection, analysis and interpretation. Also we will always cherish the wonderful experience of working with him.

Besides that, we would to thank our project coordinator, Ms. Lim Shiau Mooi, for coordinating everything pertaining to the completion undergraduate project and keeping us updated with the latest information regarding it. We do really appreciate her willingness to clarify to us when we confused about the requirement that we had to meet for our project. Without her help, we might not able to complete our research before the date line.

Last but not least, we would like to thank to our parents and friends who supported and helped us a lot in finalizing the project within the limited time frame.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIXES

ABSTRACT

The aim of this thesis is to study how the FDI, inflation, exchange rate and human capital affect the labor productivity in Finland. The reason of choosing Finland as our research object is that the Finland's labor productivity has decreased drastically since mid-1990s until nowadays. The decreasing labor productivity of Finland had raised our concern and motivated us to conduct an empirical analysis to determine whether FDI, inflation, exchange rate and human capital have significant positive or negative relationship in both short and long run toward the labor productivity. Firstly, we take into account different component of determinants that affect labor productivity by using annuallydata starting from 1980 to 2013. We used Augmented Dicky-Fuller (ADF) test, and Phillips-Perron (PP) to examine the stationarity of our data.

Subsequently, we construct cointegration test to determine the correlation between the variables. Besides, we also used the VECM model to explain the long run relationship between the variable that will fed into the short run dynamic model. The autocorrelation, heteroscedasticity and normality distribution is used for diagnostic checking. We also exploit Granger Causality test to verify the causality between FDI, inflation, exchange rate, and human capital on labor productivity. Impulse Response Function (IRF) is used to identify the response of determinants towards labor productivity in Finland. Next, we used Variance Decomposition to determine the percentage of effect of each source in explaining the variability of labor productivity in Finland

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

This research is to study and examine about the movement of labor productivity in Finland. Over the world, the labor productivity is playing an important role to the economics of a country. From the theory that we learn, when the labor productivity of a country is increase, the production of the particular country will increase due to more labor force in the country. When the production of the country is increase, it can export more their goods and services to the rest of the world. When the international trade of the country is increase, the Gross Domestic Product (GDP) of the country will increase.

This will bring a good signal to the country because it can attract more foreigners and businessmen come to its country for investment and start the business. Thus may lead to the income level in the country increase. Besides, the technology also able to transfer to the particular country and this will lead to the country become more advanced.

The labor productivity brings a lot of advantage to the economy of a country. Thus every country in the world no matter the developed country or developing country also will try their best to improve their labor productivity in the country. The developed country such as Germany, Denmark and Sweden, their labor productivity is more stable than developing country. Besides, developed countries which have less population such as Liechtenstein, and Monaco also have stable labor productivity growth.

However, from the statistic, we found that the labor productivity of Finland was decreasing since mid-1990s until now. In order to determine the reason the affect the labor productivity in Finland, we have conduct a research.

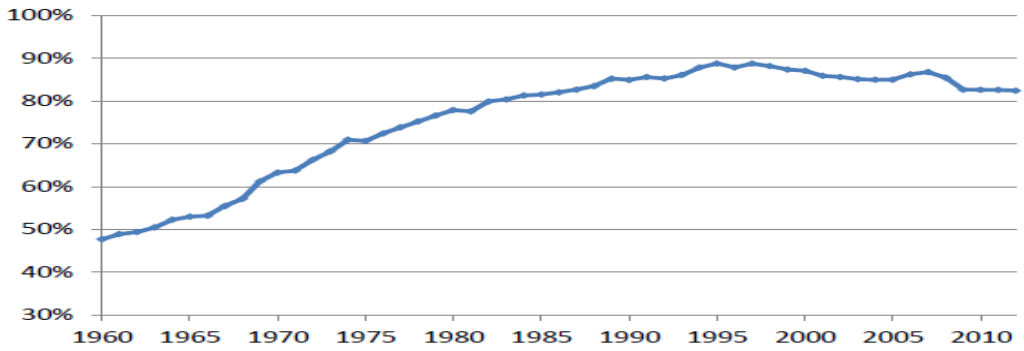
From the study, we realized that there have some determinants that will affect the movement of the labor productivity in the country. The determinants are inflation, foreign direct investment (FDI), exchange rate and human capital. This chapter will begin by the research background which to understand more about Finland' productivity and current issue about Finland through some graphical analysis. With all of this information, the problem statement can be creating in our research. Then, the reach objective and research question also will give the direction of how the study will be carried out. After that, the theoretical frameworks help the study to make the hypotheses of the study. At last, this chapter also will discuss about the significant of the study in this research.

1.1 Research Background

High economic growth is the main goal andtarget for each nations including developing countries and developed countries. The measurement used to measure the economic growth is the Gross Domestic Product (GDP). A higher GDP in a nation indicated that it has a higher economic growth. Basically, labor productivity is measured by either GDP per employed person or GDP per hour worked (The Conference Board, 2013). It simply implied that the labor productivity is used to measure the efficiency and utilization of the inputs in the production of nations (The Conference Board, 2013). Indeed, the growth of labor productivity is an element that unable to be ignored or neglected in the process of enhancing the economic growth in a country. Labor productivity is a fundamental issue to be discussed recent years due to its gradually declined rates in a huge

number of countries especially after the financial crisis happened in year 2008 and year 2009.

Figure 1.1: Labor Productivty in the EU-15 as a percentage of the US labor productivity (Labor Productivity = GDP per hour worked).



Source:The Hague Centre For Strategic Studies and TNO, 2013 (as cited in The Conference Board)

In order to view a clear declined of labor productivity growth rate, European countries is one of the good example. From the graph shown, it indicated that the labor productivity level as a percentage of US labor productivity was having an increasing trend as the labor productivity in Euro area continuously increased since year 1960 until the end of year 1990s. Although there are slight decreased between years 2000 to year 2007, the level of labor productivity in Euro area considered stable. However, in year 2008 and year 2009, the output per hours worked declined largely which affected by financial crisis. Moreover, the labor productivity of United States is much higher than the labor productivity in European countries with the total gaps of 25% less than United States in recent years (The Conference Board, 2014).According to The Conference Board (2014), the labor productivity growth rate which measured by the indicators of output per hour worked, European countries experienced the decreasing growth rate as the labor productivity growth from 0.7% in year 2012 to 0.6% in year 2013. The declined evidence is resulted from the smaller number of hours per employees in the total production of Euro area and hence reduced the labor productivity level (The Conference Board, 2014).Although there are some Euro nations are

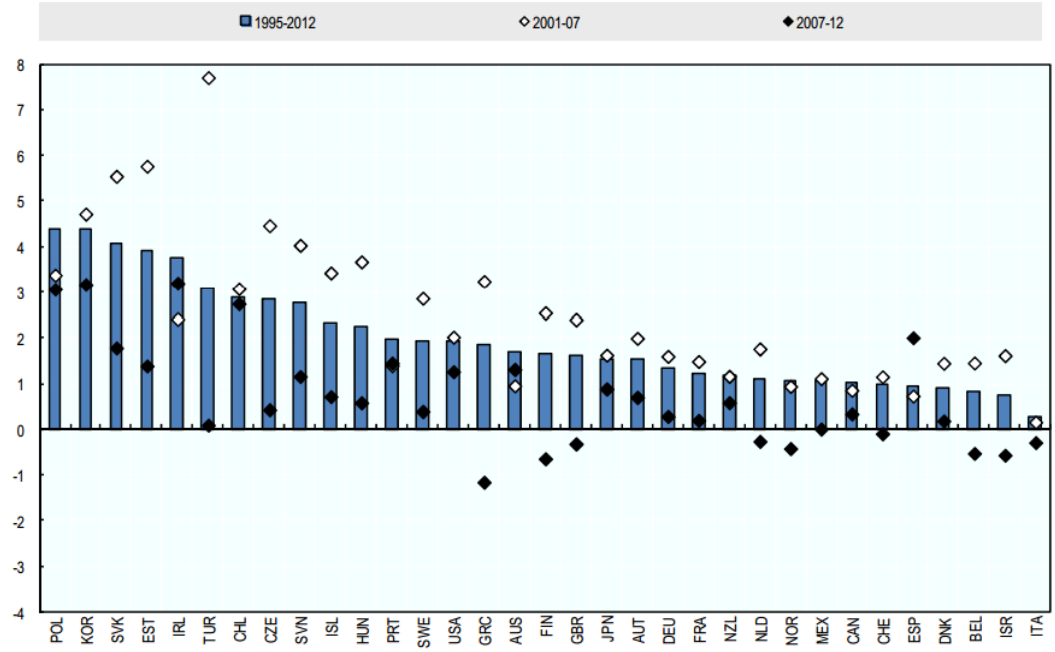
remainsstable on their labor productivity growth such as Germany, but on average, the average labor productivity in the whole labor productivity is decreasing (The Conference Board, 2014). Thus, this has typically proved that there is a significant labor productivity issue in European countries.

Another case of the decreasing labor productivity growth rates are able to be proved from most of the OECD countries. In the year between 1995 and 2002, most the countries are having the positive growth rate of labor productivity (OECD, 2003).Nevertheless, the labor productivity growth rate in most of the OECD fall significantlysince year 2007 as showed in the OECD Factbook 2014 (OECD iLibrary, 2014). Indeed, the lower labor utilization is one of the reasons that caused the low labor productivity to be happened in the OECD countries (OECD iLibrary, 2014). Labor utilization indeed is defined as the efficiency of the labor inputs and whether it has been utilized efficiently such as the working hours per workers (European Commission, 2009). In the other words, OECD countries faced the challenges of declining labor productivity growth although it has been recovered slowly in the recent years. In fact, both EU and OECD countries have the declined growth rate of labor productivity since financial crisis. The financial crisis absolutely impacts the whole economy negatively with its significant effect on labor market, investment, research and development as well as the potential productivity in the nations. By illustrated briefly, financial crisis lead to a lower investment which directly reduce the capital accumulation on the research and development process on industry production and even the nation's development. Besides, it forced the firms and industry to reduce the number of labor in the market to compensate the losses incurred from financial crisis and thus lead to a higher unemployment rate in the country (European Commission,2009). In summary, labor productivity has been reduced indirectly with those effects on its variables and inputs.

1.1.1 Finland

Finland, a relatively small country but achieved a stable and positive economic outlook in the past decades until the beginning of year 2000s. Finland is one of the nations in both European countries and OECD countries. Undoubtedly, Finland is having the similar issue as faced by most of the Euro area as well as the OECD countries. This obviously implied that the labor productivity in Finland has been fall to a lower level which mostly caused by the financial crisis.

Figure 1.2: Growth in GDP per hour worked of total economy, percentage change at annual rate.

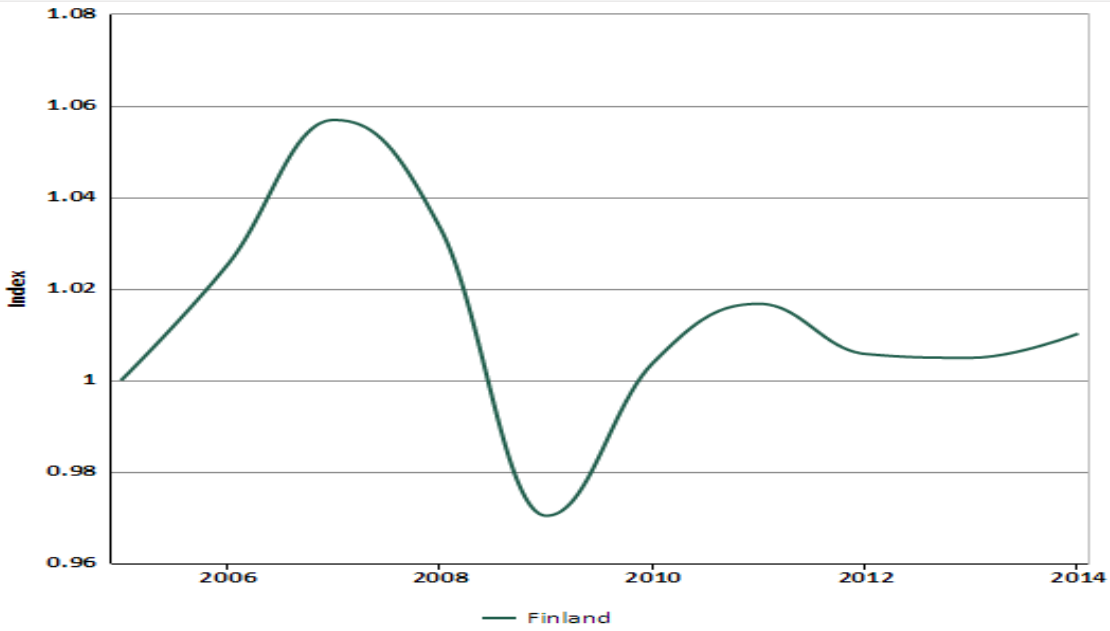


Source:OECD Compendium of Productivity Indicators.(2013)

From the graph above, it showed that Finland has the average labor productivity growth rate among the OECD countries. From year 1995 to year 2012, the overall changes of labor productivity growth in Finland has the positive growth rate. In between year 2001 and year 2007, Finland experienced a positive labor productivity growth rate which was between zeros to three percentages.

However, the growth rate of labor productivity in Finland declined dramatically since year 2007 to year 2012. Between these years, Finland unable to increase its labor productivity as the average growth rate was shown from year 2007 to year 2012 is existed to be negative growth rate. Aside from Greece which was suffering from the government debt crisis after global financial crisis at year 2008, Finland is the lowest average labor productivity growth country in OECDfor the period from year 2007 to 2012. This fact gives us incentive to have a deeper look at the labor productivity situation in Finland and that's why we choose Finland over other OECD countries.

Figure 1.3: Labor Productivity of Finland.



Source: OECD Economic Outlook No 95.(2014)

Besides, there is another empirical evidence to prove Finland has a decreasing labor productivity growth in the recent years especially in year 2008 and year 2009. The labor productivity of Finland decreased theatrically between year 2008 and year 2009 and this has attracted the attention of whole world. Although in year 2010 and year 2011, the labor productivity of Finland has been increased slightly, but Finland still unable to recover its labor productivity to the higher level as last decades. Moreover, the labor productivity in Finland further

decreased in the following year which is in year 2012.The aspects that caused the decline of labor productivity in Finland have been investigated. In most of the studies and researches, the main reason for Finland to experience a lower labor productivity growth from year 2008 to year 2009 is resulted from the financial crisis which happened in these two years as well (OECD, 2013).The financial crisis indeed has significantly affected the unemployment rate and labor productivity in Finland. According to OECD (2013), the labor productivity of OECD declined by almost four percentages and there is larger effect on Finland with the falling rate more than OECD area. When financial crisis happened, a number of firms experienced losses and even faced bankruptcy and thus lead to a high rate of unemployment existed in the economy. Besides, the losses or bankruptcy incurred in the country is the main factor to reduce the level of output. This is the way of labor productivity in Finland decreased dramatically during year 2008 and year 2009.

1.1.2 Current Issues

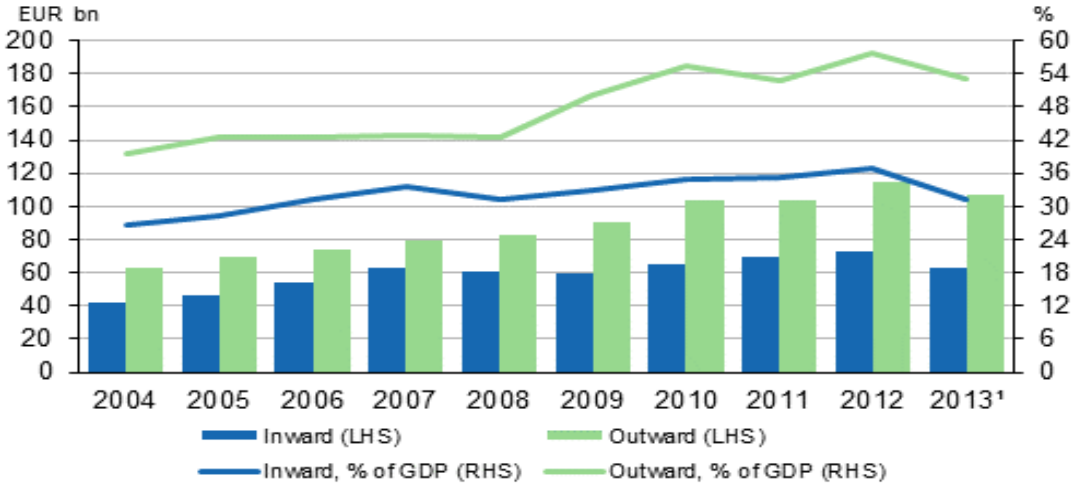
By looking forward to further years, Finland has gradually recovered its economy including the labor productivity. However, Finland had faced the challenges to improve its highest labor productivity as in previous years. The growth rate of labor productivity remains low although it was not as low as in year 2008 and year 2009. Furthermore, IMF (2014) stated that the recovery ability of Finland is low as the unemployment rate and labor productivity is unable to be fully recovered in year 2012 and year 2013. From the other study, Europe Commission (2013), it stated that the labor productivity of Finland during year 2008 and year 2009 are negative percentages which are -2.2% and -6.1% respectively. In year 2010, it has increased sharply to 3.4% but immediately it fall to 1.2% in year 2011 and further declined to negative growth rate which is -0.8%

in year 2012 (Europe Commission, 2013). Thus, the recovery level of Finland is unsatisfied as it stayed short term and conducted in a slow movement.

On the other hand, according to OECD (2012), the labor productivity growth of Finland is expected to be declined in the further years. The predictions showed that in year 2016 to year 2030, the labor productivity growth of Finland will fall to 1.9 percentages and declined to 1.5 percentages since year 2031 to year 2050. Besides, unemployment rate in Finland is expected to increase while the employment rate will decline further in the following years due to the remained low labor market performances (OECD, 2012).Indeed, the continuous and unstable labor productivity growth rate in Finland leads to substantial and significant impact to its economic growth. Although the labor productivity of Finland is gradually recovered, the risks for Finland to experience the historical decline of labor productivity growth rate are potentially high. This expectation is able to be explained by the labor structure, reform policy and other macroeconomics factors that have significant effect towards the growth of Finland in the future (Norden, 2013). When the labor productivity in the Finland continued to grow in an unstable and decreasing trend, this might eventually cause a dangerous situation to the total economy in Finland. In fact, the lower the labor productivity, the economic growth in the nation might be affected significantly as well as the development of the nation. As the development of Finland interrupted, the standard living of the citizens might lower indeed which associated with the high unemployment and other macroeconomic issues that impacted the whole economy in Finland. Thus, it is necessary to investigate the elements of threatening the labor productivity in Finland.In fact, the other factors such as inflation, FDI, human capital level and real exchange rate are attract the attention of the researchers to investigate whether they have the significant effect to cause the declined of labor productivity in Finland. The solution to solve the labor productivity issue is to determine the factors that might eventually affect the labor productivity in Finland and thus implement the actions based on the related aspects. Beside financial crisis, what are the factors contribute to the slow recovery of labor productivity in Finland?

1.1.3 FDI in Finland

Figure 1.4: Stocks of FDI in Finland from 2004 to 2013.

