AN ANALYSIS OF RELATION BETWEEN INTEREST RATE SPREAD AND ECONOMIC ACTIVITIES OF OECD COUNTRIES USING PANEL DATA ANALYSIS

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Approval of the Institute of Social Sciences

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PLAGIARISM PAGE

I hereby declare that all information in this thesis has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work; otherwise I accept all legal responsibility.

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ABSTRACT

AN ANALYSIS OF RELATION BETWEEN INTEREST RATE SPREAD AND ECONOMIC ACTIVITIES OF OECD COUNTRIES USING PANEL DATA ANALYSIS

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The aim of this study is to see long run relation between interest rate spread and economic activities for OECD countries. In this context, the research focused on the effect of spread on main maco-economic indicators such as industrial production, inflation and unemployment rate between 2005 and 2015 by using monthly data. Apart from spread, stock exchange index, M1 and long term interest rates were used to see their influence on macro-economic variables. Panel data analysis was employed to find long run linkage between the variables. The tools that necessary for panel analysis were employed. For instance panel unit root tests, panel cointegration tests, panel estimation methods were employed in the analysis.

The results reveal that while interest rate spread still has positive relation with economic activities, as pointed by some authors, the degree of positiveness seems to be declining over the years. However, due to macro-economic development around the World, some variables such as money supply is losing its significance in explaining economic activities.

This happens at the time of the economies that are in a new state, which some economists call as “New Normal”. Because, interest rates in many countries are in near-zero level and has been staying there for a along time since the financial crisis of 2008. Despite these lower rates, economic activities could not reach the level desired up until 2016. Although inflation seems to be explained well by all financial indicators, the relation between unemployment rate was not found for spread.

Keywords: interest rate spread, economic activities, panel data analysis, cointegration, OECD countries.

ÖZET

OECD ÜLKELERİNDE GETİRİ FARKI VE EKONOMİK AKTİVİTELER ARASINDAKİ İLİŞKİNİN PANEL VERİ YÖNTEMİ İLE ANALİZİ

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Bu çalışmanın amacı OECD ülkeleri için getiri farkı ve ekonomik aktiviteler arasındaki uzun dönemli ilişkiyi araştırmaktır. Bu kapsamda, bu çalışmada, 2005 – 2015 dönemi arasında getiri farkının ana makro-ekonomik göstergelere, yani sanayi üretimi, enflasyon ve işsizlik oranlarına, etkileri üzerine odaklanmıştır. Getiri farkının yanında, borsa endeksi, M1 para arzı ve uzun vadeli tahvil faizlerinin de ekonomik ektiviteler üzerindeki etkileri incelenmiştir. Değişkenler arasındaki uzun dönemli ilişkiyi bulmak için panel data analiz yöntemi kullanılmıştır. Bu çerçevede kullanılan araçlar ise panel birim kök testleri, panel eşbütünleşme testleri ve panel tahmin modellemeleri kullanılmıştır.

Sonuçlar bize getiri farkının ekonomik aktivitelerle uzun dönemli pozitif bir ilişkiye sahip olduğunu söylerken, literatürdeki bazı yazarlar ise bu ilişkinin gücünün zayıfladığını vurgulamaktadırlar. Bununla beraber dünyada meydana gelen son yıllardaki gelişmelerden dolayı para arzı gibi değişkenlerde ekonomik aktiviteleri açıklamadaki güçlerinin yitirildiği gözlemlenmektedir. Ekonomilerdeki son yıllarda vuku bulan bazı reel olayların teori ile ters düşmesi durumları bazı ekonomistler tarafından "Yeni Normal" – "*New Normal*"- olarak

adlandırılmaktadır. Çünkü, Dünyada önemli sayıda ülkede 2008 finansal krizinden bu yana faiz oranları sıfır veya sıfıra yakın seyretmektedir. Bu çok düşük faiz oranlarına rağmen ekonomilerde ekonomik aktivitelerde istenilen büyüme ve canlanmalar, en azından 2016 yılına kadar, meydana gelmemiştir. Sonuçlarda ayrıca enflasyon ile finansal göstergeler arasındaki ilişkilerin varlığı gözlemlenmiş, fakat işsizlik oranları ve finansal göstergeler arasındaki uzun dönemli ilişkinin varlığı ise görülememiştir.

Anahtar Kelimeler: getiri farkı, ekonomik aktiviteler, panel veri analizi, eşbütünleşme, OECD ülkeleri

TO MY FAMILY

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller Test
ARDL	Autoregressive Distributed Lags
BoE	Bank of England
BoJ	Bank of Japan
CADF	Cross-Sectionally Augmented Dickey-Fuller
CD	Cross-section Dependency
CIPS	Cross-sectionally Augmented IPS
CPI	Consumer Price Index
DOLS	Dynamic OLS
ECB	European Central Bank
ECM	Error Correction Model
EPU	European Payment Union
FED	Federal Reserve
FMOLS	Fully Modified OLS
GNP	Gross National Product
GDP	Gross Domestic Product
ILT	Im, Lee and Tieslau Test
IPS	Im, Pesaran and Shin Test
KPSS	Kwiatkowski-Phillips-Schmidt-Shin Test
LLC	Levin, Lin and Chu Test

LM	Lagrange Multiplier
M&W	Maddala & Wu Test
NATO	North Atlantic Trade Organization
OECD	Organization for Economic Co-operation and Development
OEEC	Organization for European Economic Co-operation
OLS	Ordinary Least Square
PMG	Pooled Mean Group
T-Bill	Treasury Bill
U.K.	The United Kingdom
U.S.	The United States
VAR	Vector Autoregression

INTRODUCTION:

This thesis is dedicated to investigate the long run relation between interest rate spreads and economic activities which includes industrial production, inflation and unemployment rate- in OECD countries over the period of between 2005 and 2015 by using panel data analysis. This thesis will use latest panel data models that take structural breaks and cross-sectional dependency into account. Besides using panel data analysis on this issue, this thesis will also try to see the effect of new monetary policies that are taken place by major central banks on yield spread and economic activities especially industrial production. As it is known that, in the post financial crisis of 2008 period, major central banks such as Federal Reserve[1] (The FED was the first central bank that started to implement new monetary policies just after collapse of several large scale investment banks in the U.S), European Central Bank, Bank of Japan and Bank of England, have taken action to stimulate the world economy. Henceforth, not only these major central banks, but also other economies started to lower their policy interest rates soon in conventional way. These policies pushed interest rates almost to zero and since then the rates have remained very low due to lower output level and disinflationary fears.

The reason why academic worlds as well as the real world institutions such as central banks and policy makers are interested to know the intuition behind yield curve and economic events is explained by Dotsey (1998). The author categorises predictive content of interest rate spread into four groups that are influenced by future economic movement. These interested groups are private businesses, central banks, governments and foreign investors. The judgement from the movement of yield curve perception can give assistance to the interested parties to take right action in their monetary policy stand and produce to help future planning decisions.

In literature, when the interest rate spread of 10-years bond and 3-months Treasury bill squeezed or narrow, it means that future economic activities should also fall accordingly. Because it is believed that when the spread between long term rates and short term rates are converge or the yield curve flattened, the economic activities are followed to be slowing

[1] The FED was the first central bank that started to implement new monetary policies just after collapse of several large scale investment banks in the U.S. For example its first action was to set up Troubled Asset Relief Program (TARP).

down in the future. This association is important for policy makers to have a better future economic planning. The intuition behind this theory is explained by Estrella and Hardouvelis (1991). Their empirical study suggests that a flattening of the yield curve predicts a drop in the future interest rates and that these lower rates are associated with a lower level of Gross National Product (GNP) output.

In their work, Estrella et al., (2003) gives the importance of yields curve spread as it helps to effectively predicts economic direction for monetary policies. If the central bank raises short-term interest rates and market participants expect this policy to be effective in curbing inflation in the long run, long-term rates (the averages of future expected short rates, according to the expectations hypothesis) should rise in smaller proportions. Thus, a restrictive monetary policy tends to flatten the yield curve, and at the same time slows down the economy (Estrella, 2005; Bernanke, 1990). Estrella and Mishkin (1997) refer that the most fundamental determinant factors behind interest rate spreads are short term interest rates, long term interest rates and central bank policy rates. These will be discussed later when variables are defined.

Proper econometric analysis can reveal useful insight that can be used for policy maker, especially for central bankers and researchers. As Dotsey (1998) quotes that *"it is important for the Federal Reserve (the Fed) in deciding the stance of current monetary policy"*. The predictive content of interest rate spreads can help market makers to foresee future economic development and take monetary and economic projections accordingly.

This thesis will document useful variables to project the long run relationship between interest rate spreads with some indicative variables such as stock market prices, money supply of M1, Long term interest rates and economic activities which includes industrial production, consumer price index and unemployment rates in OECD countries.

The objective of thesis is not only to examine the long run relation of spread and economic activities, but also considers that there are several compelling macro-economic and financial characteristics variables that had been used in the literature. These macro-economic and financial variables are as follow, *Macro-economic variables: (These are also dependent variables in our models)*

Industrial production
Consumer Price Index (CPI)
Unemployment rate

Financial variables: (These are also independent variables in our models)

Spread (Long term interest rates – Short term interest rates)
Stock exchange index
M1 money supply
Long term interest rates

The literature uses several other economic activities such as durable orders, retail sales, consumption, personal income (Bernanke, 1990). However, due to data inefficiency and duration mismatches among the OECD countries, these variables cannot be used in the analysis. Further, the reason why above macro-economic variables are chosen is explained by Bernanke (1990) and Bernanke and Blinder (1992) that these variables often monitored by policy makers in terms of measuring the economic situation.

This study will contribute to the literature in the following regards; first, this study is thought , to the best of our knowledge, the first study that uses panel data analysis in the field of relation between interest rate spread and economic activities. Second, the study also tried to imply latest panel data methods for finding long run relation and regression estimation. For instance, tests of unit root, co-integration and panel estimation considered cross-sectional dependency. In literature, the previous studies have employed usually time series analysis. When using panel data analysis, it could give the opportunity to assess the earlier results a generalisation for a group of countries. Third, this study is believed to be one of the few study that analyse the relation of spread and economic growth after the financial crisis of 2008, which is regarded as the biggest economic crisis since the Great Depression.

The organisation of this thesis is as follows:

Section I provides an overview of OECD organization including the role of the organization in the world economics, its organizational structure, members, partners and bodies. Section II will bring forth financial and economic activities in OECD countries to see comparable developments. Section III summarizes literature review on relationship between terms structure of interest rate and economic growth and the reasons behind the linkage between yield curve and economic growth and analysis of the theoretical background of interest rate. This section will further discuss the literature review on other financial and economic activity variables. Section IV will bring up identification and discussion of variables included in the analysis and outlines the thesis's methodology and hypothesis. And finally, Section V will conclude the finding of the thesis and gives brief suggestions about this issue.

CHAPTER I:

AN OVERVIEW OF THE ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

INTRODUCTION:

This chapter will introduce the role of the Organization for Economic Co-operation and Development (OECD), which was founded in 1961 in Paris. The reason why this chapter has been included in the study is that, when looking at previous studies regarding the issue of relationship between financial indicators and economic activities, we see that many empirical works focus on large economies such as the U.S, the U.K, Germany, Canada and other most advanced economies. And, all these countries are also represented in the Organization for Economic Co-operation and Development beside some other major emerging economies with the exception of largest emerging economies of China, India and Brazil. Though, the OECD is closely working and partnering with those countries.

In fact, one of the main roles of the OECD in world economics is that it produces ideas, does research on economic developments, such as what factors affect economic activities, and does recommendations on policies for member and non-member countries. In one his speech at one of the Executive Council on Global Diplomacy, Angel Gurria, the Secretary-General, described the role of the OECD as following: “the mandate of the OECD is to promote by “consultation and co-operation […] the highest sustainable growth of their economies and improve the economic and social well-being of their peoples”2.

In this chapter, the various role of the OECD in world economics, its role on designing economic developments with regards to research on financial and economic activities, organization’s structure and its members and partners will be examined.

[2] Source: OECD, http://www.oecd.org/about/secretary-general/oecd-role-in-global-economic-governance-remarks-at-executive-council-on-global-diplomacy.htm

1.1. THE CREATION OF THE OEEC

OECD was established in 1961, to restructure European economies after Second World War the organization was a continuation of the previous economic organization called The Organization for European Economic Co-operation (OEEC) which was founded just after Second World War in 1948. This was created by Marshall Plan which proposed European countries to work on and assist their recovery and aid programme. The organization's aim was not only to deal with the American aid but also to promote free trade among the countries.

OEEC originally had 18 participant countries[3]. These countries were Austria, Belgium, Denmark, France, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey, United Kingdom, United States, Western Germany and The Anglo-American zone of the Free Territory of Trieste.

The OEEC founded with the aim of the following principles[4]:

Encourging European countries to adopt national production programmes in the post war period.
To expand and develop trade between European countries, tariffs would be removed.
To create a custom union and free trade area.
Easing payment system within member countries.
Reforming labour market within the group members.

Further capacity can be mentioned about the role of the OEEC, which had the mission to encourage European countries to get the U.S. help and recover from the ruin of the World War in order to restructure their broken economies. The first objective of the OEEC was to engage to allocate moneys promised by Marshall Aid Plan for European countries with the assistance of the U.S. and to make up countries' balance deficit. Later on, when there was currency crisis in Europe, especially in Britain, the U.S decides to extend the aid by

[3] Source: OECD, http://www.oecd.org/general/organisationforeuropeaneconomicco-operation.htm
[4] Information is taken from the OECD.

providing credit to member countries in exchange to agree to free 50% of private import trade in foodstuffs, manufactured products and raw materials.

In 1950, Europeans decides to regulate their currencies trade and creates a payment system called European Payment Union (EPU) under the control of the OEEC with the following objectives:

Easing European currencies conversion.
Removing quantity restrictions.
Suppress bilateral commercial practices.

1.2. THE CREATION OF THE OECD

When the Marshall Plan ended and countries favoured North Atlantic Trade Organization (NATO), which is a mutually security and economic organization, the influence of OEEC begins to decline. However the member countries use the OEEC's structures for NATO for the aim of the functionalities. For example, to promote NATO alliance's, members propose to use the OEEC and its committees, teams of experts and statistical output. It should also be noted that the OEEC was partly used only for European member countries economic problems.

The OEEC was replaced by the Organization for Economic Co-operation and Development (OECD), a worldwide body. Members of the OECD were not consist of European founder countries but also included the U.S. and Canada. Over the years, as the organization as the integration, economic development and trade advanced among the member countries the organization has expanded. Today there are 34 countries are represented in the OECD. Since its creation in the post war period, the OECD has dedicated to improve and integrate economic policies and social welfare for members and other major trading partners.
OECD does not only promote free trade and removing barriers between its members but also contribute world economic knowledge by sharing experiences to have solutions for economic upheavals and while understanding the economic policy, the organization works closely with members governments.

A news taken from the BBC News describes the OECD as an non-academic university5. In fact, since the OECD has been engaged in dealing with the economic problems, it has produced many research articles by working closely with member governments, business industry, labour unions and academia. For example, the organization tries to find solutions on social and environmental change, measures productivity and flow of trade and investment, analysis and forecast the future economic trends and set international standards from agriculture to tax regulation.

The OECD not only assist governments with above economic issues but also help to provide policy suggestion issues like daily life, social security. For instance comparing different schooling and pension systems of countries with the aim of supporting countries by backing their market economies with democratic institutions.

1.3. THE PLACE OF OECD MEMBERS IN THE WORLD ECONOMIC SCENE

Today as the organization has an important role in world economic arena, its members also has a great place shaping the world's industrial and technological growth, trade, labour and investment environment.

Before going further to see the main economic indicators of OECD countries in world economics, first we should look at the ratio of population of OECD members to the world population. The figure below shows the number of population for both the total OECD countries and the world population over thirteen years between 2000 and 2013. The share of population of the OECD countries to the world is about 17,5% as of 2013. However, as mentioned below, the 17,5% population dominate 64% of world economic output. Which can be interpreted that the remaining population of the world countries are low income countries.

The figure indicates that while the increase in population of the OECD is steady over the years, the same increase is upward in the case of whole world. This is understandable due to aging population. Because, as the OECD mainly consist of advanced economies, there is concern that growth in population of these countries is not enough for demographic reasons

[5] Source: BBC News, http://news.bbc.co.uk/2/hi/business/92719.stm

(Fougere and Merette, 1999). The authors also point that as the aging problem arise in advanced countries, this will have significant negative effect on macroeconomic and so on fiscal policies of these countries.

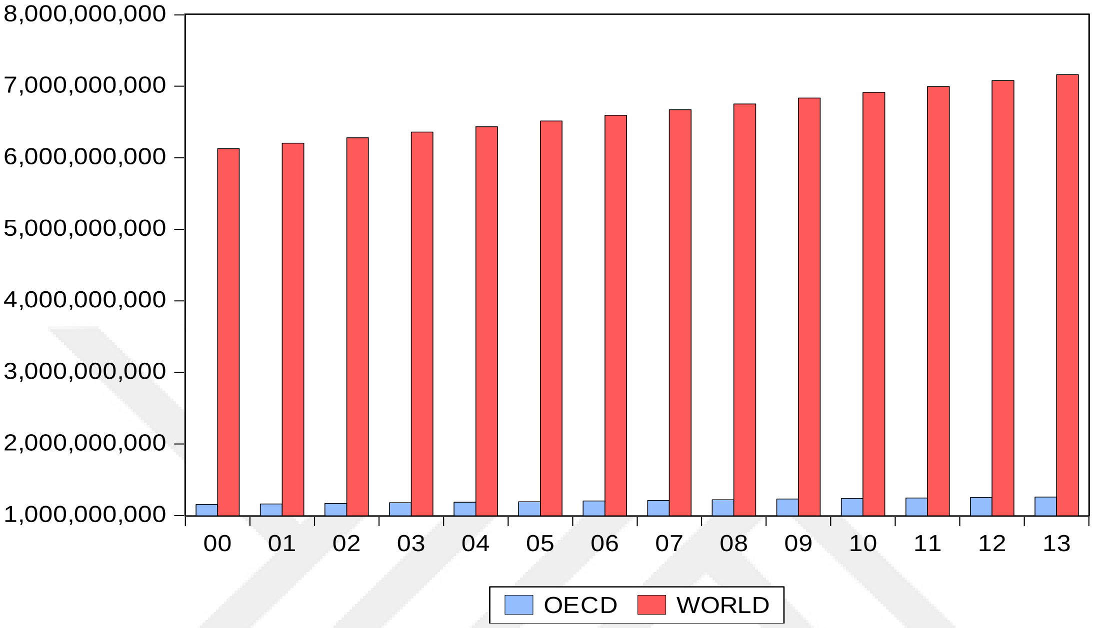

Figure 1.1: The world and the OECD population level in billions, between 2000 and 2013.

The OECD countries dominate world's trade today. Looking at the figures of Gross Domestic Products (GDP), which measures the total value of goods and services produced in a country, the OECD countries produces more than half of the world's GDP today. As of end of 2014, the world's GDP totals to about 77,8 Trillion US Dollars6 and of this value, about 50 Trillion US Dollars7 produced by 36 countries of the OECD organization (See figure 1 below). It should also be noted that the World Bank data consist of world's total 193 countries. Which indicate that the OECD members' GDP ratio to world is about 64%.

When looking at below figures, it can be seen that the OECD countries' production magnitude of goods and services has an upward trend since 1980. From 1980 to 2014, in 34 years, the OECD members increased their economic growth level almost five-fold from 10 Trillion US Dollars to 50 Trillion US Dollars.

[6] Source: World Bank, http://databank.worldbank.org/data/download/GDP.pdf
[7] Source: OECD, https://data.oecd.org/gdp/gross-domestic-product-gdp.htm#indicator-chart

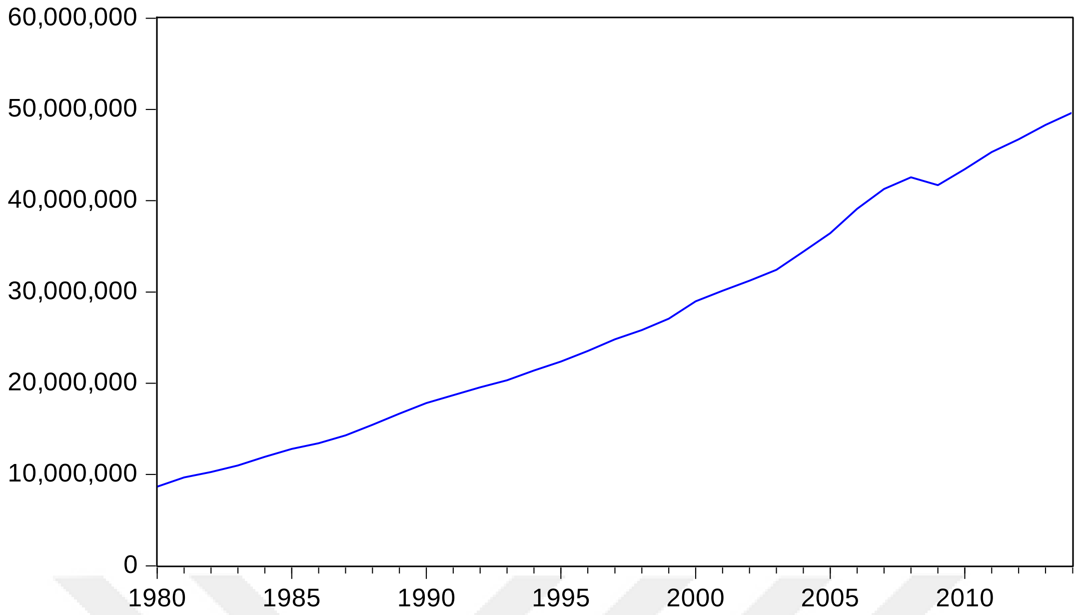

Figure 1.2: The OECD countries' Gross Domestic Products in US Dollar in current prices, between 1980 and 2014. (Total, in Million US Dollars)

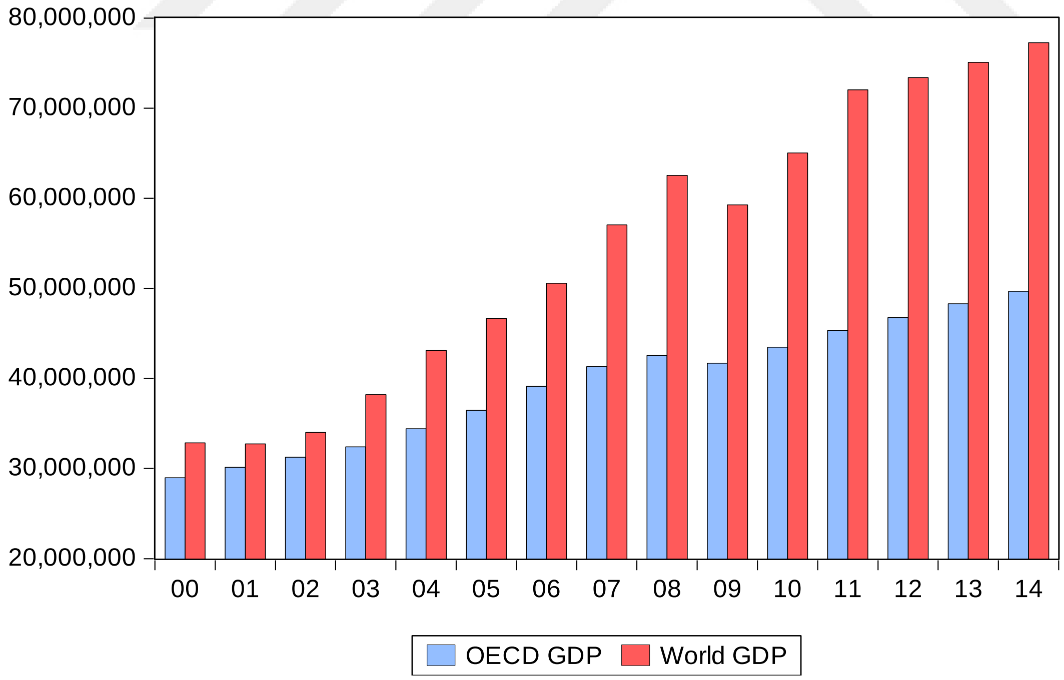

Figure 1.3: Comparison of GDP for The OECD countries and World Total in US Dollar in current prices, between 1980 and 2014. (Total, in Million US Dollars)

As it is mentioned above that OECD dominate the world economic output, this fact is backed by the number of employment level when the OECD figures compared to world. When looking at the employment ratio, i.e. the total percentage of working age population of the two groups, it appears that the number of people employed in OECD economies is much greater than the world average. For example, as of end of 2014, the OECD countries' employment rate stood at 65,6%, while the average world employment was at 59,7%. This result is quite predictable. Because, since OECD members include major industrialised countries their share of output is greater in comparison to the rest of the world. Further, as pointed out above, when the population figures introduced, the population level is steady and do not increase over the last couple of decade in OECD countries. In contrast, the rest of the world has seen a rise in their population. This situation obviously draws the employment down in especially undeveloped world. Another point is that, the graph below indicates that, at the time of financial crisis in 2008, the employment rate falls during the crisis. This drop is much more visible for the OECD members.

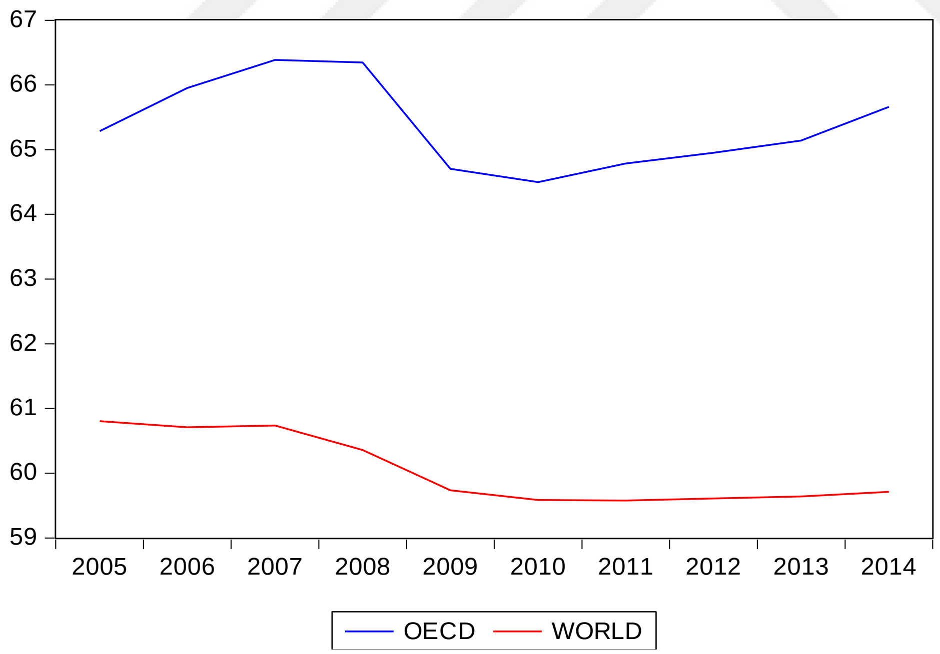

Figure 1.4: Employment Rate, Total % of Working Population, between 2005 and 2014.

1.4. ORGANISATIONAL STRUCTURE OF OECD

In this part of the chapter, an oversight of OECD will be examined to see how the organization functions with its council, committees and secretariat. Before giving information on the basic structure of OECD, some other information about the budget of the organization will be given.

The organization is funded by its members. Funds are collected in accordance with the members' economic size. For instance, the U.S. is the largest contributor with providing 21% of the budget. Japan with its size, comes second financier. The budget and related programme are decided by its members for every two years. The budget programme is supervised by external independent audit which is performed by Supreme Audit Institution of an OECD member country, appointed by the Council.

OECD exercises its information gathering power to help related parties such as governments, business and academia, to improve their prosperity, develop their economic growth and financial stability.
The OECD, when helping the governments in their research, follows the following procedures[8]:

→ Data Collection

→ Analysis

→ Discussion

→ Decisions

→ Implementation

And finally,

→ Peer reviews, Multilateral surveillance

[8] Source: OECD

1.4.1 The Council

The Council of the OECD is decision-making and governing body of the organization. The council's aim for the member countries is that it recommends policies regarding economic issues. For instance, when regular meetings are held, it can discuss economic issues ranging from financial stability of the world economics to tax agenda.

The OECD council is formed by one representative who is assigned from each member. In addition to representative by the members, a representative from the European Commission is represented in the council. The decisions of the OECD are taken unanimously when the council meets regularly. These meetings are chaired by the OECD Secretary-General. To discuss important issues of global economics, the council also meets at ministerial level once a year. The decisions taken are implemented by the Secretariat of the OECD.

For example, at the ministerial meetings, a statement of comments are drafted to present past performance of the OECD, specifies issues that member countries are facing and suggest aims and recommend policies for the OECD members (Grinvalds, 2011).

1.4.2. The Committees

The OECD states that there are about 250 committees, working and expert groups within the organization. The goal of these groups or committees are to review progress in areas such as economics, trade, science, employment and financial markets. These committees and groups are represented by the all 36 member states.

Marcussen (2004) points that about 40.000 delegates from each member country attend 15-20 working meeting each day. In her thesis, Grinvalds (2011), when reviewing the OECD's committees, she points that the committee structure of the OECD is "hierarchy of multiple -lead- committees supported by what are typically called -working parties- or -working groups"

1.4.3. The Secretariat

There is about 2.500 staff in the secretariat. The staff's main job is to support the work of committees and exercise and response priorities determined by the OECD Council. The OECD specifies that their staff include economists, lawyers, scientist and other professional.

The head of the OECD Secretariat also chairs the Council and provide the link between national delegations and the Secretariat.

CHAPTER II

A BRIEF OUTLOOK TO FINANCIAL AND ECONOMIC INDICATORS

This section introduces financial and economic activities in OECD countries to see comparable developments. In this chapter, the graphs of each variable are drawn to see comparable behaviour between the countries. Both, financial and economic indicators display that there appears to be divergence in challenging economies of European countries such as Greece, Portugal, Spain and Italy within the investigated period. For example, these countries experienced higher level of interest rate in contrast to lower level of industrial output.

2.1. INTEREST RATE SPREAD (10 years bonds – 3 months T-bills)

In the spread side, the below figure shows that the spreads between 10-year and 3-month T-bills for all OECD countries move in the same direction within the analysed period (See Figure 2.1). This situation is understandable as the OECD economies are integrated strongly. Change in interest rates in one country poses effective adjustment on other countries. Here, especially the world's most powerful central bank's, The FED, fundamental decisions are playing bigger roles.

Nevertheless, the below figure also indicates some extreme fluctuations in spread than other member countries after the financial crisis of 2008. The biggest variation and positive spread occurs for Greece and Portuguese's spread and slightly higher variation appear to have been for Ireland, Spain and Italy. This movement seems to be normal as the mentioned countries were affected most during the crisis. As the higher spreads imply greater future economic activities, so, in the post crisis period, higher spreads of these countries imply their economies were expected to recover soon according to theory. Another explanation could be that long term rates were increasing more than short term rates in that period, due to preferred habitat theory, which asserts that investors demand higher risk premium for longer term investment. In fact, when looking at long term interest rates of OECD countries from Figure 2.2, it can be seen that long term interest rates are higher for these countries.

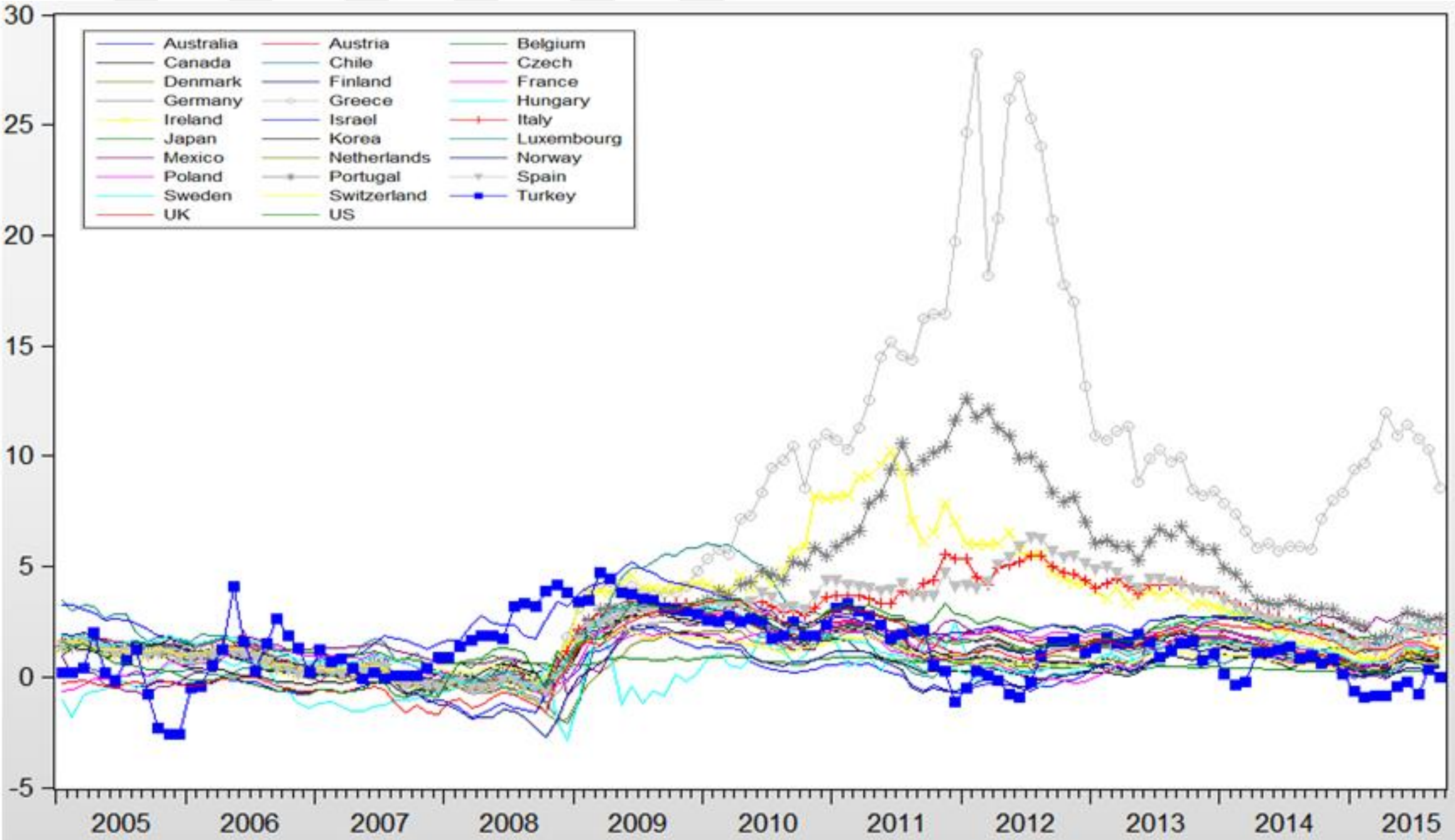

Figure 2.1: Interest Rates Spread Over the Period of 2005 and 2015

2.2. LONG TERM INTEREST RATES (10-year government bonds)

On the long term interest rates side, for all OECD countries, the longer term rates seems to be decreasing over the analysed period (See Figure 2.2). This is due to decision by central banks to stimulating economies by lowering short term interest rates and unconventional monetary policies of asset purchase program. For these reason long term interest rates of many member countries have been at low levels since the crisis. The expectation of deflation fear for developed countries, such European countries and Japan, also led long term rates to stay very low.

As it mentioned above in the case of spread, for troubled European Union countries, such as Greece, Portugal, Ireland and Italy the longer term interest rates are higher than other members. The reason for this is discussed when variation in spread introduced.

The lowest long term interest rates emerge for Japan before and after the crisis. On the other hand, the long term interest rates were much higher for Turkey prior to the crisis, however, especially after crisis, the trend for Turkish long term interest rates had gone down similar to other members.

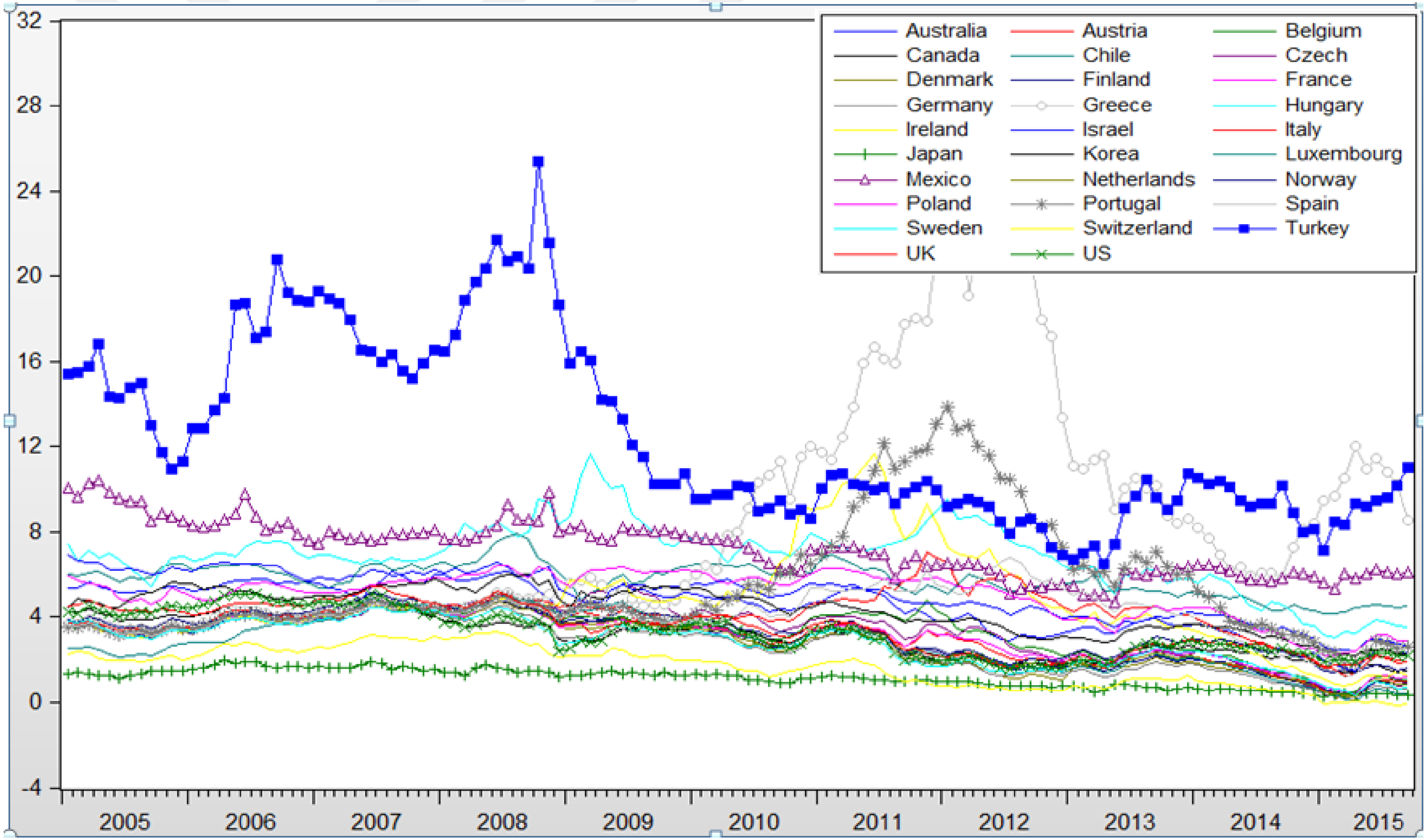

Figure 2.2: Long Term Interest Rates (10-years) Over the Period of 2005 and 2015

2.3. STOCK EXCHANGE INDEXES:

On the stock exchanges indexes side, again all OECD stock markets performance looks to be correlated in the same direction during the analysed period. The stock markets seem to be increasing before the crisis until they reached their peak level in July of 2007. However, once financial crisis of 2008 deepened, stock markets tumbled through 2008 till March of 2009 and bounced back afterwards as the markets conceived the way central banks are doing well.

The average fall in stock markets during the crisis were stood at about 50% to 60%[9]. The biggest fall took place in Greece and Ireland stock markets, which faced almost 70% of its value slipped due to debt trouble. While Irish stocks have recovered after the crisis, the Greek stocks could not regain and even fall further. From the figure 2.3, it is observed that the best performed stock market is Denmark in the post crisis period.

[9] Source: OECD Data

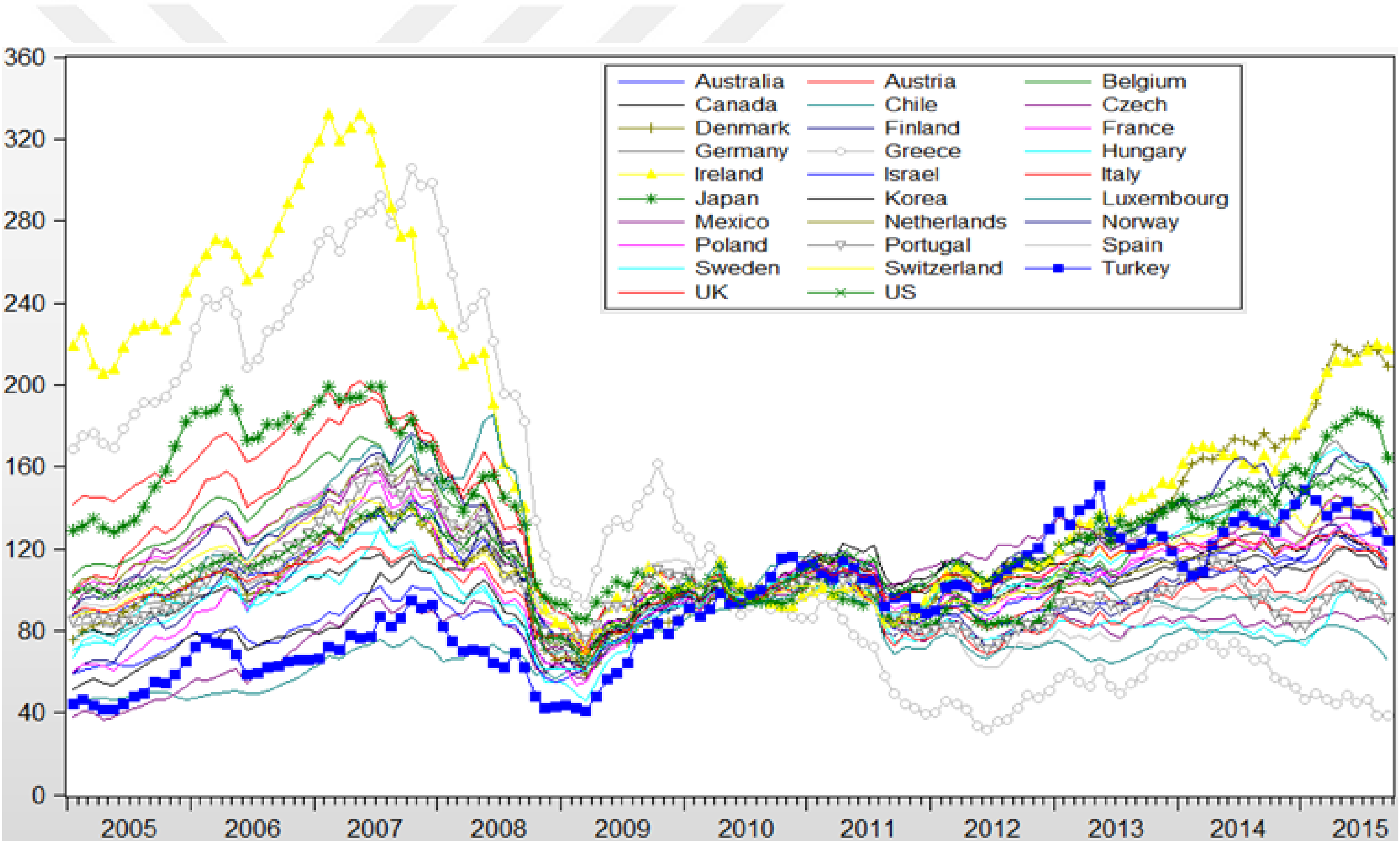

Figure 2.3: Stock Market Exchange Indexes Over the Period of 2005 and 2015

2.4. MONEY SUPPLY OF M1

On the M1 money supply side, the figure illustrates an upward trend in money supply since 2005 till 2015. The upward trend got sharper after the crisis, in particular later 2010. The reason why money supply increased in the post crisis is that almost all the major and other central banks of members of the OECD countries have undertaken stimulus programme to boost output growth and increase consumption demand.

Having said this, for instance, the FED stared to implement and unconventional monetary policy of Quantative Easing Programme, by which, the FED aimed to buy back government securities as well as corporate securities to with the goal of decreasing interest rates and increasing money supply. Not only The FED, but also other major central banks such as European Central Bank (ECB), Bank of Japan (BoJ) and Bank of England (BoE) including some of small scale economies started to use unconventional monetary policies. They also followed the FED in terms of buying longer term government securities and private sector bonds and reduced their policy interest rates. For instance, as Stiglitz (2016) reports in his paper that the balance sheet of FED, Bank of Japan, Bank of England and European Central Bank reached 25%, 82%, 21% and 31% respectively as of 2016.

Among OECD countries, the largest increase in M1 money supply comes from Turkey. Another point that this picture views is that, in the mid of 2015, the M1 money supply of Norway experiences a sudden increase of about 80% just in two months.

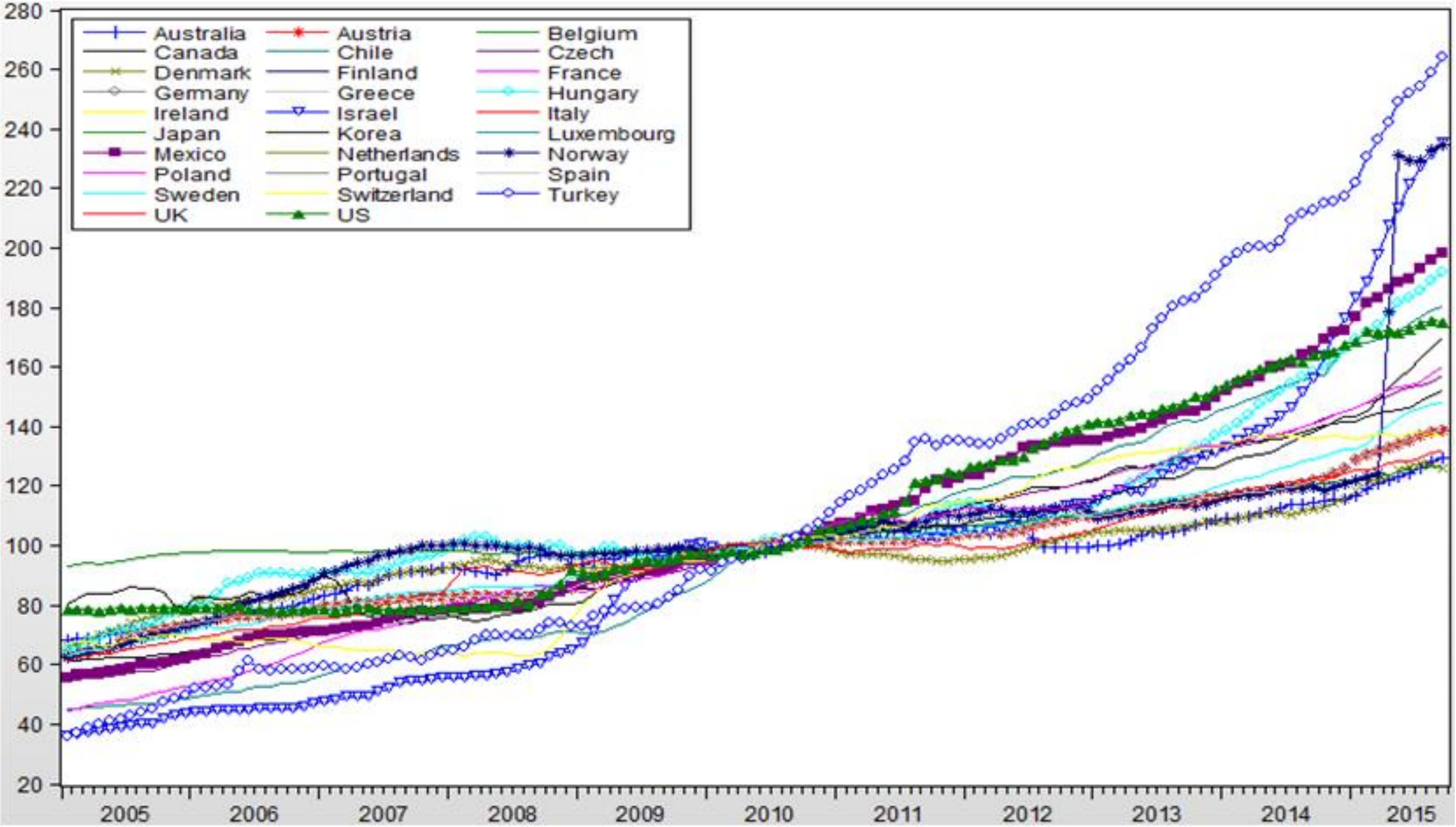

Figure 2.4: Level of M1 Money Supply Over the Period of 2005 and 2015

2.5. INDUSTRIAL PRODUCTION:

On the industrial production side, the effect of financial crisis is evident from thr Figure 2.5 in between 2008 and 2009. Prior to the crisis, there was a stable increase in all countries, however, once the crisis felt by the economies the level of industrial output fell significantly. It should be noted that industrial production index is generally used as a proxy to gauge GDP for countries.

As mentioned above in policies regarding money supply, by introducing new unconventional monetary policies and reducing interest rates, the central banks' action, actually, have succeeded in recovering the output growth in the post crisis period. Among the most affected countries from the crisis, Ireland seems better than Greece in terms of growth in industrial production. Turkey appears to be the country that performs well amid OECD countries in the post crisis period. The overall picture shows that, while some countries production levels were increasing, others seem to be experiencing struggling to raise their output level aftermath of the crisis.

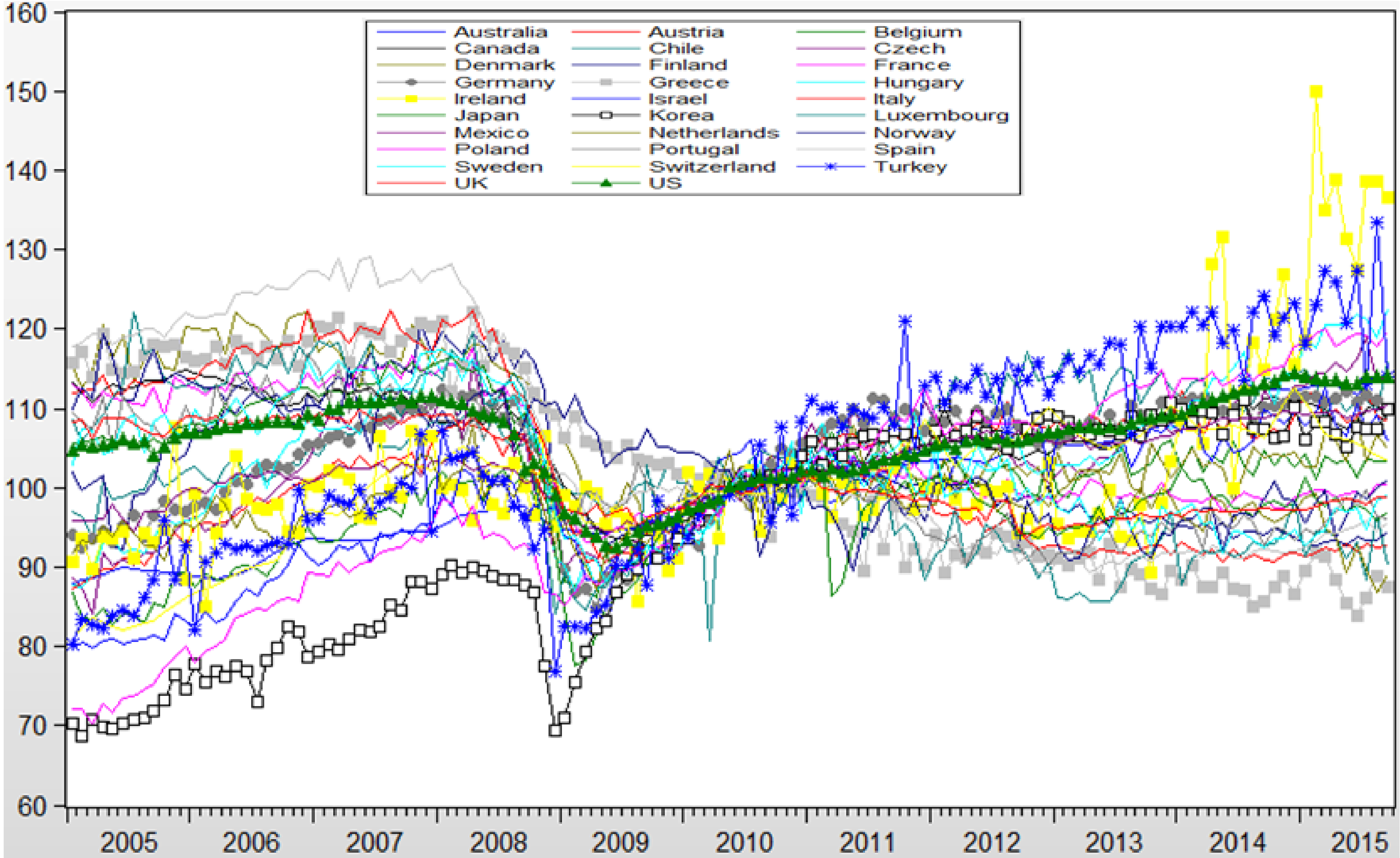

Figure 2.5: Level of Industrial Production Over the Period of 2005 and 2015

2.6. CONSUMER PRICE INDEX (CPI)

On inflation side, visible from the Figure 2.6, Turkey is the only country that had higher inflation rate in OECD group. This inflationary development for Turkey exists not only prior to the crisis but also continue after the crisis, yet slightly lower during the crisis. Apart from Turkey, the situation for Mexico and Chile look strange. For instance when the country had had lower inflation rate than other most of the OECD members, the inflation level accelerate thereafter. The only country that a flat inflation rate is Japan both prior and after the crisis. Nevertheless, it should also be noted that having implementing monetary easing, inflation seems to be slightly rising after 2014.

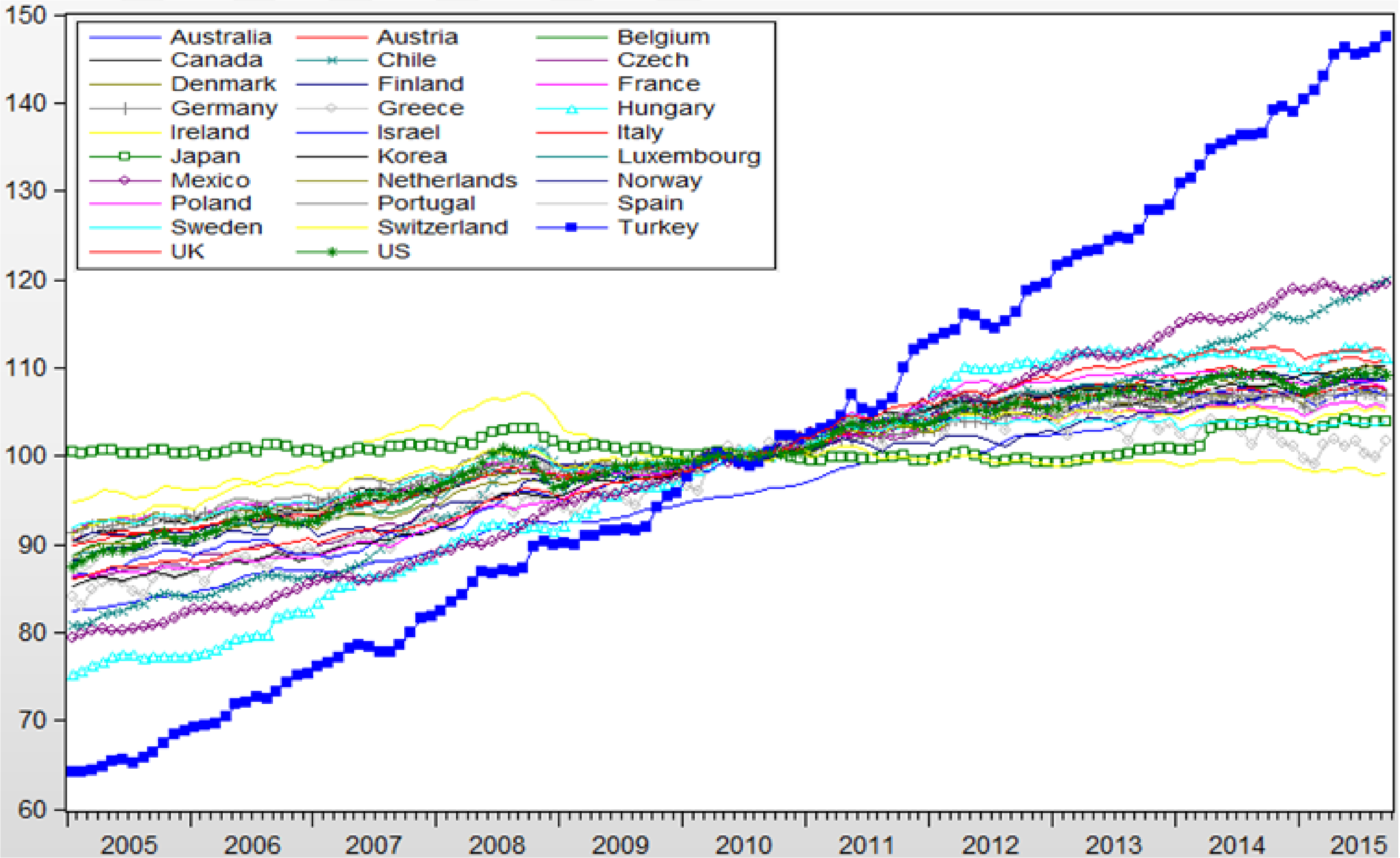

Figure 2.6: Consumer Price Index (CPI) Over the Period of 2005 and 2015

2.7. UNEMPLOYMENT RATES:

On the unemployment side, unemployment rate graph indicates that all countries have lower unemployment rates during the economic output is high and higher unemployment rates at the time lower output level. It is noticeable that the economically troubled European countries - these are Greece, Spain, Italy, Portugal and Ireland- experience the most unemployment rate during the analysis period. Even, in the post crisis period, these countries' unemployment levels peak as high as 28% and 26% respectively for Greece and Spain. On the other hand, the most developed countries such The United States, Germany and Switzerland have lowest unemployment rate in between 2005 and 2015.