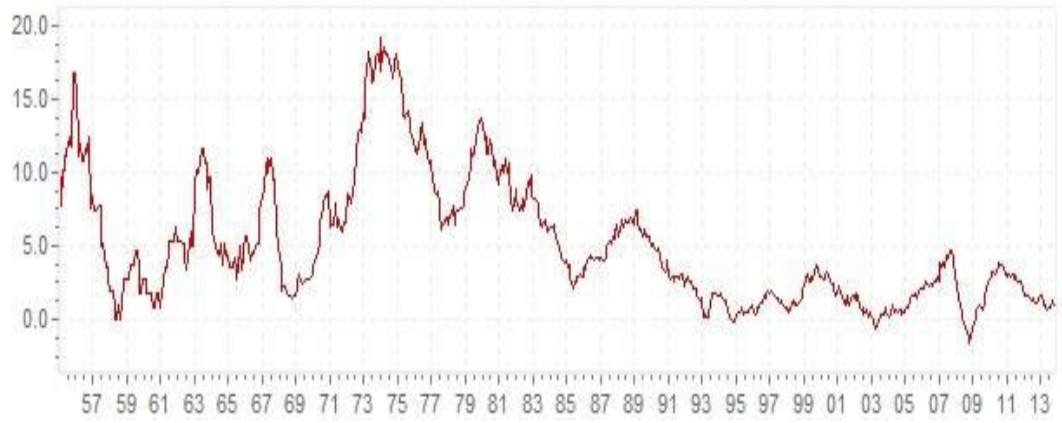


Source: Statistics Finland. (2014)

The figure above showed the trend of both inward and outward foreign direct investment (FDI) in Finland from year 2004 to year 2013. The inward FDI in Finland has an increasing trend although there were slightly fall in between year 2008 and year 2009 which caused by the financial crisis happened in these two years. Obviously, the outflow of FDI in Finland exceeded the inflow of FDI among these years. According to Statistics Finland (2014), the total value of outward FDI more than the inward FDI by approximately EUR 40 billion in year 2013. However, in recent years as in year 2013, the value of inward FDI decreased in Finland after the improvement since year 2010. This decrement of the inward FDI in Finland indeed attracted the attention to study the significance of the fall of FDI on the labor productivity in Finland.

1.1.4 Inflation in Finland

Figure 1.5: Historic CPI inflation Finland (yearly).



Source: Inflation.eu. (n.d.)

The inflation rate (CPI) in Finland was hugely fluctuated in the early century which between year 1956 to year 1980s as shown in the figure above. The trend of inflation rate considered stable since year 1990s to recent years as the range of inflation rate in Finland were fall between index negative values to 5 in these years. Indeed, Finland faced deflation in middle of year 1990s and year 2009. Nevertheless, there was a break happened in year 2008 and year 2009 which similar with other macroeconomics variables such as FDI which caused by the financial crisis in these years. Based on Inflation.eu (n.d.), the inflation rate in Finland experienced a decreasing trend since year 2011 to year 2014 which after the recovery of the financial crisis. Hence, the impact of this evidence should be studied in order to determine its effect on labor productivity in Finland.

1.1.5 Exchange rate in Finland

Figure 1.6: Exchange Rate in Finland (USD per Euro).

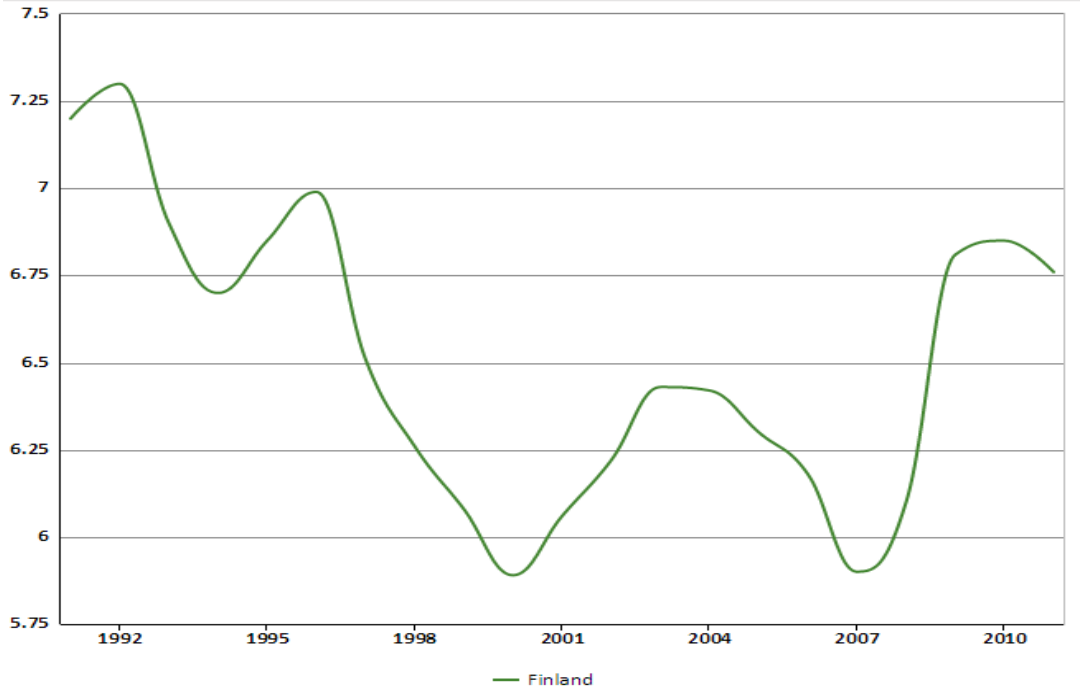
Source:SuomenPankki. (2015)

The currency of Finland is euro as Finland is one of the members in European Union since year 1995. Finland is the country adopted the euro currency in January of year 1999. In fact, the initial currency of Finland is Finnish markka and Finland started to introduce the euro banknotes from year 2002 to replace the Finnish markka (European Commission, 2011). Based on the graph above, the euro currency decreased at the beginning years and has an increasing trend since year 2002. The depreciation between years 1999 to year 2000 was mostly caused by the bad news about the European economy as the euro currency was newly introduced (Shams, 2005). After few years the euro was introduced, the euro currency began to appreciate and these phenomena could be explained by the increasing importance level of euro in the economy for its potential to become the international currency (Shams, 2005). However, there was a break from year 2008 which financial crisis happened and caused the currency fall dramatically. In recent years, the euro currency started to appreciate and this speedy appreciation worried the European economy as it impacted the export firms negatively (The

Economist, 2013).Thus, it might influence the labor productivity in Finland as well which should be investigated.

1.1.6 Human capital in Finland

Figure 1.7: Total Public Expenditure on Education as % Of GDP, For All Levels of Education Combined.



Source: Eurostat.(2014)

One of the measurements to measure the human capital is the government spending and expenditures on the education. In the graph, the total public expenditure was measured as percentage of GDP in all levels of education systems in Finland from year 1991 to year 2011. Based on the graph, it showed that the total government spending on education in Finland is fluctuated between these years as it increased and decreased among the years. Finland achieved the highest total educational spending in year 1992 and the lowest educational spending in year 2000. From year 2011, the total spending of government on education initiated to fall as showed in the graph. According to Statistics Finland (2015), it

reported that the government expenditure on the education in Finland actually decreased in year 2013 as well. Therefore, this evidence is suspected to determine the growth of labor productivity in Finland.

1.2 Problem Statement

Labor productivity is an important factor or issue to be studied because it influences the GDP of a particular country. Huge population doesn't mean that there is a big labor force while big labor force doesn't mean there is good labor productivity as it depends on many other factors in the country. Most of the researches on the determinants of labor productivity are studied in the developing countries such as Pakistan, Nigeria and Tanzania. This might due to the developing countries always have the lower growth of labor productivity compared to the developed countries and hence most of the researchers are interested to investigate the factors of labor productivity growth. As a result, we choose Finland in our research as there are limited researches have been studied on the labor productivity in developed countries. Indeed, Finland is a developed countries and one of the members in both European Union and OECD countries which attract us to investigate the determinants of its labor productivity.

Another motivation for our group to examine the determinants of labor productivity growth is the current issues on the labor productivity in Finland. The labor productivity growth rate in Finland is slow in recent years compared to past decades (IMF, 2014). Moreover, the labor productivity is expected to decrease further in the future which eventually worrying the economy of Finland (OECD, 2012). Therefore, it is an issue for our group to carry out the factors which caused the slow growth rate of labor productivity in Finland.

Furthermore, the limited researches are conducted regarding the impact of macroeconomics variables on labor productivity. A higher portion of the studies

on determinants of labor productivity growth are based on the variables such as wages, labor unit costs, income level and labor force. It is disputable that the macroeconomic variables tend to have significant effect towards the labor productivity as well. Thus, there is a motivation to encourage us to determine the impact of the macroeconomics variables on the labor productivity growth in Finland. The macroeconomics variables we choose in our research are foreign direct investment, inflation rate, exchange rate and human capital.

One of the determinants we involved in our research is foreign direct investment (FDI). In fact, the relationship of FDI and labor productivity is ambiguous as stated in the studies of other researchers. Some of the studies showed the positive impact of FDI on labor productivity such as the studies in Arbache (2004) and Ramirez (2006). On the other side of the coin, some of the researchers argued that the FDI has negative relationship with labor productivity (Vahter, 2004 &Kien, 2008). From the Statistics Finland (2014), the FDI inflows always less than the FDI outflows in Finland and the FDI inflows in Finland are decreasing as well in recent years. Hence, it is interesting to study whether the FDI impact the labor productivity in Finland significantly and whether the relationship is positive or negative.

Besides, inflation is the variable to be investigated in our study. Indeed, most of the researches argued that there is negative relationship between inflation and labor productivity. Hussain (2009) and Freeman &Yerger (2000) found negative impact of inflation on labor productivity as the price level increase in the economy tends to decrease the labor productivity. Based on the literature review, inflation is expected to impact the labor productivity negatively. Hence, the inflation rate in Finland is suspected to affect the labor productivity in Finland as well since the inflation rate in Finland is unstable as it increased and decreased among the years (Inflation.eu, n.d.).

On the other hand, the currency of Finland is euro currency from year 1999 and thus the exchange rate is based on the euro currency. From the SuomenPankki (2015), the euro currency is appreciated in recent years. In fact, there are different argument to explain the relationship between the exchange rate

and labor productivity. For example, Tang (2010) and Harris (2001) stated that the appreciation of currency increase the labor productivity while Jeanneney and Hua (2011) found that appreciation of currency decreased the labor productivity. As a result, the fluctuations of currency in Finland motivated us to investigate its effect on labor productivity growth.

Besides that, human capital is a variable we choose to determine whether it has a significant impact on labor productivity in Finland. Similarly, some of the studies found there is positive relationship between human capitals but some stated that the human capital decreased the labor productivity. The positive relationship are found in research of Corver (1996) by explaining that higher human capital level which measured by higher education level tend to increase the labor productivity. However, Nurudeen&Usman (2010) found that public spending on education as a proxy for human capital impacts the labor productivity negatively. Indeed, the human capital level which measured by the education expenditure of Finland in recent years is lower compared to the beginning of year 1990s but is higher compared to beginning of year 2000s, thus it encouraged our group to study the relationship between the human capital level and labor productivity in Finland.

1.3 Research Objective

The purpose of this research is to identify the effect of determinant on the labor productivity in Finland.

1.3.1 General objective

1. To study which factors affect the labor productivity and how they affected the labor productivity in Finland. The factors are foreign direct investment (FDI), inflation, exchange rate and human capital.

1.3.2 Specific Objective

1. To study whether FDI inflows will affect the labor productivity in Finland.

2. To study whether inflation rate will influence the labor productivity in Finland..

3. To determine whether exchange rate will influence the labor productivity in Finland.

4. To determine whether human capital will influence the labor productivity in Finland.

1.4 Research Question

With the general and specific research objectives that had clearly stated above, our targeted research questions are acting as the guidance for the arguments and inquiries of our research in respect to the problem statement.

1. What is the impact of changes in foreign direct investment (FDI) on Finland's labor productivity?

2. What is the impact of changes in inflation on Finland's labor productivity?

3. What is the impact of changes in exchange rate on Finland's labor productivity?

4. What is the impact of changes in human capital on Finland's labor productivity?

1.5 Hypotheses of the Study

We use some theoretical framework to make hypotheses in our study.

1. The labor productivity in Finland and the foreign direct investment (FDI) have a positive relationship.
2. The labor productivity in Finland and the inflation have a negative relationship.
3. The labor productivity in Finland and the exchange rate have a positive relationship.
4. The labor productivity in Finland and the human capital have a positive relationship.

1.6 Significance of Study

Our empirical research aims at contributing to the literature by examining the effects of changes in foreign direct investment (FDI), inflation, exchange rate and human capital on the labour productivity in Finland. By empirically investigating the effects of these factors on the labour productivity, the result or findings of our study will help to answer the question of our research.

Besides, this study will also bring contribution to the policy makers or government in Finland as this study would provide a better and clearer picture to

them about how these factors are going to influence the labour productivity. As this will help them in strategic design or policy decisions that will bring either direct or indirect effects to the labour productivity in the country through the factors which are FDI, inflation, exchange rate and human capital.

Chapter 2: Literature Review

2.0 Introduction

Labor productivity is measure the total output per total productive hours.

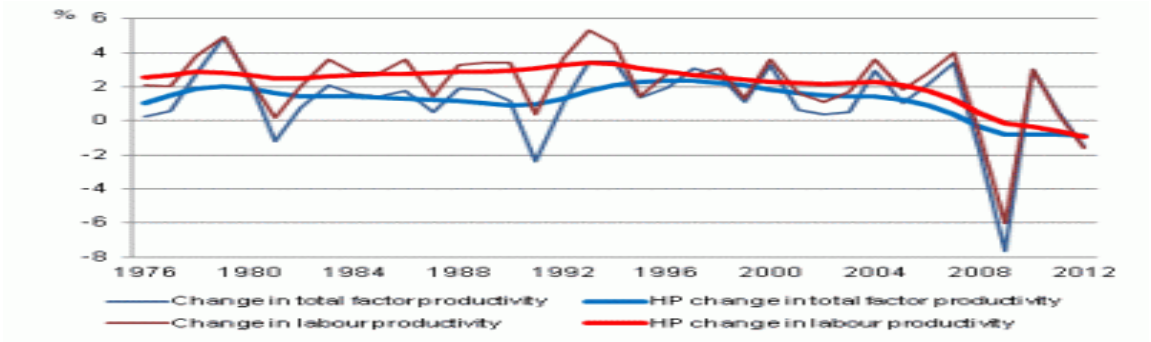
$$LaborProductivity = \frac{TotalOutput}{TotalProductiveHours}$$,

where the total output always will be Gross Domestic Product (GDP) (Investing Answers, n.d.). According to TejvanPettinger, labor productivity is an important indicator to examine the productive of the economy (Pettinger, 2014). It is because the labor productivity can interpreted or function as human capital resources, technology innovation and investment in a country (Investing Answers, n.d.).

From the formula and definition above, we can explain that the stronger the country's labor productivity, the more sustain economic growth in the particular country. When the economic growth of the country become stronger, the GDP in the country will more stable and this will lead to consumers continue to purchase and invest in the particular country (Jonathan Lister, Demand Media, n.d.).

In Finland, the changes in labor productivity are in a decreasing trend from 1980 until 2012.

Figure 2.1: Changes in Total Factor Productivity and Labor Productivity



Source: Statistics Finland

From the figure 2.1, we can clearly know that the economy of Finland is going down since 1990s. The changes of labor productivity are dropped from 3.5% to -1%. The economy growth and GDP of Finland is no longer stable and consistence since the labor productivity is represent and lead the technology innovation, the quality if the organization, capital resources, development and others in a country (Salkunrakentaja, 2013). When consumers would not willing to have sustained or continuous purchase and invest in the country which the economy is unstable. They are not willing to face and meet the loss. Thus Finland will lose many financial support and foreign investment in it country.

There have many variables may influence the labor productivity in a country. There have many others researcher shown that the foreign direct investment (FDI), exchange rate, inflation, human capital and unemployment rate will have impact to the labor productivity of the country. There have different relationship between those variables with labor productivity.

2.1 Determinant of Labor Productivity

2.1.1 The relationship between human capital and labor productivity

In the basic concept, the human capital normally measured by the public expenditure on education, job training, skills and education level which are expected to improve the labor productivity in the economy (OECD, 2009). Many researches and studies explained the relationship between the human capital and the labor productivity in the economy by using the human capital theory. For instances, Aggrey, Eliab and Joseph (2010) applied the human capital theory to state that human capital improved the technology advancement and innovation which eventually enhanced the productivity. Afrooz (2010) explained the human capital theory that the human capital with high educational level is fundamental in achieving the economic growth. In fact, human capital theory proposed that the investment in human capital through the channel of education and training encouraged the labor to increase their knowledge, skills and innovation in the production and thus improve the productivity growth in the economy (Kavanagh & Doyle, 2006).

One of the investment and accumulation in human capital is the public spending and expenditure on the education (OECD, 2009). When there is an increment of public spending on education, more research and development activities will be developed to improve the innovation, technology advancement as well as the skills of the labors in the production (OECD, 2000). Based on OECD (2000), the spending on education tends to have a permanent effect towards the productivity through the high educational based and skilled labors by handling the advanced technologies. The public expenditure on education is fundamental element as an investment of human capital especially in the tertiary

education level (European Commission, 2010) The public expenditure enables the tertiary education system to improve their quality by developing efficient resources allocation and enhancing the facilities and development in the institutions (European Commission, 2010). As a result, more highly skilled and knowledge labor force are generated to involve in promoting the labor productivity in the future (European Commission, 2010).

It is indisputable that education and skills are the main variables in the development of human capital. Fischer, Bartkowska, Riedl, Sardadvar and Kunnert (2008) supported that education is a significant factor to enhance the productivity as well as the development of the economy. The role of human capital in terms of education and skills have been explained by other researches as Menon (2010) and Escosura, Roses (2010) stated that the education attainment tend to improve the skills of the labors which eventually increased the efficiency in the production. The increasing skills on labors enhanced the ability of the labors in utilizing the capitals such as the technologies and thus the labor productivity growth was stimulated (Lottum&Zanden, 2014). Other than human capital theory, some of the studies used the Solow Model to discuss the relationship between the human capital and labor productivity. Kavanagh and Doyle (2006) explained that the labors with higher skills in technology advancement generated a higher productivity growth by using the Solow Model in their explanation. A higher skills in a labor, a higher ability of labor to handle the technology capitals, hence a higher efficiency in the production, this was the framework explained by Kavanagh and Doyle (2006).

The relationship between the human capital and the labor productivity is the interesting issue to be studied by the researchers and economist. Many researches and analysis have been generated to determine the impact of the human capital level on the labor productivity growth. In fact, most of the studies found that there were positive relationship between the labor productivity and the human capital to support the theory proposed. According to Escosura and Roses (2010), they found that the human capital level contributed positively to the labor productivity although the effect was quite small. They explained that the investment in human capital level included the income based and education based

lead to the productivity improvement through the channel of technology advancement and innovation. From the estimation result of Fischer, Bartkowska, Riedl, Sardadvar and Kunnert (2008), it showed that the increase in the human capital level impact the labor productivity insignificantly in the Spartial Durbin Model. However, they analyzed the relationship between the human capital and labor productivity by studying the impact of human capital levels in a region on the labor productivity of other regions and found that the increment of the human capital in a region decreased the labor productivity of other regions involved and vice versa. Thus, they stated that the human capital levels in a region improved the labor productivity in the particular region which able to explain that human capital played an important role in the economic growth.

Other researchers have the similar result to match with the concept and mainly based on the education level. For instances, Fallahi, Sojoodi and Aslaninia (2011) found that the labor with higher education level has a positive and significant impact on the labor productivity as increased in the portion of high educated workers lead to the increment of labor productivity as well. Moreover, Arvanitis and Loukis (2009) also found that there were positive and significant relationship between the human capital and labor productivity in Greece and Swiss and the human capital from the education level has the stronger effect by using the share of employees with tertiary education level and share of employees received job training as the human capital variables. Another study from Corvers (1996) support the positive relationship by stating that the higher education lead to higher skills of the labor. From his empirical result, it showed that the share of employment with high skills affect the labor productivity of sectors positively and significantly while the labor with intermediate skill have the positive impact but insignificant on the labor productivity. He explained that this might probably due to the lower education level of the intermediate skill labors less productive in the sectors.

Training on job is one of the human capital investments as well. Aggrey, Eliab and Joseph (2010) stated that the job training was estimated to have significant effect to improve the labor productivity growth in manufacturing sector of Kenya since the job training increased the skills and knowledge of the labor

such as learning the operations of the new machines, the innovation of the products and the new techniques to improve the quality of the outputs. On the other hand, Fallahi, Sojoodi and Aslaninia (2011) found that the training on the labor was estimated to affect the labor productivity negatively and significantly. The negative effect of the training on labor productivity might cause by the training costs outstripped the positive effect of training effect on labor and the inefficient of training provided by the firms to improve the labor skills. In addition, some of the studies argued that more investment in education lead to a negative effects on the labor productivity. Based on the case in China, the negative consequences of the educational spending on productivity might be caused from the investment in developing area instead of developed areas which finally lower the rate of educated labors in developed areas when the population size is large in the developing areas (Su &Heshmati, 2011). The government spending on education has negative effect on the productivity as well when the expenditure was utilized inefficient and ineffective in the education sectors (Nurudeen&Usman, 2010).

2.1.2 The relationship between inflation and labor productivity

Inflation is one of the big factors that are important to the economic. Government also takes inflation as a serious matter in the policies decision especially from the perspective of micro-economic. The relationship between inflation and productivity seem to be negative because generally when there is an inflation, the price level goes up, cost of the production will increase and then will decrease the aggregate supply. Meanwhile, the aggregate demand will decrease and it will lead to a decline in the total output of the country. However in the realistic inflation is not the only factors that affect the economic. The AD-AS model is not the absolute way or the only way to show the change in the economic.

There are literatures that describe the relationship between inflation and labor productivity. Their relationship is ambiguous because the impact of inflation to productivity is not constant. The effect will be different because of the different time period or other different economic factors. According to Hussain (2009), inflation affected the labor productivity negatively in both long run and short run. However, based on Sbordone and Kuttnner (1994), the negative relationship between inflation and productivity is more sensitive in long run.

Base on Freeman and Yerger (2000), inflation may cause the interest rate increase, in turn reducing the output. As the interest rate increase, different effects that cause by the rising of the interest rate will cause the labor productivity decrease. For example the increase in the interest rate will increase the incentive to save. From the perspective of the household, when people spend less, firms will not produce more to prevent supply surplus. From the perspective of firms, the cost of producing will increase due to higher borrowing cost and also decline in investments, less money will operate in the cash flow of the companies, therefore production will be decrease to save more cost or even unemployment would occurred. Based on Nahidi and Badri (2014), inflation and employment are negatively related, which mean inflation will cause unemployment and unemployment may bring negative effects to the labor productivity.

However through the study of Freeman and Yerger (2000), stated that the negative relationship between inflation and labor productivity only existed in some countries such as Canada, Denmark and United State. The effect maybe slightly negative in some other countries, depend on other economic factors. Kumar, Webber and Perry (2009) stated that relationship between inflation and productivity is negative, however the effect is relatively weak negative effect. According to Bulman and Simon (2003), the productivity and inflation is negatively related, the slowdown of the productivity in 1970s of Australia is cause by the inflation. Besides, the acceleration in 1990s is because of the rise and fall of inflation.

On the other hand, there are studies saying that inflation and productivity is not related to each other, or they are slightly related. According to Sbordone and

Kuttnner (1994), negative correlation is easy to find in the relationship between inflation and productivity. It is difficult to determine the relationship between productivity and inflation are negatively related. Base on Bulman and Simon (2003), industry inflation explains the productivity more than the aggregate inflation. There are other factors that affect productivity more than inflation.

2.1.3The Relationship between exchange rate and labor productivity

In fact, the relationship between the labor productivity and the movement of exchange rate is suspicious. Some of the research found that the appreciation of the currency increased the labor productivity growth. From Tang (2010) and Harris (2001), they stated that the appreciation of currency increased the industry competition based on the contract theory. When the currency appreciated, the import will be increased which means there are more competitors within the market and thus induce the firms to improve their productivity especially in high traded area. According to Neoclassical framework, it emphasized that profit maximization equal to cost minimization which explained that the currency appreciation reduce the imported input costs of the firms and hence increase their profit to improve the productivity (Tang, 2010, Caglayan&Demir, 2014).

The other theory implied that the currency appreciation increased the pressure to the less efficient and small firms which caused them to exit the market and thus the productivity growth will be improved when the more productive firms remained (Tang, 2010). Moreover, the currency appreciation increased the foreign investment as the investors willing to invest or borrowed more in the foreign currency which the foreign investment able to increase the technology advancement and innovation on the productivity growth (Harris, 2001).While, Stopler-Samuelson effect emphasized that the depreciation of the currency increased the migration of the skilled labor to other country with higher currency

in order to earn more income which directly decreased the productivity growth of the own country (Harris, 2001).Besides, the depreciation of the currency increase the imported input costs which discouraged the firms to import more imported advanced technology and thus reduce the productivity growth (Harris, 2001).

Indeed, many research also found that there was positive relationship between the exchange rate and labor productivity to prove these theoretical explanations. Caglayan&Demir (2014), Xu (2008) and Tang (2010) realized that the appreciation in the exchange rate increased the labor productivity in Turkey, Taiwan and Canada respectively. The labor productivity growth of the firms was found to be affected by the real exchange rate appreciation through the competition pressure in the market as shown in the study in Norway (Ekholm, Moxnes, Ulltveit-Moe, 2009). This positive impact of appreciation on labor productivity supported by the study of Jeanneney, Hua (2011) as well since they found that the appreciation on the exchange rate improved the capital intensity with the lower imported inputs costs and the increment of import exposure in the market respectively. In addition, the undervalued of exchange rate lead to negative impact on the labor productivity due to the higher import price of inputs as well as the technology transfer as Harris (2001) found in the long run model.

However, some of the studies argued that the currency appreciation actually impact the labor productivity negatively. Based on Harris (2001), the appreciation of the currency reduced the export as the firms found there were lesser profit and thus produce less products and invested less in the production which finally caused the productivity slowdown. While, the New Keysian stated that the depreciation of the currency increased the foreigners to import more from our country, hence the demand of the products increases and enhanced the factors utilization as well as the competition to improve the productivity growth (Harris, 2001).

This negative relationship between exchange rate and labor productivity was supported by some studies and analysis. For instance, Harris (2001) found that the depreciation of exchange rate lead to increase of the labor productivity in short run by explaining the increased of the demand in the trading market

especially for the export market. In the study of Murphy &Siedschlag(2012) in Iran, the appreciation of the exchange rate tends to lower the labor productivity when the export exposure increased in the market. Besides of export exposure, Jeanneney&Hua (2011) also found that labor productivity decreased when the appreciation occurred through the export and FDI as shown by their estimation result.

2.1.4 How FDI affect the labor productivity

FDI (foreign direct investment) is one of the key components that can affect the economy of a nation. When the economy of the nation was get affected the labor productivity of the nation also will get influenced. FDI can be separate into two types which is direct FDI (tangible FDI) and indirect FDI (intangible FDI). The examples of direct FDI are machinery, equipment and building. The example of indirect FDI was portfolio investment (Graham, 2005). FDI can lead a nation to become more develop, access to new technology, improve the GDP of the nation and many others.

According to Ramirez (2006) and Arbache (2004), they said that the FDI and labor productivity has a positive and significant relationship. At the beginning, the FDI that do not fully utilize use by the country do not lead to any improvement in any sector. Then, the FDI had been investing in the domestic capital formation based on the traditional factor in order to increase the labor productivity in the host country. After that, the FDI flow to the manufacturing sector in the country. This flow makes the technology spillover effect increase in the country. This mean that there will have others unrelated factor will influence the FDI and labor productivity in the country. The government of the country had take action to reduce the spillover effect on the country and to attract more FDI flow into its country such as reduce restriction, subsidiaries on tax and others.

However, according to Mebratie (2010), there has no either positive or negative spillover effect from FDI to local firm of the nation. It might be due to the limitation of the business relationship with foreign companies. The companies which that only produce the domestic goods also will lead the spillover effect decrease because the technology and the firm specific do not flow out of the nation. This will lead to the nation could not enjoy the benefit of spillover effect such as limitation of the multinational companies in joint venture in the nation. Thus, the labor productivity of the nation would not increase because the FDI cannot flow into the country.

On the other hands, there have some researcher found that the FDI and labor productivity have the negative relationship. From Vahter (2004), when the increase in the labor productivity, the FDI will be decrease. The wrong policy implication by the government is the main reason that lead to this negative relationship occurs. For example, when the government reduces the interest rate to the maximum level, there are many foreigner invest and set companies in the particular country. There will produce goods and services in the country with mostly machinery instead of local worker. It is because they can buy the machinery with lower cost in the country or the country only has less skill worker to handle the high technology machine. The machine will take over the position of the local worker. The unemployment rate in the country will increase. From this case, although the FDI is increase in the country but the labor productivity in the country will decrease.

The opportunity to work and improve of the working condition has increase significantly with the flow of FDI into the country according to the Cheng and Kwan (2000). When the working condition was increase, the educational level of the worker will increase through training that given. The skilled labor will increase in the country and they can be transfer to other sectors to produce the goods and services more effective and efficient. This can lead to the labor productivity of the country maintain stable or will increase. However, there has an adverse effect occur. The well train labors require paid high wages to them and this lead to the average wages of the countries increase. This will bring the negative affected on FDI flow into the country.

According to Kien (2008), the FDI and labor productivity will have negative relationship may due to many reason. The one of the reason that he found through the research is that the different location of the country might get the productivity in the country. The cities in the country can attract more FDI compare with the rural area of the country. This only can earn the profit and increase the labor productivity in short run. In the long run, the FDI and the labor productivity still will in the negative relationship. It is because there have the gap of technology between the host country and the foreign country. This situation is more serious especially in the rural area of the host country.

Besides, the spillover effect also will show the different result across the location. This is because the cities area and the rural area of the country have the different technology. This difference will let some cities area of the country can enjoy the effect benefit but not the rural area. Thus the long term effect benefit would not get in the country since the FDI and the technology grow in the country is limited.

2.2 Conclusion

From this chapter, we explain that the literature and review of the variable based on the previous researcher. There have different relationship mention by different author in the same variables. For the next chapter, we will have the methodology and estimation of technique to explain and describe the relationship of FDI and others variable in Finland.

CHAPTER 3: METHODOLOGY

3.0 Introduction

The main methodology that will be used in our study to fulfill the research objectives will be discussed in Chapter 3. The model specification, data collection method, data processing, data treatment and data analysis will be further explained in this chapter. Other than that, variables analysis and inference analysis will also be shown in this section.

We will divide this chapter into 3 parts, which are data collection methods, empirical framework and data analysis. In order to ensure our research result's accuracy, we will use several statistical tests to diagnostic checking on our model.

At first, we will use unit root test to test whether time series variables are stationary or non-stationary. Two unit root test that we will adopt are Augmented Dickey Fuller (ADF) and Phillips Perron Test (PP Test). If the variables are non-stationary, it is possible that will lead our model to a spurious result which is not valid and cannot be trusted. Therefore, we will use Johansen Juselius co-integration test to examine whether there is a short run or long run relationship between the variables.

Moreover, Vector Auto regression (VAR) model will be used to capture the linear interdependence among different period of time within the variables in short run. If there are co-integration between variables, we will continue with Vector Error Correlation Model (VECM) model.

Pairwise Granger Causality test will be used to inspect the presence and the nature of the causality between independent variables and dependent variables in short run.

Lastly, the diagnostic checking will start by checking normality with Jacque-Bera (JB) Test, checking autocorrelation with Breusch-LM Test, and heteroscedasticity with Autoregressive Conditional Heteroscedasticity (ARCH) test.

The main computer program that will be used in our research to analyze the data will be the E-views 6.0. Those main statistical techniques we applied would be further discussed in the next few sections in this chapter.

3.1 Data Collection Method

We use secondary data to conduct our research. Due to data availability, we are only able to obtain annual data from 1980 to 2012 for the variables in our model. There is foreign direct investment, inflation rate, exchange rate and education expenditure which are a proxy for human capital and GDP per hour working which is a proxy for the labor productivity. All data are collected from the database of European Union (EU), World Bank, Organisation for Economic Co-operation and Development (OECD) and International LabourOrganisation (ILO) and DataStream software which is provided by UTAR.

In our research, the dependent variable is labor productivity and the independent variables are unemployment rate, inflation rate, exchange rate, foreign direct investment and education expenditure.

Labor productivity in our model is using GDP per hour worked (constant 1990 US$ at PPP) in Finland as the measure. GDP per hour worked (constant 1990 US$ at Purchasing Power Parity) is gross domestic product (GDP) which

converted to constant international dollars with same purchasing power that US Dollar has in the United States in 1990, divided by annual total hours working in Finland.

On the other hand, let's continue to discuss on the independent variables in our model. Firstly, exchange rate in our model is calculated as an annual average based on monthly averages in terms of local currency units relative to the US Dollar. Since Finland joined European Union at the end of year 1998 and used Euro afterwards, the exchange rate in our model is the annual average in terms of Euro versus US Dollar after year 1998.

Besides, foreign direct investment that used in our model is net foreign direct investment which is net foreign direct investment inflow of Finland from foreign countries less net foreign direct investment outflow of Finland to the rest of the world in terms of million US Dollar.

Other than that, inflation rate that we adopted in our model is measured by consumer price index (CPI) which reflects the annual percentage change in the expenses to the average consumer of acquiring a basket of goods and services.

Nonetheless, proxy for human capital in our model is the natural log education expenditure in term of current billion USD after adjusting the savings. It indicates that the education expenditure that we choose in our model is the annual operating expenditure in education, including wages and salaries but excluding capital investments in buildings and equipment in Finland.

3.2 Unit Root Test

Stationary is an important feature for time series analysis. According to Gujarati and Porter (2009), when the time series is stationary, mean, variance and autocorrelation will all be constant over time which are unaffected by the change of time origin. The stationary of time series can greatly affecting its movement and test statistic value. As an example, a shock in non-stationary time series will have a permanent effect to the dependent variable in the model. Therefore, if the time series is non-stationary, it may lead to spurious result in the regression which means regression result cannot be trusted due to misleading test statistics.

If a linear stochastic model have unit root, it will represent non-stationary for a time series model. Since the shock effect is accumulated permanently in non-stationary time series, it will lead to an underestimation of mean and variance over time. As a consequence, non-stationary data will lead to a spurious result which is no relationship between variables in the regression model even with high R^2 and significant t-ratio in the model (Cameron, 2005).

In our research, we will test the presence of unit root on single variables in isolation with using Augmented Dickey Fuller (ADF) unit root test and Phillips-Perron (PP) unit root test to double check for the stationary of our model.

3.2.1Augmented Dickey Fuller (ADF)

ADF Test was proposed initially by Dickey and Fuller (1979) with the assumption of the error terms follows auto regression (AR) process with known order. This test augmented the Dickey-Fuller test by adding the lagged value of all variables such as $\Delta Yt_{-1,}\, \Delta Yt_{-2}$ until appropriate lag length, p in order to deal with the situations of serial correlation of error terms.

The equation of ADF unit root test is given by:

$\Delta Yt=\alpha_0+\alpha_1 t+ \delta Yt_{-1}+\Sigma\gamma i\Delta Yt_{-i}+ \varepsilon_t$

In this equation, Yt is represent to level form of the variables (LP, EXR, FDI, INF, EDU, UNE) and the first difference of the series (ΔLP, ΔEXR, ΔFDI, ΔINF, ΔUNE ΔEDU). While α_0 is an intercept term, $\alpha_{1t}$is the trend variable, δYt_{-1} is the lagged level, and $\Sigma\gamma i\Delta Yt-i$ is the total summation of lagged changes in variables. Δ is the first difference operator, where ε_t is white noise error term. Other than that, ε_t will be autocorrelated if there was autocorrelation in the dependent variable of the regression (ΔYt) which has not accounted.

However, ADF unit root test consists of a major weakness which is always tends to do not reject null hypothesis which is the time series variable consist of a unit root.

3.2.2 Phillips-Perron (PP)

PP test is one of the alternative tests for unit root test. The serial correlation in the error term will be minimized by using non parametric method without add lagged difference of error terms like ADF Test. This feature giving PP test an advantage over ADF Test which allows researchers need not to identifying an appropriate lag length for the unit roots checking.

The equation of PP unit root test is given by:

$\Delta Yt=\beta_0+\rho Yt_{-1}+\varepsilon t$

ADF and PP unit root tests have same asymptotic distribution but just different by the way of dealing with serial correlation in the regression. However, there is criticism on PP test that PP test is performing less well compared to ADF Test in a small sample size.

However, ADF test has its own limitation. AR order in ADF test is very important. If we underspecified the AR order in ADF test, the test will be mis-sized. On the other hand, if we over-specified AR order, ADF test's power will suffer. Although these problems can be prevented in the PP test, the PP test will be less powerful than ADF test if we can correctly specify AR order.

Since we use Eviews 6.0 software to run ADF test which can directly provide the correct AR order of the variables in the test, we should prioritized the result of ADF test over PP test due to its powerfulness.

After taking a few of consideration, we decided to use both ADF and PP test to examine for the presence of unit root in our research in order to ensure the accuracy of the test by double checking and compare the result from ADF test and PP test.

ADF test and PP test share the same null hypothesis which is there is a unit root or the time series variable is non-stationary while the alternative hypothesis is there is no unit root in the time series variable. We will reject the null hypothesis if the p-value is smaller than 10%, 5% and 1%, otherwise we do not reject the null hypothesis.

3.3 Cointegration

According to Cameron (2005), a presence of cointegration represents there are a long run equilibrium relationship between time series variables in the model. In order to determine the cointegration of a collection of time series variables, we must run a cointegration test. Cointegration test is also able to prove that the stationary relationship between time series variables is genuine rather just a coincidently stationary. If cointegration relationship is not found between the variables, the series will remain using VAR for estimation. If cointegration

relationship is found, the variables will use Vector Error Correction Model for the estimation.

3.3.1 Johansen and Juselius (JJ) Test

JJ Test was introduced in year 1990 and famous for the ability to test of more than one cointegration relationship. . In other words, it allows us to examine for the multiple cointegration relationship when our data set has more than one time series. Therefore, we opt to use JJ test to check for the cointegration of time series variables in our model. JJ test consists of two different types of tests which are Trace Test and Maximum Eigenvalue test.

Trace test formula:

$(r/n)=-T*\Sigma(1-\lambda i)$

Maximum Eigenvalue test formula:

$(r/n)=-T*\ln(1-\lambda i)$

, where λ is the Maximum Eigenvalue while T is the sample size in our model.

Both tests are quite similar to each other. The difference between them is the null hypothesis of Maximum Eigenvalue test is r is less than or equal to 1 while the alternative is r>1 (Ssekuma, 2011).

According to Hurst and Paul (2007), the rejection rate of null hypothesis for simple bivariate system by using Maximum-Eigenvalue is less than Trace Test by using 5 percent of significant value. The result shows that the Trace values are less significant accurate to the Maximum-Eigenvalue test. According to another study of Lutkepohl, Saikkonen, &Trenkler (2001), trace test tends to have greater distorted sizes in some situation especially in small sample although trace test power performance is far better than maximum eigenvalue test. This shows that

maximum eigenvalue test is more preferred to use in small sample size than trace test. In order to ensure the accuracy of the research, we decided to use both test and crosscheck the result.

3.4 Vector Autoregression (VAR) model

VAR model is a model that all its variables not only affected by its own history but also other variables' past. It is a development of Autoregression (AR) model which includes multiple independent variables. VAR model allows us to obtain the short run dynamic relationship between variables in our model.