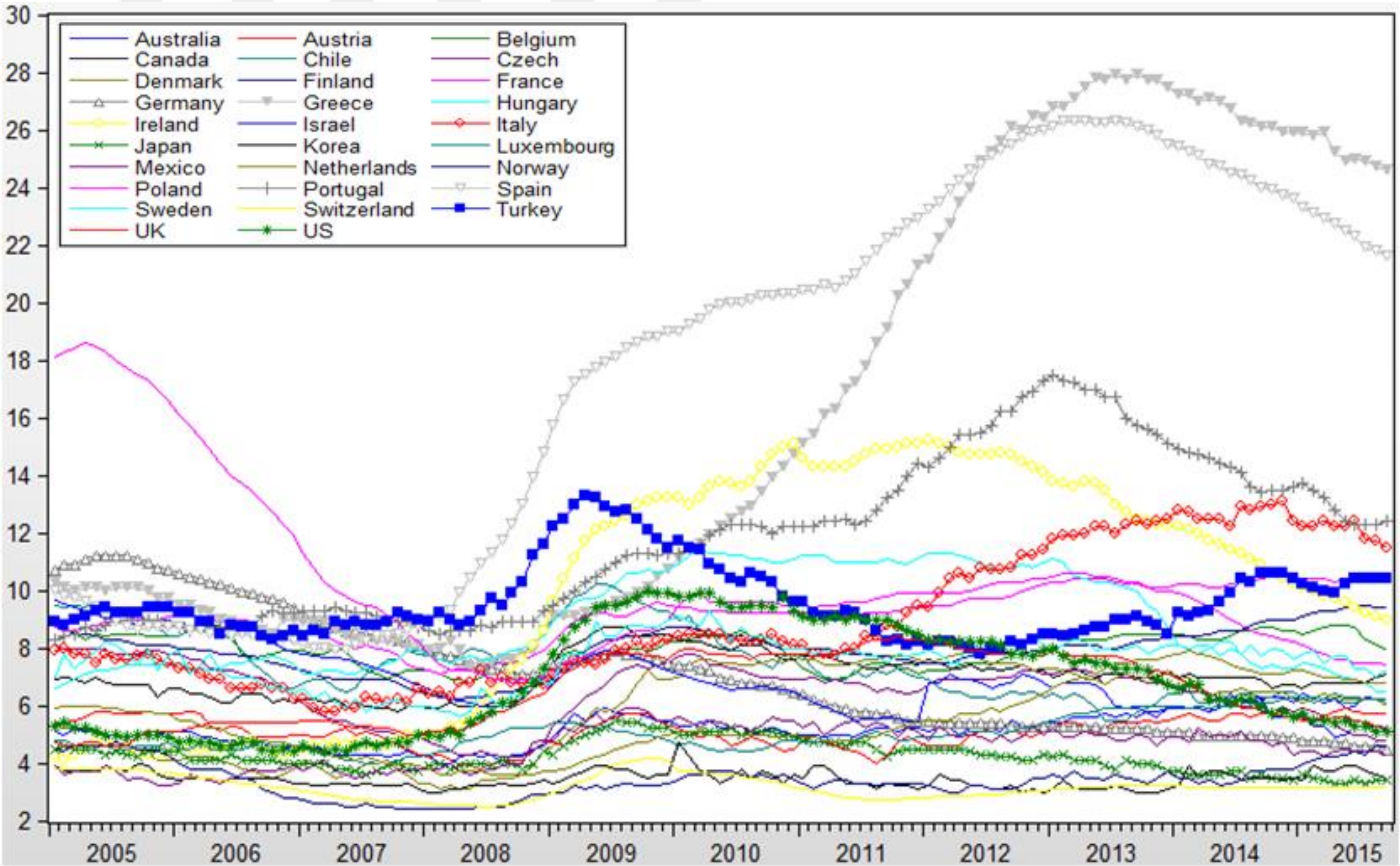

Figure 2.7: Consumer Price Index (CPI) Over the Period of 2005 and 2015

CHAPTER III

LITERATURE REVIEW AND THEORTICAL BACKGROUND

This chapter will summarize literature review on relationship between terms structure of interest rate and economic growth and the reasons behind the linkage between yield curve and economic activities with the theoretical background of interest rates. This section will further discuss the literature review on other financial and economic activity variables.

3.1 DISCUSSION OF VARIABLES IN THE ANALYSIS

3.1.1 Spread (Long term bond - Short term bill)

Interest rate spread or sometimes called term structure of interest rate (or yield curve) is defined by Estrella and Hardouvelis (1991) as the difference between 10-year Treasury bond yield and 3-month Treasury bills yield. The main argument that has been debated over the last couple of decades is the relation between spread and economic activities. Many empirical studies assert that in many cases when interest rate spread narrows or even becomes negative, the economic activities follow to slowdown afterwards or if the other way around occurs, then the economic growth will have an upward phase.

In the case of lower long term interest rates will give the expectation of future slower productivity growth in economies (Bauer and Rudebusch, 2016). When this expectation realised the long term interest rates will be lower than short term and this will imply a negative spread or a flat yield curve.

This issue of spread and economic activities is not only investigated by government long term bonds and short term bonds but also has taken several other interest rate spreads or other related variables into account. Among these, for instance, corporate bond spread (Papadamou and Siriopoulos, 2009), corporate profits (Ergungor, 2016), spread between overnight interest rates and Treasury auction interest rates (Berument et al. 2014), In the last couple of decades, many studies have been conducted to examine a variety of country's sovereign bond's interest rate spread and economic growth and/or economic activities. Virtually, entire empirical works proved that there is a positive relation between the slope of yield curve and future economic activities. Among these empirical works, the well-known papers are Bernanke (1990), Estrella and Hardouvelis (1991), Plosser and Rouwenhorst (1994), Haubrich and Dombrosky (1996), Estrella and Mishkin (1997, 1998), Estrella et.al, (2003) Cuaresma et.al (2005) and Dotsey (1998). Likewise, Estrella and Mishkin (1996), Kozicki (1997), Bernard and Gerlach (1996) and Dueker (1997) used the yield curve to predict recessions and inflation in the U.S., Euro area, Germany and Canada.

This positive relationship does not occur at any time. Sometimes, As Bernanke (1990) point out that there may be no relation between spread and economic activities at some point. For example the author states that as time go on, this relation disappear in the United States.

On the other hand, there is the opposite case, where there is no relationship between interest rate spread and economic activities. This case exist especially for developing or less developed countries for example see Telatar et.al (2003) ; Omay (2008) Berüment et. al, (2014) for Turkey, Gupta et.al (2013) for India, Papadamou (2009) for Hungary. The reason for this may be that there are no well-functioning financial and capital markets and as stated by Nickel (2011) political and some other internal risks. Further, these countries did not have very long term borrowing securities due to inefficient capital markets and higher risk premium.

The Theory of Why Do Interest Rate Spreads Affect Economic Activities

According to Estrella and Hardouvelis (1991) a flat or concave yield curve can be interpreted as falling future interest rates and that these lower rates are associated with a lower level of GNP output. For example Fama (1986) and Stambaugh (1988) show that increase in forward rates can be portrayed a future increase in economic expansion and a fall in forward rates will deemed activities to slowdown.

The main economic rationale for the yield spread's predictive power is that it serves as an indicator of the effectiveness of the stance of the monetary policy (Estrella et al., 2003). The author believe that if central banks raise short-term interest rates and market participants expect this move as effective in curbing future inflation in the long run, long-term rates (the averages of future expected short rates, according to the expectations hypothesis) should rise in smaller fraction. For this reason a confining monetary policy, in this case, will lead to flatten the yield curve, and at the same time slows down the economy (Estrella, 2005).
When looking at the literature, there are four common theories that try to explain movement in term structure of interest rates. These are expectation hypothesis, liquidity preference hypothesis, market segmentation hypothesis of Culbertson (1957) and preferred habitat theory. These theories identify and extract information about the changes in the variables that affect term structure of interest rate.

The expectation theory suggest that long term bonds rates indicate current short term bond or T-bills rates and expected future short term bond rates. According to expectation theory, in the case of an investment in bonds, it should not matter whether to invest in long term bonds or short terms bonds as their expected rate of return should be the same in terms of maturity that investment is placed. In that, investors should not be worry in their return, because the return in long term investment will almost be the same as short term investment. For instance, suppose that short term interest rates provide greater return when compared to long term interest rates. In this case the demand for short term bonds will increase and their prices and as a result the yield will fall. According to expectation theory, if investors expect interest rates will increase in the future, then the investors will require higher rates for long term interest rates to invest.

The theory of liquidity preference is simply that most of the investors try to invest their savings in liquid form. For this reason, investor can expect a higher premium for long term maturity securities. In opposite, by having short term securities, investor could easily sell their short term assets for liquidity purpose.

This theory first introduced by John Maynard Keynes in economics. Keynesian theory is based on three motives. The first one is transaction aim, which states that demand for money is depend on the level of income. In this case, income or money is needed for daily expense transactions. The second motive is related to precautionary motive. In this case, people need demanding money for unknown periods. The third motive to hold money is about speculative aim. In this case, people can use these investments to take advantage of change in interest rates.

Market segmentation theory hypothesis was developed by Culbertson (1957) and is assumed that interest rates level are set in their own markets for different interest rates in different maturities, thereby there will be no link between long term interest rates and long term interest rates. For this reason, Culbertson (1957) suggests that interest yield in one segment of market cannot be used to estimate interest rate yield of a different maturity asset.

Preferred habitat theory suggests that investors could prefer one period of time segment which is proper maturity for their investment objectives. However, these investors could go for other securities in different maturities only if the available risk premiums are higher, i.e. if higher interest rates are offered, investor could change their investing period. For this reason, long term rates will be higher than short rates.

3.1.2 Long term interest rates (10-year Government Bonds)

Monetary policies taken by central banks have effect on economies through interest rates. For instance, industries such as durable goods, housing and fixed investments are sensitive to change in interest rates (Roley and Sellon, 1995). Long term rates are not influenced only by short term rate decision but also prospective inflationary expectations and risk premium. An upward long term real interest rates due to fiscal and monetary policies, could lower stock market prices (Blanchard and Summers, 1984). However, in their empirical work, they also see that when interest rates are higher stocks continue to be higher before 1984.

Stock and Watson (1989) believe that change in long term government bonds have effects on forecasting of economic activities. This relation is discussed when the relation of spread have been introduced above.

The reason why long term interest rates are chosen instead of short term rate is that short term interest rates are affected by business fluctuations and monetary policies in the short run, however, long term interest rates considers longer term economic prospect (Humpe and Macmillan, 2007).

Beside long term rates of 10-years, the literature also uses 3-month Treasury bill rates in several empirical studies. However, due to high correlation between long term rates and short term rates, short term interest rates are excluded from the analysis period[10].

Furthermore, any movement of long term interest rates will have effect on the level interest rate spread which is altered by both short and long interest rate change. For instance, an increase in long term bonds interest rates, if greater than relative to short term rates, will expand spread. In opposite case, i.e. if short term interest rates increase more than long term rates than the spread will narrow. One of the example of this case has been given in the theory of spread that in inflationary period, if the market believe that central banks are going to decrease inflationary effects in the future, short term rates will be quick to rise relative to long term interest rates.

The empirical studies uses 3-month treasury bills and define short term rates that are influenced directly by the monetary policies set by the central banks. In their empirical works, Sim (1980), Grossman and Weiss (1980), Litterman and Weiss (1983) found that interest rates are better at predicting future output better than monetary base or money stock. Similar conclusion also was drawn by Bernanke's paper of 1990.

Grossman and Weiss (1980) suggest Treasury bill interest rates are better for prediction, because the authors state that *"interest rates affect output because they help to distinguish relative from aggregate productivity shocks which influence each agent's desired level of investment"*. It is understood from this passage that when there is an interest rate shock, the investment decision of firms will be affected and this effect will be channelled to change the level of output produced. These results are consistent with economic theories that due to tight monetary policy, real interest rates become higher which leads delay in investment and

[10] The statistical results reveal that the correlation coefficient is 96% among short and long term interest rates in this analysis within the estimated period.

decline in future output (Stock and Watson, 1989). According to Cozier and Tkacz (1994), the cycle of lower short term rates relative to long term rates could react to liquidity effect on short term rates of expansionary monetary policies.

3.1.3 Stock Index

The stock prices movement are thought to be one the financial indicators that can predict the future direction of economic activities, because financial markets are forward looking. In fact, stock markets price assets when new information arrives and reacts to this news accordingly (Chan, 2003). Hence, if the future of economic movement appears to be positive, then the stock prices buy these positive developments in advance and their prices increases with the magnitude of information at hand. Hence, there should be long run relation between stock prices and economic activities.

When looking at the literature that how stock prices are correlated with economic activities, Cozier and Tkacz (1994) uses the growth of stock price index to see the relation to the economic growth. The authors note that stock prices predict economic activities for only short term of one to two quarter. Similarly, Valadkhani (2004) uses Australian stock price index to show the prediction power of stock prices to economic growth and finds that stock prices can predict Australia's economic output. Nevertheless, Papadamou (2009) found negative relation between stock market index and economic activities for Eastern European countries and noting the reason that stock markets in those countries may not be well developed. In the Turkish context, Cankal (2015) investigates the relation between stock market and macro-economic variables in Turkey. The author finds a negative correlation between stock market and inflation, exchange rate and interest rates.

3.1.4 Industrial Production Index

Despite using Gross Domestic Product (GDP) as a common measure of the overall economic performance of an economy, Industrial production index will be used in the analysis because of availability of monthly data as GDP is computed quarterly. These two measures, GDP and Industrial production, usually used by economist to see the business cycle; however GDP is more extensive measure of overall economy than industrial production (Moody et. al., 1993).

Industrial output, which sometimes referred as business cycle in literature, is directly related to the growth of the economy in a country. Therefore, a change in output level is easily affected by the change in economic and fundamentals such as interest rates, monetary stance of central banks, price of assets, which is stock prices, and political issues.

Further, Industrial production even determine other economics activities such as unemployment rate, produced goods, housing units, investment and saving rates (Moody et. al. 1993), inflation and capacity utilisation.

The relation between industrial production, alongside with other economic activities, and financial variables is going to be analysed. For example, the literature suggest that if interest spread widens then it is highly likely that the industrial output will be affected positively and there will be an increase in output in the near future. Similarly, an increase in stock prices will mean good news for corporate in particular and for the economy as a whole and subsequently the industrial output will benefit from this positive environment.

3.1.5 Consumer Price Index

The literature suggests that there is predictive power of interest rate spreads for inflation, alike output. For example Estrella (1997, 2004); Ivanova et. al. (2000); Bernanke (1990); investigated the predictive power of interest rate spreads on inflation on several developed countries and Telatar et. al. (2003) and Şahinbeyoğlu and Yalçın (2000) on Turkey.

The above researches find the power of spread to predict the future inflation. The rationale behind interest rate spread and inflation is the theory that an upward sloping yield curve indicates an expected higher future interest rates i.e. a positive interest rate spread will signal higher future interest rates.

When the theory of interest rate and economic activities were explained, Estrella et al., (2003), Estrella (2005) and Bernanke (1990) introduced the reasoning of why interest rate spread is so informative about future economic growth and future inflation. In that, the authors give justification that if the central bank increases its monetary policy rate, then the market participants will react to this news. The way of the reaction is that the participants will consider this move by central bank to tame future or decrease future inflation. Hence, if the increase in short term rate were to be successful in reducing future inflation rate, then the increase in future expected long term interest rates will be less than the increase in short term interest rates.

As a result, the yield curve will be flattened as mentioned by Estrella (2005). In terms of future expected inflation, this procedure will drive down the inflation. It can be concluded that an inverse yield curve will signal a future lower inflation rates for the countries.

3.1.6 Unemployment Rates

Employment rate is another economic indicator that especially central banks are focused on since the economic slowdown of 2008 financial crisis. When looking at Federal Reserve policy of late economic discussion, the FED puts emphasis on, apart from price stability, employment rate of the U.S. economy. The FED’s goal is that if the economy is in full employment level then there may be some room to increase interest rate which also might be considered the economy’s growth phase is accelerating. As previously mentioned above, if the FED increases its policy rate, the capital markets will consider this rate hike a signal of robust economic growth and short term rates increases more than long term rates and the interest spread will fall. (See discussion related the behaviour of short interest rate and long term interest rates above).

In literature, Papadamou and Siriopoulos (2009), when analysed the effects of monetary policies on unemployment rate in South Korean economy, they find a positive relation between corporate bond spread and unemployment rate which was predicted several months ago by the spread used. However, the authors also believe that the response of unemployment rate to change in monetary policies were smaller.

In contrast to employment rate, unemployment rate decreases if the economic growth increases. Seasonally adjusted employment rate and non-agricultural unemployment rate will be used in the analysis to see their relation with the financial variables.

3.1.7 Money supply of M1

Several researches point that money supply can be use to see future economic developments. For instance, Estrella and Mishkin (1995) uses M1 money supply as a proxy for monetary policy and uses M1 beside spread and short term rates in analysing the effect of spread on economic activities. Berument et. al (2014) state money supply of M1 as total size of monetary aggregates and a measure of liquidity. Here is the rationale is that increasing money supply will lower interest rates as the supply of monetary base increases according to central banks' policy decisions. The conventional wisdom is that short term interest rates will soon react to the money supply and these rates will increase before long term interest rates in capital markets. Hence, increase in short term rates will lower interest rate spread in the short term.

From the perspective of economic activities, as the amount of money rises the interest rates on loanable funds will decrease and the availability of funds would be easier for businesses. Thus, expanding monetary base will boost industrial production and accordingly will lower unemployment rate in the period concerned. However, on the other hand, as money supply increase, inflation may be triggered as the consumption and investment increases.

In fact, more recently, when central banks' action are being analysed, major central banks such as the FED, ECB and BoJ by employing unconventional monetary policies of increasing money supply in the markets have tried also to increase inflation rates which have been in very low level in the post crisis period.

3.2 LITERATURE REVIEW

Literature review on the issue of spread and economic activities are documented below. General literature studies have been on countries on more advanced economies. This seems to be reasonable as advanced economies have had longer term rates previously. However, developing countries or less developed countries, on the other hand, did not have very long term borrowing securities due to inefficient capital markets and their higher risk premium.

The predictive content of interest rate spread appears to be weak especially for developing countries such as Turkey (Berüment et. al, 2014, Omay, 2008), India (Gupta et. al, 2013), Hungary (Papadamou, 2009).

Here below, the literature review documented by including a summary of researches, applied econometric models, authors and publishing journals.

Author- Year	Published Paper	Analysed Countries	Data Type and Frequency	Econometric model	Results and Conclusions
Bernanke, 1990	NBER working paper	USA	Monthly data Financial variables: - Variables used: 10 Yr Gov bonds minus 3 Month T-Bill spread. - Commercial paper and T-Bill spread (6 month). - Commercial bond and Gov. bond spread(10 year). - 10 yr T bond minus Fed Fund spread. Explained economic variables: - Industrial Production - Capacity Utilisation - Housing stats - Unemployment - Employment - Retail sales - Personal ıncome - Consumption - Inflation	OLS model - univariate and multivariate comparisons.	The spread between commercial paper rate and T-Bill seems to be a better at forecasting economic activities. This spread further gives information about default risk. This spread is also a measure of monetary policy. The author suggest that the power of spread is more in 1980's and weak afterwards. This is due to the FED's procedures of interest rates and substitutability among the other money market instruments due to deregulation and financial innovations.
Estrella and Mishkin, 1997	European Economic Review	USA, Germany, France, Italy and UK	To explain Spread: (Bond-Bill) or (Bond-Central bank rate) - Central bank rate - T-Bill rate (3-month) - 10 yr gov. bond used. To explain output: - Spread	VAR, OLS and Probit model (This is for predicting recession)	The authors conclude that monetary policy plays an important role in terms of determining interest rate spread. This paper applied the power of spread to predict future output and inflation not only on the US but for major European countries such as Germany, the UK, France and Italy and

			- GDP - Central bank rate - T-Bill rate - Real central bank rate - Money supply (M1) To explain Inflation: - Spread		previous results are similar for these countries. Spread can predict real activity and inflation at least one year in advance for the US but for European countries at least for two years horizons. Not only spread that has the predicted power but also other monetary policy instruments have effect on future output and inflation which defers country to country. The authors suggest ECB that spread can be influenced by monetary policy actions.
Ivanova Lahiri and Seitz, 2000	International Journal of Forecasting	Germany	Monthly data used. To explain inflation: - Public_TS= Spread between 9-10 years bond and 1-2 years bond (public) - Bank_TS= Spread between 9-10 years bond and 1-2 years bond (Bank bonds) - Bank_Public= Spread between bank 1-2 years and public 1-2 years bonds - Lombard_TS= Spread between 9-10 years public bond and Lomard rate - Call_TS= Spread between 9-10 years public bond and call rate.	Two-regime Markov-switch model, Turning point forecast.	They suggest that public and bank term structures are obviously influenced by monetary policies. The bank–public spread, in addition, captures factors such as default risk and private financing needs (pointed by Bernanke, 1990), especially in building and construction in the context of Germany. It is the aim of this paper to see comparative performance of several spreads. Their finding conforms to previous researches that yield spreads are useful tool for forecasting inflation and business cycles. They found that bank term structure, public term structure and spread based on call rate had been successful in predicting activities. The bank public spread were giving false signal in some periods.

Duarte, Venetis, and Paya, 2005	International Journal of Forecasting	Euro Area,	Quarterly data used. For growth: - Spread between 10 yr gov. Bond and 3-month deposit rate.	For Linear model: OLS. For non-linear model: The change point model and Threshold model.	The authors suggest nonlinearity of cycle of growth and spread force to use nonlinear model for explanation as they are not linear. Thus, they use both, linear (OLS) and non-linear models and conclude that spread is a leading indicator for Euro area. However non-linear model do better than linear model in terms of predicted time horizons. i.e., can forecast growth 1 year ahead annual growth (or four quarter).
Haubrich and Dombrosky, 1996	Economic Review	USA	Monthly data used. - Inflation - Interest rate - Commodity prices to see the effect of rate increase on prices and commodities.	VAR model	By using VAR model to see the effect of monetary shocks on output and price levels. They use impulse response function to see how a 100 basis point increase in FED rates affect inflation and output. The result is that this rate increase initially leads a rise in prices, however within six months prices fall below their initial level.
Cozier and Tkacz, 1994	Department of Monetary and Financial Analysis, Bank of Canada	Canada	Quarterly data used. To explain growth: - 10 yr gov bond yield minus 90 day commercial paper rate - 10 yr gov bond yield minus 30-day commercial paper rate - 10 yr gov bond yield minus call loan rate	OLS model, VAR model	They find a positive relationship between the spread for long and short rates and future changes in real GDP in Canada. This relationship is strongest at the 1-year horizon or just beyond. The spread also forecast inflation for about 2 year in advance. They conclude that the bigger the maturity used for spread the better the predictive power of the spread for output. Interest rate spread is strongly related to the output and

			- 10 yr gov bond yield minus 1- to 3 yr gov bond yield - 10 yr gov bond yield minus 3- to 5 yr gov bond yield - 1- to 3-yr gov bond yield minus 90-day commercial paper rate - 1- to 3-year gov bond yield minus 30-day commercial paper rate - 1- to 3-year gov bond yield minus call loan rate - 3- to 5- year government bond yield minus 90-day commercial paper rate - 3- to 5-year gov bond yield minus 30-day commercial paper rate - 3- to 5-year gov bond yield minus call loan rate - 90-day commercial paper rate minus 30-day commercial paper rate And also Inflation, Money supply (M1) stock prices, the US spread and real interest rate and Canada's Leading Indicators.		also strongly related to the change in consumer durable goods. Apart from spread, when stock prices, real interest rates, M1 and Canada's leading indicators were put in regression to explain growth, then the power will became more robust. For example, when using FED rate for prediction of output, FED were doing better forecasting than Canada's central bank rate. The author suggests this may be due to the fact of exchange rate differential.

Estrella and Hardouvelis,1991	The Journal of Finance	USA	Quarterly data used. Variables used: - Spread (10 yr – 3 month) - GDP - Inflation - FED Funds rate	OLS model And probability function to estimate recession.	The authors use the difference between the 10-year government bond rate and the 90-day T-bill rate to forecast U.S. output growth and its components up to 5 years into the future. They find that the term structure is an excellent predictor of output growth and its private components. Further, 100 basis point increase in the spread translates into just over a 1 percentage point increase in growth a year later. When they add extra variables to their model, such as the growth rate of an index of leading indicators, a short term interest rate, the inflation rate and a lagged growth rate, the term structure remains significant at predicting output growth up to three years. Out of sample, the term structure based models outperform American Statistical Association/National Bureau of Economic Research survey-based forecasts of output growth for the 3 following quarters. In terms of the components of growth, the authors find that the term structure is most closely related to durables consumption and investment
Ang, Piazzesi and Wei, 2006	Journal of Econometrics	USA	Quarterly data used. To explain GDP - Spread (10 yr gov bond and 3-month T-bill) - Short rate	VAR model	After building dynamic model for GDP and yields, in their work, they find the short term rate has more predictive power than any term spread. Their model suggests the use of lagged GDP

					and the longest maturity yield to measure the slope. The paper employs a no arbitrage framework that is used for bond pricing and used to predict future GDP.
Bernard and Gerlach, 1996	BIS Working Paper	USA, Germany, the UK, France, Japan, Belgium, Canada and Netherlands	- Spread - Long rates (over 6 years or 10 yr gov bond) - Short rates (3-month T-Bill or 3 month interbank rates) - Leading indicators for each country.	Probit regression,	The authors focused on forecasting future recessions in analysed countries. In all eight countries, yield curve has the power to predict likelihood of recessions. The forecasting power is higher for Canada, Germany and the US. And the differing results may be due to financial market regulation of countries. Term spread can predict recession in 6 quarters ahead in some countries.
Valadkhani, 2004	Economic Analysis & Policy	Australia	Quarterly data used. To explain output growth: - Spread (10 yr gov bond minus 3-month Tbill) - Spread of US (the same maturity) - M1 money supply - Stock price ındex (Australia) - Composite leading index	OLS model	By using four leading indicator the author tries to explain output growth in Australia. When combining the entire variable into regression with the interest rate spread, the regression become significant in explaining output growth. The author concludes that spread explains 26% of future output growth. When Australian the largest trade partner's (USA) spread is also considered, it is also found to be a significant variable with the Australian leading economic indicator in explaining future output for at least 6 quarter ahead. Stock market indices and M1 also are found to be useful for predicting of future output.

Kuosmanen and Vataja, 2010	University of Vaasa Department of Economic Working Paper	Finland	Quarterly data used. To explain GDP growth: - Spread (10 yr gov bond minus 3-month Tbill) - 3-month T-Bill - Stock market price (Finland)	OLS model AR model for forecasting	This paper examines the effect of some financial variables on future economic activities of Finland. The authors argue that while financial variables are good in estimating the future activities, however, when the economy is in stable condition, the prediction power of stock market and short interest rates are better. On the other hand at the time of unstable economic conditions the term spread and stock market prices appear to be a good indicator of the economy.
Thompson, Eyden and Gupta, 2014	Studies in Economics and Finance	South Africa		OLS, ARDL model, Causality test	The aim of the paper is to build up a forecasting indicator by using financial variables including interest rate spread to create financial condition index (FCI). Other variables are stock market index, asset prices, stock market yield and volatility, bond market volatility and monetary aggregates. After using various methodologies, they find that the created FCI is a good predictor of South African economic activity. And further, they suggest that this indicator is a good predictor for output growth and T-Bill rate. On the other hand, the prediction becomes weak for future inflation.