Essentially, we need to determine appropriate lag length for VAR model because according Gujarati and Porter (2009), including too much lag in the model will consume the degree of freedom of the model, however, including too few lags in the model will be mis-specified the model and causing autocorrelation problems.

Most of the VAR models are using the same lag length for all variables in the equation of the model. Lag length can be chosen by using Akaike's Information Criterion (AIC) and Schwarz's Information Criterion (SIC). Since our sample size is quite small, we will prioritize the SIC result over the AIC in our research. Symmetric lagged-VAR models are easier to be used since we can use OLS to estimate the model with the same specification.

VAR model can be expressed as,

$$A_t = B_1A_{t-1} + B_2A_{t-2} + \ldots\ldots + B_nA_{t-n} + \varepsilon_t$$

Where A_t is a vector of endogenous variables at time period of t, B_t(i= 1, 2, 3, 4…, p) are coefficient vectors, n is the number of lags included in the model and ε_t is a vector of error terms.

VAR model requires all the variables are covariance stationary in our model. If there is absence of covariance stationary or presence of cointegration among the variables, we can estimate our model with Vector Correction Model (VECM).

3.5 Vector Error Correction Model (VECM)

If our time series variables are found that not stationary and have a unit root in level, but stationary in the first difference, we can use VECM to deal with the situation in our research. VECM provides more efficient test result of cointegrating vectors due to VECM is a perfect information maximum likelihood estimation model. It is able to test co-integration in the whole model in a simple one step. Also, VECM does not need the variables to be normally distributed. Meanwhile, VECM is also able to capture long run equilibrium relationship between time series variables when the variables are cointegrated in our model. This will increase the significance of our study since long run relationship is always prioritized in economic research. Furthermore, ECT (error correction term) can be describe as the how the time-series adjust to disequilibrium, other implications is that error correction term is the estimation of the speed at dependent variable returns to equilibrium from the changes in independent variables. Thus, it shows that the deviation of current situation will be fitted into its short-run relationship from long-run relationship.

3.6 Granger Causality

According to Gujarati and Porter (2009), regression analysis only able to capture the relationship between variables but it does not show the causality between variables either unidirectional or bidirectional. To checking the causality, we will apply the pair wise Granger Causality test. This test is testing the causality between 2 variables, whether unidirectional, bidirectional or no relationship in short run.

The null hypothesis is independent variable, X does not granger-cause the dependent variable, Y. We reject the null hypothesis if the p-value of F test statistic is lower than significance level of 1% and 5% and 10%, which means that X granger-cause Y.

However, we only able to obtain the direction of causality between variables based on Granger causality, but cannot estimate what is the impact and effect on the dependent variable in short run. Therefore, we still need to analyze our model by impulse-response function and the variance decomposition to capture the impact between time series variables.

3.7 Impulse-response function analysis

Since Granger Causality is unable to capture the complete story about the interaction between variables in the model, we will use impulse-response function analysis in order to obtain the reaction of a variable to an impulse in another variable. In short, the reaction of dynamic model in response to some external shock on one of the independent variables is defined as impulse response function (IRF). We can obtain direction and magnitude of the impact between the endogenous variables from IRF that Granger causality does not provide. With an

introduction of new information such as dropping crude oil price, any shock in a variable will affect the variable itself as well as other variables in the system. IRF will allow us to obtain a clearer view on the response of variables in our model react to an external change of one variable.

3.8 Variance decomposition

The variance decomposition will describe how is the variable adjustment under the effect of its individual shock and the shock of other variables. It is also can explain the relative importance of each random shock in affecting the variables in VAR model. Variance decomposition will be used to forecast the percentage of change of each variable due to changes in other variables in the VAR system.

3.9 Diagnostic Checking

3.9.1 Normality of Residual Test (Jarque-Bera Test)

There are several alternative methods can be used for testing the normality distribution to the model which are Jarque-Bera test, Shapiro-wilk test and Anderson-Darling test.

According to Enders (1995) criticized that the Jarque-Bera test is mainly based on moment-based comparison approach regarding to sample skew and kurtosis whether matching a normal distribution.

This equation shows the JB test statistic:

$$\text{JB} = \frac{n}{6}\left(S^2 + \frac{1}{4}(K-3)^2\right)$$

To determine our model is normally distribution by using JB test statistic however it has an issue which is about the chi-squared distribution with degrees of freedom of two is overly sensitive for the small sample size and it will always reject the null hypothesis to alter the fact result when the hypothesis testing JB test statistic $>x^2$ critical value or p-value < significant level.

If the normality distribution test ultimately is rejecting for null hypothesis then we will have to proceed to model setting process to change our model to be VAR model to overcome the spurious result of normality distribution testing.

3.9.2 Autocorrelation

Basically autocorrelation can be simply defined as the cross-correlation between the variables which have a time lag between each other. Breusch-Godfrey serial correlation LM test will be assisting us to detect the autocorrelation problem in our model by Eview software and is useful to figure out whether the independent variable included lags of the dependent variable or not (Godfrey, 1978 & Godfrey, 1996).

$$u_{t=P_1U_{t-1}+P_2U_{t-2}+\cdots+P_pU_{t-p}+E_t}$$

Ordinary residual model

However, we will be involving to change the ordinary residual model follow with autoregressive scheme to an auxiliary regression.

$$U_t = \alpha_0 + \alpha_1 X_{t,1} + \alpha_2 X_{t,2} + p_1 U_{t-1} + p_2 U_{t-2} + \cdots + p_p U_{t-p} + \varepsilon_t$$

Transformation to Auxiliary regression model

Eview will come out with the result and test when the probability of the Breusch-Godfrey LM test at chi-sqaure result lower then alpha significant level then the null hypothesis will be rejected as the null hypothesis is set for no autocorrelation. The result of the testing will be persuasive then using Durbin-watson test statistic or other autocorrelation method of testing this is because Breusch-Godfrey LM take the residual of each variables from the model to take in to consideration on the regression and the test statistic result will be derived from the regression and is different from Durbin–Watson statistic nor Durbin's h statistic just only be valid for testing the result with non-stochastic independent variables and just only for the first-order autoregressive model.

3.9.3 Heteroscedasticity

Incurring of heteroscedasticity is because of the variance of the disturbance is inconsistent across the independent variables. However, it is a problem common in a series of cross sectional data (Gujarati & Porter, 2009). Furthermore, there are several methods of testing to detect heteroscedasticity which are ARCH test, White test, Glejser and so on. The reason that we are using the ARCH test to detect the heteroscedasticity is due to ARCH test considered stochastic volatility to be in the models according to Engle, Robert, Granger, Clive (1987). The hypothesis testing assumes that there is no autocorrelation problem as null hypothesis therefore when result P-value of chi-square or F-statistics is below the alpha significant level we reject the null hypothesis.

3.10 Empirical Framework

We will examine how foreign direct investment, inflation, exchange rate, and education expenditure in Finland from year 1980 to year 2012 will affect the labor productivity in Finland with the VAR model below.

VAR Model

$$LP_t = \alpha_0 + \alpha_1 LP_{t-1} + \alpha_2 EXC_{t-1} + \alpha_3 FDI_{t-1} + \alpha_4 INF_{t-1} + \alpha_5 EDUt_{-1}$$

Where,

LP	= GDP per hour worked in Finland
EXC	= exchange rate in Finland
FDI	= net foreign direct investment in Finland (in Billion USD)
INF	= inflation rate in Finland
EDU	= education expenditure in Finland (in Billion USD)

If we find out that the variables have a unit root in our model, and reach stationary at the same difference level as well as there is cointegrating vector between variables in our model, we need to change to use VECM model to capture long run equilibrium relationship.

VECM Model

$$\Delta LP_t = \alpha_0 + \alpha_1 \Delta LP_{t-1} + \alpha_2 \Delta EXC_{t-1} + \alpha_3 \Delta FDI_{t-1} + \alpha_4 \Delta INF_{t-1} + \alpha_5 \Delta EDU_{t-1} + ECT_{t-1}$$

Where, ECT is the error correction terms in the model.

3.11 Conclusion

In conclusion, this chapter has discussed the methodologies we will be carried out for testing, checking and analysing in our research. Eventually, the test statistics result of our research will be analysed systematically and explained in detail systematically in the following chapter.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

In chapter 4, we will be running out the hypothesis testing then to interpret the coefficient result with the negative or positive sign, analyses the empirical result whether is significant to the level of 1%, 5% and 10% while p-value is out of the significant level the rejection of the testing will be applied.

There is several of empirical testing being tested in the model such as unit root test, cointegration test, granger causality test, impulse response test.

Furthermore, we will emphasize on the empirical result of the relationship between labor productivity, real exchange rate, inflation and unemployment.

Besides, we will be using several tests for fix and fulfill the requirement in the model that we chose therefore we will run unit root test to test the stationery of all the variables in the model, diagnostic checking on autocorrelation, heteroscedasticityand normality distribution.

Meanwhile, the cointergration testing will enable us to the long-run relationship or short-run relationship towards among the variables.

Also, we will be testing for the stationary for the variables in the model which to avoid the historical effect or trend on the variables bring forward to the result to alter the result to be inefficient and unconvincing.

4.1 Unit root test

Table4.1: Stationary test for all variables – I (0)

Details	in Level – I (0)			
Variables	Constant with Trend		Constant without Trend	
	ADF	PP	ADF	PP
Labor productivity	-0.952465	-1.130167	-0.999891	0.973671
	(0.9368)	(0.9078)	(0.7413)	(0.7506)
Foreign direct	-4.013691**	-4.014815**	-4.017864***	-4.015192***
investment	(0.0184)	(0.0183)	(0.0040)	(0.0040)
Inflation	-2.155126	-1.795783	-2.726084*	-3.481313**
	(0.4971)	(0.6832)	(0.0808)	(0.0152)
Exchange rate	-2.859261	-2.856117	-0.980878	-0.926102
	(0.1882)	(0.1892)	(0.7480)	(0.7667)
Education	-1.721595	-1.920719	0.148247	0.148247
expenditure	(0.7181)	(0.6205)	(0.9646)	(0.9646)

Table 4.2: Stationary test for all variables – I (1)

Details	In First difference – I (1)			
Variables	Constant with Trend		Constant without Trend	
	ADF	PP	ADF	PP
Labor productivity	-4.665615***	-4.763823***	-4.680846***	-4.695507***
	(0.0042)	(0.0031)	(0.0007)	(0.0007)
Foreign direct	-7.647441***	-12.51020***	-7.782920***	-12.82264***
investment	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation	-4.426483***	-7.135545***	-5.251023***	-5.242689***
	(0.0098)	(0.0000)	(0.0002)	(0.0002)
Exchange rate	-5.267915***	-5.766052***	-5.342068***	-5.832374***
	(0.0009)	(0.0003)	(0.0001)	(0.0000)
Education	-3.769700**	-3.618669**	-3.885898***	-3.758349***
expenditure	(0.0322)	(0.0445)	(0.0057)	(0.0079)

Note: *, **, *** denotes that reject the null hypothesis at the level of significance of 10%, 5%, and 1% respectively.

H_0: There is a unit root in the variable.

H_1: There is no unit root in the variable.

Although we show the result of ADF test and PP test with trend and without trend in level form and first difference in table 4.1 and 4.2, only the test results with trend in level form and without trend in first difference are our main concerns in the interpretation of unit root test. This is due to most of the time

series variables have trend within itself in level form. Besides, time series variables' trend will be removed after first differencing according to what we have learned in Time Series Analysis class. Therefore, after first differencing, time series variables will no longer have trend within itself.

Table 4.1 shows the unit root test result in level form of the variables in our model. From the test result, most of time series variables that we used in our research have a unit root in level form after tested by ADF test and PP test which indicates that non-stationary in level form at 10%, 5% and 1% significant level Foreign direct investment is only stationary at 5% and 10 % significant level in level form but not stationary at 1% significant level. Our aim to achieve all 10%, 5% and 1% significant level to ensure our unit root test result are precise while FDI in level form does not fulfill this condition. Therefore, we proceed to another unit root testing in first difference form in order to check for stationary and presence of unit root.

Table 4.2 shows the unit root test result in first difference form of the variables in our model. From the test result, all of time series variables that we used in our research do not have a unit root in first difference after tested by ADF test and PP test which indicates the variables achieve stationary in first difference at all significant level which are 10%, 5% and 1%. This result shows that all variables in our model achieved stationary at the first difference. Therefore, we can conclude that all variables in our model are stationary in the first difference form and thus we proceed to cointegration test analysis.

4.2 Cointegration analysis

4.2.1 Johansen and Juselius cointegration test

Table 4.3: Result of Johansen and Juseliuscointegration test			
Null hypothesis	Alternative hypothesis	Trace Statistic	Critical value 0.01
r = 0	r > 1	115.2197***	77.81884
r ≤ 1	r > 2	48.52511	54.68150
r ≤ 2	r > 3	26.83527	35.45817
r ≤ 3	r > 4	13.33255	19.93711
r ≤ 4	r > 5	4.122962	6.634897
Null hypothesis	Alternative hypothesis	Maximum Eigen Statistic	Critical value 0.01
r = 0	r = 1	66.69463***	39.37013
r = 1	r = 2	21.68983	32.71527
r = 2	r = 3	13.50273	25.86121
r = 3	r = 4	9.209584	18.52001
r = 4	r = 5	4.122962	6.634897

*** indicates that reject H_0 at critical value of 0.01.

Note: r indicates the number of cointegration in the model

H_0: There is no long run equilibrium relationship between the time series variables.

$H_{1:}$ There is long run equilibrium relationship between the time series variables.

Table 4.3 shows the JJ test result for our model to checking for presence of cointegrated vector. When the test statistic is greater than critical value, then we need to reject H_0 which represents there is long run equilibrium relationship in our model.

From the JJ test result, H_0 is only rejected once for both trace test and maximum eigenvalue test which indicates that there is only one cointegrating vector in the model. Once the H_0 of r=1 do not reject, the H_0 of subsequent number of cointegration does not need to interpret due to the number of cointegrating vector had been confirmed from the acceptance of H_0. From the JJ test result, we can conclude that there is a long run equilibrium relationship between the time series variables in our model. We are no longer can use VAR model to estimate our variables, we must proceed to use Vector Error Correction Model since there are long run equilibrium relationship in our model.

4.3 Lag Length Selection

Table 4.4: Lag Length Criterion

Lag Length	AIC	SIC
0	29.84601	30.08391*
1	29.71461	31.14197
2	30.27787	32.89470
3	28.94478	32.75108
4	26.83284*	31.82861

Source:Eviews 6.0

*indicates lag order selected by the criterion

AIC: Akaike Information Criterion

SIC: Schwarz Information Criterion

Table 4.4 shows the result of optimum lag length selection criteria by using AIC and SIC. In our research, we emphasize the result of SIC in order to estimate VECM because SIC always underestimates the lag length in the lag length selection process. Since we are using small sample size, SIC underestimation may avoid the model from the problem of loss of information.

From the Table 4.4, the lag length selected by SIC is 0. Since we are choosing VECM, lag will always be involved in our model. Therefore, we decide to use the second minimum SIC lag order which is 1 in our model.

4.4 Vector Error Correction Model

$$\Delta LP_t = 0.723135 - 0.020736\Delta LP_{t-1} + 0.093712\Delta EXC_{t-1} + 0.012055\Delta FDI_{t-1}$$
$$(0.0000) \quad (0.8585) \quad (0.1003) \quad (0.3248)$$
$$+ 0.069324\Delta INF_{t-1} - 0.391948\Delta EDU_{t-1} - 0.151059$$
$$(0.1406) \quad (0.0000) \quad (0.0000)$$

Where,

ΔLP = first difference of GDP per hour worked in Finland

ΔEXC = first difference of exchange rate in Finland

ΔFDI = first difference of net foreign direct investment in Finland (in BillionUSD)

ΔINF = first difference of inflation rate in Finland

ΔEDU = first difference of education expenditure in Finland (in Billion USD)

( ) represents p-value

After ensuring all variables in the model are I (1) and cointegrated, a VECM with a cointegrating vector and a lag in a model has been estimated. VECM allows the long run behavior of independent variables to adjust to their long run equilibrium relationship with allowing short run dynamics at the same time. Therefore, the coefficient of error correction term in the model will be our main concern for interpretation.

The error correction term in our model is statistically significant at 1 percent of confidence level and showing negative sign. This shows that our model adjusts 15.1059% annually of short run dynamics between dependent variables and independent variables to achieve long run equilibrium relationship. This indicates that the speed of adjustment of our model is quite slow due to take more than 6 years to fully adjust.

4.5 Diagnostic checking

Table 4.5: Result of Diagnostic Checking

	Model 1
R- Square	0.801976
Durbin-Watson stat	2.245560
Prob (F-stat)	0.0000
Breusch-Godfrey LM Test	0.3274

Heteroskedasticity	0.2688
ARCH Test	
Jarque-Bera	1.281320
(Normality Test)	
Probability	0.526944

Note *, **, *** denotes that reject the null hypothesis at the level of 10%, 5% and 1% respectively.

4.5.1 Autocorrelation

Note: p indicates the number of lags of the error term

H_0 : There is no serial correlation of any order up to p.

H_1 : There is serial correlation of any order up to p.

After using Breusch-Godfrey Serial Correlation LM test, we generate the result at p-value 0.3274 is lower than the significant level 0.1, 0.05, 0.01 therefore we do not reject the null hypothesis which indicates that the model has not occurred serial correlation between the observations over the time.

4.5.2 Heteroscedasticity

H_0 : There is no heteroscedasticity problem

H_1 : There is heteroscedasticity problem.

Running out the ARCH test we have discovered that the result determine there is no heteroscedasticity problem in the model where the p-value 0.2688 is lower than the significant level 0.1, 0.05, 0.01 therefore do not reject null hypothesis. Gujarati& Porter (2009) also mentioned that variance of the random variables have same variability is the presence of homoscedasticity.

There are several tests can be used in identifying heteroscedasticity however we chose to use ARCH test it is due to (Engle, Robert, Granger, Clive, 1987) stated that autoregressive conditional heteroscedasticity (ARCH) models are used to characterize and model observed time series.

4.5.3 Normality distribution

H_0 : Error term is normally distributed

H_1 : Error term is not normally distributed

For testing normality distribution, we used Jarque-Bera test to determine whether the model is normality distribution otherwise the model is not goodness of fit to the data. As the result of p-value 0.526944 shows lower than the significant level 0.1, 0.05, 0.01 therefore we do not reject null hypothesis.

4.6 Spurious result R^2> DW

As the empirical result show that the model has high R^2 which can be explained the explanatory variables is well fit in to the model corresponding to explained variable. The R^2 is the model is 0.801976. However, R^2 high doesn't mean that the empirical result towards the model is necessarily to be goodness therefore we have to inspect that the R^2> DW, 0.801976 > 2.245560 so it shows that the model doesn't occur autocorrelation and the result is not spurious.

4.7 Pairwise Granger causality test

Table 4.6Result of Granger Causality Test

Dependent variables, Y / Independent variables, X	LP	FDI	INF	EXR	EDU
LP		0.2955	0.3541	0.2442	0.0542*
FDI	0.0024***		0.0245**	0.4705	0.2507
INF	0.0116**	0.3785		0.6581	0.8915
EXR	0.5908	0.0453**	0.0204**		0.6570
EDU	0.0052***	0.4587	0.4654	0.7597	

Note: *, **, *** denotes that reject the null hypothesis at the level of significance of 10%, 5%, and 1% respectively.

H_0: X does not Granger Cause Y in short run.

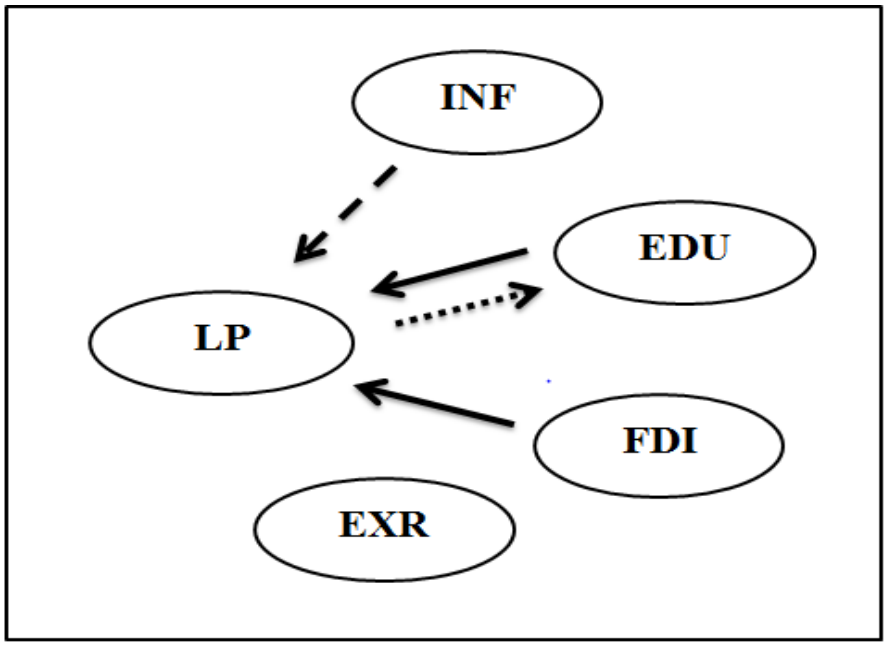
$H_{1:}$ X Granger Cause Y in short run.

Table 4.6 shows the Granger Causality test result for the variables in the model. Granger Causality test able to capture the direction of relationship between two variables. Therefore, we focus on the direction of relationship between independent variables and dependent variables. We are using stationary data in Granger Causality test due to short run model requirement.

From the result, all variables except exchange rate and inflation rate are Granger Cause labor productivity in Finland at 1%, 5% and 10% of significance level. Inflation rate is only Granger Cause labor productivity in Finland at 5% and 10% of significance level while exchange rate does not Granger Cause labor productivity in Finland at 1%, 5% and 10% of significance level.

Besides, labor productivity in Finland is only Granger Cause education expenditure in Finland at 10% of significance level. Except education expenditure, labor productivity does not Granger Cause exchange rate, inflation rate, foreign direct investment in Finland at 1%, 5% and 10% of significance level.

Figure 4.1: Granger causality between variables



Note:

Granger cause at 10% significance level

Granger cause at 5% and 10% significance level

Granger cause at 1%, 5% and 10% significance level

Where,

LP = GDP per hour worked in Finland

EXC = exchange rate in Finland

FDI = net foreign direct investment in Finland (in Billion USD)

INF = inflation rate in Finland

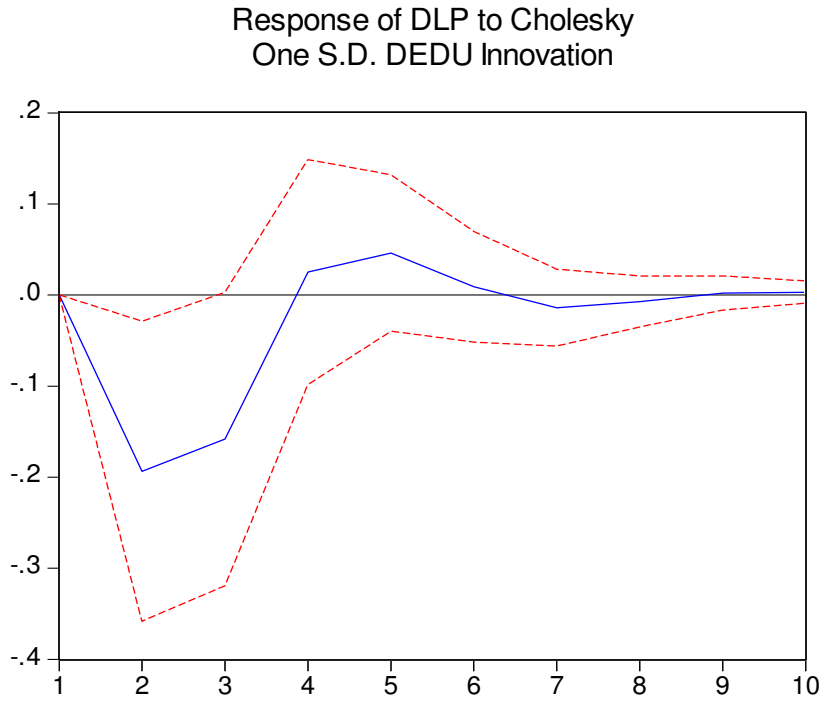
EDU = education expenditure in Finland (in Billion USD)

Therefore, we can conclude that labor productivity has bidirectional relationship with education expenditure only. Besides, labor productivity has unidirectional relationship with inflation rate and foreign direct investment. Lastly, labor productivity has no relationship with exchange rate. Since granger causality test only provide the direction of relationship, we need to proceed to impulse response function analysis and variance decomposition analysis to identify the magnitude of impact between the relationships.

4.8 Impulse Response Function Analysis

4.8.1 Response of LP to EDU

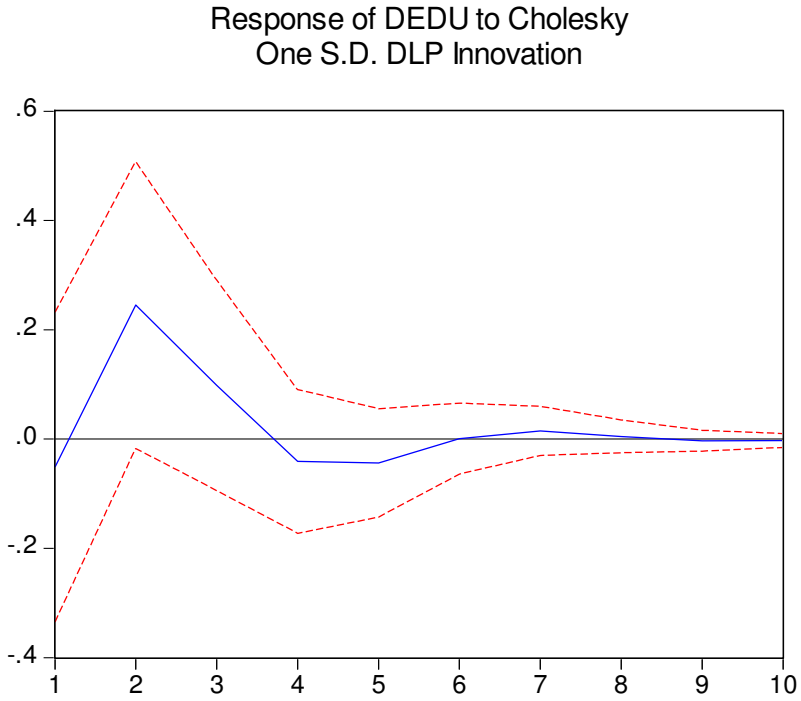
Figure 4.2: Impulse Response of LP to EDU



The figure 4.2 shows the impulse responsive analysis for education expenditure and labor productivity in Finland. The response of labor productivity due to a shock of education expenditure is fluctuating and minimizing towards the end of the periods. The response of labor productivity begins with a negative response and has minimal effects in the end of the period to education expenditure shock. We can conclude that the effect of education expenditure to labor productivity is negative first and continuously fluctuating over the period before reaching minimal effect.

4.8.2 Response of EDU to LP

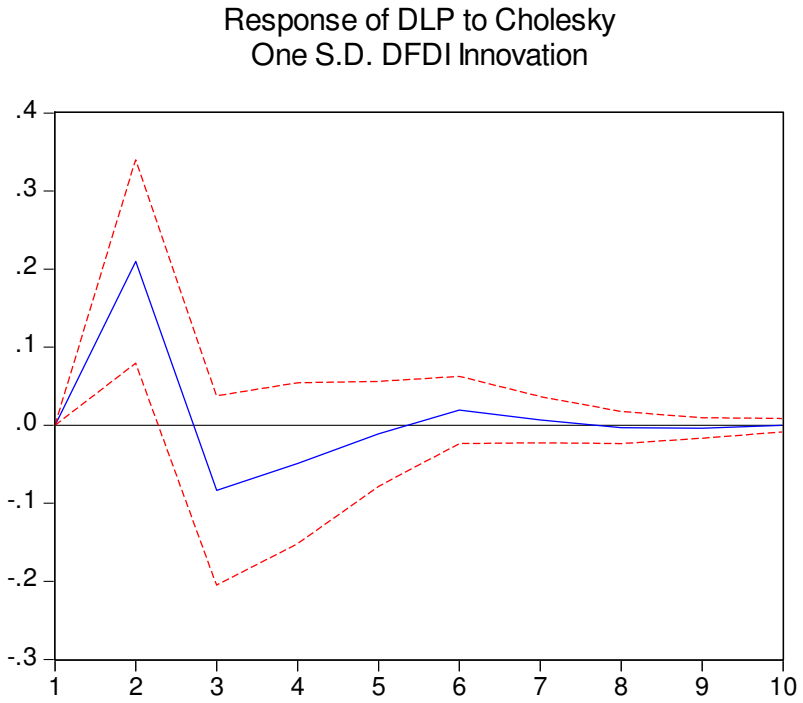
Figure 4.3: Impulse Response of EDU to LP



The figure 4.3 shows the impulse responsive analysis for education expenditure and labor productivity in Finland. The response of education expenditure due to a shock of labor productivity is fluctuating and minimizing towards the end of the periods. The response of education expenditure begins with a positive response and has minimal effects in the end of the period to labor productivity shock. We can conclude that the effect of labor productivity to education expenditure is positive first and continuously fluctuating over the period before reaching minimal effect.

4.8.3 Response of LP to FDI

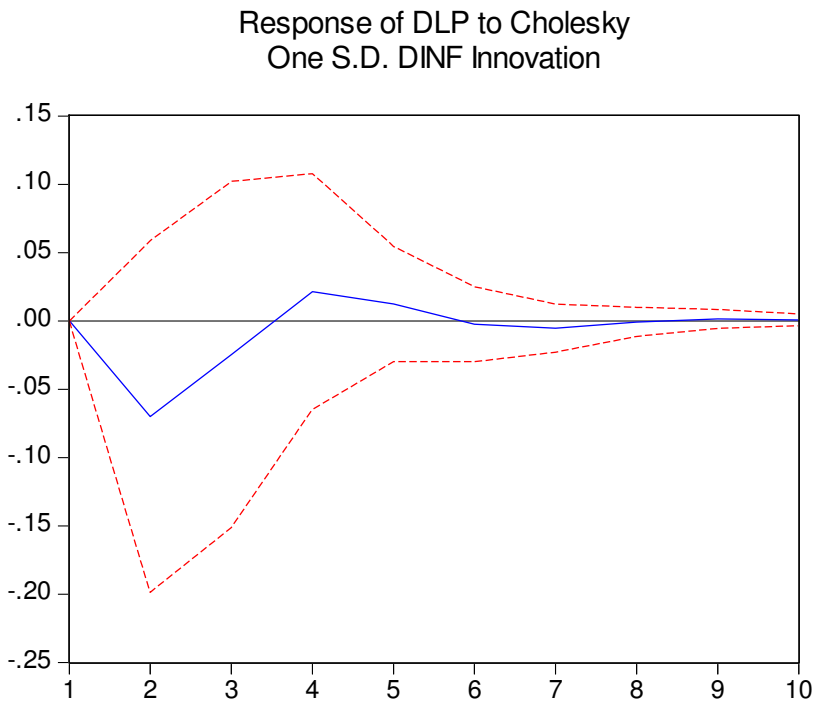
Figure 4.4: Impulse Response of LP to FDI



The figure 4.4 shows the impulse responsive analysis for foreign direct investment and labor productivity in Finland. The response of labor productivity due to a shock of foreign direct investment is fluctuating and minimizing towards the end of the periods. The response of labor productivity begins with a positive response and has minimal effects in the end of the period to foreign direct investment shock. We can conclude that the effect of foreign direct investment to labor productivity is positive first and continuously fluctuating over the period before reaching minimal effect.

4.8.4 Response of LP to INF

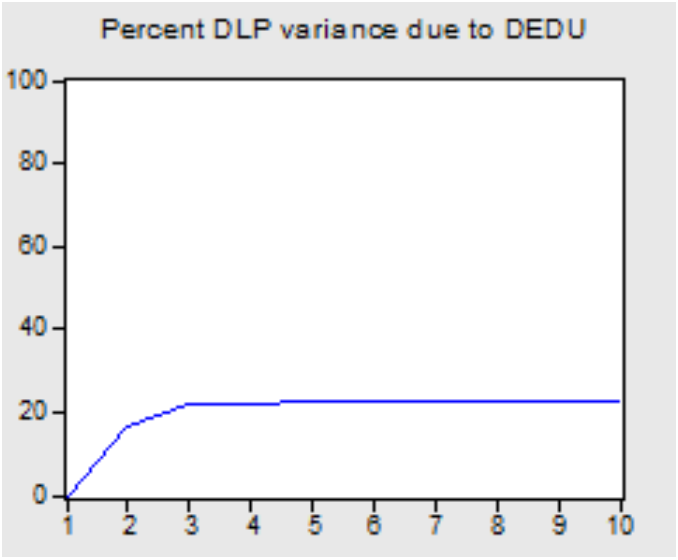
Figure 4.5: Impulse Response of LP to INF



The figure 4.5 shows the impulse responsive analysis for inflation rate and labor productivity in Finland. The response of labor productivity due to a shock of inflation rate is fluctuating and minimizing towards the end of the periods. The response of labor productivity begins with a negative response and has minimal effects in the end of the period to inflation rate shock. We can conclude that the effect of inflation rate to labor productivity is negative first and continuously fluctuating over the period before reaching minimal effect.

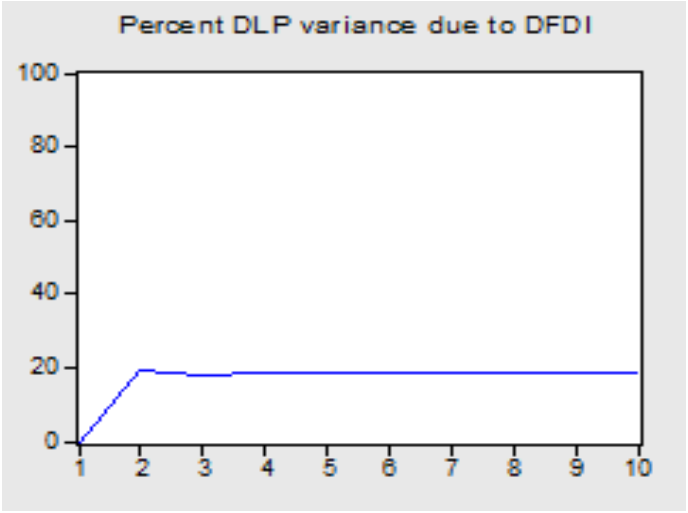
4.9 Variance Decomposition Analysis

Figure 4.6: Variance Decomposition of LP with EDU



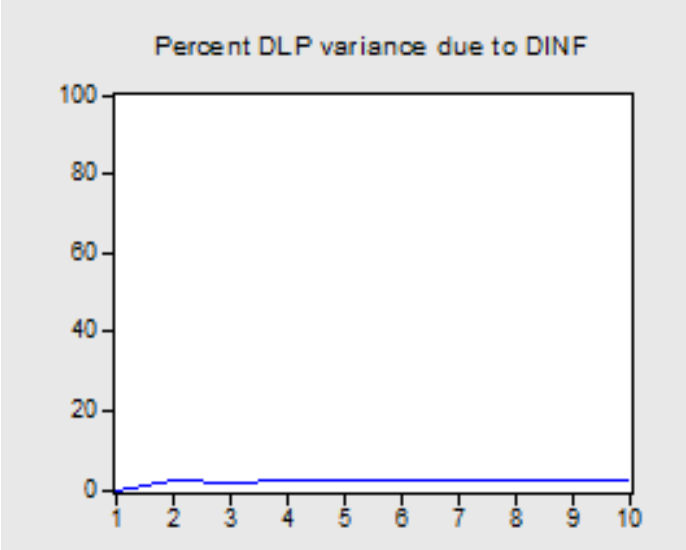
The figure 4.6 shows that variance decomposition analysis between the labor productivity and education expenditure in Finland. The variance decomposition of labor productivity due to education expenditure is sharply increasing until around 20% at the third period and remaining constant around 20% for the rest of the period. This shows that labor productivity is greatly affected by education expenditure in short run.

Figure 4.7: Variance Decomposition of LP with FDI



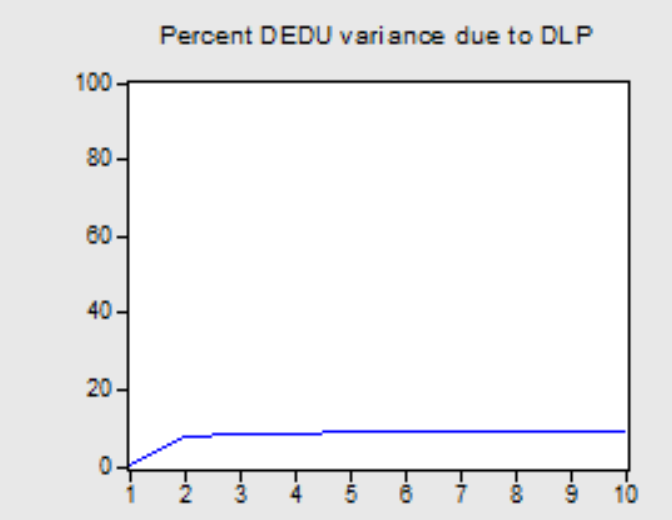
The figure 4.7 shows that variance decomposition analysis between the labor productivity and foreign direct investment in Finland. The variance decomposition of labor productivity due to foreign direct investment is sharply increasing until around 20% at the second period and remaining constant around 20% for the rest of the period. This shows that labor productivity is greatly affected by foreign direct investment in the short run.

Figure 4.8: Variance Decomposition of LP with INF



The figure 4.8 shows that variance decomposition analysis between the labor productivity and inflation rate in Finland. The variance decomposition of labor productivity due to inflation rate is slightly increasing until the third period and remaining constant for the rest of the period. This shows that labor productivity is insignificantly affected by inflation rate in short run.

Figure 4.9: Variance Decomposition of EDU with LP



The figure 4.9 shows that variance decomposition analysis between the labor productivity and educational expenditure in Finland. The variance decomposition of education expenditure due to labor productivity is increasing until around 9% at the fourth period and remaining constant around 9% for the rest of the period. This shows that educational expenditure is slightly affected by labor productivity in short run.

We can conclude that only education expenditure and foreign direct investment are greatly affecting the labor productivity in Finland in short run. The effect of inflation rate towards labor productivity is insignificant because merely 2% of variance decomposition of labor productivity is due to inflation rate in Finland. Besides, the effect of labor productivity on education expenditure in Finland is significant because around 10% of variance decomposition of education expenditure in Finland due to labor productivity.

4.10 Conclusion

In chapter 4, we have interpreted the result of unit root test, cointegration test, granger causality test, diagnostic checking, and impulse response function and variance decomposition. After the interpretation, we found out that the variables that we used have unit root in level form but stationary in first difference. There is also a cointegrating vector in our model which indicates that we are no longer allowed to use VAR model to estimate the time series variables. Therefore, we conduct VECM in our research. After the diagnostic checking, we conclude that no autocorrelation and heteroskedascity problems in our model. The error terms in our model is also normally distributed. Besides, labor productivity and education expenditure has bidirectional relationship while labor productivity is unidirectional affected by inflation rate and foreign direction investment in Finland.