Papadamou, 2009	Applied Economics Letters	East European Countries: Czech, Poland, Hungary, Slovakia	Monthly data used. Variables used are: - Spread (10 yr gov bond minus 3-month money market rate) - Industrial production - Inflation - Stock index - Unemployment rate		When explaining the power of yield curve on economic activities of East European countries, the author find that the yield curve can predict economic activities up to 24 months and 3 months' time horizon. The impact of interest rate spread is the most influential in the case of Czech Republic with 47% variation that explain the future growth. The author also suggest that the spread can be a good indicator in stable economy such as Czech Republic and may be weak indicator in countries like Hungary with high and volatile inflation rate.
Banerji, Ventouri and Wang, 2014	Economic Modelling	Malaysia Indonesia China Philippines	To explain external variables: - Term structure - Corporate bond spread - Variance risk premium - Dollar index To explain domestic variables: - Trade/GDP ratio - Debt/GDP ratio - Log spread (Emerging market bond index) - Control variable is the US term structure of interest rates.	SVAR model	The authors try to find relations between external factors, domestic macroeconomic variable and sovereign spreads in the mentioned countries. They conclude that the variation of interest rate spread in Asian economies is mainly affected by the external factors. For example, the US interest rate spread and credit risk aversion plays an important role. They further imply that the US variables directly affect sovereign spread and indirectly affect macroeconomic fundamental in those countries.

Gonzalez, Spencer and Wlaz, 1999	Journal of International Financial Markets, Institutions and Money	Mexico			During the 1995 and 1997 when Mexico experienced and economic instability, the authors tested the predictability of term structure of interest rate for Mexican output. Their findings are in line with the result of developed countries. However this may not exactly the case due to Mexican economic conditions.
Papadamou and Siriopoulos, 2009	Journal of Economic Integration	South Korea	To explain unemployment rate: - Corporate bond spread - External financing premium (difference between gov bond and corporate bond with the same maturity)	Generalised Methods of Moment (GMM), İmpulse response of VAR	They uses corporate bond spread to see the estimation of future unemployment rate in South Korea. The authors find that Korean corporate bond spread can predict up to six month unemployment rate. When using impulse response function, they see that in the case of rising risk premium (or external financing premium) of corporate bonds, unemployment rate increases too.
Oyedele, 2014	International Journal of Innovation and Scientific Research	Nigeria	Quarterly data used. To explain GDP: - Spread - Money supply (M2) - Stock exchange index To explain inflation: - Spread - GDP - M2	Dynamic OLS	Aiming to explain spread and economic activities and inflation in Nigeria. The author concludes that spread in Nigeria can predict output and future inflation.

Yamak and Tanrıöver, 2009	Dokuz Eylül Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi	Turkey	To explain GDP: - Spread (12 months deposit rate minus 3 month deposit rate) - GDP - Inflation - Short rate (3-month deposit rate) (in a different regression) - Long rate 12-month deposit rate) (in a different regression)	OLS model	In the case of Turkey, they conclude that the spread has a positive effect on the future growth. However when short and long rates were added into regression, the growth affected negatively. And further, short rates are more effective in determining the future growth than long term interest rates.
Kaya, 2007 (Tez)	Y.Lisans Tezi	Turkey	Monthly data used. To explain industrial production: - Spread (360 day and 30 day bill) (270 day and 30 day bill, 180 day and 30 day bill, 90 day and 30 day bill) etc	ARDL model	The author found for Turkey the following results: there is positive relation between analysed spread and economic activity and inflation. Also points that the predictive power of spread for economic activity is more than inflation. As the spread horizon get longer the power of predicting also gets higher and the spread in Turkish case is not affected by the monetary policy.
Telatar, Telatar and Ratti, 2003	Journal of Policy Modelling	Turkey	Monthly data used. To explain dynamic of inflation: - İnflation, Interest rate, Money supply, wages and import price index used. To explain future inflation: Term structures of interest used are: - From 1 month interest rate to 6 month interest rates.	Time-varying-parameter model with Markov-switching heteroskedastic disturbances	To get information about the effect of spread on Turkish inflation, the author's results suggest that a time-varying parameter model with Markov-switching heteroskedastic disturbances provides a reasonable explanation of the relation between the term structure of interest rates and changes in inflation. Nevertheless, they also point that one–three-month range, predictions from changes in slope of yield curve for inflation

					(the slope coefficient) is not time-varying. They conclude that the term structure of interest rates is limited as a source of information for future inflation, especially at longer horizons.
Berüment, Ceylan and Dogan, 2014	Applied Economics	Turkey	Monthly data used. - Spread (between interbank and Treasury auction rate) - Industrial production - Consumer Price Index (CPI) - Exchange rate (0.50 USD and 0.50 Euro basket).	VAR model	To see the monetary policy evaluation of Turkish Central Bank, the authors suggest that spread between overnight interest rate and treasury bill interest rates has information for exchange rate, output (measure of income) and inflation (price level). They also point to the case that if there is a monetary tightening measures, output will temporarily will decrease, and price level will decreases permanently and the domestic currency will appreciate.
Başdaş and Soytaş, 2010		Turkey	Monthly data used.	Unrestricted VAR model and Granger Causality	This paper looks at the relation between stock returns and economic growth and sees the effect of stock return on economic growth. The authors conclude that when analysing return of stock to cause economic growth and inflation, they see no significant results. However, in the period of 2002 and 2008, the link between variables almost disappears. Finally, they believe that the link between stock return and economic growth is weak.

Şahinbeyoğlu and Yalçın, 2000	Central Bank of Turkey, Discussion Paper	Turkey	Monthly data used, variables to explain Inflation: - Spread between different maturities of Bills ranging from 1- 3-6-9 and 12 months. - Inflation rate (CPI and PPI).	Forecasting regression (of Fisher)	To see the effect of interest rate spread on inflation in Turkey, the authors empirically tested the variables and conclude that contrary to the previous work of OECD countries, In Turkey, the nominal interest rate spread has a significant but negative effect on future inflation. The spread's effect on inflation is for about 3- month ahead. The authors also state that the slope of yield curve of real interest rate is not stable overtime.
Omay, 2008	Munich Personal RePEc Archive	Turkey	Monthly data used. Variables used: - Spread (3-month Bill minus 1-month Bill) - Industrial production - Inflation -	Generalized Impulse Response (GIRF) analysis to the Logistic Smooth Transition Vector Autoregressive (LSTVAR) model	To predict inflation and real economic activity in Turkey, the author uses nonlinear econometric approach. By using Chow Structural Break test to the linear model, the author found a non-stable condition for spread and economic activity and inflation. When using LSTVAR model to see the cause of negative relation between spread and economic activity and inflation, the author conclude the reason of negative relation by two dimensions. The first is expectation hypothesis and the second interest rate transmission channel. Finally when using GIRF model, it appears that the non-stable condition of spread and economic activity is exist in the investigated period of 1991 and 2004.

Gupta, Ye and Sako, 2013	Technological and Economic Development of Economy	India	Monthly data used. To explain industrial production: - Industrial production - M0, M1, M2 and M3 money supply. - Lending rate - Term spread (10 yr gov bond minus 3 month T-bill) - 3-month bill - Exchange rate - Stock prices - Dividend yield - Non-food credit growth	Recursive out-of-sample forecast based on ARDL model	By forecasting the future industrial production level in India, the authors used in and out of sample of financial variables. They observed evidence for M0, M1, M2, M3, Lending rate and stock prices that can predict output at least for one horizon. However, the predictability power of variables seemed to be weak for Indian future output growth when using linear methods.
Kanagasabapathy and Goyal, 2002	IMF Working Paper	India	To explain Industrial production: - Spread (10 yr gov bonds minus 2-3 month Bills) - Industrial production	OLS and Probit model	The authors not only investigate the effect of spread on output but also analysed prediction of recession in India by using spread. They conclude that in Indian case, there is evidence of yield curve effect on Indian output (i.e. higher- positive- yield curve followed by higher industrial output). When looking at the recession estimate, again, the authors find positive correlation between spread and likely future recession. A decrease in spread will be followed by a likelihood increase of recession in the future of Indian economy.

Nickel, Rother and Ruelke, 2011	Applied Financial Economics	Eastern European Countries: Czech, Hungary, Poland, Russia and Turkey	Monthly data used. - The fiscal expectations measured by survey data. - Economic variables: Short term interest rates, unemployment rates, real growth rate and budget deficit. - Bond spread is USD denominated bonds. To explain Bond spread: - Expected fiscal deficit - Expected GDP growth - Expected inflation - Dummy variable for countries entered EU - Emerging countries bond spread - Exchange rate - Change in stock index	Panel Data analysis , OLS	To find effect of fiscal policies (financial markets) on bond spread (Computed by JP Morgan) for East European countries, the authors find that EU accession dummy is negative and means that after entrance the bonds spread decreases. Expected GDP has a negative impact on spread. Investors assign different weights to macro-economic and fiscal variables for each country when they do investment decisions. The authors believe that there may be different factors, such as politic risk or some other internal risk that may play behind bond risk in investigated countries.

Hsing and Hsieh, 2004	Economics of Planning	China	To explain GDP - GDP - Monetary variable(interest rate or M2 money supply) - Exchange rate - Fiscal policy rate - Inflation - World output	VAR model	Using interest rate as a monetary variable the authors try to find their effect on China's output. They find that lower interest rates, higher M2, lower government debt ratio and more lagged output increases China's GDP. They point that higher inflation negatively affect GDP. However, when real M2 and inflation considered together higher inflation has a positive impact on GDP.
Duca, 2007	Bank of Valletta Review	USA, UK, Japan, Germany, France	- Nominal GDP - Stock Price Indexes	Granger Causality Test	To explain relation between economic growth and stock markets, the author find as previous research revealed that the potential level of economic activities are possibly depend of stock market performance or asset prices. When looking at the time of Great Depression and Lost Decade of Japan, all happened after the asset price bust. Stock prices not only affect economic activities in advance but also cause volatility in activities. And, the author also explains the reason why stock market is a cause for economic activity in the paper.

CHAPTER IV

DATA AND METHODOLOGY

4.1 DATA DESCRIPTION

In this study, to find long run relationship between interest rate spread and economic activities, all data are collected from the OECD data base. However, some missing data for some countries are found through their Central Bank statistics[11]. Further, long rates for Turkey, i.e. 10 years government bonds is taken via Bloomberg Terminal.

In model estimation, monthly periods are used for the period of 2005:1 and 2015:9. The below OECD countries are included in the analysis with the exception of New Zealand, Estonia, Slovenia, Slovak Republic due to missing data and time mismatches.

OECD countries included in the analysis are:

Australia	Austria
Belgium	Canada
Chile	Czech Republic
Denmark	Finland
France	Germany
Greece	Hungary
Iceland	Ireland
Israel	Italy
Japan	Korea (South)
Luxembourg	Mexico
Netherlands	Norway
Poland	Portugal
Spain	Sweden
Switzerland	Turkey
United Kingdom	United States

[11] For example, Australia, Israel and Turkey.

When identifying and selecting the appropriate variables, the previous studies in literature are followed. The reason for this is that consistency is aimed with literature in terms of definition and identification of variables.

Natural logarithms of some variables were taken, some were not. Literature generally uses the logarithm of industrial production, inflation, and M1 money supply and stock prices. In this analysis, the variables; spread, long term rates, unemployment are taken in their level formation. In fact, even one cannot take logarithm of interest rate spread and long term interest rate in this analysis because of some negative values that these variables contain. In this analysis, the value of industrial production, inflation, M1 money supply and stock prices are taken as natural logarithm. The reason for taking logarithm of values of variables that are going to be used in econometric analysis is that by having logarithm, the scale of data transformed in order to make variables seem to be normally distributed.

The definitions of variables that are going to be used in the model are as follow:

Industrial Production (LnIND):

OECD defines industrial production as the level of output generated by industrial sectors i.e. B, C, D and E of the International Standard Industrial Classification of all Economic Activities. Seasonally adjusted industrial production index were used for each countries. For seasonally adjusting, the method of X12-ARIMA and TRAMO-SEATS is used by OECD. Average monthly data are used for calculation.

Consumer Price Index (LnCPI):

As for inflation, monthly Consumer Price Index (CPI) is used for OECD countries. These data are calculated by OECD. CPI measures the changes in price of goods and services bought by households. The ways the OECD calculate CPI differ for 3 zones. They calculate CPI for Europe (for European countries in the OECD), all OECD and for major seven countries. CPI is calculated monthly.

Unemployment Rate (UNEMP):

Monthly and seasonally adjusted unemployment rate are used for the analysis. All data are collected from OECD data. Unemployment rate is calculated for the people who aged 15 or over without work. To be named as unemployed, OECD defines that, people who are over 15 are actively seeking a job for about four weeks.

Spread (SPREAD):

The literature on this issue generally uses the spread as the difference between 10-year government bonds and 3-month Treasury bills. The OECD refers 10-year government bonds as long term interest rates and 3-month Treasury bills as short term interest rates. All available interest rates are taken from OECD. OECD uses monthly average interest rates. However, long term interest rates for Turkey were not available in OECD data. This data were taken from Bloomberg Data Terminal. Interest rates defined as the price of borrowing funds from lenders as compensation to lenders for differing their expenditures.

Long Term Interest Rates (LONG):

As mentioned above long term interest rates refer to interest rates on 10-year government bonds. These figures are taken from OECD data and are calculated average of daily quotations. Turkish long term interest rates were taken from Bloomberg Data Terminal. It should also be noted that Turkish 10-year government bonds started to have been issued since the beginning of 2010 and 5-year Turkish government bonds started to have been issued since the beginning of 2005. However, the Bloomberg created values of interest rates of 10-year Turkish government bonds by using interest rates on 5-year and 2-year government bonds.

Stock Price Index (LnSTOCK):

Stock price indexes refer to all share prices of stock exchange of each OECD countries. Standardised OECD monthly share price index for countries are used in the analysis. The OECD uses share indices that contain all national shares. The closing date of each day then computed as arithmetic average for monthly figures. The OECD put distinction to price index and return index. Their concept states that while price index measures changes in market capitalisation of shares in index, return index also includes dividend payments. For this reason, while price index shows how share price values changes, the return index shows how the stock is performing.

M1 Money Supply (LnM1):

Monetary aggregate is generally measured by M1 and M2. M1 measures physical money, such as coins and banknotes in circulation, and demand deposits and checking accounts in banks. This part is the most liquid fundamental of money supply. It can be seen that the literature of interest rate spread mainly uses M1 money supply data. The reason for this is that, as M1 is the most liquid part of money supply, the reaction of M1 to economic activities or changes in interest rates in capital markets may be very quick to respond changes accordingly. The OECD M1 data are monthly averages.

4.2. ECONOMETRIC METHODOLOGY

The econometric framework will be introduced to see the long run relationship between financial and macro-economic variables such as spread, stock prices, M1, long term rates and some components of economic activities such as industrial production, inflation and unemployment. While presenting the finding of the econometric works, the previous empirical studies will also be compared to the outcome of these findings.

Empirical Model:

To examine long-run relationship between term structure of interest rates and economic activities for the OECD's selected countries, Panel Cointegration Analysis will be employed to see whether there is a long run relationship between the below models. As being said before as economic activities, industrial production, consumer price index and unemployment rate will be used as dependent variable. In addition, the independent variables will be financial variables which have been used in literature before. So, the independent variables in this model are interest rate spread, stock exchange index, money supply of M1 and long term interest rates. The equations that are going to be modelled in panel data analysis are presented like this:

Relationship between *Industrial Production and Spread, Stock Prices, M1 and Long rates*

$$LnIND_{it} = \beta_i + \beta_1 SPREAD_{it} + \beta_2 LnSTOCK_{it} + \beta_3 LnM1_{it} + \beta_4 LONG_{it} + \varepsilon_{it} \quad (4.1)$$

Relationship between *Consumer Price Index and Spread, Stock Prices, M1 and Long rates*

$$LnCPI_{it} = \beta_i + \beta_1 SPREAD_{it} + \beta_2 LnSTOCK_{it} + \beta_3 LnM1_{it} + \beta_4 LONG_{it} + \varepsilon_{it} \quad (4.2)$$

Relationship between *Unemployment and Spread, Stock Prices, M1 and Long rates*

$$UNEMP_{it} = \beta_i + \beta_1 SPREAD_{it} + \beta_2 LnSTOCK_{it} + \beta_3 LnM1_{it} + \beta_4 LONG_{it} + \varepsilon_{it} \quad (4.3)$$

In above equations, *i* and t indicate cross-section units (here it is OECD countries) and times respectively. *i* (where *i* =1, 2, ..., 29) are cross-section for the periods $t = 1, 2, \ldots, 129$; the β_i is the term for constant in the model and ε_{it} is the error term of the model. *LnIND* represents logarithm of industrial production, *LnCPI* shows logarithm of consumer price index, *UNEMP* indicates unemployment rates, *SPREAD* stands for interest rate spread between 10-year bond and 3-month T-bill, *LnSTOCK* indicates stock price index of the countries, *LnM1* represents M1 money supply and *LONG* shows 10-year government bonds of the OECD countries in question.

Before proceeding further to see the statistical assessment of the variable by using panel cointegration analysis, it is necessary to check whether the variables are stationary or not. For instance, for the case of time series, Sarı et. al., (2007) suggest that the characters of time series can be determined by applying robust unit root estimators that will suit the model. Similar to time series, variables in panel data analysis, which comprises both time series and cross sections, must be stationary in order to avoid spurious regression. In other words, the traditional values of t, F and R^2 tend to be biased, the regression output may give a wrong result, even though the regression may contain higher value, despite this higher value these variables may not be related at all (Brooks, 2004). By having stationary variables, the likelihood of spurious regression will be removed and also the significance of regression will be higher (MacKinnon, 1991).

Unit root tests that are going to be tested are Levin, Lin and Chu (LLC) Test, Im, Pesaran and Shin (IPS) test and, Hadri LM unit root test and Maddala & Wu (M&W) test. These tests are also called as first generation panel unit root tests.

However, it should also be noted that the first generation unit root test results may not be proper in the case of cross-sectional dependency, in which case the results will assume over rejection of null hypothesis (O'Connell, 1998). To see whether the variables in this analysis have cross-section dependency, a test of cross-sectional dependency will be applied to the analysis[12]. In panel data, cross-sectional dependency is important, because as Bai and Kao (2006) point that having leaving the assumption of dependence would give biased and inconsistent results and size distortions.

Hence, this thesis will use unit root tests to check the stationarity of the variables. The reason why all the above tests are going to be performed is to see whether all test results will give the same answer (Mahadeva and Robinson, 2004).

Kar et.al (2011) believe that the case of cross-sectional dependency can occur, because in today's global world, a shock in one country may also has effect on other countries and for this reason cross-section independence may not be valid.

4.3. PANEL UNIT ROOT TESTS

The first group of unit root tests do not take account cross-sectional dependencies. However, on the other hand, the second group, or also called second generation unit root tests, panel unit root tests can deal with cross-sectional dependencies. Here, first, first generation unit root tests will be introduced and then results will be given in table, then the study will jump to analyse second generation unit roots tests.

4.3.1. First generation panel unit root tests

Levin, Lin and Chu (2002) Unit Root Test:

This unit root test is developed by Levin Lin and Chu (LLC). The model testing first estimate the following equation:

$$\Delta y_{it} = \mu_i + \theta_t + \delta_i t + \rho y_{it-1} + \sum_{j=1}^{k} \alpha_j \Delta y_{it-j} + \varepsilon_{it} \tag{4.4}$$

[12] Pesaran's (2004) Cross-section dependency (CD) Test is used for checking cross-section dependency. As a result, it is found that cross-sectional dependencies are found among the variables.

In equation (1.1), y indicates the variable that is going to be tested for unit root, Δ is the operator for first difference process, μ_i display fixed effects, θ_t shows time effects and t is for trend. LLC test suggests that fixed effects vary among countries, and assume ρ (Rho) to be homogeneous across cross-section units, which means that cross-section dependency is not taken account. Under these assumptions, the null and alternative hypothesis is shown like this:

H_0 : $\rho = 0$ (Indicate unit root)
H_1 : $\rho < 0$ (Indicate no unit root)

However the weaknesses of this test lie on the assumption that ρ is homogeneous for all cross-sections. This problem was assessed by Im, Pesaran and Shin (IPS).

Im, Pesaran and Shin (2003) Unit Root test:

Im,Pesaran and Shin (IPS) unit root test was developed to satisfy the weaknesses caused by LLC test. In this method, IPS estimated the ρ for all cross-sections independently, i.e allowed this to be heterogeneous for all cross-sections units. The approach of Im et.al (2003) is similar to the LLC unit root equation of (4.4) above. The difference arises from the use of ρ which is said to be difference for each cross-section. Hence, IPS unit root test equation can be written as;

$$\Delta y_{it} = \mu_i + \theta_t + \delta_i t + \rho_i y_{it-1} + \sum_{j=1}^{k} \alpha_j \Delta y_{it-j} + \varepsilon_{it} \qquad (4.5)$$

The null and alternative hypothesis of IPS test is shown below;

H_0 : $\rho_i = 0$, for all cross-sections ($i = 1,2,3, ..., N$)
H_1 : $\rho_i < 0$, for at least one cross-section ($i = N_1 + 1, ..., N$)

The null hypothesis of this test assumes unit root for all cross-sections, i.e depicts non-stationarity. On the other hand, the alternative hypothesis assumes one or more cross-sections in the panel do not have unit root. IPS test demonstrate how one series can turn to its average value with ρ is different across cross-sections.

To test unit root, IPS, first, calculate t-statistics for ρ_i coefficient for each cross-sections. Second, it takes the averages of t-statistics and third, by normalising mean and variances, this test can have standard normal distribution. The test statistics for this method is found through this formula;

$$t_{IPS} = \frac{\sqrt{N}(\bar{t} - \frac{1}{N}\sum_{i=1}^{N} E(t_{it}, \rho_i = 0))}{\sqrt{\frac{1}{N}\sum_{i=1}^{N} var(t_{it}, \rho_i = 0)}} \tag{4.6}$$

Hadri (2000) Unit RootTest:

Hadri (2000) uses a residual based Lagrange Multiplier (LM) test for finding unit root in heterogeneous panel data series. The null hypothesis of this test contradicts others where the null hypothesis suggest unit root in the series. However, Hadri calls the null hypothesis to be stationary, i.e. no unit root in the series. Hadri's unit root test formulation is like this:

$$y_{it} = z_{it}\gamma + r_{it} + \varepsilon_{it} \tag{4.7}$$

In equation (4.7), Hadri defines z_{it} as individual deterministic trend and r_{it} as random walk process. Then Hadri rewrites (4.7) as,

$$y_{it} = z_{it}\gamma + \varepsilon_{it} \tag{4.8}$$

Then Hadri construct LM statistic as,

$$LM = \frac{1}{\sigma 2_e}\frac{1}{NT^2}\left(\sum_{i=1}^{N}\sum_{t=1}^{T} S_i^2\right) \tag{4.9}$$

Maddala & Wu (1999) Unit Root Test:

Maddala & Wu (1999), hereafter referred to as M&W, suggest somewhat a different version, (in fact a combination of them) of unit roots test developed by Im, Pesaran and Shin (IPS), Levin Lin and Chu (LLC) and Fisher ADF test. Similar to IPS test, which uses ρ to be homogeneous for all cross-section units, M&W also apply uses ρ to be heterogeneous for all cross-sections.

This test suggest Fisher type of ADF test statistic by using each cross-sections' p-value in panel data for the examining unit root test. The formulation is as follow:

$$P = -2 \sum_{i=1}^{n} lnp_i \to x^2(2n) \quad (4.10)$$

4.3.2. Second generation panel unit root tests

Pesaran Cross-Sectionally Augmented Dickey-Fuller (2007) Unit Root Test:

Pesaran's (2007) Cross-Sectionally Augmented Dickey-Fuller (CADF) unit root test takes cross-sectional dependency into account when examining unit root in heterogeneous panel data series. Pesaran also assumes a common factor that affects cross-section units.

The intuition behind this is that it uses ADF statistic and then takes average of all cross-section units. By taking the averages, the test removes dependency. This unit root test is estimated by the following equation:

$$\Delta y_{it} = \mu_i + \rho_i y_{i,t-1} + c_i \bar{y}_{t-1} + c_i \Delta \bar{y}_t + \varepsilon_{it} \quad (4.11)$$

$$\bar{y}_{t-1} = \frac{1}{N} \sum_{i=1}^{N} y_{i,t-1} \; ; \; \Delta \bar{y}_t = \frac{1}{N} \sum_{i=1}^{N} \Delta y_{it} \quad (4.12)$$

Adding $\bar{y}_{t-1}$ and $\Delta \bar{y}_t$ to the equation (4.11), this will take into account cross-sectional dependency in the case of one common factor (Baltagi, 2005). The null and alternative hypotheses are stated below:

H_0 : $\rho_i = 0$ (for all cross-section)
H_1 : $\rho_i < 0$ (i= 1,2,3, ...,N), ρ_i=0 (i= N_1+1, N_1+2, ...,N)

The null hypothesis state that each of the cross-sections has unit root and alternative suggest that some of the cross-section do not have unit root.

Hadri and Kurozumi Augmented Panel KPSS (2012) Unit Root Test:

This test is a version of time series KPSS unit root for panel data series. Similar to CADF test, this test also takes cross-sectional dependency into account. The model that is going to be estimated is as follow:

$$y_{it} = z_t{}'\delta_i + f_t\gamma_i + \varepsilon_{it} \tag{4.13}$$

Where ε_{it} is:

$$\varepsilon_{it} = \theta_{i1}\varepsilon_{i,t-1} + \cdots + \theta_{ip}\varepsilon_{i,t-p} + v_{it} \tag{4.14}$$

In equation (4.13), z_t represents the determinitic trend that indicates variation in dependent variable. The null hypothesis of Hadri and Kurozumi test states stationarity in series of heterogeneous panel data, i.e. no unit root.

H_0 : θ_i (1) # 0 for all i's
H_1 : θ_i (1) = 0 for some i's

Test statistics of Hadri and Kurozumi are calculated through the followings Z statistics. First they build the following test statistics:

$$ST_i^{LA} = \frac{1}{\widetilde{\sigma^2}_{iLA}T^2}\sum_{t=1}^{T}(S_{it}^{w})\,2 \tag{4.15}$$

Where, $\tilde{\sigma}_{iLA}^2 = \frac{\tilde{\sigma}_{vi}^2}{(1-\acute{\theta}_{i1}- \ldots -\hat{\theta}_{ip})^2}$ (4.16)

Hadri and Kurozumi, while expressing this statistic as Z_A^{LA}, also build another statsitic called Z_A^{SPC}. The formulation for the latter is shown below:

$$ST_i^{SPC} = \frac{1}{\widetilde{\sigma^2}_{iSPC}T^2} \sum_{t=1}^{T} (S_{it}^{w})\ 2 \quad (4.17)$$

Finally, through these two above statistics, Hadri and Kurozumi calculate the unit root statistics.

Im, Lee and Tieslau (2012) Unit Root Test:

Im, Lee and Tieslau (ILT) test, when looking at existence of unit root in panel series, considers structural breaks in both intercepts and trends of cross-section units and allows heterogeneity in series. This test is based on Lagrange Multiplier (LM) statistics. While Im, lee and Tieslau (2005) dealt with only level shift, this test also takes trend shift into account. The basic intuition behind this model is that, it applies lee and Strazicich (2003) test statistic.

The testing regression for each cross section is as follow:

$$\Delta y_{it} = \delta_t' \Delta Z_{it} + \theta_i \acute{y}_{i,t-1} * + \sum_{j=1}^{k} d_{ij} \Delta \acute{y}_{i,t-j} + \varepsilon_{it}, i = 1, .., N \quad (4.18)$$

The null and alternative hypothesis are:

$H_0 : \theta_i = 0$, for all i's

$H_1 : \theta_i < 0$, for some i's

The T-bar statistic is calculated as the average of test statistics, and shown below:

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} \widetilde{\tau_i^*} \quad (4.19)$$

Finally ILT's LM panel test statistic is calculated as:

$$LM(\tilde{\tau}^*) = \frac{\sqrt{N}\,[\bar{t} - \tilde{E}\overline{(t)}]}{\sqrt{\tilde{v}\overline{(t)}}} \tag{4.20}$$

In equation (4.20), $\tilde{E}\overline{(t)}$ and $\tilde{v}\overline{(t)}$ are estimates of average of $\bar{t}$'s mean and variances and calculated like this:

$$\tilde{E}\overline{(t)} = \frac{1}{N}\sum_{i=1}^{N} E(\,\bar{t}(\widetilde{R_i}, \tilde{p}_i)) \tag{4.21}$$

$$\tilde{V}\overline{(t)} = \frac{1}{N}\sum_{i=1}^{N} Var(\,\bar{t}(\widetilde{R_i}, \tilde{p}_i)) \tag{4.22}$$

Where $\widetilde{R_i}, \tilde{p}_i$ are the value of the number of breaks and lags for each cross-section units.

Unit Root Test Results:

Having introduced specification and definition of each unit root test, now, the test results are illustrated in below Table 4.1. In this table, only the results of LLC, IPS, Hadri, Maddala & Wu, and Pesaran's CADF test are documented. As can be seen from the table almost all variables in the analysis contain unit root according to all employed test results. The majority of unit root tests imply non-stationarity of variables at level. Though, while spread seems to be stationary at level when only constant used, by adding trend in to the series it becomes non-stationary subsequently. In contrast, M1 variable seems stationary at level when trend added conforming to LLC, IPS and M&W tests. However, this variable is non-stationary at level when only constant is used in the equation.

In addition, when variables are first differenced, all employed test suggest that all the variables clearly become stationary. Similarly, when applying Hadri and Kurozumi (2012) test of no unit root in panel data, results (See Table 4.2) are in line with the previous unit root tests. Hadri and Kurozumi test also reveal that all variables are non-stationary at level.

These results satisfy the condition of running cointegration. As all variable seems to I(1).

Table 4.1: Panel Unit Root Test at Level

Variables	Test	Constant		Constant and Trend	
		Statistics	*p-value*	*Statistics*	*p-value*
Lnind	LLC	-1.601	0.054	-1.412	0.079
	IPS	-1.067	0.143	-2.321	0.010
	HADRI	31.17	0.000	9.271	0.000
	M&W	61.15	0.364	66.18	0.215
	CIPS	3.339	1.000	1.962	0.975
Unemp	LLC	-3.203	0.001	-1.768	0.038
	IPS	-0.879	0.189	1.731	0.958
	HADRI	32.73	0.000	20.78	0.000
	M&W	70.71	0.122	52.38	0.683
	CIPS	2.685	0.996	6.956	1.000
Lncpi	LLC	-7.712	0.000	1.213	0.079
	IPS	-1.028	0.152	0.862	0.010
	HADRI	43.24	0.000	21.65	0.000
	M&W	51.76	0.705	32.40	0.997
	CIPS	0.309	0.621	1.080	0.860
Spread	LLC	-1.941	0.026	-0.715	0.237
	IPS	-3.430	0.001	-0.646	0.259
	HADRI	16.80	0.000	12.83	0.000
	M&W	77.97	0.041	48.20	0.817
	CIPS	-2.328	0.010	0.558	0.712
Lnstock	LLC	-1.302	0.096	0.819	0.793
	IPS	-2.296	0.010	-0.206	0.418
	HADRI	21.85	0.000	13.51	0.000
	M&W	115.70	0.000	83.99	0.014
	CIPS	2.992	0.999	3.448	1.000
Lnm1	LLC	-0.138	0.445	-3.433	0.001
	IPS	7.686	1.000	-3.641	0.001
	HADRI	43.20	0.000	14.411	0.000
	M&W	13.68	1.000	119.74	0.000
	CIPS	-6.175	0.000	1.223	0.889
Long	LLC	2.996	0.998	-0.975	0.164
	IPS	4.165	1.000	-1.169	0.121
	HADRI	20.91	0.000	14.57	0.000
	M&W	18.61	1.000	85.50	0.011
	CIPS	0.339	0.633	-2.161	0.015

Table 4.2: Panel Unit Root Test First-Differenced

Variables	Test	Constant		Constant and Trend	
		Statistics	*p-value*	*Statistics*	*p-value*
Lnind	LLC	-64.64	0.000	-73.61	0.000
	IPS	-62.90	0.000	-66.44	0.000
	HADRI	-2.410	0.992	-0.009	0.504
	M&W	562.78	0.000	456.26	0.000
	CIPS	-23.57	0.000	-23.62	0.000
Unemp	LLC	-21.59	0.000	-25.14	0.000
	IPS	-27.73	0.000	-27.88	0.000
	HADRI	5.162	0.000	15.23	0.000
	M&W	295.15	0.000	228.94	0.000
	CIPS	-12.82	0.000	-12.95	0.000
Lncpi	LLC	-16.33	0.000	-17.070	0.000
	IPS	-23.63	0.000	-23.65	0.000
	HADRI	5.753	0.000	3.422	0.000
	M&W	840.16	0.000	774.60	0.000
	CIPS	-21.17	0.000	-20.4	0.000
Spread	LLC	-43.02	0.000	-48.81	0.000
	IPS	-40.04	0.000	-40.62	0.000
	HADRI	-1.830	0.966	3.079	0.001
	M&W	497.67	0.000	381.07	0.000
	CIPS	-15.85	0.000	-13.90	0.000
Lnstock	LLC	-41.07	0.000	-45.14	0.000
	IPS	-42.33	0.000	-42.47	0.000
	HADRI	-1.876	0.970	1.634	0.051
	M&W	376.48	0.000	275.80	0.000
	CIPS	-17.78	0.000	-17.23	0.000
Lnm1	LLC	-15.54	0.000	-19.96	0.000
	IPS	-17.32	0.000	-17.29	0.000
	HADRI	2.476	0.007	11.51	0.000
	M&W	370.26	0.000	268.14	0.000
	CIPS	-12.01	0.000	-10.02	0.000
Long	LLC	-49.31	0.000	-55.42	0.000
	IPS	-45.98	0.000	-46.85	0.000
	HADRI	-1.400	0.919	0.497	0.310
	M&W	596.67	0.000	515.66	0.000
	CIPS	-15.26	0.000	-13.49	0.00

Table 4.3: Hadri and Kurozumi Augmented Panel KPSS test, (2012)

Augmented Panel KPSS test, (2012)

	Constant		Constant and Trend	
At level	*Statistic*	*p-value*	*Statistic*	*p-value*
lnIND				
ZA_spac	137.67	0.000	11.2285	0.000
ZA_la	1032.53	0.000	57.6965	0.000
lnCPI				
ZA_spac	-0.302	0.618	3.3861	0.000
ZA_la	33.50	0.000	20.9303	0.000
UNEMP				
ZA_spac	53.19	0.000	55.4134	0.000
ZA_la	126.80	0.000	171.7712	0.000
SPREAD				
ZA_spac	4.476	0.000	2.7309	0.003
ZA_la	18.33	0.000	11.9727	0.000
lnSTOCK				
ZA_spac	128.46	0.000	17.2907	0.000
ZA_la	97.09	0.000	14.278	0.000
lnM1				
ZA_spac	12.21	0.000	43.7	0.000
ZA_la	179.35	0.000	504.4	0.000
LONG				
ZA_spac	13.25	0.000	1.6814	0.046
ZA_la	39.23	0.000	20.6288	0.000
First differenced				
lnIND				
ZA_spac	-1.751	0.960	-3.171	0.999
ZA_la	-1.650	0.950	-2.846	0.997
lnCPI				
ZA_spac	1.467	0.071	3.391	0.001
ZA_la	1.724	0.042	3.877	0.000
UNEMP				
ZA_spac	10.38	0.000	9.192	0.000
ZA_la	14.05	0.000	13.78	0.000
SPREAD				
ZA_spac	-1.802	0.964	0.749	0.226
ZA_la	-1.892	0.971	0.633	0.263
lnSTOCK				
ZA_spac	1.795	0.036	-0.523	0.699
ZA_la	1.738	0.041	-0.5552	0.710
lnM1				
ZA_spac	2.963	0.001	2.430	0.007
ZA_la	2.219	0.013	0.652	0.257
LONG				
ZA_spac	-1.412	0.921	0.984	0.162
ZA_la	-1.418	0.922	0.914	0.180

Table 4.4: Im, Lee Tieslau (2013) Structural Break Unit Root Test

Variables		level Shift		Trend and level Shift	
		Panel LM stat.	*p-value*	*Panel LM stat.*	*p-value*
Lnind	One Break Model	-21.160	0.000	-18.197	0.000
	Two Break Model	-39.694	0.000	-37.647	0.000
Unemp	One Break Model	-8.955	0.000	-7.183	0.000
	Two Break Model	-22.483	0.000	-22.219	0.000
Lncpi	One Break Model	-22.683	0.000	-17.750	0.000
	Two Break Model	-35.606	0.000	-29.091	0.000
Spread	One Break Model	-10.260	0.000	-7.198	0.000
	Two Break Model	-25.116	0.000	-32.600	0.000
Lnstock	One Break Model	-9.093	0.000	-3.619	0.000
	Two Break Model	-20.786	0.000	-32.220	0.000
LnM1	One Break Model	-8.555	0.000	-10.428	0.000
	Two Break Model	-18.587	0.000	-21.707	0.000
Long	One Break Model	-17.841	0.000	-11.871	0.000
	Two Break Model	-26.810	0.000	-30.833	0.000
Spread	One Break Model	-10.260	0.000	-7.198	0.000
	Two Break Model	-25.116	0.000	-32.600	0.000

Meanwhile, when implementing Im, Lee Tieslau (2013) unit root test to the series, this test deals with level shift and trend shift in panel series, the results suggest that all variables are stationary at level when structural breaks are taken account. The Table 4.4 only indicates panel LM unit roots results for each variable but not for all cross-section units or countries. In Appendix A, all result of this test can be seen for each country. This Appendix further indicates structural breaks for each country.

4.4. HOMOGENEITY TEST

As some panel roots test statistics and cointegration tests are based on homogeneity or heterogeneity of cross-sectional units' parameter estimates, it is useful to run homogeneity panel test of Pesaran and Yamagata (2008). This test suggests T (i.e. time dimension) should be greater than the number of observation N. This situation is valid for this analysis, as the number of T is much greater than number of N (T=129, and N=29).

The null hypothesis of this test specifies that all the parameters of all betas are the same, i.e. equal to zero. The alternative suggests that the beta parameters of the cross-sectional units are different from each other.

There will be three models, as there are three dependent variables. Regression models are:

$LnIND_{it} = \alpha_i + \beta_{1i}SPREAD + \beta_{2i}STOCK + \beta_{3i}M1 + \beta_{4i}LONG + \varepsilon_{it}$

$LnCPI_{it} = \alpha_i + \beta_{1i}SPREAD + \beta_{2i}STOCK + \beta_{3i}M1 + \beta_{4i}LONG + \varepsilon_{it}$

$UNEMP_{it} = \alpha_i + \beta_{1i}SPREAD + \beta_{2i}STOCK + \beta_{3i}M1 + \beta_{4i}LONG + \varepsilon_{it}$

Table 4.5: Homogeneity Test Results

Homogeneity test (for *ln*IND)	Statistic	p-value
$\tilde{\Delta}$	51.645	0.000
$\tilde{\Delta}_{adj}$	52.879	0.000
Homogeneity test (for *ln*CPI)	Statistic	p-value
$\tilde{\Delta}$	37.782	0.000
$\tilde{\Delta}_{adj}$	38.685	0.000
Homogeneity test (for UNEMP)	Statistic	p-value
$\tilde{\Delta}$	113.62	0.000
$\tilde{\Delta}_{adj}$	116.34	0.000

The above results indicate a strong rejection of homogeneity of betas. Then, it can be concluded that the panel cross-sections slope coefficients are heterogeneous.

4.5. PANEL COINTEGRATION ANALYSIS

To analyse long term relation between interest rate spread –including some other financial variables- and economic activities, a residual cointegration tests that are suggested by Pedroni (2004) and Westerlund's (2007) Error Correction Model will be used in this study. One of the main conditions that the cointegration analysis requires is that all variables in interest must be integrated in the same order of integration. The variables in this thesis satisfy this precondition of being stationary when differenced once, or first differenced. Bearing this in mind, it could be said that Pedroni (2004) and Westerlund (2007) panel cointegration models can be suitable to estimate long term relation of the subject investigated.

Westerlund's Error Correction Model (ECM) (2007):

Although this test is similar to test models that are not taking account cross-sectional dependency among cross section unit, it employs bootstrap method. By having this, it demeans the cross-sectional averages to reduce the effects of dependency and time effects (Westerlund, 2007). Then, when the cross-section dependency is valid, this method uses bootstrap values.

If the error correction mechanism works, then the cointegration exists among the underlying variables. Here comes alpha values (α_i), if $\alpha_i = 0$ this mechanism does not work and there will be no cointegration. For cointegration to exist among the variable this alpha should be negative. Which also mean that the series are cointegrated within themselves.

In Westerlund's (2007) ECM tests:

- Panel statistics assume homogeneity of the cross-sections.
- Group statistics assume heterogeneity of the cross-sections.

The null hypothesis of ECM is no cointegration among the variables. H_0: $\alpha_i = 0$ and H_1: $\alpha_i < 0$. The important part of the below results for this analysis are group statistics values as the variables of this study indicate a heterogeneous panel, which has been tested earlier.

Table 4.6: Westerlund (2007) cointegration testing results

y		Constant only			Constant and Trend		
ln*IND*	***Test***	*Statistics*	*p-value*[a]	*p-value*[b]	*Statistics*	*p-value*[a]	*p-value*[b]
	G_{tau}	-7.026	0.000	0.000	-7.151	0.000	0.000
	G_{alpha}	-7.171	0.000	0.000	-6.372	0.000	0.000
	P_{tau}	-8.343	0.000	0.000	-8.143	0.000	0.000
	P_{alpha}	-10.198	0.000	0.000	-7.578	0.000	0.000
ln*CPI*							
	G_{tau}	3.31	1.000	0.991	-7.151	0.000	0.000
	G_{alpha}	1.996	0.977	0.958	-6.372	0.000	0.000
	P_{tau}	3.352	1.000	0.981	-8.143	0.000	0.056
	P_{alpha}	2.077	0.981	0.958	-7.578	0.000	0.001
UNEMP							
	G_{tau}	-0.749	0.227	0.487	1.479	0.930	0.945
	G_{alpha}	-1.287	0.099	0.213	-0.068	0.473	0.673
	P_{tau}	-0.064	0.475	0.639	1.302	0.904	0.874
	P_{alpha}	1.617	0.947	0.898	1.806	0.965	0.933

[a] p-values are for a one-sided test based on the asymptotic distribution.
[b] p-values are for a one-sided test based on the bootstrap distribution.
For bootstrap 1000 replicaitons were used.
The lags and leads were chosen according to AIC.

The above results in table 4.6 according to Westerlund (2007) shows that the cointegration between industrial production and financial variables (Spread, Stock prices, M1 and long rates) exists strongly. Further, there is also a cointegration between consumer price index and financial variables. However, there seems no cointegration between unemployment and financial variables.

Pedroni (2004) Cointegration Test:

This test is based on Engle and Granger (1987) cointegration test. The basic estimation of Pedroni test by OLS regression is as follows:

$$y_{it} = \alpha_i + \delta_{it} + \beta_i X_{it} + \varepsilon_{it} \quad (4.23)$$

Here, in above equation (4.23), y represents dependent variable, α_i shows constant, t indicates time trend and X represents independent variable. As mentioned above, cointegration tests require first difference order, i.e. all variables must be stationary when they are first differenced. In equation (4.23), as the β_i vary across each cross unit, the cointegration vector is heterogeneous across individual cross units.

Pedroni (2004) suggest the following hypothesis:

H_0: There is no cointegration for all cross-sections.
H_1: There is cointegration for all cross-sections.

To test the null and alternative hypothesis of cointegration in heterogeneous panel analysis, Pedroni suggest seven cointegration statistics. These tests involve four panel tests (within dimension) and other three cover three group mean tests (between dimensions). All the tests are assumed to be normally distributed. In within dimension test statistics, auto-regressive term is considered to be the same across all individual cross section units. On the other hand, in between dimension tests, coefficients can vary on individual cross-section units.
The equations of these seven statistics are shown below:

Within dimension cointegration tests equations can be calculated as below:

Panel v-statistic: $Z_v = T^2 N^{3/2}(\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\widehat{e^2}_{i,t-1})^{-1}$
Panel $\rho-$ statistic:

$$Z_\rho = T^2\sqrt{N}(\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\widehat{e^2}_{i,t-1})^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i)$$

Panel t-statistic (non-parametric model)

$$Z_t = (\hat{\sigma}_{N,T}^2\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\widehat{e^2}_{i,t-1})^{-1/2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i)$$

Panel t-statistic (parametric model)

$$Z_t^* = (\widehat{s^*}_{N,T}^2\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\widehat{e^{*2}}_{i,t-1})^{-1/2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}(\widehat{e^*}_{i,t-1}\Delta\widehat{e^*}_{i,t}) \qquad (4.24)$$

Between dimension cointegration test equations:

Group ρ- statistic: $\tilde{Z}_\rho = TN^{-1/2}\sum_{i=1}^{N}(\sum_{t=1}^{T}\hat{e}_{i,t-1}^2)^{-1}\sum_{t=1}^{T}(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} - \hat{\lambda}_i)$

Group t-statistic: (non-parametric model)

$$\tilde{Z}_t = N^{-1/2} \sum_{i=1}^{N} (\hat{\sigma}_i^2 \sum_{t=1}^{T} \hat{e}_{i,t-1}^2)^{-1/2} \sum_{t=1}^{T} (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i)$$

Group t-statistic: (parametric model)

$$\widetilde{Z^*}_t = N^{-1/2} \sum_{i=1}^{N} (\sum_{t=1}^{T} \hat{s}_i^{*2} \hat{e}_{i,t-1}^{*2})^{-1/2} \sum_{t=1}^{T} (\widehat{e*}_{i,t-1} \Delta \hat{e}*_{i,t}) \qquad (4.25)$$

All above statistics are taken from the work of Pedroni (1999).

By looking at the above cointegration test result statistics of within dimension test, it can be said that if the null hypothesis is rejected, the cointegration exist among all the cross- section units. However, when looking at between dimension, and group mean test statistics, if the null hypothesis is rejected the cointegration exist at least for one of the cross-section unit (Sarı et al, 2015).

Pedroni (1997) offers the processes of finding test statistics in this way:

First, when estimating equation (4.24), all the relevant information should be taken into account such as; desired intercept, time trend or if necessary time dummies. And then, get residuals for error term for later use. Second, each variables should be differenced and then residual of differenced regression of $\Delta y_{i,t} = b_{1i} \Delta x_{1i,t} + b_{2i} \Delta x_{2i,t} + \cdots b_{Mi} \Delta x_{Mi,t} + \tau_{i,t}$. Third, by using Newey-West (1987) estimator, L_{11i}^2 can be computed as the the long run variance. Finally, for non-parametric models, the following model will be estimated and its residuals will be used to compute long run variance, $\hat{e}_{i,t} = \hat{y}_i \hat{e}_{i,t-1} + \hat{u}_{i,t}$. for parametric model Pedroni uses this model, $\hat{e}_{i,t} = \hat{y}_i \hat{e}_{i,t-1} + \sum_{k=1}^{Ki} \hat{y}_{i,k} \Delta \hat{e}_{i,t-k} + \hat{u}_{i,t}^*$ later uses the residuals to compute variance that is denoted as $\hat{s}_i^{*2}$.

After having the above procedures, panel cointegration test can be computed. As reported in below Table 4.7, the Pedroni (2004) cointegration test outcomes suggest that while there is cointegration between industrial production and financial variables, there seems to be a weak cointegration between industrial production and financial variables. On the other hand, it seems that there is no cointegration at all for unemployment rate with respect to variables in the analysis.

It can be concluded that Westerlund (2007) and Pedroni (2004) cointegration test statistics somehow give similar results in terms of long run relations between the variables.

Westerlund (2007) and Pedroni (2004) tests do not take cross-section dependency into account, as most panel data variables actually seems cross-sectionally dependent.

To find whether cross-sections are independent in this analysis, Pesaran's (2004) proposed test of Cross-Section Dependence test will be performed.

Table 4.7: Pedroni (2004) Cointegration testing results

y		**Constant only**				**Constant and Trend**			
ln*IND*		*Statistic*	*p-value*	*WeightStat.*	*p-value*	*Statistic*	*p-value*	*WeightStat.*	*p-value*
	Panel v-Stat.	3.33	0.000	2.53	0.005	3.33	0.000	2.53	0.005
	Panel rho-Stat.	-15.73	0.000	-10.54	0.000	-15.73	0.000	-10.54	0.000
	Panel PP-Stat.	-14.02	0.000	-10.21	0.000	-14.02	0.000	-10.21	0.000
	Panel ADF-Stat.	-5.82	0.000	-6.10	0.000	-5.82	0.000	-6.10	0.000
	Group rho-Stat.	-12.71	0.000			-12.71	0.000		
	Group PP-Stat.	-10.77	0.000			-10.77	0.000		
	Group ADF-Stat.	-6.46	0.000			-6.46	0.000		
ln*CPI*									
	Panel v-Stat.	-1.39	0.917	-1.73	0.957	13.57	0.000	10.35	0.000
	Panel rho-Stat.	3.63	0.999	3.70	0.999	-0.22	0.411	-0.66	0.254
	Panel PP-Stat.	4.38	1.000	4.60	1.000	-0.94	0.172	-1.52	0.064
	Panel ADF-Stat.	3.57	0.999	3.74	0.999	0.23	0.592	-0.74	0.229
	Group rho-Stat.	4.52	1.000			0.19	0.577		
	Group PP-Stat.	5.32	1.000			-1.42	0.078		
	Group ADF-Stat.	4.36	1.000			-1.38	0.084		
UNEMP									
	Panel v-Stat.	-2.70	0.996	-1.15	0.874	-1.74	0.959	-0.90	0.816
	Panel rho-Stat.	5.06	1.000	2.34	0.990	4.79	1.000	1.74	0.958
	Panel PP-Stat.	5.93	1.000	2.03	0.978	5.04	1.000	0.79	0.786
	Panel ADF-Stat.	6.67	1.000	1.97	0.975	5.64	1.000	-0.19	0.425
	Group rho-Stat.	2.55	0.994			1.96	0.975		
	Group PP-Stat.	2.83	0.997			1.72	0.957		
	Group ADF-Stat.	2.58	0.995			1.15	0.874		

Automatic lag length selection based on SIC with a max lag of 12 Newey-West automatic bandwidth selection and Bartlett kernel.

4.6. PESARAN (2004) CROSS-SECTION DEPENDENCY (CD) TEST

Pesaran (2004) suggests a basic test for finding out cross-section dependency for panel data. His test method is built on OLS test, from which he takes average of residuals from each individual regression of panel data.

Table 4.8: Pesaran (2004) CD test results

	LnIND		***LnCPI***		***UNEMP***	
CD Test	**Stats**	**p-value**	**Stats**	**p-value**	**Stats**	**p-value**
CD LM (Breusch-Pagan, 1980)	4598.17	0.000	12542.7	0.000	4654.11	0.000
CD LM (Pesaran CD, 2004)	147.11	0.000	425.91	0.000	149.08	0.000
CD (Pesaran, 2004)	37.501	0.000	80.01	0.000	5.15	0.000
Bias-adjusted CD	642.17	0.000	754.55	0.000	208.96	0.000

The null hypothesis of this test is strongly rejected, meaning that there is cross-sectional dependency among the variables in this panel data.

Having found cross-section dependency among the panel variables according to Pesaran's CD test, then, it would be appropriate to use cointegration test that take cross-section dependency into account in order to have more reliable conclusions beside the previous cointegration models . Firstly, Westerlund and Edgerton (2007) LM cointegration test, which considers cross-sectional dependency, will be used. Secondly the cointegration model that includes unknown structural breaks, recognising cross-sectional dependency, serially correlated errors.

4.7. COINTEGRATION TESTS CONSIDERING CROSS SECTIONALLY DEPENDENCY

Westerlund and Edgerton (2007) LM Cointegration test:

Westerlund and Edgerton (2007) in contrast to Pedroni (2004) hypothesis of cointegration in panel series. Westerlund and Edgerton (2007) use a LM statistics to estimate statistics. This model uses Fully Modified Ordinary Least Square (FMOLS) regression to estimate residuals. The residuals are taken from the following equation:

$$y_{it} = \alpha_i + \beta_i X_{it} + z_{it} \qquad (4.26)$$

Where z_{it} is:

$$z_{it} = u_{it} + v_{it} \qquad (4.27)$$

Then the model process to calculate LM statistic as below:

$$LM_N^+ = \frac{1}{NT^2}\sum_{i=1}^{N}\sum_{t=1}^{T}\omega_i^2 S_{it}^2 \sim N(0, var(LM_N^+) \qquad (4.28)$$

In equation (4.28), S_{it}^2 and ε_{it} indicate partial sum process, and ω_i^2 is run on long term variance of u_{it} .

The null and alternative hypothesis of this test is as follow:

H_0 : σ_i^2 = 0, there is cointegration for all i's

H_1 : σ_i^2 > 0, there is no cointegration for some i's

Then, accepting null hypothesis will tell cointegration exist in panel data series.

Table 4.9: Westerlund and Edgerton (2007) cointegration testing results

y		**Constant only**			**Constant and Trend**		
ln***IND***	***Test***	*Statistics*	*p-value*[a]	*p-value*[b]	*Statistics*	*p-value*[a]	*p-value*[b]
ln***CPI***	LM stat	15.975	0.000	0.284	26.557	0.000	0.000
UNEMP	LM stat	22.686	0.000	0.316	26.655	0.000	0.000
	LM stat	20.442	0.000	0.302	29.828	0.000	0.000

The bootstrap p-value was generated with 10.000 replications. This model was arranged as a constant and trend mod.

The above figures from Westerlund and Edgerton (2007) indicate that there is cointegration for all dependent variables, i.e. economic activities between the independent variables of financial indicators in constant level. The crucial value to determine cointegration is bootstrap value of LM test. However, when trend and constant are considered together the cointegration does not appear between the variables.

Westerlund Multi-Structural Break Cointegration Test (2006)

Westerlund (2006) uses LM based test to test cointegration in panel data series. The advantage of this test is that it takes serial correlation, cross-sectional dependency and breaks in series into account.

The null hypothesis of this test is cointegration exist in panel data series. The hypotheses follow this;

H_0 : $\theta_i = 0$ for all i= 1, ..., N

H_1 : θ_i # 0 for i= 1, ..., N and $\theta_i = 0$ for i = N_1 + , ... ,N

And, panel LM statistic is defined as;

$$Z(M) \equiv \sum_{i=1}^{N}\sum_{j=1}^{M_i+1}\sum_{t=T_{ij-1}+1}^{T_{ij}}(T_{ij}-T_{ij-1})^{-2}\hat{\omega}_{i1.2}^{-2}S_{it}^{2} \qquad (4.29)$$

In equation (4.29) M is used to imply certain number of breaks. And further, Westerlund uses Dynamic Ordinary Least Square (DOLS) of Saikkonen (1991) or Fully Modified OLS (FMOLS) of Philips and Hansen (1990) to give the estimation of error term e_{it}. The consistent estimator of $\hat{\Omega}_i$ Kernel estimator form is used;

$$\hat{\Omega}_i = T^{-1}\sum_{j=-k}^{k} 1-\frac{j}{k+1})\sum_{t=j+1}^{T}\hat{w}_{it}\hat{w}_{it-j}'. \qquad (4.30)$$

When Westerlund (2006) multiple structural breaks cointegration is run, the following results come out:

Table 4.10: Westerlund (2006) Cointegration testing multibreak LM statistics results

y				
ln*IND*	***Test***	*Statistics*	*p-value*[a]	*p-value*[b]
	Constant (No break)	21.34	0.000	0.340
	Constant and trend (No break)	34.26	0.000	0.000
	Break in constant	4.428	0.000	0.790
	Break in constant and trend	10.36	0.000	0.820
lnCPI	***Test***	*Statistics*	*p-value*[a]	*p-value*[b]
	Constant (No break)	30.05	0.000	0.250
	Constant and trend (No break)	34.42	0.000	0.000
	Break in constant	5.204	0.000	0.610
	Break in constant and trend	13.22	0.000	0.060
Unemp	***Test***	*Statistics*	*p-value*[a]	*p-value*[b]
	Constant (No break)	27.13	0.000	0.360
	Constant and trend (No break)	35.58	0.000	0.000
	Break in constant	4.694	0.000	0.810
	Break in constant and trend	11.91	0.000	0.920

When structural breaks are included in the cointegration model, the Westerlund (2006) test suggests that there is cointegration among all variables. Here is again, the significance of bootstrap values are critical. Bootstrap p-values suggest that industrial production, inflation and unemployment rates are cointegrated with financial variables of spread, stock market index, money supply of M1 and long term rates.

The result contradicts with the previous cointegration of Pedroni (1999) and Westerlund and Edgerton (2007) in finding cointegration between unemployment and economic activities, where the latter test results suggested no cointegration. However, multiple structural cointegration of Westerlund, evidence strong cointegration among all variables when breaks in series taken into account. The other reason why the results differ from each other is that, the multiple structural breaks cointegration of Westerlund (2006) also considers cross-sectional dependency between panel series.

4.8 PANEL DATA ESTIMATION

Panel ARDL Model:

Having found the cointegration among the variable investigated, panel data estimation model can be run. For this purpose, Pesaran et. al. (1999) Panel Autoregressive Distributed Lags (ARDL) approach is going to be used. This model estimation can be applied to the variables no matter they are either I(0) or I(1) of integrated order. Erdem et.al. (2010) suggest that due to globalization and interconnection between many countries around the world (OECD can be a good example of this situation), using ARDL's PMG estimator would be better estimator as this method considers short run heterogeneity with respect to long run homogeneity of the series.

As can be remembered that some unit root test results produced some mix results whether the variables are stationary in level or stationary when first differenced. The majority of tests concluded that variables in this study are stationary after being first differenced. And, this why cointegration test are conducted to see long run relationship between the spread and economic activities.

However, to estimate the value of parameters in question to find out statistical relation between industrial production and financial variables, ARDL method will be used for the reason just stated that in case the variables that which appear to be stationary when first differenced actually may not be stationary in level form. ARDL approach likewise may be the most proper estimation approach if there is question regarding the level in which that are integrated.