We will conclude our whole research in the next chapter which including our major finding from the research, policy implication, limitation of our study and recommendation for future research.

Chapter 5: Conclusion

5.0 Introduction

This section focused on the evaluation of some major findings in the research paper and some policy implication for the labor productivity of Finland through different factors which are inflation, foreign direct investment (FDI), human capital and exchange rate. Besides, some limitations occurred in this research paper will be highlighted and recommendation will be provided for future research.

5.1 Summary of Statistical Analyses

As generating empirical result from the data availability we have to make sure the results that are avoided from any econometrical problems. After checking our model has clear from autocorrelation and heteroscedasticity problem tested by Breusch-Godfrey Serial Correlation LM test and ARCH test respectively, lastly we use Jarque-Bera test to testing the normality distribution in our VECM model. Since there is no every variable in our model is stationary in level form therefore we have to use unit root test to test for the stationary of the variable.

After testing, we have found that inflation rate, education expenditure and exchange rate in the model are not stationary in level form at significance

level of 1%, 5% and 10%and FDI is not stationary at significance level at 1%. But, all variables will be stationary at first difference with same order form. Due to there are same order between all the variables thus we proceed to cointegration testing to identify whether our model has short run relationship effect or long run relationship effect. The empirical result shows that we have a long run equilibrium relationship between labor productivity to exchange rate, foreign direct investment, education expenditures and inflation rate. Through the result we can determine that our model is affected by the long run equilibrium relationship and we will be using VECM model instead of VAR model which is used for short run effect.

However, there is a long run relationship and there must be short run relationship between the variables so granger causality testing will be applied to determine the short run causes between labor productivity to exchange rate, foreign direct investment, education expenditures and inflation rate and granger causality testing the result will also show is there unidirectional or bidirectional causal. We have found that there is a bidirectional causal between labor productivity to education expenditures at significant level 10%, 5%, and 1% and two unidirectional causal which is between foreign direct investment to labor productivity at significant level 10%, 5%, and 1% and inflation to labor productivity at significant level 10%, and 5% only.

5.2 Discussion of Major Findings

The objective we conduct this research is to determine the impact of the macroeconomic variables on the labor productivity in Finland. In other words, we aimed to find out the determinants that affect the labor productivity growth in Finland. The determinants we choose in our research are FDI, inflation rate, exchange rate and human capital.

In order to examine the relationship between the labor productivity and other independent variables in short run, we decided to conduct the Pairwise Granger causality test. From the result obtained, we found that inflation rate, education expenditure and foreign direct investment granger cause the labor productivity while labor productivity only granger causes the education expenditure. The relationships of FDI, inflation and education expenditure on labor productivity are supported by different researchers in Chapter 2. Indeed, we found that exchange rate does not granger cause labor productivity and labor productivity does not granger cause exchange rate as well, which implied that there is no relationship between exchange rate and labor productivity. The result is inconsistent with our hypotheses.This might be caused by the structural break in exchange rate of Finland during year 1999 due to Finland joined European Union and used currency euro but meanwhile labor productivity in Finland still remain increasing. The exchange rate become stable after this event however the labor productivity still shows changes in increasing trend. The labor productivity seems to be not affected by the change in the exchange rate. Besides, according to Harris (2001), the appreciation of the currency tends to increase the labor productivity through the international market such as import and export. Indeed, the export and import activities of Finland decreased since year 2008 (TulliTiedottaa, 2014). This indicated that the international trade with the foreign countries and firms decreased. When there is less foreign market, the exchange rate become insignificant to the labor productivity in Finland.

Moreover, we conducted the impulse response function analysis to analyze the direction of impact of independent variables on the dependent variable in our model. In the analysis of impulse response function, we found that the response of labor productivity towards the education expenditure is negative in the first four periods and fluctuated in the further period and become minimal effects in the end. This result is against with our hypothesis. But, the negative relationship is consistent with the study of Su &Heshmati (2011) and Nurudeen&Usman (2010) as they explained that the negative relationship is caused by the inefficient utilization of the public spending on education in suitable areas. Although our hypothesis is the human capital impact the labor productivity positively, however,

we have to consider that the higher education expenditure in Finland will also lead to more educated citizens and these highly educated people might migrate to other more developed countries such as United States since Finland is a relatively small country. They might migrate to other countries to seek for higher income and more opportunities therefore the labor productivity in Finland will decline due to loss of educated and skilled labors. Besides, in our research, we measured our human capital by using the proxy, education expenditure. Thus, this might lead to a different result as human capital considered many other variables as well such as educational level, training and skills. Hence, we found a negative relationship between human capitals which measure by educational expenditure and the labor productivity.

For the variables between FDI and labor productivity, the impulse response function analysis showed that FDI has a positive impact to the labor productivity in the first two periods and started to have negative impact after two periods and turned to minimal effects near the end of period. This result is consistent with our hypothesis. The positive relationship can be explained by the FDI inflows tends to increase the capital and technology advancement of the country as stated in study of Ramirez (2006) and Arbache (2004). However, FDI impact the labor productivity for few periods only as shown in impulse response function and become insignificant. This evidence might due to FDI is more significant and positively impact the productivity in developing countries as the developing countries needed a higher capital and financing funds to invest in their activities compared to developed countries (IMF, 1999).

Besides, the impulse response analysis also showed that there is negative impact of inflation towards the labor productivity at the beginning period and started to fluctuate. The impact of inflation becomes lesser when the time period increased. This result is consistent with our hypothesis as well. The negative relationship between inflation and labor productivity in Finland is supported by the research of Freeman and Yerger (2000). In other words, when inflation increased in Finland, the interest rates will increase which tends to decrease the consumption rate and the labor productivity of Finland decreased. But this relationship will only hold for few periods and inflation will become insignificant

towards labor productivity and this might due to the policies implemented by the federal to maintain the inflation rate in the country.

Finally, we proceeded to the variance decomposition to determine the effect of the independent variables on the dependent variable. From the result obtained, we found that the education expenditure and FDI affect the labor productivity significantly in the short run. However, inflation has lower significant effect towards the labor productivity in short run which showed by the lower variance decomposition of labor productivity.

In short, we concluded that FDI has positive relationship with labor productivity but inflation rate and human capital which measured by education expenditure has negative impact on labor productivity in Finland. While, we also found that there is no relationship between exchange rate and labor productivity in Finland. In fact, we have fulfilled our objectives to determine the relationship between the variables and study the impact of FDI, inflation rate, human capital and exchange rate on the labor productivity in Finland. This research is helpful as it identified the factors that might influence the labor productivity of Finland and thus the authorized parties able to implement policies and improve the labor productivity growth in Finland as well as other nations.

5.3 Implication of the Study

Foreign Direct Investment (FDI) is one of the determinants in affecting the labor productivity in our research. The positive relationship between FDI and labor productivity are found in our model. In other words, increased of FDI will increase the labor productivity in the economy. Based on the study (Bellak, Leibrecht&Stehrer, 2008), government should increase the expenditure on the research and development process in order to improve the quality of the inputs

such as labors and capital to increase the potentiality of higher production and thus able to attract more foreign firms to invest in the country. Moreover, government should implement more internationalization program in the financial market in order to communicate with foreign investors or firms who finally contributed to the increment of FDI inflows to the country (The Research and Innovation Council of Finland, 2010). In addition, government should implement the strategy clearly towards the FDI attractiveness in the domestic market such as encouraged the import and export activity in order to increase the inflow of foreign investment (Vaisanen, 2012).

The other variable which expected to have a negative impact on the labor productivity is inflation rate. Thus, government should implement the price stability policy in the country to maintain the inflation rate in order to prevent the hyperinflation and deflation happened in the economy. Based on SuomenPankki (n. d.), government should ensure the price level in the country are controllable through the monetary policy by central bank. Money supply is the determinant of the price stability. Hence, government and central bank played an important role to enhance the price stability in the country. For instances, central bank should control the money supply through different ways such as open market operations, minimum reserve requirements and standing facilities (European Central Bank, n.d.). In fact, central bank should have a proper planning based on the money market and economic conditions to ensure the operation of money market functioned smoothly and promote the price stability (European Central Bank, n.d.).

Based on our empirical result, human capital which measured by the government expenditure on education are found negatively impact the labor productivity in our model as well. This probably due to the inefficient utilization of public spending on education in Finland and thus produce a negative relationship. Indeed, the educational expenditure is one of the important investment in human capital to increase the growth of labor productivity when these public spending are utilized fully and effectively on educational sectors (O.Odior, 2011). Indeed, government should allocate the capital and funds efficiently and appropriately in different sectors which included the education system. Besides, the government spending on education should be financed for the

groups who truly needed the financial support on the education system in order to improve the education quality (O.Odior, 2011).When the government spending on education increase in the institutions which will potentially increase the education level in economy are provided with sufficient financial support, the education level in the country could be improved and thus enhancing the labor productivity (The Research and Innovation Council of Finland, 2010). In addition, training and education level is the investment of human capital as well although these variables are not included in our model as a proxy of human capital. According to OECD (2004), government should increase the training and education level of the labors by designing suitable training programs and encouraging the researches and development in the education system, hence more educated and skilled labors in the economy to improve the labor productivity.

5.4 Limitation of the Study

Every researcher will found the limitation of the study after they do the empirical framework. Thus, there have some limitations found in our study as expected. The model that use by us does not included the structural break. Structural break occurs when there have the unexpected move or change in a time series. This structural break helps us to capture and forecast the errors in the model (Hyndman, 2014). When our model does not included the structural break in our empirical framework, we are unable to capture when the Finland use the euro currency, when the crisis happen in the Finland and many others. Besides, we also cannot compare the past and current issue of Finland through our model. This limitation will lead our model become unspecific.

Due to unavailability of data for longer period, the sample size that we use in the model is small and this becomes the limitation in our study. When the sample size use in the model is small, the model has higher chance to be

inaccurate. This is because small sample size will lead to less information in our regression and diagnostic checking result may not be so accurate. This will lead to the model become less specific and misleading.

In addition, we are unable to capture the data sources for one of the independent variables – human capital in our model. Thus we use the education expenditure as the proxy to run the test. This lead to the limitation occurs in our model because the human capital is not only include the education expenditure but it may include many others variables such as experience, ability, etc. The proxy that we used for human capital is merely focus on the education expenditure.

5.5 Recommendation for Future Research

Since our study has some limitation, so we having so recommendation and suggestion for future researcher in this study. At the first, we suggest that the model to include the structural break in the model. It is because the structural break helps to forecast and identify the changes or movement in the time series. This can help the model become more specific and the empirical result become more accurate.

Other than that, the sample size that used in the model should be larger. We suggest future researchers to use monthly data or quarterly data to conduct their researches. It is because the larger the sample size, the result that generated from the model will provide more information and more accurate result.

Moreover, we recommended that future researchers may try to obtain other data for human capital as much as possible such as literacy rate and school enrollment to be the proxies to enhance the result effectiveness. Human capital not only included the education expenditure but many other elements as well, so the result will be more effective when we study the relationship between human capital and labor productivity.

REFERENCES

Arbache, J. S. (2004). The impacts of foreign direct investments on the labor market in brazil.

Afrooz, A. (2010). Human capital and labor productivity in food industries of iran.*International Journal of Economics and Finance, 2(4)*

Aggrey, N., Eliab, L. & Joseph, S. (2010). Human capital and labor productivity in east african manufacturing firms. *Current Research Journal of Economic Theory, 2(2),* 48-54.

Arvanitis, S &Loukis, E. N. (2009).Information and communication technologies, human capital, workplace organization and labour productivity: A comparative studybased on firm-level data for Greece and Switzerland. *Information Economics and Policy, 21,* 43–61

Bellak, C., Leibrecht, M. &Stehrer, R. (2008).*Policies to attract foreign direct investment: an industry-level analysis* .Retreived from http://www.oecd.org/investment/globalforum/40301081.pdf

Bulman, T., & Simon, J. (2003). PRODUCTIVITY AND INFLATION . *Research Discussion Paper*.

Caglayan, M. &Demir, F. (2014). Firm productivity, exchange rate movements, sources of finance, and export orientation. *World Development, 54*, 204-219.

Cameron, S. (2005). *Econometrics.* Berkshire: McGraw-Hill Education.

Cheng,L.K., &Kwan,Y.K. (2000). What are the determinants of the location of foreign direct investment? The Chinese experience. Journal of International Economics, 379-400.

Corvers, F. (1996).The impact of human capital on labour productivity in manufacturing sectors of the European Union. *ROA-RM-1996/2E.*

Ekholm, K., Moxnes, A. &Ulltveiit-Moe, K. H. (2009).Manufacturing restructuring and the role of real exchange rate shocks. *CEPR DP, 6904.*

Enders, W. (1995).Applied econometric time series.*John Wiley & Sons*, 86-87

Engle, Robert F., Granger, Clive W. J. (1987). Co-integration and error correction: Representation, estimation and testing. *Econometrica 55(2),* 251–276.

Escosura, L. P. & Rosés, J. R. (2010).Human capital and economic growth in Spain, 1850–2000.*Explorations in Economic History, 47,* 520–532

European Central Bank. (n.d.).*Monetary policy.* Retrieved from https://www.ecb.europa.eu/mopo/implement/sf/html/index.en.html

European Commission.(2010). *Efficiency and effectiveness of public expenditure on tertiary education in the EU.*Retrieved from *http://ec.europa.eu/economy_finance/publications/occasional_paper/2010/pdf/ocp70_en.pdf*

European Commission.(2011). *Finland and the euro.* Retrieved from http://ec.europa.eu/economy_finance/euro/countries/finland_en.htm

European commission.(2009). *Impact of the current economic and financial crisis on potential output.* Retrieved from http://ec.europa.eu/economy_finance/publications/publication15479_en.pdf

European commission.(2013). *Labour market developments in Europe 2013.*Retrieved from http://ec.europa.eu/economy_finance/publications/european_economy/2013/pdf/ee6_en.pdf

European commission.(2009). *What explains the differences in income and labourutilisation and drives labour and economic growth in Europe? A GDP accounting perspective.* Retrieved from http://ec.europa.eu/economy_finance/publications/publication13796_en.pdf

Eurostat.(2014). *Expenditure on education as % of GDP or public expenditure.*Retrieved from http://knoema.com/educ_figdp/expenditure-on-education-as-of-gdp-or-public-expenditure?geo=1040190-finland

Fallahi, F., Sojoodi, S. &Aslaninia, N. M. (2011). Determinants of labor productivity in iran's manufacturing firms: with emphasis on labor education and training. *International Conference On Applied Economics – ICOAE 2011*

Fischer, M. M., Bartkowska, M., Riedl, A., Sardadvar, S. &Kunnert, A. (2008).*The impact of human capital on regional labor productivity in europe.* Retrieved from http://www.researchgate.net/profile/Manfred_Fischer/publication/226230689_The_impact_of_human_capital_on_regional_labor_productivity_in_Europe/links/0deec52b04f9e78c77000000.pdf

Freeman, D. G., & Yerger, D. B. (2000). Does inflation lower productivity? Time series evidence on the impact of inflation on labor productivity in 12 OECD nations. *Atlantic Economic Journal*, 315-332.

Graham, J. P. (2005, June 18). *Going global*. Retrieved from Understaanding Foreign Direct Investment (FDI): http://www.going-global.com/articles/understanding_foreign_direct_investment.htm

Godfrey, L. G. (1978). Testing against general autoregressive and moving average error models when the regressors include lagged dependent variables. *Econometrica*, *46*, 1293–1302.

Godfrey, L. G. (1996). Misspecification tests and their uses in econometrics. *Journal of Statistical Planning and Inference*, *49(2*), 241–260.

Gujarati, D.N., Porter, D.C. (2009). *Basic Econometrics* (Fifth ed.). New York: McGraw-Hill Irwin. pp. 365–411.

Harris, R.G. (2001). Is there a case for exchange rate induced productivity changes? *Centre For International Economic Studies Discussion Paper, 0110.*

Hussain, K. (2009). Causal ordering between inflation and productivity of labor and capital: an empirical approach for pakistan.

Hurst, E., & Paul, W. (2007). Social security and unsecured debt. *Journal of Public Economics* , 1273-1297.

Hyndman,R.J.(2014, May23). Hyndsight. Retrieved from Structural breaks: http://robjhyndman.com/hyndsight/structural-breaks

Inflation.eu. (n.d.).*Historic inflation Finland – CPI inflation*. Retrieved from http://www.inflation.eu/inflation-rates/finland/historic-inflation/cpi-inflation-finland.aspx

IMF.(1999). Foreign direct investment in developing countries.*Finance & Development, 36(1).* Retrieved from http://www.imf.org/external/pubs/ft/fandd/1999/03/mallampa.htm

IMF. (2014). Finland: Concluding statement for the 2014 article IV consultation. Retrieved from http://www.imf.org/external/np/ms/2014/031414.htm

Investing Answers. (n.d.). *Labor Productivity*. Retrieved from: http://www.investinganswers.com/financial-dictionary/economics/labor-productivity-3494

Jeanneney, S.G. &Hua, P. (2011). How does exchange rate influence labour productivity in China? *China Economic Review, 22,* 628-645

Jonathan Lister, Demand Media. (n.d.). Small Business Chron. Retrieved from What is Productivity of Labor?: http://smallbusiness.chron.com/productivity-labor-17636.html

Kavanagh, C. & Doyle, E. (2006).*Human capital and productivity in the irish context.*
Retrieved from http://www.skillsstrategy.ie/pdfs/Human_Capital_and_ Productivity_in_the_Irish_Context.pdf

Kien, P. X. (2008). The impact of foreign direct investment on the labor productivity in host countries: the case of vietnam. *VDF Working Paper* .

Kumar, S., Webber, D. J., & Perry, G. (2009). Real wages, inflation and labour productivity in Australia.

Kuttner, K., & Sbordone, A. (1994). Does inflation reduce productivity? *Federal Reserve Bank of Chicago* .

Lottum, J. &Zanden, J. L. (2014).Labour productivity and human capital in the European maritime sector of the eighteenth century.*Explorations in Economic History, 53,* 83–100

Lutkepohl,H.,Saikkonen,P. &Trenkler,C. (2001). Maximum eigenvalue versus trace tests for the cointegrating rank of a VAR process. *The Econometrics Journal*, 287-310.

Mebratie, A. D. (2010). Foreign direct investment and labour productivity in south africa.

Menon, M. E. (2010). The link between education and productivity: the employers' perspective. *International Conference On Applied Economics – ICOAE 2010*

Murphy, G. &Siedschlag, I. (2012).The effect of real exchange rate changes on labour productivity growth. *ESRI Working Paper, 439.*

Nahidi, M. M., & Badri, A. K. (2014). FDi and Employment in D8 Countries . *Merit Research Journal* , 015-020.