In this study, the long run models of ARDL are as follow:

$$lnIND_{it} = \alpha_i + \sum_{j=1}^{p} \beta_{ij} lnIND_{it-j} + \sum_{j=0}^{q} \delta_{ij} SPREAD_{it-j} + \sum_{j=0}^{k} \vartheta_{ij} lnSTOCK_{it-j} \sum_{j=0}^{l} \gamma_{ij} lnM1_{it-j} \sum_{j=0}^{m} \theta_{ij} LONG_{it-j} + \varepsilon_{it} \tag{4.31}$$

$$lnCPI_{it} = \alpha_i + \sum_{j=1}^{p} \beta_{ij} lnCPI_{it-j} + \sum_{j=0}^{q} \delta_{ij} SPREAD_{it-j} + \sum_{j=0}^{k} \vartheta_{ij} lnSTOCK_{it-j} \sum_{j=0}^{l} \gamma_{ij} lnM1_{it-j} \sum_{j=0}^{m} \theta_{ij} LONG_{it-j} + \varepsilon_{it} \tag{4.32}$$

$$UNEMP_{it} = \alpha_i + \sum_{j=1}^{p} \beta_{ij} UNEMP_{it-j} + \sum_{j=0}^{q} \delta_{ij} SPREAD_{it-j} + \sum_{j=0}^{k} \vartheta_{ij} lnSTOCK_{it-j} \sum_{j=0}^{l} \gamma_{ij} lnM1_{it-j} \sum_{j=0}^{m} \theta_{ij} LONG_{it-j} + \varepsilon_{it} \tag{4.33}$$

In all above equations, cross-sections represented i=1,...,N, and time period is represented by t. The above ARDL equations can be written in the form of error correction model to estimate short run and long run estimation parameter. These forms are written below:

Model for Industrial Production: (4.34)

$$\begin{aligned}\Delta lnIND_{it} &= \alpha_i + \omega_i lnIND_{it-1} + \delta_i SPREAD_{it} + \vartheta_i lnSTOCK_{it} + \gamma_i lnM1_{it} + \theta_i LONG_{it} \\ &+ \sum_{j=1}^{p-1} \beta_{ij} \Delta lnIND_{it-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta SPREAD_{it-j} \\ &+ \sum_{j=0}^{k-1} \vartheta_{ij} \Delta lnSTOCK_{it-j} \sum_{j=0}^{l-1} \gamma_{ij} \Delta lnM1_{it-j} \sum_{j=0}^{m-1} \theta_{ij} \Delta LONG_{it-j} + \varepsilon_{it}\end{aligned}$$

Model for Consumer Price Index: (4.35)

$$\Delta lnCPI_{it} = \alpha_i + \omega_i lnCPI_{it-1} + \delta_i SPREAD_{it} + \vartheta_i lnSTOCK_{it} + \gamma_i lnM1_{it} + \theta_i LONG_{it} + \sum_{j=1}^{p-1} \beta_{ij} \Delta lnCPI_{it-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta SPREAD_{it-j} + \sum_{j=0}^{k-1} \vartheta_{ij} \Delta lnSTOCK_{it-j} \sum_{j=0}^{l-1} \gamma_{ij} \Delta lnM1_{it-j} \sum_{j=0}^{m-1} \theta_{ij} \Delta LONG_{it-j} + \varepsilon_{it}$$

Model for Unemployment Rates: (4.36)

$$\Delta UNEMP_{it} = \alpha_i + \omega_i UNEMP_{it-1} + \delta_i SPREAD_{it} + \vartheta_i lnSTOCK_{it} + \gamma_i lnM1_{it} + \theta_i LONG_{it} + \sum_{j=1}^{p-1} \beta_{ij} \Delta UNEMP_{it-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta SPREAD_{it-j} + \sum_{j=0}^{k-1} \vartheta_{ij} \Delta lnSTOCK_{it-j} \sum_{j=0}^{l-1} \gamma_{ij} \Delta lnM1_{it-j} \sum_{j=0}^{m-1} \theta_{ij} \Delta LONG_{it-j} + \varepsilon_{it}$$

In above error correction models of ARDL equations, Δ indicate first difference operator, $\omega_i = -(1 - \sum_{j=1}^{p} \beta_{ij})$ and $\omega'_i = -(1 - \sum_{j=1}^{p} \beta'_{ij})$ shows error correction coefficients.

Pesaran et. al. suggest this test of pooled mean group (PMG) estimation can be used for heterogeneous panel series. In fact, the panel series of this study found to be heterogeneous when Pesaran and Yamagata's (2008) test of homogeneity were run earlier. In this case, the data seems to be suitable for panel ARDL model.

While PMG test procedure allows long-run coefficients to be equal, however, short-run parameters and error variance differ across each cross-section. PMG estimator's residuals are calculated under the assumption of maximum likelihood and expected to be normally distributed. The long run coefficients and error correction parameters for each cross-section are calculated by Logarithmic Probability Density Function.

4.9 EMPIRICAL FINDINGS

Industrial Production:

The below results in Table 4.11 panel A and panel B bring forth two relations. One is the long run relation between industrial production and independent variables and the second is short run relation between industrial production and independent variables of this study's model.

The PMG estimator of ARDL approach reports that there is positive long run relation between spread and industrial production which is regarded as the main indicator of economic activities. This result is in line with the literature that state as increase in spread is followed by increase in economic activities. Further, the p-value of spread variable is also significant in explaining the industrial production.

The same consequences can similarly be driven by stock index and long term interest rates which seem significant in explaining industrial production. The stock market index, as explained in literature is one of the leading indicators of economic outlook in the future. Because, investors in stock markets are forward looking and price their assets accordingly in terms of their investment value. Hence, when the economic future is not bright the investors either withdraw their funds from the stocks or stop to invest into stocks. On the other hand, when the economic futures are seen to be expanding, the stock markets react positively. In this thesis, stock market index and industrial production seem to be positively correlated in line with the literature.

In the case of long term interest rates, the intuitive behind this idea is that increase in long term interest rates may be signalling an overheating economy or as discussed earlier a signal of inflationary expectation. Thus, when long term interest rates increase industrial production will negatively be affected as the result and also an outcome of this research.

Nevertheless, M1 money supply seems to be insignificant in the regression of ARDL model. This should be viewed as normal, because especially in the post crisis period of 2008 and 2009, major central banks around the world have increased money supply level to lead economic recovery after the collapse of capital markets in 2008. The central banks aim to increase liquidity available for loanable funds through open market operations or buying back government and private sector long term debt securities. Once the credits are available for reel economy, the output growth should follow. However, the output figures in many OECD countries were lower than expected until recently.

In Chapter 2, when looking at the figure 2.5 which indicated level of industrial production in OECD members, the recovery of output growth looked weak in many members. This result is also in line with view of Stiglitz (2016), as the author points out that when running a simple regression there is low correlation between large money supply and GDP. In addition, the authors suggest that, this weak relation between money base and interest with output not only exists in the post financial crisis but also over the last quarter. Further, the author also asks where these extra liquidity have gone? These questions may be found out in future experiments. However, it could be said that when looking at stock market indexes, the value of stocks have increased since financial crisis of 2008 and reached their record level as of end of 2016 for the U.S indices and for other developed countries. This could have been one of the simple answers for the question Stiglitz asks.

As pointed, the central banks' actions to increase money supply and make available loanable funds to the reel sector have had positive impact on stock market indexes, especially for advanced countries' capital markets. The excess money supplies have thought to be notably directed into stock markets. As noted in the section of variable discussion, there is positive relation between stock market and industrial production due to perception about future economic conditions. The PMG analysis result suggests that there is positive relationship between stock markets and industrial production in the long run.

Estimation of ARDL for industrial production as being dependent variable:

Table 4.11: Panel ARDL model for industrial production test results

Panel A: Long Run Estimation			
Variables	*Coefficient*	*t-stat*	*p-value*
Spread	0.0220	3.4352	0.0006
lnstock	0.3156	10.919	0.0000
lnM1	-0.0466	-1.2670	0.2052
Long	-0.0095	-1.7757	0.0759
Panel B: Short Run Estimation			
Variables	*Coefficient*	*t-stat*	*p-value*
EC (Error Correction Term)	-0.0586	-6.4780	0.0000
D(lnind(-1))	-0.2369	-3.9314	0.0001
D(lnind(-2))	-0.1063	-4.3719	0.0000
D(lnind(-3))	-0.0090	-0.3556	0.7221
D(Spread)	-0.0227	-5.8547	0.0000
D(lnstock)	0.0163	1.7344	0.0829
D(lnM1)	0.1364	1.1812	0.2376
D(Long)	0.0193	5.8018	0.0000
C	0.1988	6.3570	0.0000

Consumer Price Index (CPI) - Inflation:

The PMG estimator reveals that all independent variables in the system of equations are significant with the dependent variable of inflation. The results suggest that there is long run relation between inflation and interest rate spread, stock market index, money supply of M1 and long term interest rates.

The literature on relation between spread and inflation suggest positive direction, i.e. as the spread increases the inflation increases in the coming few years, but not in the short run for example for the U.S. (Miskin, 1997) and for Germany (Ivanova et. al. 2000). On the other hand, Sahinbeyoglu and Yalcin (2000) found negative relation between spread and inflation for Turkey.
The rationale behind interest rate spread and inflation is the theory that an upward sloping yield curve indicates an expected higher future interest rates i.e. a positive interest rate spread will signal higher future interest rates.

As shown in Table 4.12, Panel A, the long run relation between interest rate spread and inflation is negatively correlated for the OECD countries between 2005 and 2015. One reason for this may be the disinflationary period that many advanced countries have been experiencing in the post crisis period in which central banks tried to prevent negative inflation- the case of Japan- or to increase the level of inflation to a more stable level- the case for Euro area, the U.S and the U.K.

When looking at the relation between long term interest rates and inflation, it seems there is positive relation between them. This is obvious as the long term interest rates tolerate future trend in inflation rates accordingly. Goodfriend (1993) state that if there is an expectation of inflation in future, interest rates of U.S. bonds will react quickly which may be result of FED's weaknesses in tackling inflation and hence, monetary restriction will follow this. Money supply evidently will cause inflation rates rise in the future as the amount of expandable money is ready for consumption. Hence, there seems positive relation between money supply and inflation in this study's analysis.

Table 4.12: Panel ARDL model for consumer price index test results

Panel A: Long Run Estimation			
Variables	*Coefficient*	*t-stat*	*p-value*
Spread	-0.0140	-3.3211	0.0009
lnstock	0.0515	3.6918	0.0002
lnM1	0.2321	10.623	0.0000
Long	0.0239	4.7516	0.0000
Panel B: Short Run Estimation			
Variables	*Coefficient*	*t-stat*	*p-value*
EC (Error Correction Term)	-0.0154	-4.3734	0.0000
D(lncpi(-1))	0.1230	2.3801	0.0174
D(lncpi(-2))	-0.0989	-3.7370	0.0002
D(lncpi(-3))	-0.1137	-3.3219	0.0009
D(Spread)	-0.0014	-1.6272	0.1038
D(lnstock)	0.0035	1.7867	0.0741
D(lnM1)	-0.0479	-3.2970	0.0010
D(Long)	0.0028	2.6754	0.0075
C	0.0519	4.5508	0.0000

Unemployment:

The below table shows the results of PMG that indicates long run and short run relation between financial variables and unemployment rate in OECD countries. In this model, relation betwen spread and unemployment rate looks statistically insignificant. However, Bernanke (1990) and Papadamou and Siriopoulos (2009) who found significant and positive relation between the spread and unemployment rate as a macro-economic variable.

The stock exchanges have negative relation with unemployment rate. This outcome is in line with the theory that the stock exchanges foresee the future of economic standing and it will rise or fall depending on the direction economies go. On the other hand, money supply of M1, according to the results, does not give what the literature suggests. In fact, if remembered M1 money supply did not give the same results even for the variable industrial production which had negative link with the spread.

Table 4.13: Panel ARDL model for unemployment test results

Panel A: Long Run Estimation			
Variables	*Coefficient*	*t-stat*	*p-value*
Spread	0.1265	1.2584	0.2083
lnstock	-7.6729	-13.021	0.0000
lnM1	3.3012	6.0133	0.0000
Long	0.2886	2.7271	0.0064
Panel B: Short Run Estimation			
Variables	*Coefficient*	*t-stat*	*p-value*
EC (Error Correction Term)	-0.0221	-5.3329	0.0000
D(Uenmp(-1))	0.1377	2.7079	0.0068
D(Unemp(-2))	0.1040	2.8500	0.0044
D(Unemp(-3))	-0.0132	-0.5006	0.6166
D(Spread)	0.1298	3.7299	0.0002
D(lnstock)	-0.0245	-0.4227	0.6729
D(lnM1)	-0.8951	-2.2758	0.0229
D(Long)	-0.1080	-2.9102	0.0036
C	0.6103	5.2778	0.0000

4.10 PANEL CAUSALITY TEST

While Dumitrescu and Hurlin's (2012) panel causality test advice Granger (1969) non-causality test that is used for heterogeneous panel data series, it is built on Granger's Wald statistic which takes average of cross-section units. This causality test also takes cross-section dependency into account.

Dumitrescu and Hurlin's (2012) propose the following model for stationary models:

$$y_{it} = \alpha_i + \sum_{k=1}^{K} y_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \qquad (4.37)$$

In equation (4.37), i = 1,2,...,N and t = 1,2,...,T and $\beta_i^{(k)}$ for β_i, the authors fixes α_i for time-dimension. The authors also assume that lag order of K are the same for all cross-section units in the panel and allow autoregressive parameters of $y_i^{(k)}$ and regression parameters of $\beta_i^{(k)}$ to vary across each group.

The null hypothesis is by assuming homogeneous non-causality, i.e no causality between the variables in the panel series. So the null hypothesis is constructed as:

H_0 : β_i = 0 $\quad \forall_i$ = 1,2, ..., N

If β_i vary across cross-sections, then the alternative model of heterogeneity will be defined by assuming no causality from x to y for each unit. So, the alternative hypothesis is given as:

H_1 : β_i = 0 $\quad \forall_i$ = 1,2, ..., N

β_i # 0 $\quad \forall_i$ = N_1 + 1, N_1 + 2,..,N

When running non-causality test of Dumitrescu and Hurlin's (2012) for the variables under considerations, the results are reported in below table (XX). Looking at the outcomes of causality, it can be said that the causality reveals bi-directional relationship for spread and industrial production in all lags which specified from 1 to 4 lags. In fact, as it is found that there exists positive relation between spread and industrial production when long and short run estimators determined, the effect of spread on industrial production is clear. However, as causality test offers, industrial production has also effect on spread. This is situation is obvious as monetary policies follow economic conditions. Because policy changes will consider the economic path and adjust interest rates accordingly, and hence, the spread will be affected correspondingly.

There seems also a positive bi-directional causality relationship between spread and consumer price index or inflation in series.

Table 4.14: Dumitrescu & Hurlin (2012) panel causality test results

lag (k)		Spread > Ind	Ind > Spread	Stock > Ind	Ind > Stock	M1 > Ind	Ind > M1	Long > Ind	Ind > Long
1	W-Stat.	1.7591	2.3759	5.0725	1.0226	1.3172	1.7401	1.8060	1.3595
	P-value	0.0060***	0.0000***	0.0000***	0.9816	0.2656	0.0074***	0.0035***	0.2041
2	W-Stat.	3.0309	5.9771	9.9119	3.8692	2.3952	3.3375	2.8711	2.5163
	P-value	0.0094***	0.0000***	0.0000***	0.0000***	0.3464	0.0007***	0.0292**	0.2088
3	W-Stat.	4.2689	7.8797	13.086	4.0008	3.4204	4.3853	4.3712	3.3129
	P-value	0.0100***	0.0000***	0.0000***	0.0447**	0.4354	0.0048***	0.0053***	0.5806
4	W-Stat.	5.4912	10.146	15.671	4.7300	5.0182	5.7256	5.3944	4.3720
	P-value	0.0096***	0.0000***	0.0000***	0.2297	0.0843*	0.0026***	0.0159**	0.5830
lag (k)		Spread > Cpi	Cpi > Spread	Stock > Cpi	Cpi > Stock	M1 > Cpi	Cpi > M1	Long > Cpi	Cpi > Long
1	W-Stat.	1.9788	1.6058	3.5368	1.4330	0.9371	1.6104	1.3819	2.8053
	P-value	0.0004***	0.0292**	0.0000***	0.1231	0.7693	0.0279**	0.1761	0.0000***
2	W-Stat.	2.9339	3.0100	4.5975	2.9600	1.6911	3.1933	2.3424	4.2803
	P-value	0.0191**	0.0110**	0.0000***	0.0200**	0.3700	0.0000***	0.4200	0.0000***
3	W-Stat.	3.8010	4.7251	5.3793	4.5934	2.7140	4.3296	3.8479	6.2264
	P-value	0.1130	0.0004***	0.0000***	0.0011***	0.4750	0.0069***	0.0921*	0.0000***
4	W-Stat.	5.2580	6.4434	6.4053	6.6777	4.0866	5.4040	5.5904	7.6357
	P-value	0.0300**	0.0000***	0.0000***	0.0000***	0.9800	0.0200**	0.0100***	0.0000***
lag (k)		Spread > Unem	Unem > Spread	Stock > Unem	Unem > Stock	M1 > Unem	Unem > M1	Long > Unem	Unem > Long
1	W-Stat.	2.5806	2.2752	1.5739	1.0879	2.0752	1.4623	1.1611	0.5331
	P-value	0.0000***	0.0000***	0.0400**	0.7900	0.0000***	0.0989*	0.5923	0.0738*
2	W-Stat.	3.5410	3.9942	3.9568	2.3047	2.5064	3.4614	2.5318	1.9715
	P-value	0.0000***	0.0000***	0.0000***	0.4802	0.2182	0.0002***	0.1945	0.8715
3	W-Stat.	4.6274	5.3897	6.8224	3.4482	3.5570	3.6448	3.7747	3.3457
	P-value	0.0009***	0.0000***	0.0000***	0.4016	0.2851	0.2096	0.1261	0.5340
4	W-Stat.	5.7088	6.4690	9.7376	5.0661	4.6540	5.1566	5.3501	3.9385
	P-value	0.0028***	0.0000***	0.0000***	0.0697*	0.2878	0.0479**	0.0197**	0.8095

***, **,* Indicates the rejection of the null hypothesis at 1%, 5% and 10% level of significance respectively.

CHAPTER V

CONCLUSION

In this thesis, the relation between economic activities and spreads have been analysed for a group of countries. OECD countries were preferred for the study due to their similar economic structure and economic interdependence. In the analysis, three main macro-economic indicators were selected as dependent variable and their response to financial indicators are seen through the econometric models. As the focus was set on term structure of interest rates, several other financial indicators were also chosen to see which financial variable is the most effective on selected economic activities.

Through the thesis, the organization of OECD has been defined and their role in World economy has been given. In later stage, the variables in question were introduced and graphs of each variable for each country were drawn to see comparable behaviour between member countries of OECD. In all variables, the movement of macro-economic indicators and financial indicators were seen almost in the same direction within the investigated period. There were some disparate among the countries. The fluctuations arise from the troubled European countries such as Greece, Ireland, Portugal, Spain and Italy. However, this disparity of movement of variables of the mentioned countries is not extraordinary over time. For example, in some cases, they were lagging behind other peer countries – for instance, in the case of industrial production- or in some cases, they were leading other countries – for example the case of interest rate spread.

Following viewing the changes of indicators through the analysis, the literature review on the issue was introduced. In this part, firstly the theory of interest rate spread were given and explained. The theory suggests that a widening spread mean a future rising economic activity in economies. Or, on the other hand, if long term interest rates are higher than short term interest rates, the spread between the two will be negative and this will send negative signal to markets as the future economic activities will slow down. The view of Estrella et al., (2003) is that if central banks raise short-term interest rates and market participants expect this move as effective in curbing future inflation in the long run, long-term rates (the averages of future expected short rates, according to the expectations hypothesis) should rise in smaller fraction. For this reason a confining monetary policy, in this case, will lead to flatten the yield curve, and at the same time slows down the economy (Estrella, 2005). It has been found that relation between spread and economic activities are positive especially for developed countries and negative for some developing countries such as Turkey. However, it is also clear from the investigation that this case may not be true all the time as Bernanke (1990) points out. And Ergungor (2016) in his latest paper argues that the power of interest rate spread to predict future economic state is weak and instead, the author uses corporate profits.

In empirical side of the thesis, before finding long run relation between spread and economic activities, the variables are first checked whether they are level stationary or first difference stationary. Several methods have been used for analysing stationarity. First and Second Generation unit root tests were applied. The Second Generation unit root tests take into account cross-sectional dependency among the countries as there is cross-sectional dependency in the panel data of this thesis according to Pesaran's CD test results. The majority of unit test results reveal that all variables seem to be stationary when first differenced. Though, while spread seems to be stationary at level when only constant used, by adding trend in to the series it becomes non-stationary subsequently. In contrast, M1 variable seems stationary at level when trend added conforming to LLC, IPS and M&W tests. However, this variable is non-stationary at level when only constant is used in the equation.

Further, the heterogeneity of the variables was tested by Pesaran and Yamagata test. Results indicate a strong rejection of homogeneity of betas. It was concluded that the panel cross-sections slope coefficients are heterogeneous in this panel series.

Regarding all the variable as I(1), cointegration method were selected to find long run relation between interest rate spread and economic activities. Firstly, the cointegration methods that do not consider cross-sectional dependency were used. When Pedroni (2004) and Westerlund's (2007) Error Correction Model were run for the variable in question, both methods give similar result of cointegration between industrial production and spread and other financial indicators. Similar conclusions were also drawn for the consumer price index. However, cointegration between unemployment rate and financial indicators did not exist according to test results.

As data contain cross-section dependency, the study chooses cointegration test methods which allow for dependency. The first test is Westerlund and Edgerton (2007) and the second is Westerlund Multi-Structural Break Cointegration Test (2006) which takes serial correlation, cross-sectional dependency and breaks in series into account in panel data. When looking at the results of the Westerlund and Edgerton (2007), there seems cointegration among all variables including unemployment rate which was not cointegrated with other variables in previous tests. When structural breaks are included in the cointegration model, the Westerlund (2006) test suggests that there is cointegration among all variables. Bootstrap p-values suggest that industrial production, inflation and unemployment rates are cointegrated with financial variables of spread, stock market index, money supply of M1 and long term rates. The result contradicts with the previous cointegration of Pedroni (1999) and Westerlund and Edgerton (2007) in finding cointegration between unemployment and economic activities, where the latter test results suggested no cointegration.

After having found cointegration among the variable, Pesaran's (1999) ARDL approach were used to estimate regression parametres. This model estimation can be applied to the variables no matter they are either I(0) or I(1) of integrated order. ARDL's PMG estimator was chosen to have a better estimator as this method considers short run heterogeneity with respect to long run homogeneity of the series.

ARDL results suggested that spread, stock exchange index are significant and positively correlated with industrial production in the long run for OECD countries. Long term interest rates seem to be significant only at %10 confidence level. However, M1money supply looks insignificant in explaining industrial production.

On the consumer price index or inflation side, all financial indicators – spread, stock exchange index, M1 and long rates - appear to be compelling to explain CPI. The results imply that when spread becomes positive inflation decreases in the long run. This results contradicted the theory of positive direction between spread and inflation, but in line with several other case, for instance researches on Turkey. The negative relation between spread and inflation was noted earlier that this could be the reason that disinflationary period that many advanced countries have been experiencing in the post crisis period in which central banks tried to prevent negative inflation- the case of Japan- or to increase the level of inflation to a more stable level- the case for Euro area, the U.S and the U.K. long term rates seem o be positively correlated with inflation as the literature suggest.

The relation between unemployment rate and interest rate spread is found to be insignificant in the long run. However, some studies found significant and positive relation. The result of relation between stock exchange index and unemployment rate found to be negative. This outcome is in line with the theory that the stock exchanges foresee the future of economic standing and it will rise or fall depending on the direction economies go. On the other hand, money supply of M1, according to the results, does not give what the literature suggests. In fact, if remembered M1 money supply did not give the same results even for the variable industrial production which had negative link with the spread.

Overall, it can be concluded that the outcomes of this thesis are close to the literature when using latest methods in panel data analysis for OECD countries. While interest rate spread still has positive relation with economic activities, as pointed by some authors, the degree of positiveness seems to be declining over the years. However, due to macro-economic development around the World, some variables such as money supply are losing its significance in explaining economic activities. This happens at the time of the economies that are in a new state, which some economists call as “New Normal”. Because, interest rates in many countries are in near-zero level and has been staying there for a along time since the financial crisis of 2008. Despite these lower rates, economic activities could not reach the level desired up until 2016.

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APPENDICES

APPENDIX A: IM, LEE AND TIESLAU (2013) STRUCTURAL BREAK UNIT ROOT TEST RESULTS FOR THE ANALYS

One Break Model

Variable ***lnIND***	**Level Shift** (Break in constant)			**Level and Trend Shift** (Break in constant and trend)		
Countries	*LM-stat*	*Break(s)*	*Lags*	*LM-stat*	*Break(s)*	*Lags*
Australia	-5.236***	47	1	-6.466***	113	4
Austria	-2.224	50	3	-3.280	110	0
Belgium	-4.136**	19	1	-4.320**	109	6
Canada	-3.377*	59	1	-3.404	59	1
Chile	-5.704***	47	1	-5.568***	43	0
Czech	-3.034	42	1	-4.038**	43	5
Denmark	-6.078***	50	1	-5.470***	48	2
Finland	-3.489*	48	3	-3.929*	16	3
France	-3.157	45	3	-3.838*	43	6
Germany	-2.981	58	3	-3.027	57	3
Greece	-7.556***	45	1	-7.689***	45	11
Hungary	-3.672**	46	1	-3.293	46	3
Ireland	-8.951***	98	1	-7.731***	103	0
Israel	-4.251***	29	10	-4.838***	103	12
Italy	-3.080	45	3	-3.106	37	3
Japan	-3.865**	47	1	-3.461	76	3
Korea	-3.511*	74	0	-3.662*	86	0
Luxembourg	-3.727**	41	1	-4.951***	102	0
Mexico	-2.641	45	4	-3.002	22	4
Netherland	-4.474***	114	9	-5.389***	110	5
Norway	-6.822***	64	9	-6.832***	64	12
Poland	-3.799**	44	8	-4.225**	41	8
Portugal	-5.299***	45	1	-5.903***	40	0
Spain	-2.961	44	3	-2.641	35	3
Sweden	-4.798***	44	4	-3.675*	102	11
Switzerland	-3.922**	20	1	-4.202**	25	1
Turkey	-3.474*	47	1	-7.106***	103	1
UK	-3.620**	46	0	-3.535	45	0
US	-3.877**	58	4	-3.898*	58	4
Panel_LM Stat.	-21.16***			-18.197***		
p-value	0.000			0.000		

Two Breaks Model

Variable ***lnIND***	**Level Shift** (Break in constant)				**Level and Trend Shift** (Break in constant and trend)			
Countries	*LM-stat*	*Break(s)*		*Lags*	*LM-stat*	*Break(s)*		*Lags*
Australia	-5.944***	17	49	1	-7.087***	71	76	4
Austria	-5.339***	45	65	3	-5.476***	44	54	0
Belgium	-6.087***	45	71	1	-6.081***	45	71	0
Canada	-5.571***	47	73	1	-5.660***	46	69	5
Chile	-7.414***	47	86	1	-13.01***	61	64	7
Czech	-4.806***	40	50	1	-7.255***	38	46	12
Denmark	-8.361***	45	61	1	-6.887***	49	97	11
Finland	-7.520***	46	76	3	-7.636***	46	76	3
France	-4.797***	27	47	3	-6.124***	36	46	6
Germany	-5.398***	44	67	3	-6.812***	45	68	7
Greece	-10.58***	44	91	1	-10.303***	44	79	12
Hungary	-4.526**	45	82	1	-5.564***	70	73	12
Ireland	-10.67***	37	107	1	-9.672***	21	106	10
Israel	-6.079***	43	56	10	-6.046***	31	69	10
Italy	-5.215***	40	71	3	-6.790***	35	43	4
Japan	-5.228***	45	59	1	-7.245***	73	79	3
Korea	-6.078***	45	72	0	-7.931***	45	51	0
Luxembourg	-5.711***	45	57	1	-6.210***	46	57	0
Mexico	-4.162**	43	67	4	-5.714***	34	46	4
Netherland	-6.005***	46	59	9	-6.113***	38	50	9
Norway	-7.315***	66	91	9	-7.096***	30	65	12
Poland	-5.358***	39	74	8	-5.761***	34	39	8
Portugal	-6.158***	45	105	1	-8.334***	25	46	0
Spain	-3.556*	27	46	3	-5.202**	27	58	3
Sweden	-6.197***	44	74	4	-6.115***	44	76	11
Switzerland	-4.990***	34	56	1	-5.087**	25	104	1
Turkey	-11.24***	45	70	1	-10.663***	45	82	1
UK	-6.313***	44	73	0	-6.749***	45	73	0
US	-5.826***	43	70	4	-8.207***	36	50	4
Panel_LM	-39.694***				-37.647***			
p-value	0.000				0.000			

One Break Model

Variable *lnCPI*	**Level Shift** (Break in constant)			**Level and Trend Shift** (Break in constant and trend)		
Countries	*LM-stat*	*Break(s)*	*Lags*	*LM-stat*	*Break(s)*	*Lags*
Australia	-5.594***	93	1	-5.490***	74	1
Austria	-4.774***	86	12	-4.213**	86	12
Belgium	-2.548	102	1	-2.532	97	1
Canada	-4.568***	50	1	-4.684***	47	1
Chile	-3.135	50	1	-3.205	49	1
Czech	-4.654***	31	12	-5.029***	31	12
Denmark	-5.315***	101	12	-4.338**	49	12
Finland	-4.793***	97	12	-5.172***	97	12
France	-4.943***	110	12	-4.891***	116	12
Germany	-4.020**	21	12	-3.891*	71	12
Greece	-5.265***	87	6	-4.407**	87	12
Hungary	-4.515***	77	12	-4.477**	86	12
Ireland	-5.772***	67	12	-5.849***	67	12
Israel	-3.976**	68	1	-3.920*	68	12
Italy	-4.591***	77	12	-4.854***	108	12
Japan	-3.796**	79	12	-3.881*	86	12
Korea	-4.403***	76	12	-4.613***	80	12
Luxembourg	-4.242***	115	6	-3.973**	55	12
Mexico	-6.733***	44	1	-6.029***	44	12
Netherland	-3.629**	86	12	-6.310***	36	12
Norway	-3.548**	77	12	-3.654*	20	12
Poland	-2.810	86	1	-3.049	48	12
Portugal	-4.453***	68	12	-4.435**	116	12
Spain	-1.893	28	3	-3.730*	116	12
Sweden	-4.353***	101	12	-4.331**	59	12
Switzerland	-5.466***	59	3	-5.351***	59	12
Turkey	-5.499***	37	1	-5.226***	47	12
UK	-3.577**	90	12	-3.320	69	12
US	-5.013***	35	1	-5.209***	50	1
Panel_LM Stat.	-22.683***			-17.750***		
p-value	0000			0.000		

Two Breaks Model

Variable *lnCPI*	**Level Shift** (Break in constant)				**Level and Trend Shift** (Break in constant and trend)			
Countries	*LM-stat*	*Break(s)*		*Lags*	*LM-stat*	*Break(s)*		*Lags*
Australia	-5.953***	38	72	1	-6.790***	68	73	1
Austria	-5.147***	44	88	12	-6.217***	101	112	12
Belgium	-3.413	41	72	1	-5.303**	37	49	4
Canada	-5.910***	46	75	1	-5.954***	46	75	1
Chile	-4.392**	28	51	1	-5.289**	40	51	1
Czech	-6.025***	35	107	12	-6.348***	31	107	12
Denmark	-5.820***	44	87	12	-6.222***	94	98	12
Finland	-5.233***	53	92	12	-5.648***	35	62	6
France	-6.319***	63	99	12	-6.060***	56	99	12
Germany	-4.760***	31	71	12	-4.963**	31	71	12
Greece	-6.653***	90	116	6	-6.438***	90	94	12
Hungary	-5.682***	33	100	12	-6.009***	33	97	1
Ireland	-7.669***	45	80	12	-7.559***	45	89	12
Israel	-5.099***	50	87	1	-6.077***	24	91	1
Italy	-5.392***	46	85	12	-5.409***	46	85	6
Japan	-4.806***	39	91	12	-6.526***	108	112	12
Korea	-6.285***	37	92	12	-6.376***	35	92	12
Luxembourg	-6.783***	54	98	6	-6.357***	54	93	5
Mexico	-7.024***	34	44	1	-7.152***	44	79	12
Netherland	-8.437***	57	100	12	-7.782***	57	99	12
Norway	-5.123***	32	80	12	-5.460***	20	64	0
Poland	-5.267***	32	94	1	-5.373***	18	85	12
Portugal	-6.370***	44	88	12	-6.359***	44	88	12
Spain	-5.064***	54	93	3	-7.812***	48	102	1
Sweden	-5.470***	31	103	12	-5.117**	31	59	12
Switzerland	-6.901***	33	84	3	-7.719***	20	38	12
Turkey	-6.240***	43	66	1	-6.273***	76	89	1
UK	-5.768***	70	97	12	-5.495***	70	97	12
US	-6.002***	45	77	1	-7.086***	39	49	1
Panel_LM Stat.	-35.606***				-29.091***			
p-value	0.000				0.000			

One Break Model

Variable ***UNEMP***	**Level Shift** (Break in constant)			**Level and Trend Shift** (Break in constant and trend)		
Countries	*LM-stat*	*Break(s)*	*Lags*	*LM-stat*	*Break(s)*	*Lags*
Australia	-2.653	26	3	-3.84*	43	10
Austria	-3.402*	37	1	-3.793*	18	1
Belgium	-3.863**	40	1	-4.257**	47	1
Canada	-2.633	49	3	-2.88	22	3
Chile	-2.133	63	1	-2.665	18	1
Czech	-2.057	50	1	-3.611	116	8
Denmark	-2.593	55	5	-3.056	40	7
Finland	-1.98	21	1	-2.903	30	2
France	-2.683	31	1	-3.096	31	5
Germany	-2.058	102	1	-3.102	82	2
Greece	-1.517	41	1	-3.994**	115	6
Hungary	-2.351	85	1	-2.785	87	1
Ireland	-2.193	62	1	-2.199	62	1
Israel	-3.742**	90	1	-4.453**	90	6
Italy	-4.483***	75	12	-4.306**	75	11
Japan	-2.907	51	0	-3.279	49	0
Korea	-2.847	110	4	-5.228***	108	0
Luxembourg	-4.364***	94	9	-4.389**	109	8
Mexico	-5.653***	49	1	-4.813***	47	3
Netherland	-2.383	49	2	-2.451	87	2
Norway	-2.694	19	2	-3.298	17	7
Poland	-3.093	64	1	-3.099	64	1
Portugal	-2.15	85	1	-2.36	91	1
Spain	-2.203	59	1	-2.282	59	1
Sweden	-4.691***	46	1	-4.675***	46	5
Switzerland	-3.976***	61	1	-4.075**	61	1
Turkey	-3.028	63	4	-3.061	63	4
UK	-1.861	79	1	-1.856	78	1
US	-2.934	70	2	-2.932	65	2
Panel_LM Stat.	-8.955***			-7.183***		
p-value	0			0		

Two Breaks Model

Variable *UNEMP*	**Level Shift** (Break in constant)				**Level and Trend Shift** (Break in constant and trend)			
Countries	*LM-stat*	*Break(s)*		*Lags*	*LM-stat*	*Break(s)*		*Lags*
Australia	-5.298**	43	70	3	-4.963**	34	43	4
Austria	-5.315**	42	76	1	-6.201***	66	70	1
Belgium	-4.331**	47	74	1	-5.901***	36	52	1
Canada	-4.488**	45	55	3	-5.399***	42	50	3
Chile	-4.156**	43	68	1	-5.06**	42	48	1
Czech	-2.949	35	53	1	-4.455*	100	113	10
Denmark	-5.039***	24	67	5	-5.159**	35	59	9
Finland	-2.927	47	72	1	-5.707***	36	44	5
France	-4.133**	31	55	1	-5.408***	17	23	8
Germany	-3.444	47	76	1	-5.291**	100	107	2
Greece	-2.996	47	85	1	-5.05**	20	114	10
Hungary	-3.383	48	93	1	-4.123	95	101	1
Ireland	-3.636*	46	79	1	-5.185**	60	68	1
Israel	-5.491***	29	90	1	-7.04***	81	85	7
Italy	-5.849***	53	95	12	-6.309***	53	105	11
Japan	-6.144***	46	56	0	-6.569***	46	56	0
Korea	-6.514***	50	107	4	-7.701***	59	64	0
Luxembourg	-5.256***	30	70	9	-5.746***	33	70	8
Mexico	-7.233***	45	51	1	-6.388***	45	54	0
Netherland	-3.651*	31	99	2	-4.146	75	78	2
Norway	-3.758*	57	115	2	-4.396*	72	94	5
Poland	-3.577*	32	64	1	-6.034***	60	68	1
Portugal	-3.347	34	93	1	-5.495***	76	83	1
Spain	-3.155	44	109	1	-3.219	37	43	1
Sweden	-6.159***	45	77	1	-6.114***	45	79	0
Switzerland	-4.608***	20	61	1	-9.038***	53	67	1
Turkey	-4.122**	44	76	4	-4.648**	45	63	4
UK	-2.907	47	107	1	-5.348**	59	65	1
US	-4.231**	46	70	2	-4.701*	46	70	2
Panel_LM Stat.	-22.483***				-22.219***			
p-value	0.000				0.000			

One Break Model

Variable *SPREAD*	**Level Shift** (Break in constant)			**Level and Trend Shift** (Break in constant and trend)		
Countries	*LM-stat*	*Break(s)*	*Lags*	*LM-stat*	*Break(s)*	*Lags*
Australia	-2.930	102	1	-3.715*	116	3
Austria	-3.212*	49	1	-3.182	48	1
Belgium	-2.953	50	1	-3.020	48	1
Canada	-2.242	51	1	-3.866*	112	12
Chile	-2.657	68	1	-3.252	16	1
Czech	-4.000**	49	1	-3.842*	49	1
Denmark	-3.492*	51	1	-3.767*	50	1
Finland	-3.173	51	1	-3.269	48	1
France	-3.177	49	1	-3.197	48	1
Germany	-3.211*	51	1	-3.210	48	1
Greece	-2.625	76	2	-2.885	94	4
Hungary	-4.377***	100	12	-4.687***	100	5
Ireland	-2.802	70	1	-2.963	70	1
Israel	-2.579	48	1	-3.188	43	1
Italy	-2.389	84	1	-2.783	84	1
Japan	-3.359*	20	11	-3.722*	32	11
Korea	-3.281*	49	1	-3.804*	49	1
Luxembourg	-3.712**	49	1	-3.773*	48	1
Mexico	-3.448*	46	3	-3.877*	52	0
Netherland	-3.248*	51	1	-3.284	48	1
Norway	-3.305*	50	1	-3.561	48	1
Poland	-2.986	81	1	-3.508	15	1
Portugal	-2.529	68	1	-2.734	82	7
Spain	-2.182	93	1	-2.751	47	1
Sweden	-2.240	65	1	-2.417	20	1
Switzerland	-3.499*	48	1	-3.553	48	1
Turkey	-4.265***	45	4	-5.711***	19	0
UK	-2.811	51	1	-2.944	48	1
US	-2.755	43	8	-2.815	48	10
Panel_LM Stat.	-10.260***			-7.198***		
p-value	0.000			0.000		

Two Breaks Model

Variable *SPREAD*	**Level Shift** (Break in constant)				**Level and Trend Shift** (Break in constant and trend)			
Countries	*LM-stat*	*Break(s)*		*Lags*	*LM-stat*	*Break(s)*		*Lags*
Australia	-3.840**	45	69	1	-6.232***	42	48	3
Austria	-5.567***	41	52	1	-7.078***	42	48	1
Belgium	-4.888***	41	53	1	-6.199***	44	49	1
Canada	-4.413**	45	73	1	-5.735***	29	49	12
Chile	-4.720***	50	77	1	-7.054***	44	52	1
Czech	-5.778***	41	52	1	-6.418***	48	62	1
Denmark	-4.982***	43	56	1	-6.813***	44	51	1
Finland	-4.977***	46	64	1	-6.676***	42	48	1
France	-5.149***	41	52	1	-6.376***	42	48	1
Germany	-4.533**	46	67	1	-6.002***	42	48	1
Greece	-3.635*	45	93	2	-11.71***	82	87	4
Hungary	-6.273***	48	86	12	-7.587***	45	52	0
Ireland	-4.799***	32	74	1	-6.058***	78	84	1
Israel	-4.764***	44	75	1	-6.115***	38	49	9
Italy	-4.621***	46	98	1	-5.139**	81	88	1
Japan	-5.420***	18	51	11	-5.431***	29	48	12
Korea	-5.427***	48	78	1	-6.879***	44	50	9
Luxembourg	-4.714***	45	69	1	-7.095***	42	48	1
Mexico	-5.164***	52	101	3	-6.376***	42	47	0
Netherland	-4.878***	41	51	1	-6.647***	42	48	1
Norway	-4.254**	48	82	1	-7.327***	43	47	1
Poland	-3.302	46	79	1	-5.084**	42	52	9
Portugal	-4.077**	30	82	3	-5.815***	74	105	7
Spain	-4.622***	45	71	1	-5.455***	45	71	1
Sweden	-3.519*	47	82	1	-5.283**	41	48	1
Switzerland	-4.937***	45	79	1	-8.453***	43	48	1
Turkey	-4.954***	41	85	4	-6.935***	15	18	12
UK	-4.497**	47	79	1	-7.004***	42	47	1
US	-3.880**	26	52	8	-7.948***	42	47	10
Panel_LM Stat.	-25.116***				-32.599***			
p-value	0.000				0.000			

One Break Model

Variable *lnSTOCK*	**Level Shift** (Break in constant)			**Level and Trend Shift** (Break in constant and trend)		
Countries	*LM-stat*	*Break(s)*	*Lags*	*LM-stat*	*Break(s)*	*Lags*
Australia	-3.852**	45	1	-2.627	36	1
Austria	-2.968	44	1	-2.771	34	1
Belgium	-2.401	45	1	-2.916	114	1
Canada	-3.041	45	1	-3.585	44	2
Chile	-2.919	65	1	-3.034	74	0
Czech	-3.847**	44	1	-3.704*	44	1
Denmark	-2.868	44	1	-2.713	44	1
Finland	-2.659	44	1	-2.615	38	1
France	-2.724	45	1	-2.711	36	1
Germany	-2.979	45	1	-2.586	82	1
Greece	-2.214	44	1	-3.012	103	6
Hungary	-3.342*	41	1	-3.365	38	1
Ireland	-2.302	44	1	-1.981	41	1
Israel	-3.173	42	1	-3.239	40	1
Italy	-2.645	44	6	-2.653	82	1
Japan	-2.255	47	1	-2.323	84	1
Korea	-3.122	26	1	-3.966**	42	1
Luxembourg	-3.504*	45	1	-3.522	44	1
Mexico	-3.923**	21	1	-4.344**	21	1
Netherland	-3.679**	45	1	-3.426	45	1
Norway	-2.927	45	1	-3.054	19	1
Poland	-3.151	44	1	-3.628	42	1
Portugal	-2.737	42	1	-2.833	17	1
Spain	-2.581	44	1	-2.573	27	1
Sweden	-2.790	42	1	-2.639	36	1
Switzerland	-3.058	45	1	-3.040	45	3
Turkey	-2.859	53	1	-2.970	91	1
UK	-2.872	52	3	-3.200	45	3
US	-2.594	45	1	-3.338	44	1
Panel_LM Stat.	-9.093***			-3.619		
p-value	0.000			0.000		

Two Breaks Model

Variable *lnSTOCK*	**Level Shift** (Break in constant)				**Level and Trend Shift** (Break in constant and trend)			
Countries	*LM-stat*	*Break(s)*		*Lags*	*LM-stat*	*Break(s)*		*Lags*
Australia	-4.445**	20	45	1	-6.253***	38	46	1
Austria	-4.482**	41	55	1	-7.317***	38	48	1
Belgium	-4.476**	27	46	1	-7.354***	38	46	1
Canada	-4.565***	43	54	1	-8.781***	44	56	2
Chile	-4.268**	44	79	1	-5.587***	44	64	0
Czech	-4.937***	44	59	1	-7.969***	44	60	1
Denmark	-3.621*	44	111	1	-6.940***	44	61	1
Finland	-3.428	41	107	1	-5.535***	44	57	1
France	-3.758*	26	47	1	-5.769***	33	46	1
Germany	-4.429**	26	47	1	-5.399***	41	46	1
Greece	-3.730*	35	95	1	-5.225**	43	103	6
Hungary	-4.001**	43	57	1	-6.395***	28	40	1
Ireland	-3.398	26	47	1	-6.861***	40	60	1
Israel	-3.531	42	57	1	-6.708***	33	39	1
Italy	-4.322**	44	92	1	-5.776***	44	61	1
Japan	-3.757*	42	102	1	-5.395***	44	58	11
Korea	-5.078***	39	55	1	-6.954***	35	43	1
Luxembourg	-4.416**	42	55	1	-7.381***	44	66	1
Mexico	-5.895***	40	61	1	-6.980***	36	47	4
Netherland	-4.904***	41	58	1	-7.814***	38	48	1
Norway	-4.915***	41	54	1	-7.303***	44	57	1
Poland	-4.267**	41	62	1	-7.426***	26	43	1
Portugal	-3.604*	35	54	1	-5.787***	34	43	1
Spain	-3.726*	40	107	1	-4.497*	36	52	1
Sweden	-3.694*	34	55	1	-6.037***	33	43	1
Switzerland	-3.927**	45	95	1	-5.625***	31	46	3
Turkey	-4.352**	35	55	1	-7.453***	29	43	1
UK	-4.399**	40	65	3	-7.533***	38	46	0
US	-4.864***	44	68	1	-7.976***	42	46	4
Panel_LM Stat.	-20.786***				-32.220***			
p-value	0.000				0.000			

One Break Model

Variable *lnM1*	**Level Shift** (Break in constant)			**Level and Trend Shift** (Break in constant and trend)		
Countries	*LM-stat*	*Break(s)*	*Lags*	*LM-stat*	*Break(s)*	*Lags*
Australia	-2.560	89	1	-2.908	89	1
Austria	-2.682	79	1	-4.183**	15	1
Belgium	-2.682	79	1	-4.183**	15	1
Canada	-3.070	55	9	-3.189	40	9
Chile	-2.964	64	1	-2.960	64	12
Czech	-3.500*	35	3	-3.931**	35	3
Denmark	-2.434	75	1	-3.422	23	1
Finland	-2.682	79	1	-4.183**	15	1
France	-2.682	79	1	-4.183**	15	1
Germany	-2.682	79	1	-4.183**	15	1
Greece	-2.682	79	1	-4.183**	15	1
Hungary	-2.128	51	1	-2.288	51	1
Ireland	-2.682	79	1	-4.183**	15	1
Israel	-2.591	77	1	-2.486	77	1
Italy	-2.682	79	1	-4.183**	15	1
Japan	-2.881	50	1	-2.655	53	3
Korea	-3.346*	29	1	-5.408***	30	1
Luxembourg	-2.682	79	1	-4.183**	15	1
Mexico	-3.955**	33	3	-3.914*	33	0
Netherland	-2.682	79	1	-4.183**	15	1
Norway	-3.615**	7	7	-5.634***	9	6
Poland	-3.105	42	1	-2.872	44	1
Portugal	-2.682	79	1	-4.183**	15	1
Spain	-2.682	79	1	-4.183**	15	1
Sweden	-2.650	76	1	-2.850	28	1
Switzerland	-3.426*	54	1	-3.495	54	1
Turkey	-4.395***	32	7	-5.266***	30	1
UK	-2.694	49	1	-3.291	42	1
US	-2.599	43	3	-2.658	41	6
Panel_LM Stat.	-8.555***			-10.428***		
p-value	0.000			0.000		

Two Breaks Model

Variable *lnM1*	**Level Shift** (Break in constant)				**Level and Trend Shift** (Break in constant and trend)			
Countries	*LM-stat*	*Break(s)*		*Lags*	*LM-stat*	*Break(s)*		*Lags*
Australia	-5.123***	28	90	1	-4.933**	86	91	1
Austria	-3.211	46	79	1	-4.851**	15	115	1
Belgium	-3.211	46	79	1	-4.851**	15	115	1
Canada	-4.608***	53	81	9	-5.137**	32	55	11
Chile	-4.268**	59	74	1	-4.697**	4	111	12
Czech	-4.407**	26	81	3	-5.530***	36	41	0
Denmark	-4.355***	17	77	1	-7.295***	23	78	1
Finland	-3.211	46	79	1	-4.851**	15	115	1
France	-3.211	46	79	1	-4.851**	15	115	1
Germany	-3.211	46	79	1	-4.851**	15	115	1
Greece	-3.211	46	79	1	-4.851**	15	115	1
Hungary	-3.499	46	102	1	-4.816**	38	44	1
Ireland	-3.211	46	79	1	-4.851**	15	115	1
Israel	-3.498	47	83	1	-5.356***	70	79	1
Italy	-3.211	46	79	1	-4.851**	15	115	1
Japan	-3.844**	35	80	1	-3.966	53	82	3
Korea	-4.185**	30	74	1	-8.344***	22	29	1
Luxembourg	-3.211	46	79	1	-4.851**	15	115	1
Mexico	-4.414**	33	91	3	-5.006**	37	52	3
Netherland	-3.211	46	79	1	-4.851**	15	115	1
Norway	-7.096***	29	116	7	-6.524***	94	113	6
Poland	-4.417**	33	89	1	-6.030***	35	42	1
Portugal	-3.211	46	79	1	-4.851**	15	115	1
Spain	-3.211	46	79	1	-4.851**	15	115	1
Sweden	-3.969**	38	106	1	-4.574*	28	106	1
Switzerland	-5.003***	34	53	1	-7.857***	40	50	1
Turkey	-4.673***	31	41	7	-8.646***	15	20	1
UK	-5.165***	35	86	1	-7.015***	35	42	1
US	-4.904***	43	113	3	-5.836***	46	49	7
Panel_LM Stat.	-18.587***				-21.707***			
p-value	0.000				0.000			

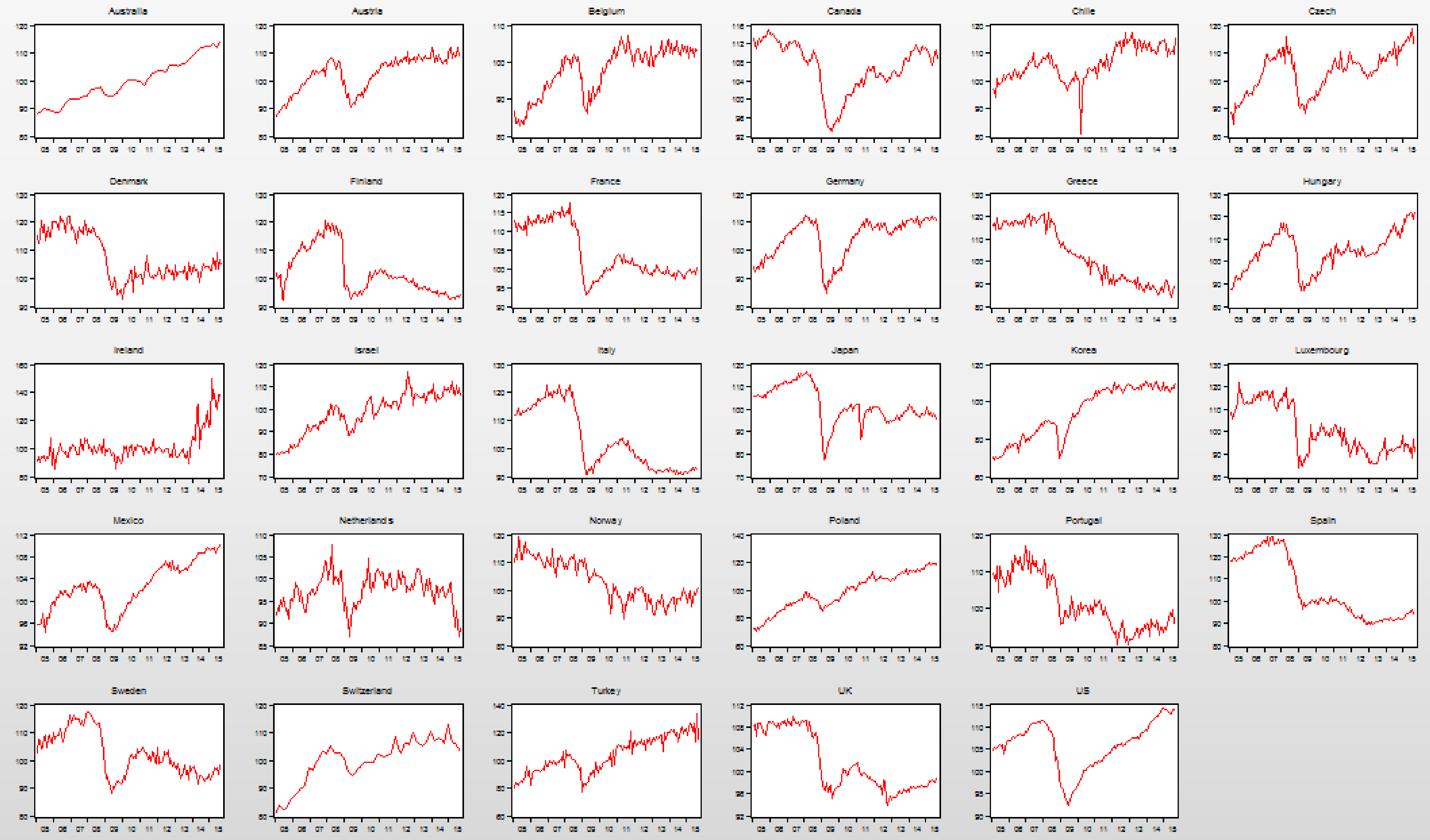
One Break Model

Variable *LONG*	**Level Shift** (Break in constant)			**Level and Trend Shift** (Break in constant and trend)		
Countries	*LM-stat*	*Break(s)*	*Lags*	*LM-stat*	*Break(s)*	*Lags*
Australia	-3.451*	82	1	-3.663*	32	1
Austria	-4.293***	42	1	-4.311**	43	1
Belgium	-3.446*	88	1	-3.445	80	1
Canada	-3.400*	82	1	-3.356	32	1
Chile	-4.456***	77	1	-4.617***	78	1
Czech	-5.033***	52	1	-5.081***	52	1
Denmark	-3.835**	44	1	-3.893*	43	1
Finland	-4.096**	43	1	-4.176**	43	1
France	-4.239***	43	1	-4.327**	43	1
Germany	-4.130**	30	1	-4.105**	43	1
Greece	-2.687	76	2	-3.031	99	4
Hungary	-3.609**	89	2	-3.723*	43	1
Ireland	-4.166**	84	5	-4.122**	86	7
Israel	-4.512***	75	1	-4.387**	75	1
Italy	-3.591**	87	1	-3.882*	80	1
Japan	-6.827***	16	2	-5.181***	16	11
Korea	-3.961**	38	10	-4.118**	47	0
Luxembourg	-3.869**	30	1	-3.789*	32	1
Mexico	-4.499***	102	0	-4.203**	89	0
Netherland	-4.020**	43	1	-4.191**	43	1
Norway	-3.261*	27	1	-3.378	27	1
Poland	-3.669**	74	1	-3.614	74	1
Portugal	-2.817	74	3	-2.939	77	7
Spain	-3.590**	82	12	-3.429	82	12
Sweden	-3.584**	27	1	-3.848*	116	3
Switzerland	-3.554*	28	0	-3.994**	31	0
Turkey	-3.964**	52	4	-4.086**	50	4
UK	-3.141	44	1	-3.349	32	1
US	-3.756**	82	1	-3.564	34	3
Panel_LM Stat.	-17.841***			-11.871***		
p-value	0.000			0.000		