Norden. (2013). *Economic outlook in the nordic countries 2014.* Retrieved from http://www.fjarmalaraduneyti.is/media/frettir/economic-outlook-in-the-nordic-countries-2014.pdf

Nurudeen, A. &Usman, A. (2010).Government expenditure and economic growth in nigeria, 1970-2008: a disaggregated analysis. *Business and Economics Journal, 4.*

OECD. (2003). *Comparing labour productivity growth in the OECD area: the role of measurement. OECD Science, Technology and Industry working papers 2003/14*.Retrieved from http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?doclanguage=en&cote=std/doc(2003)5

OECD. (2004). *Developing highly skilled workers: review of Finland.* Retrieved from http://www.oecd.org/industry/ind/34458180.pdf

OECD.(2013). *Finland. Economic policy reforms 2013: going for growth.* Retrieved from http://www.oecd.org/eco/growth/finland.pdf

OECD. (2013). *Finland fit for the future.* Retrieved from http://www.oecd.org/finland/finland-fit_for_the_future.pdf

OECD.(2009). Human capital and its measurement.*OECD World Forum 2009*. Retrieved from http://www.oecd.org/site/progresskorea/44109779.pdf

OECD. (2000). Links between policy and growth: cross-country evidence. *OECD Economic Outlook 68.*Retrieved from*http://www.oecd.org/eco/outlook/2086084.pdf*

OECD.(2013). *OECD compendium of productivity indicators 2013.* Retrieved from http://www.oecd.org/std/productivity-stats/2013compprodind_fin_workshop.pdf

OECD.(2012). *OECD economic surveys Finland.* Retrieved from http://www.oecd.org/economy/surveys/49564001.pdf

OECD.(2014). *OECD Economic Outlook No 95*. Retrieved from http://knoema.com/OECDEO95/oecd-economic-outlook-no-95-may-2014?location=1000090-finland

OECD iLibrary. (2014). *OECD Factbook 2014: Economic, environmental and social statistics.* Retrieved from http://www.oecd-ilibrary.org/sites/factbook-2014-14-en/index.html;jsessionid=5mpv28p1rglup.x-oecd-live-01?contentType=%2Fns%2FChapter%2C%2Fns%2FStatisticalPublication&itemId=%2Fcontent%2Fchapter%2Ffactbook-2014-14-en&mimeType=text%2Fhtml&containerItemId=%2Fcontent%2Fserial%2F18147364&accessItemIds

O.Odior, E. S. (2011).Government spending on education, economic growth and long waves in a cge micro-simulation analysis: the case of Nigeria. *British Journal of Economics, Finance and Management Sciences, 1(2).*

Pettinger, T. (2014, October 2). *Economics help*. Retrieved from UK Labor Productivity: http://www.economicshelp.org/blog/5887/economics/uk-labour-productivity/

Ramirez, M. D. (2006). Does foreign direct investment enhance labor productivity in chile? *Eastern Economic Journal* , 205-220.

Salkunrakentaja. (2013, November 30). Salkunrakentaja. Retrieved from Decreasing labour productivity growth – key problem in Finnish economy: http://www.salkunrakentaja.com/2013/11/decreasing-labour-productivity-growth-key-problem-finnish-economy/

Shams, R. (2005).Dollar-Euro exchange rate 1999-2004-Dollar and Euro as international currencies.*HWWA Discussion Paper, 321*.

Ssekuma, R. (2011). *A study of cointegrating models with applications.* University of South Africa.

Statistics Finland. (2014). *Most significant direct investors to Finland were Sweden and the United States in 2013.* Retrieved from http://www.stat.fi/til/ssij/2013/ssij_2013_2014-11-18_tie_001_en.html

Statistics Finland. (2015).*The share of social protection in general government expenditure grew in 2013.* Retrieved from http://www.stat.fi/til/jmete/2013/jmete_2013_2015-01-30_tie_001_en.html

Su, B. &Heshmati, A. (2011).Development and sources of labor productivity in Chinese provinces.*Discussion Paper Series, 6263.*

SuomenPankki.(2015). *Exchange rates-US dollar (USD).* Retrieved from http://www.suomenpankki.fi/en/tilastot/valuuttakurssit/valuuttakurssit_(ekp)/pages/eurofxref-graph-usd.aspx

SuomenPankki.(n.d.).*Why price stability?* Retrieved from http://www.suomenpankki.fi/en/rahapolitiikka/hintavakaus/pages/default.aspx

Tang, Y. (2010). Does productivity respond to exchange rate appreciations? A Theoretical and Empirical Investigation.*Economics Department Working Paper Series.*

The Conference Board. (2013). *International comparisons of GDP per capita & per hour worked*. Retrieved from http://www.conferenceboard.org/retrievefile.cfm?filename=ilcgdptechnicalnotes.pdf&type=subsite

The Conference Board. (2014). *Global productivity slowdown moderated in 2013 –2014 may see better performance.* Retrieved from https://www.conference-board.org/pdf_free/economics/ted3.pdf

The Economist. (2013). *If the European economy is so shaky, why is the euro so strong?* Retrieved from http://www.economist.com/blogs/economist-explains/2013/11/economist-explains-10

The Hague Centre For Strategic Studies and Tno. (2013). *The European labor market and technology: employment, inequality, and productivity.* Retrieved from www.hcss.nl/reports/download/142/2273/

The Research and Innovation Council of Finland.(2010). *Research and innovation policy guidelines for 2011–2015.*Retrieved from http://www.tem.fi/files/30413/Research_and_Innovation_Policy_Guidelines_for_2011_2015.pdf

TulliTiedottaa. (2014). *Exports decreased slightly in 2013.* Retrieved from http://www.tulli.fi/en/releases/ulkomaankauppatilastot/tiedotteet/kuluvavuosi/summary07022014/liitteet/Tullitiedottaa_EN.pdf

Vaisanen. (2012). *The attractiveness of Finland in the host country screening of inward foreign direct investment: A case study.* Retrieved from https://helda.helsinki.fi/bitstream/handle/10138/37166/Master%20Thesis_Heta%20T.%20Vaisanen_Sep2012.pdf?sequence=2

Vahter, P.(2004). The effect of foreign direct invesmenton labor productivity: evidence from estonia and Slovenia.

Xu, Y. (2008). Lessons from Taiwan's experience of currency appreciation.*China Economic Review, 19,* 53-65

APPENDIX

Appendix 1: Augmented Dickey-Fuller unit root tests results-with trend, level form

1.
Null Hypothesis: EDU has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.721595	0.7181
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

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

2.
Null Hypothesis: EXR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.859261	0.1882
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

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

3.
Null Hypothesis: FDI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.013691	0.0184
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

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

4.
Null Hypothesis: INF has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.155126	0.4971
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

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

5.
Null Hypothesis: LP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.952465	0.9368
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

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

Appendix 2: Phillips-Perron unit root tests results - With trend, level form

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

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.920719	0.6205
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

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

2.
Null Hypothesis: EXR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.856117	0.1892
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

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

3.
Null Hypothesis: FDI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.014815	0.0183
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

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

4.
Null Hypothesis: INF has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.795783	0.6832
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

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

5.
Null Hypothesis: LP has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.130167	0.9078
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

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

Appendix 3: Augmented Dickey-Fuller unit root tests results - Without trend, Level form

1.
Null Hypothesis: EDU has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.148247	0.9646
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

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

2.
Null Hypothesis: EXR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.980878	0.7480
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

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

3.

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.017864	0.0040
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

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

4.
Null Hypothesis: INF has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.726084	0.0808
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

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

5.
Null Hypothesis: LP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.999891	0.7413
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

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

Appendix 4: Phillips-Perron unit root tests results-Without trend, Level form

1.
Null Hypothesis: EDU has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.148247	0.9646
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

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

2.
Null Hypothesis: EXR has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.926102	0.7667
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

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

3.
Null Hypothesis: FDI has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.015192	0.0040
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

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

4.
Null Hypothesis: INF has a unit root
Exogenous: Constant
Bandwidth: 9 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.481313	0.0152
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

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

5.
Null Hypothesis: LP has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.973671	0.7506
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

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

Appendix 5: Augmented Dickey-Fuller unit root tests results - Without trend, first difference

1.
Null Hypothesis: D(EDU) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.885898	0.0057
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

2.
Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.342068	0.0001
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

3.
Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.782920	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

4.
Null Hypothesis: D(INF) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.251023	0.0002
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

5.
Null Hypothesis: D(LP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.680846	0.0007
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 6: Phillips-Perron unit root tests results - Without trend, first difference

1.
Null Hypothesis: D(EDU) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.758349	0.0079
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

2.
Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant
Bandwidth: 10 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.832374	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

3.
Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Bandwidth: 9 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.82264	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

4.
Null Hypothesis: D(INF) has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.242689	0.0002
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

5.
Null Hypothesis: D(LP) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.695507	0.0007
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

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

Appendix 7: Augmented Dickey-Fuller unit root tests results - With trend, first difference

1.
Null Hypothesis: D(EDU) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.769700	0.0322
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

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

2.
Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.267915	0.0009
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

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

3.
Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.647441	0.0000
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

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

4.
Null Hypothesis: D(INF) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.426483	0.0098
Test critical values:	1% level	-4.416345	
	5% level	-3.622033	
	10% level	-3.248592	

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

5.
Null Hypothesis: D(LP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic based on SIC, MAXLAG=8)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.665615	0.0042
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

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

Appendix 8: Phillips-Perron unit root tests results-With trend, first difference

1.
Null Hypothesis: D(EDU) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.618669	0.0445
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

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

2.
Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 10 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.766052	0.0003
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

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

3.
Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-12.51020	0.0000
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

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

4.
Null Hypothesis: D(INF) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 8 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.135545	0.0000
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

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

5.
Null Hypothesis: D(LP) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.763823	0.0031
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

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

Appendix 9: Johansen and Juselius Cointegration Test Result

Date: 03/11/15 Time: 13:03
Sample (adjusted): 1983 2012
Included observations: 30 after adjustments
Trend assumption: Linear deterministic trend
Series: EDU EXR FDI INF LP
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.01 Critical Value	Prob.**
None *	0.891733	115.2197	77.81884	0.0000
At most 1	0.514703	48.52511	54.68150	0.0432
At most 2	0.362430	26.83527	35.45817	0.1057
At most 3	0.264339	13.33255	19.93711	0.1032
At most 4	0.128406	4.122962	6.634897	0.0423

Trace test indicates 1 cointegrating eqn(s) at the 0.01 level
* denotes rejection of the hypothesis at the 0.01 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.01 Critical Value	Prob.**
None *	0.891733	66.69463	39.37013	0.0000
At most 1	0.514703	21.68983	32.71527	0.2367
At most 2	0.362430	13.50273	25.86121	0.4071

At most 3	0.264339	9.209584	18.52001	0.2691
At most 4	0.128406	4.122962	6.634897	0.0423

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level
* denotes rejection of the hypothesis at the 0.01 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

EDU	EXR	FDI	INF	LP
0.044726	0.363014	-0.655635	0.759686	0.462773
-0.168224	-1.992237	-0.086003	-1.164871	-1.024419
-0.768474	1.220300	0.009426	0.075133	0.945244
-0.628503	0.137736	0.163651	0.475269	0.599141
-0.064055	0.076407	-0.081584	-0.190935	-0.257560

Unrestricted Adjustment Coefficients (alpha):

D(EDU)	-0.105738	0.213292	0.165237	0.237461	-0.112189
D(EXR)	-0.174166	0.037892	-0.453226	0.125027	-0.026322
D(FDI)	1.731277	2.111267	0.468113	-0.098282	0.414680
D(INF)	-0.363277	0.069753	0.055710	-0.234633	-0.230348
D(LP)	-0.180062	0.086005	0.010603	-0.038026	0.041818

1 Cointegrating Equation(s): Log likelihood -152.4597

Normalized cointegrating coefficients (standard error in parentheses)

EDU	EXR	FDI	INF	LP
1.000000	8.116350	-14.65884	16.98524	10.34678
	(4.17287)	(1.24097)	(2.71692)	(2.46345)

Adjustment coefficients (standard error in parentheses)

D(EDU)	-0.004729
	(0.00728)
D(EXR)	-0.007790
	(0.00842)
D(FDI)	0.077434
	(0.03497)
D(INF)	-0.016248
	(0.00854)
D(LP)	-0.008053
	(0.00205)

2 Cointegrating Equation(s): Log likelihood -141.6148

Normalized cointegrating coefficients (standard error in parentheses)

EDU	EXR	FDI	INF	LP
1.000000	0.000000	-47.70001	38.89791	19.61908
		(4.41000)	(5.91196)	(3.25523)
0.000000	1.000000	4.070939	-2.699819	-1.142422
		(0.41323)	(0.55397)	(0.30502)

Adjustment coefficients (standard error in parentheses)

D(EDU)	-0.040610	-0.463312
	(0.02693)	(0.31333)
D(EXR)	-0.014164	-0.138715
	(0.03273)	(0.38075)
D(FDI)	-0.277732	-3.577666
	(0.10498)	(1.22129)
D(INF)	-0.027982	-0.270839
	(0.03309)	(0.38501)
D(LP)	-0.022522	-0.236708
	(0.00714)	(0.08310)

3 Cointegrating Equation(s):	Log likelihood	-134.8634

Normalized cointegrating coefficients (standard error in parentheses)

EDU	EXR	FDI	INF	LP
1.000000	0.000000	0.000000	0.772165	-0.343834
			(0.32080)	(0.18013)
0.000000	1.000000	0.000000	0.554008	0.561305
			(0.08479)	(0.04761)
0.000000	0.000000	1.000000	-0.799282	-0.418510
			(0.11375)	(0.06388)

Adjustment coefficients (standard error in parentheses)

D(EDU)	-0.167590	-0.261674	0.052539
	(0.11799)	(0.35404)	(0.09903)
D(EXR)	0.334129	-0.691787	0.106658
	(0.12192)	(0.36582)	(0.10232)
D(FDI)	-0.637464	-3.006428	-1.312248
	(0.46718)	(1.40183)	(0.39211)
D(INF)	-0.070794	-0.202856	0.232704
	(0.14945)	(0.44844)	(0.12543)
D(LP)	-0.030670	-0.223768	0.110758
	(0.03227)	(0.09684)	(0.02709)

4 Cointegrating Equation(s):	Log likelihood	-130.2586

Normalized cointegrating coefficients (standard error in parentheses)

EDU	EXR	FDI	INF	LP

1.000000	0.000000	0.000000	0.000000	-0.628501
				(0.09057)
0.000000	1.000000	0.000000	0.000000	0.357064
				(0.06712)
0.000000	0.000000	1.000000	0.000000	-0.123846
				(0.09813)
0.000000	0.000000	0.000000	1.000000	0.368661
				(0.11249)

Adjustment coefficients (standard error in parentheses)

D(EDU)	-0.316836	-0.228967	0.091400	-0.203512
	(0.13999)	(0.32894)	(0.09462)	(0.20439)
D(EXR)	0.255549	-0.674566	0.127119	-0.151082
	(0.15309)	(0.35973)	(0.10348)	(0.22353)
D(FDI)	-0.575694	-3.019965	-1.328332	-1.155667
	(0.59715)	(1.40314)	(0.40363)	(0.87186)
D(INF)	0.076673	-0.235173	0.194306	-0.464558
	(0.18286)	(0.42968)	(0.12360)	(0.26699)
D(LP)	-0.006770	-0.229006	0.104535	-0.254252
	(0.04028)	(0.09465)	(0.02723)	(0.05881)

Appendix 10: Lag Length Criteria

VAR Lag Order Selection Criteria
Endogenous variables: DLP DEDU DEXR DFDI DINF
Exogenous variables: C
Date: 03/11/15 Time: 13:11
Sample: 1980 2012
Included observations: 28

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-219.4270	NA	6.304534	16.03050	16.26840*	16.10323
1	-192.5874	42.17661*	5.717010	15.89910	17.32646	16.33546
2	-175.4730	20.78169	12.13562	16.46236	19.07919	17.26235
3	-131.8098	37.42564	5.595795	15.12927	18.93557	16.29289
4	-77.24264	27.28358	2.879156*	13.01733*	18.01310	14.54459*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix 11:VECM model (LP as dependent variable)

Dependent Variable: DLP
Method: Least Squares
Date: 03/07/15 Time: 15:20
Sample (adjusted): 1982 2012
Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLP(-1)	-0.020736	0.115056	-0.180228	0.8585
DEDU(-1)	-0.391948	0.060845	-6.441803	0.0000
DEXR(-1)	0.093712	0.054818	1.709497	0.1003
DFDI(-1)	1.21E-05	1.20E-05	1.005282	0.3248
DINF(-1)	0.069324	0.045489	1.523983	0.1406
Z	-0.151059	0.027360	-5.521167	0.0000
C	0.723135	0.091500	7.903126	0.0000

R-squared	0.801976	Mean dependent var	0.503226
Adjusted R-squared	0.752470	S.D. dependent var	0.489322
S.E. of regression	0.243449	Akaike info criterion	0.207862
Sum squared resid	1.422419	Schwarz criterion	0.531665
Log likelihood	3.778142	Hannan-Quinn criter.	0.313414
F-statistic	16.19961	Durbin-Watson stat	2.245560
Prob(F-statistic)	0.000000		

Appendix 12: Diagnostic Checking Result

1. Autocorrelation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.734454	Prob. F(1,23)	0.4003
Obs*R-squared	0.959284	Prob. Chi-Square(1)	0.3274

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 03/11/15 Time: 13:17
Sample: 1982 2012
Included observations: 31
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLP(-1)	0.065629	0.138746	0.473018	0.6407

DINF(-1)	-0.007228	0.046514	-0.155394	0.8779
DFDI(-1)	0.004093	0.012970	0.315577	0.7552
DEXR(-1)	-0.011600	0.056762	-0.204367	0.8399
DEDU(-1)	-0.000389	0.061186	-0.006366	0.9950
C	-0.036746	0.101510	-0.361992	0.7207
Z	0.003210	0.027766	0.115602	0.9090
RESID(-1)	-0.235239	0.274490	-0.857003	0.4003

R-squared	0.030945	Mean dependent var	-4.48E-17
Adjusted R-squared	-0.263985	S.D. dependent var	0.217747
S.E. of regression	0.244807	Akaike info criterion	0.240944
Sum squared resid	1.378403	Schwarz criterion	0.611006
Log likelihood	4.265362	Hannan-Quinn criter.	0.361575
F-statistic	0.104922	Durbin-Watson stat	2.048838
Prob(F-statistic)	0.997454		

2. Heteroscedasticity

Heteroskedasticity Test: ARCH

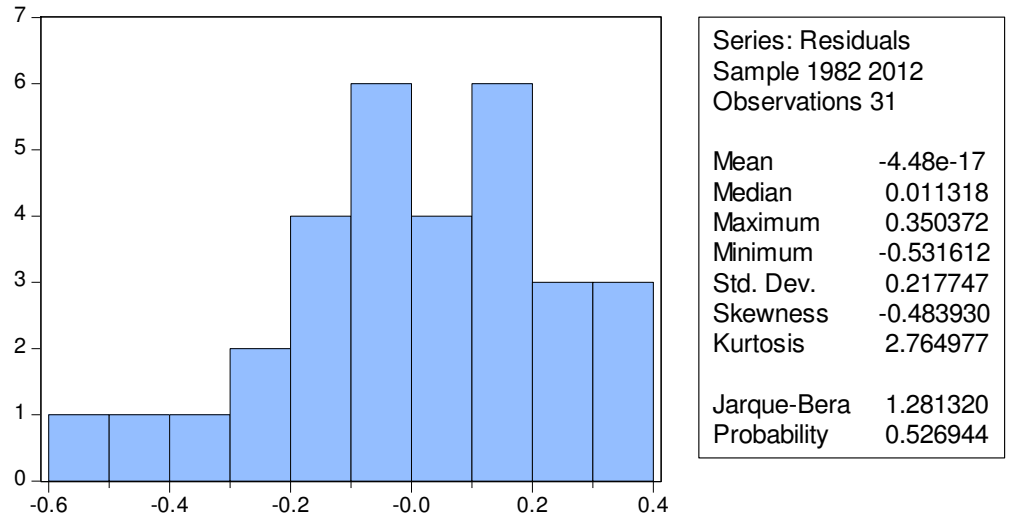
F-statistic	1.189789	Prob. F(1,28)	0.2847
Obs*R-squared	1.222814	Prob. Chi-Square(1)	0.2688

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/11/15 Time: 13:18
Sample (adjusted): 1983 2012
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.037999	0.014241	2.668243	0.0125
RESID^2(-1)	0.200587	0.183894	1.090775	0.2847

R-squared	0.040760	Mean dependent var	0.047355
Adjusted R-squared	0.006502	S.D. dependent var	0.062473
S.E. of regression	0.062270	Akaike info criterion	-2.650347
Sum squared resid	0.108570	Schwarz criterion	-2.556934
Log likelihood	41.75521	Hannan-Quinn criter.	-2.620464
F-statistic	1.189789	Durbin-Watson stat	1.987055
Prob(F-statistic)	0.284670		

3. Normality Distribution



Appendix 13: Granger Causality Test Result

Pairwise Granger Causality Tests
Date: 03/11/15 Time: 13:23
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DEXR does not Granger Cause DEDU	31	0.20142	0.6570
DEDU does not Granger Cause DEXR		0.09542	0.7597

Pairwise Granger Causality Tests
Date: 03/11/15 Time: 13:24
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DFDI does not Granger Cause DEDU	31	1.37555	0.2507
DEDU does not Granger Cause DFDI		0.56464	0.4587

Pairwise Granger Causality Tests
Date: 03/11/15 Time: 13:24
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DINF does not Granger Cause DEDU	31	0.01896	0.8915
DEDU does not Granger Cause DINF		0.54769	0.4654

Pairwise Granger Causality Tests
Date: 03/11/15 Time: 13:24
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DLP does not Granger Cause DEDU	31	4.03918	0.0542
DEDU does not Granger Cause DLP		9.19151	0.0052

Pairwise Granger Causality Tests
Date: 03/11/15 Time: 13:25
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DFDI does not Granger Cause DEXR	31	0.53521	0.4705
DEXR does not Granger Cause DFDI		4.38868	0.0453

Pairwise Granger Causality Tests
Date: 03/11/15 Time: 13:25
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DINF does not Granger Cause DEXR	31	0.20002	0.6581
DEXR does not Granger Cause DINF		6.04822	0.0204

Pairwise Granger Causality Tests
Date: 03/11/15 Time: 13:25
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DLP does not Granger Cause DEXR	31	1.41519	0.2442
DEXR does not Granger Cause DLP		0.29588	0.5908

Pairwise Granger Causality Tests
Date: 03/11/15 Time: 13:25
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DINF does not Granger Cause DFDI	31	0.80084	0.3785
DFDI does not Granger Cause DINF		5.65575	0.0245

Pairwise Granger Causality Tests
Date: 03/11/15 Time: 13:26
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DLP does not Granger Cause DFDI	31	1.13648	0.2955
DFDI does not Granger Cause DLP		11.1572	0.0024

Pairwise Granger Causality Tests
Date: 03/11/15 Time: 13:26
Sample: 1980 2012
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DLP does not Granger Cause DINF	31	0.88806	0.3541
DINF does not Granger Cause DLP		7.28777	0.0116

Appendix 14: Summary of Literature Review

1. Relationship between FDI and labor productivity

Author's Name	Data	Methodology	Major Findings
Abdullah Alam, M. UsmanArshad, and WasimUllah Rajput (2013)	-Country OECDs -Time period 1980 – 2009 -Variables are Labor productivity, FDI, economic -Source from the World Development Indicators (WDI), OCEDs database	-panel unit root test -panel co-integration test -panel causality test -GMM (generalized method of movement)	-There have short term causality between FDI to economic growth, labor productivity to economic growth and FDI to labor productivity after running the test. -There have long term causality between the FDI to economic growth after running the test. - Thus, there have impact between FDI and economic growth through the interaction of labor productivity. -The authors suggest using policy to promote the economic growth of a country.
Pham XuanKien (2008)	-Country Vietnam -Time period 2005 -Variables are FDI(capital intensity, skill of labor, scale of domestic firm) and labor productivity -Source from the data of Enterprise Survey 2005 by the General Statistics Office of Vietnam.	-model specification -cross sectional data	-There have negative relationship between the capital intensity and skill with the labor productivity. -There have different effect to labor productivity in the different location of the country. -There have also different spillover effect due to different FDI in the country. -Author concludes that there different impact of FDI also affect the labor productivity in the country.

Buckley, Peter J. Clegg, Jeremy Zheng, Ping Siler, Pamela A. Giorgioni, Gianluigi (2007)	-Country China (automobile industry) -Time period 1995 – 1999 -Variables are Labor productivity, FDI, capital intensity, firm size, labor quality, innovation, turnover worker capital -Source from the China Automotive Industry Yearbook 1996-2000	-Pooled ordinary least squares model (POLS) -fixed effects model (FES)	-The result shows that there have positive relationships between the FDI and labor productivity. -The author also mention that the government of China can't merely depend on FDI since the capital intensity, turnover worker capacity and firm size also play important role in the country but it is fragmented in the testing result.
Nigel Driffield, Karl Taylor (2000)	-Country United Kingdom (UK) -Time period 1983-1992 -Variables are FDIand labor productivity -Source from the Census of Production, ONS	-Hausman test	-The demand of skill worker and wages dispersion increase since the MNEs entered. -There have technologies spillover from foreign firm to domestic firm. - FDI and labor productivity have a positive relationship and FDI and unemployment have a negative relationship.
AnagawDerseh Mebratie (2010)	-Country South Africa -Time period 2003-2007 - Source from the World Bank -Variables are Labor productivity, FDI	-Pooled OLS -Meta Analysis	-The result shows that there have positive impacts between the FDI and labor productivity. -The author also mentions that there have no positive or negative effects between spillover effects from FDI to local firm.

Miguel D. Ramirez (2006)	-Country Latin America, Chile -Time period 1960-2000 -Variables are FDIand labor productivity -Source from the InstitutoNacional de Estadisticas(various issues), the BancoCentral de Chile, MemoriaAnual(various issues), OECD,International Finance Corporation, Trends in Private Investment in Developing Countries:Statistics for 1970-2000	-ADF Test -Johansen cointegration test	-The result shows that the FDI have positive and significant effect to labor productivity. -The authors also mention that from the result that had done, he find that the FDI do not get fully utilized used from the beginning until 1995. -The FDI to financing or private capital had significant reduced in Chile.
PriitVahter (2004)	-Country: Estonia and Slovenia -Time period: 1996-2001 -Variables: FDI, labor productivity -Sources: world investment report	-Dummy variables -Pooled LS -FE (fix effect) model: F-test -RE (Random effect) model: Breusch-Pagan LM test -Hausman test	-Based on the theory, FDI can bring both positive and negative effect to the economy. -However, from the research, the increase in FDI leads to decrease in labor productivity in Estonia. -The increase in FDI leads to increase in labor productivity in Slovenia. -This may be due to the different policy implication of the different country thus bring to different relationship between the labor productivity and FDI

Jorge Saba Arbache (2004)	-Country Brazil -Time period 1995-2000 -Variables are FDI, education, type of firm, labor force, personal characteristic, experience of workers, occupation, wages, culture factors of firm -Source from PIS, CNPJ, IBGE-PAND, MLE, RAIS, Central Bank of Brazil	-Pool OLS -Fix effect panel	-The result shows that the FDI have positive and significant effect to labor that have education and skilled. -Besides, from the test, the author also concludes that the multinational company can bring more FDI to the country compare with non-multinational firms. -The human capital and FDI also have positive relationship in the research done by the authors.

2. Relationship between inflation and labor productivity

Author's Name	Data	Methodology	Major Findings
KarrarHussain (2009)	-1960-2007 -total labor employed -gross fixed capital formation -monetary aggregate -real GDP -exchange rate -money market discount rate -inflation change in CPI	-VAR and VECM model	-Inflation affects the labor productivity negatively in both long run and short run.

Donald G. Freeman and David B. Yerger (2000)	-annual data from 1955-1994 -12 OECD countries	-DCPI -D2CPI	-Inflation may cause the interest rate increase, in turn reduce the output. -The negative relationship between inflation and labor productivity only existed in some countries such as Canada, Denmark and United State. -The effect maybe slightly negative in some countries, depend on other economic factors.
ArgiaSbordone and Kenneth Kuttner (1994)			-Negative correlation between inflation and productivity. -It is difficult to determine negative relationship between inflation and productivity. -The negative relationship between inflation and productivity is more sensitive in long run.
Tim Bulman and John Simon (2003)	-annual data		-Industry inflation explains the productivity more than the aggregate inflation. -Rise and fall of the inflation cause the slowdown in 1970s and acceleration in 1990s of Australia.

3. Relationship between exchange rate and labor productivity

Author's Name	Data	Methodology	Major Findings
Caglayan, M. &Demir, F. (2014)	Country: Turkey Time period: 1993-2005 Source: annual surveys of the Istanbul Chamber of Industry on the first and second largest 500 manufacturing firms (based on sales) in Turkey, Istanbul Stock Exchange (ISE) database IV: real effective exchange Rate, percentage share of foreign ownership in a firm's total equity, publicly traded versus non-traded firms percentage share of exports in output, real total assets of the firm and manufacturing industry output growth	GMM dynamic panel data estimator	-Volatility in exchange rate is negatively impact on the firm productivity as it will affect the behavior of investment. -Indeed, the appreciation on real exchange rate have significant and negative impact on productivity due to the negative effects appreciations on exchange rate is outweigh the positive effects especially to the domestic firms. -On the other hand, the appreciation in the real exchange rate is able to improve the productivity for those export oriented firms. It is resulted from the export-oriented firms need to compete with others when the currency appreciates.

Harris, R.G. (2001)	Country: Canada and US Time period: 1970-1997 Source: OECD Database IV: exchange rate- Last period's change in misalignment and long run measure of the level of misalignment, Openness, average labor productivity gap of the industry, average Investment-output ratio.	Baseline Productivity Model Misalignment Models Interaction Models	-In the misalignment model, depreciation of exchange rate leads to increase of the labor productivity in short run. -This probably due to the demand of export and tradable increases when depreciation took places. -In long run the undervalued of exchange rate might lead to negative impact on the labor productivity due to the higher import price of inputs as well as the technology transfer.
Tang, Y. (2010)	-Country: Canada -Time period: 1997-2006 -Source: Annual Survey of Manufacturers (ASM), the CanadianSocioeconomic Information Management (CANSIM) Database, the Bank of Canada -IV: Real effective exchange rate, concentration ratio	-Fixed effect model	-When there is appreciation of the exchange rate associated with the higher concentration ratio, the labor productivity increase. -Appreciation of the exchange rate has the positive impact towards the labor productivity due to the lower losses during the costly transitions and the competitive pressures. -The labor productivity in Canada during year 2002 to year 2006 is higher when the appreciation occurred during these periods.

Jeanneney, S. G. &Hua, P. (2011)	Country: China Time period: 1986 – 2007 Sources: IMF, International Financial Statistics, IMF, Direction of Trade, China Statistical Yearbook, several editions, China Customs Statistics IV: real effective exchange rate, industrial production, capital intensity, education, Export ratio, FDI	The Levin–Lin–Chu panel unit root test GMM system	-From the empirical result, the real exchange rate appreciations have the positive effect on the labor productivity growth with the positive coefficient. -They found that the appreciation on the exchange rate improve the capital intensity with the lower imported inputs costs and the education level, while they also found that the appreciation indeed affected the export rate and foreign direct investment negatively. -The appreciation improved the labor productivity through capital intensity and education level. While, the negative impact of appreciation on labor productivity through export , FDI and industrial production are lower than the positive impact.
Xu, Y (2008)	Country: Taiwan Time period: 1986 – 1992 Sources: -Asian Development Bank's Key Indicators of Developing Asian and Pacific Countries,International Monetary Fund. IV: currency	- short run and long run impacts	- From the data, Taiwan experienced a rapid appreciation between the period year 1987 to 1992. - Based on the analysis, the appreciation of dollar in Taiwan have a significant impact on the labor productivity growth - The labor productivity growth between 1986-1992 is the highest which during the period of appreciation in Taiwan. - This was explained by the improvement of technology and other resources when the dollar appreciated and thus improved the productivity growth.

Murphy, G. &Siedschlag, I (2012) ESRI Working Paper No 439	Country: Irish Time period: 1995 to 2002 Sources: Irish Census of Industrial Production (CIP), OECD STAN database IV: real exchange rate, export share, share of imported material inputs, vectors of firm and industry characteristics	OLS fixed effects estimator	-Based on the result, it showed that the labor productivity of non-importing and exporting firms not influenced by the import and export weighted real exchange rates. -The author found that the appreciation of the exchange rate impact the labor productivity growth negatively when the export exposure is more than 14%. -On the other hand, the appreciation of the exchange rate influenced the labor productivity growth positively when the import exposure level more than 33%. -The appreciation of the exchange rate indeed affected the labor productivity growth through export and import activities which eventually induce the firms to increase their productivity.
Ekholm, K, Moxnes, A, Ulltveit-Moe, K.H. (2009) CEPR DP # 6904	Country: Norway Time Period: 1996-2004 Source: Statistics Norway's capital database, IV: real exchange rate, firm size, skill intensity, export and import status	OLS estimator attrition model, estimated by maximum likelihood (ML-HS)	-From the result, the author found that the appreciation of the real exchange rate has a positive impact on the labor productivity with its positive coefficient of net exposure. -The analysis showed that the labor productivity growth of the firms affected by the real exchange rate appreciation through the competition pressure in the market. -The empirical result showed that real exchange rate appreciation leads to increase in labor productivity with the appreciation between years 2000 to 2004.

4. Relationship between human capital and labor productivity

Author's Name	Data	Methodology	Major Findings
Aggrey, N., Eliab, L. Joseph, S. (2010)	Country: Kenya, Tanzania and Uganda Time period: 2002 - 2003 Source: from an interview during 2002-2003, by World Bank as a part of the Investment Climate Survey IV: capital-labor ratio, total number of employees, weighted average Education, education of the manager, *train,* average experience of workers, ratio of foreign ownership, union members, Other sectors, textiles, chemical and metal	-Random Effect and Fixed Effect	-The result indicated that the education level and job training which considered as the human capital variables have the positive relationship with the labor productivity in Kenya, Uganda and Tanzania. -The managers who have the higher skills and education level tend to improve the productivity level in the analysis. -The job training was estimated to have significant effect to improve the labor productivity growth in manufacturing sector of Kenya since the job training increased the skills and knowledge of the labor. -While, the job training was insignificantly to affect the productivity in both Uganda and Tanzania which probably due to the reduction of the labor in production when the labor participated in the training or the training were not aimed to improve the productivity but other purposes. -In summary, all of three countries, Uganda, Tanzania and Kenya were having the similar result in implying that the skilled and higher educated labors improved the labor productivity.

Fischer, M. M., Bartkowska, M., Riedl, A., Sardadvar, S. andKunnert, A. *(2008)*	Country: 198 NUTS-2 regions in continental Europe Time period: 1995 and 2004, Source: Eurostat's REGIO database, Statistics Norway (Division for National Accounts) and the Swiss Office Féderal de la Statistique (ComptesNationaux) IV : human capital	-spatial Durbin model	-From the estimation result, it showed that the increase in the human capital level impact the labor productivity insignificantly in the SDM model. -The authors analyzed the relationship between the human capital and labor productivity by studying the impact of human capital levels in a region on the labor productivity of other regions. -They found that the increment of the human capital in a region decreased the labor productivity of other regions involved and vice versa. -The conclusion was made by stating that the human capital levels in a region improved the labor productivity in the particular region which able to explain that human capital played an important role in the economic growth.

Cörvers, F (1996)	-Country: fifteen manufacturing sectors in seven countries of the European Union Time period: 1988 to 1991 Source: Eurostat, STAN industrial database, STAN industrial database IV: employment shares of intermediate and highly skilled workers per sector, capital intensity and average firm size	-Least squares estimations	-From the empirical result, it showed that the share of employment with high skills affect the labor productivity of sectors positively and significantly. -Besides, they found that the labor with intermediate skill have the positive impact but insignificant on the labor productivity. -This might probably due to the lower education level of the intermediate skill labors less productive in the sectors.

Arvanitis, S., Loukis, E. N. (2009)	Country: Greece, Swiss Time period: 2005 Source: use firm-level data collected in 2005 through a common questionnaire administered to samples of similar composition IV: ICT capital, organizational capital, human capital (share of employees with vocational education at the tertiary level and the share of employees receiving job-related training), physical capital and knowledge capital.	-Basic model -Compact model	-The authors used the share of employees with tertiary education level and share of employees received job training as the human capital variables. -They found that there were positive and significant relationship between the human capital and labor productivity. -From the result, it indicated that the independent variables, human capital have the significant and positive impact on labor productivity in Greece and Swiss and the human capital from the education level has the stronger effect than the job training.

Fallahi, F., Sojoodi, S., Aslaninia, N. M. (2011)	Country: Iran Time period: 2007 Source: Iran Statistical Center IV: employees with college or higher degree to total firm work force, ratio of employee training expenses to its total non-industrial expenditures, capital intensity, r&d, firm size, status of exporting, ownership status, wage level	-Cross sectional regression	-Based on the result, the labor with higher education level has a positive and significant impact on the labor productivity as increased in the portion of high educated workers lead to the increment of labor productivity as well. -on the other hand, the authors found that the training costs on the labor were estimated to affect the labor productivity negatively and significantly. -The negative effect of the training on labor productivity might cause by the training costs outstripped the positive effect of training effect on labor and the inefficient of training provided by the firms to improve the labor skills.
Lottuma, J., Zanden, J. L. (2014)	Country: European Time period: the eighteenth century (1702–1712) and the second several decades later (1777–1801) Source: Prize Paper archive IV: human capital	-regression analysis	-Authors estimated the impact of human capital on the labor productivity in maritime sector of European country. -From the analysis, it showed that the human capital which included both educations based and job related training based indeed a significant and positive -The result can be explained by the data which showed that the crews with higher education or skills intended to increase the productivity of the ships in maritime sectors. -In summary, the productive ship was generated by the labor with higher numeracy and literacy skill in the data analyzed.

Escosura, L. P., Rosés, J. R. (2010)	Country: Spain Time period: 1850-2000 Source: Instituto de ReformasSociales, Prados de la Escosura and Rosés IV: Income based and education based human capital		-According to the result, they found that the human capital level contributed positively to the labor productivity although the effect was quite small. -They explained that the investment in human capital level lead to the productivity improvement through the channel of technology advancement and innovation. -Besides, the human capital in both income based and education based were estimated to have positive impact and significant contribution on the labor productivity.
Afrooz, A. (2010)	Country: Iran Time period: 1995-2006 Source: Statistical Centre of Iran. *IV:* ratio of educated workers to uneducated workers in ith sub-sector, ratio of skilled workers to unskilled workers in ith sub-sector, ratio of capital to worker in ith sub-sector.	-Fixed effect model	-The authors found that human capital which measured by education and skill level tend impact the labor productivity of food sectors in Iran positively and significantly -They believed that the human capital investment able to increase the growth of labor productivity through the result they obtained.

Schwerdt, G., Turunen, J. (2007)	Country: Euro area Time period: 1994 – 2001 Source: The European Community Household Panel (ECHP) Euroststst		-From the study, the labor productivity improved by the investment of human capital such as the labor quality which included the education level and achievement of the labor. -Education played a role to increase the labor productivity growth.
Su &Heshmati (2011)	-Country: China -Time period: 2000-2009 -Source: World Bank and National Bureau Yearbook 2000 to 2009 -IV: Business volume Expenditure in education, GDP, Investment in fixed asset ,Total industry value , Profit of industrial enterprises, average annual wage , Total labor, Urban labor, Female employment	Fixed effect panel multiple regression function	-Based on the case in China, the negative consequences on the educational spending on productivity -this might be caused from the investment in developing area instead of developed areas which finally lower the rate of educated labors in developed areas when the population size is large in the developing areas

Nurudeen&Usman (2010)	Country : Nigeria Time period: 1970-2008 Source: Central Bank of Nigeria IV: total capital expenditure, total recurrent expenditure ,expenditures on defense, agriculture, transport and communication, education and health (HEA), inflation (IFN) and overall government fiscal balance (FISBA)	Cointegration and VECM model	- The government spending on education has negative effect on the productivity -This is because the expenditure was utilized inefficient and ineffective in the education sectors