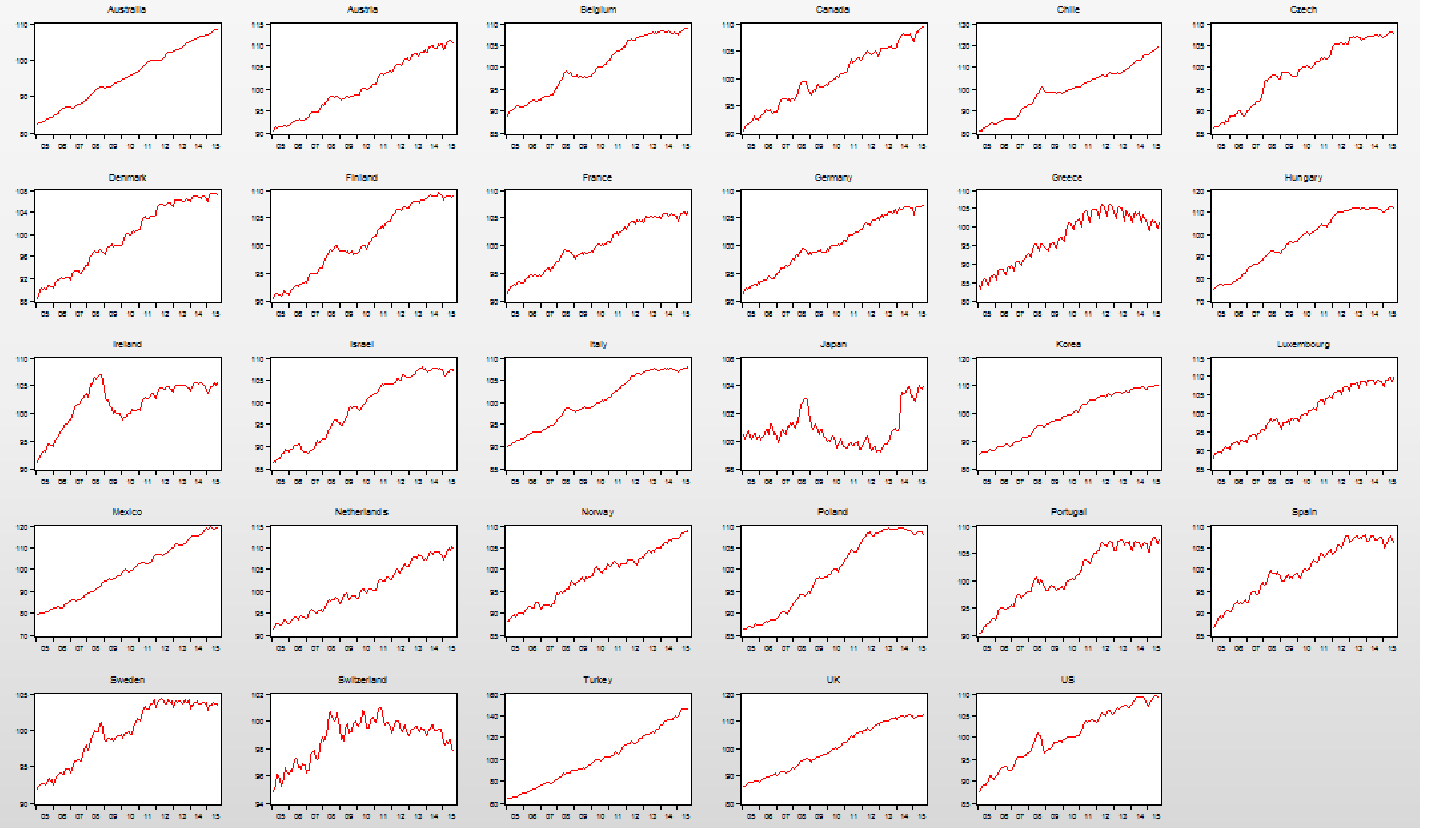
Two Breaks Model

Variable *LONG*	**Level Shift** (Break in constant)				**Level and Trend Shift** (Break in constant and trend)			
Countries	*LM-stat*	*Break(s)*		*Lags*	*LM-stat*	*Break(s)*		*Lags*
Australia	-3.886**	78	104	1	-6.573***	40	44	1
Austria	-4.604***	43	83	1	-5.797***	78	84	1
Belgium	-4.308**	44	75	1	-6.278***	66	73	1
Canada	-4.323**	78	104	1	-5.110**	46	57	1
Chile	-5.082***	46	60	1	-6.711***	40	45	1
Czech	-5.232***	55	110	1	-6.095***	56	72	1
Denmark	-4.477**	27	82	1	-5.573***	31	44	1
Finland	-4.332**	42	104	1	-5.958***	23	30	1
France	-5.018***	27	116	1	-6.006***	78	84	1
Germany	-4.708***	26	82	1	-5.958***	37	44	1
Greece	-3.990**	62	93	2	-11.88***	82	87	4
Hungary	-4.479**	53	85	2	-7.768***	44	54	0
Ireland	-7.809***	68	91	5	-7.625***	69	91	7
Israel	-5.220***	73	115	1	-6.784***	43	48	1
Italy	-4.887***	54	82	1	-7.319***	80	88	1
Japan	-7.072***	16	72	2	-6.822***	16	61	0
Korea	-5.054***	46	102	10	-8.256***	46	51	0
Luxembourg	-4.294**	26	59	1	-4.509*	31	56	1
Mexico	-6.105***	41	101	0	-7.651***	41	48	0
Netherland	-4.376**	42	103	1	-6.077***	27	30	1
Norway	-3.950**	29	101	1	-4.837**	61	68	1
Poland	-4.481**	32	88	1	-5.583***	42	50	1
Portugal	-6.961***	73	104	3	-7.659***	74	104	7
Spain	-4.374**	86	107	12	-5.999***	78	83	1
Sweden	-4.065**	42	103	1	-5.171**	40	44	1
Switzerland	-5.175***	42	101	0	-5.251**	42	57	12
Turkey	-5.150***	15	53	4	-8.038***	44	58	12
UK	-4.113**	42	103	1	-5.195**	33	44	1
US	-4.386**	33	102	1	-5.458***	44	48	10
Panel_LM Stat.	-26.810***				-30.833***			
p-value	0.000				0.000			

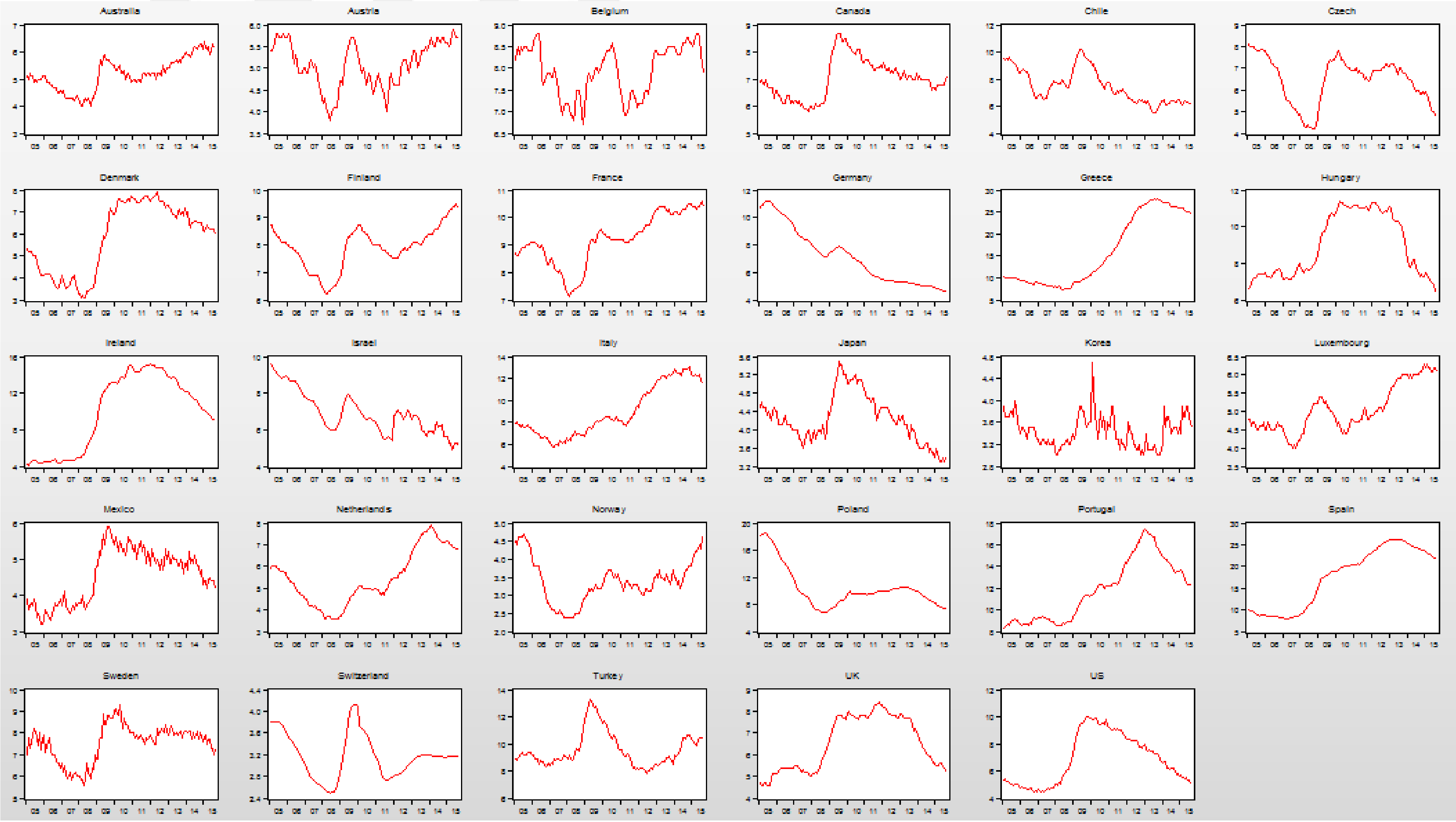
APPENDIX B: GRAPHS OF INDUSTRIAL PRODUCTION FOR EACH OECD COUNTRIES:



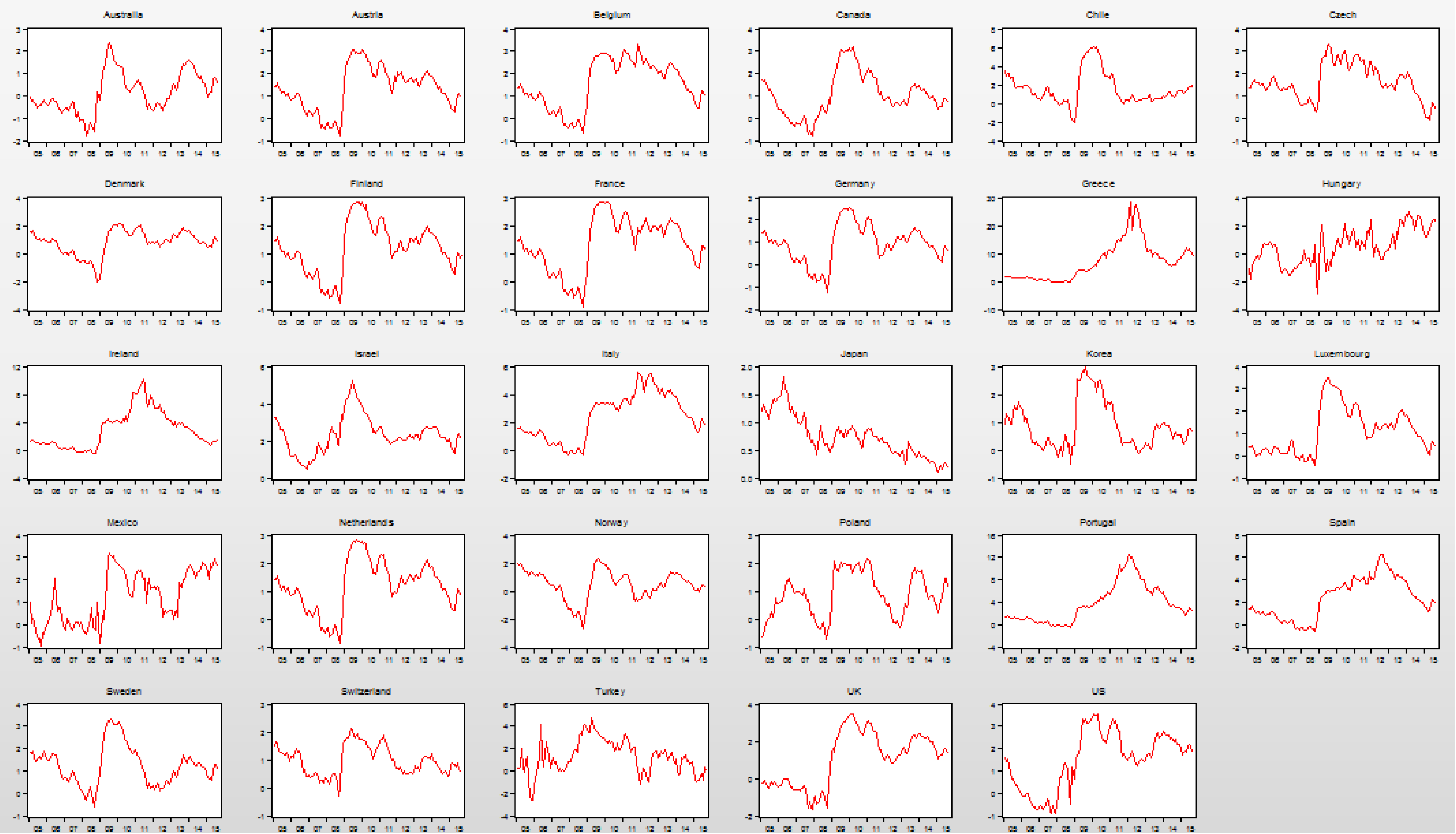
GRAPHS OF CONSUMER PRICE INDEX (CPI) FOR EACH OECD COUNTRIES:



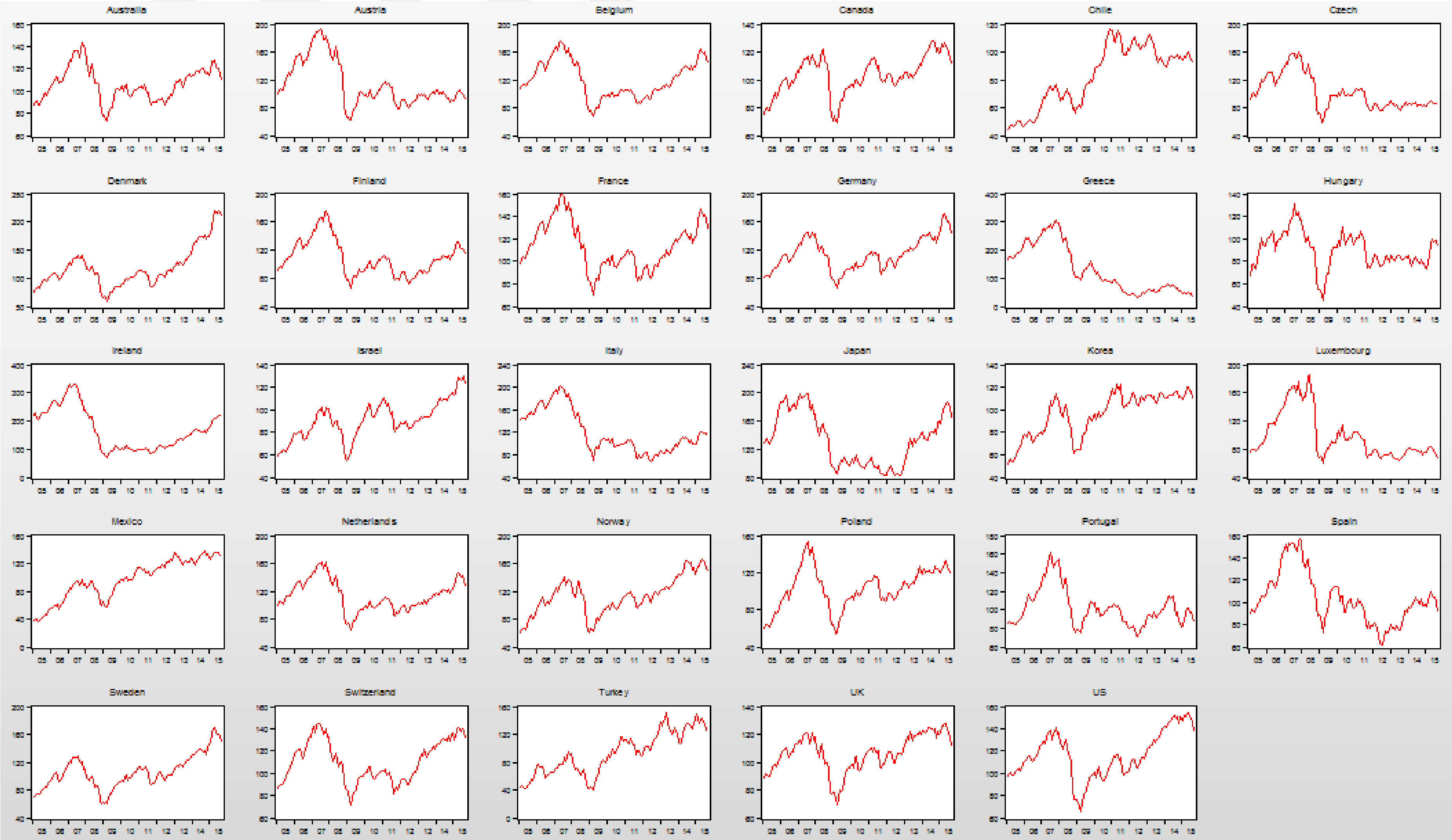
GRAPHS OF UNEMPLOYMENT RATES FOR EACH OECD COUNTRIES:



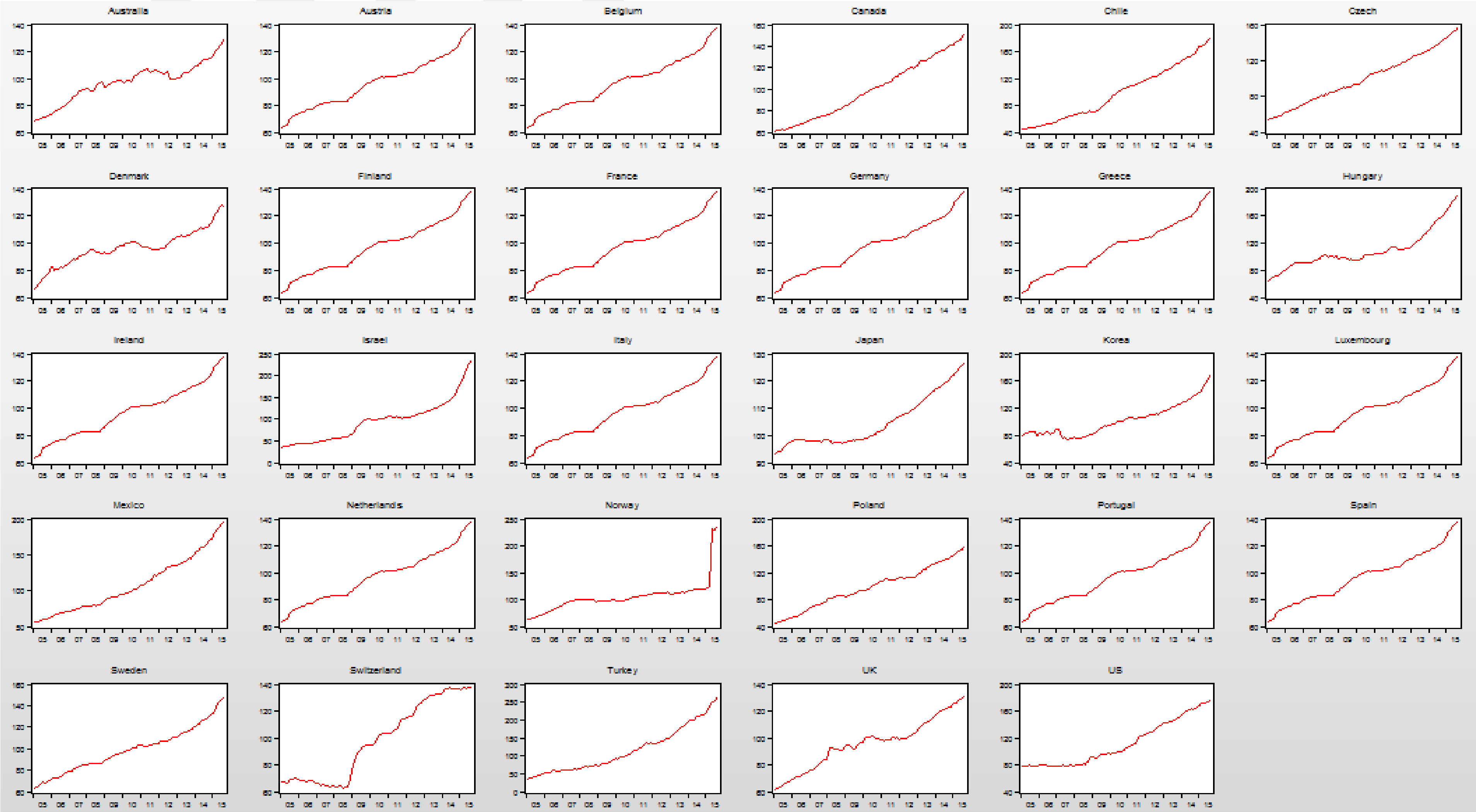
GRAPHS OF SPREAD FOR EACH OECD COUNTRIES:



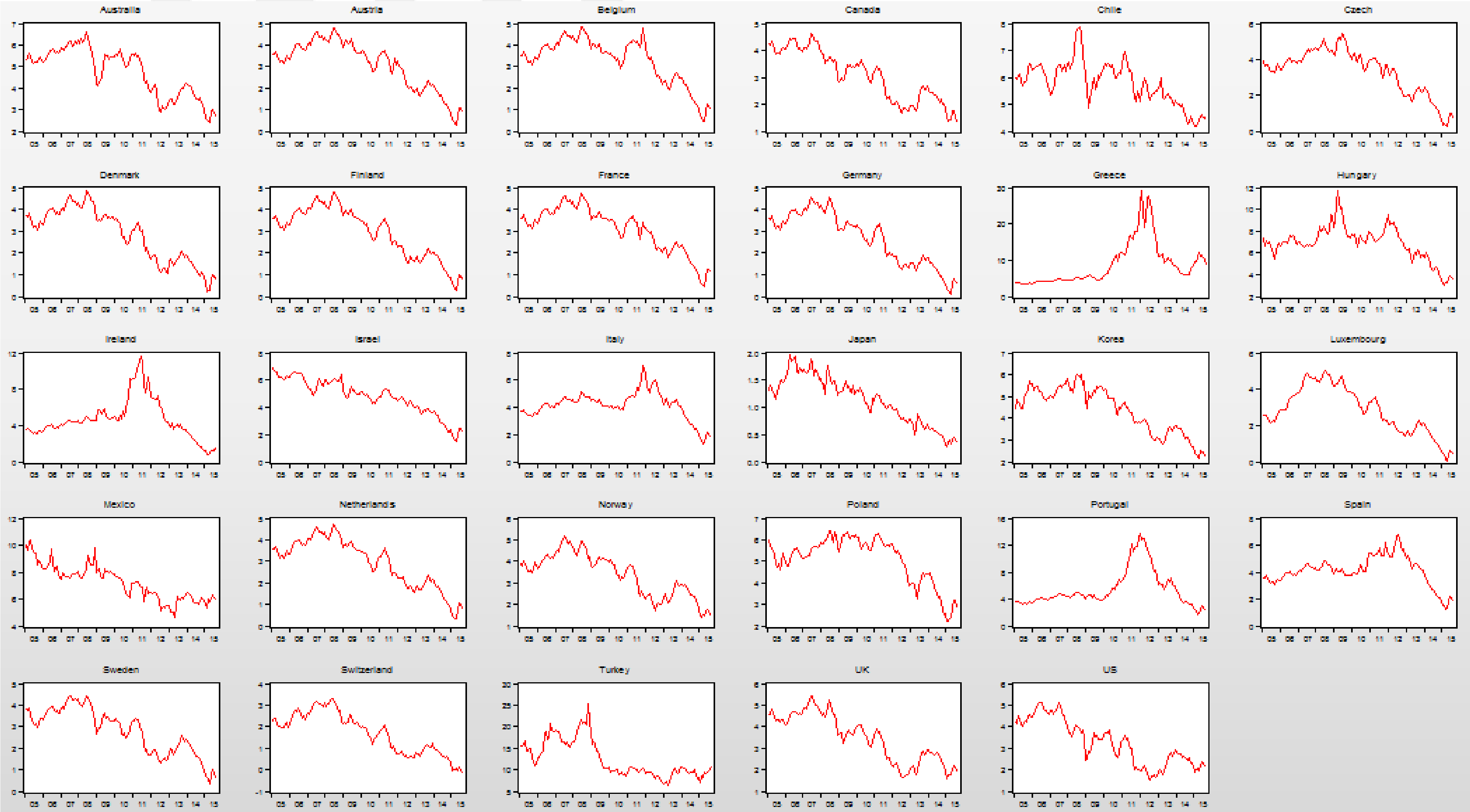
GRAPHS OF STOCK PRICE INDEX FOR EACH OECD COUNTRIES:



GRAPHS OF M1 MONEY SUPPLY FOR EACH OECD COUNTRIES:



GRAPHS OF LONG TERM INTEREST RATES (10-YEARS) FOR EACH OECD COUNTRIES:



TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ☐

YAZARIN

Soyadı: KARA

Adı: ERKAN

Bölümü: BANKACILIK ve FİNANS

TEZİN ADI (İngilizce):

AN ANALYSIS OF RELATION BETWEEN INTEREST RATE SPREAD AND ECONOMIC ACTIVITIES OF OECD COUNTRIES USING PANEL DATA ANALYSIS

TEZİN TÜRÜ: Yüksek Lisans ☐ Doktora ☐

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
3. Tezimden bir bir (1) yıl süreyle fotokopi alınamaz. ☐

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FOREIGN LANGUAGES

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PUBLICATIONS

Corporate Governance and Share Prices: Firm Level Review in Turkey

(With Raif Parlakkaya and Ahmet Diken)

International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering Vol:9, No:7, 2015

The Relationship Between Ratio of Investment and Ratio of Export Share in Sector of Agriculture: The Case of Turkey.

(With Ahmet Tayfur Akcan, Fatih Azman, Hasan Ali Akyürek and Mahmut Baydaş)

Macro Trend Conference, Proceeding.

TURKISH SUMMARY

Bu tez OECD ülkelerinde getiri farkı ve ekonomik aktiviteler arasındaki uzun dönemli ilişkiyi incelemek için yazılmıştır. Ekonomik aktiviteler olarak sanayi üretimi, enflasyon ve işsizlik oranları 2005 ve 2015 dönemi baz alınarak panel veri yöntemi ile incelenecektir. Bu çalışma panel veri analizinde son dönemlerde kullanılan yöntem ve modelleri uygulayacak ve yatay kesit bağımlılığını dikkate alan testleri ve yapısal kırılmaları da uygulamaya katacaktır. Bununla beraber, bu çalışma aynı zamanda yeni parasal politikaların etkilerinin de ekonomik aktiviteler üzerindeki etkilerine de bakacaktır. Bilindiği gibi, 2008 finansal krizinden sonra – ki bu dönemde bir çok banka iflası gerçekleşmiştir- Federal Reserve (FED) gibi bazı önemli merkez bankaları yeni parasal politikaları devreye sokarak ekonomilerini krizden çıkartmaya uğraşmışlardır. İlk uygulamalar FED tarafından yapılmış öncelikle sorunlu varlıklara el atılmış sonrasında ise varlık alım programları açıklanarak yeni uygulama başlamıştır. Daha sonra Amerikan merkez bankasını Avrupa Merkez Bankası, Jponya Merkez bankası ve İngiltere Merkez bankası bu yeni uygulamalarda takip etmiştir. Sadece bu önemli merkez bankaları değil daha sonra diğer ülkelerin merkez bankaları da faiz oranlarını düşürerek ekonomilerinin daralmadan çıkmasını hedeflemiştir. Öyle ki, hem ekonomilerin daralması hem de deflasyon korkusundan dolayı bazı ülkelerde faiz oranları sıfır veya sıfıra yakın olarak gerçekleşmiştir.

Akademik dünyanın ve dünyadaki diğer finansal kurumların getiri eğrisi (verim eğrisi olarak da adlandırılır) üzerinde durmalarının nedeni Dotsey (1998) tarafından şöyle açıklanmıştır. Yazar, özellikle dört grubun getiri farkının ekonomik olaylar üzerindeki etkileri üzerinde durduğunu belirtmiştir. Bu gruplar; özel sektör iş çevresi, merkez bankaları, hükümetler ve yabancı yatırımcılardır. Bu birimlerin teeml amacı ise getiri eğrisindeki değişimleri takip ederek bunların olası etkilerini tahmin edebilmek ve gerekli politika ve planları yapabilmektir.

Literatürde getiri farkı olarak 10 yıllık devlet tahvili ve 3 aylık hazine bonosu faizleri arasındaki farkın daralması gelecekteki ekonomik aktivitelerde bir düşüşün olacağını göstermektedir. Estrella ve Hardouvelis (1991) getiri farkının gelecekte planlanmasını düşünülen ekonomiler için önemli olduğunu ve empirik olarak da düzleşen bir verim eğrisinin gelecekteki faiz oranlarının düşeceğini, bunun ise gelecekteki gayri safi milli hasılanın düşeceğini gösterdiğini belirtmişlerdir.

Estrella v.d, (2003)' e göre ise getiri eğrisinin önemli olduğunu, çünkü bu hareketlerin parasal politikaların belirlenmesinde kullanıldığını söylemiş ve teorinin şöyle olduğunu açıklamışlardır. Eğer merkez bankaları kısa vadeli faizleri artırırsa ve piyasa oyuncuları bu faiz artırımını gelecekte uzun vadede oluşabilecek yüksek enflasyona karşı olduğunu düşünürlerse, uzun vadeli faiz oranları da yükselecek ancak bu yükseliş kısa vadeli faizlerden daha az olacaktır. Bu yüzden, daraltıcı para politikaları getiri eğrisinin düzleşeceğini gösterir ve aynı zamanda bununda ekonomiyi yavaşlatacağını göstermişlerdir (Estrella, 2005; Bernanke, 1990). Estrella and Mishkin (1997).

Bu tez getiri farkı ile ekonomik aktiviteler arasındaki ilişkiye bakarken aynı zamanda diğer bazı önemli finansal göstergeleri de kullanacaktır. Bu değişkenler borsa endeksi, M1 para arzı ve uzun vadeli faiz oranlarıdır. Ekonomik aktivite olarak da (Ki, bu değişkenler bağımlı değişkenler olacaktır) sanayi üretimi, enflasyon ve işsizlik oranıdır. Aynı zamanda sadece getiri farkının uzun dönemde ekonomik aktiviteleri değil, diğer finansal göstergelerinde etkileri incelenecektir. Bu göstergeler piyasada en çok takip edilen değişkenler olması nedeniyle seçilmiştir Bernanke (1990) and Bernanke and Blinder (1992).

Literatür, dayanıklı mallar, perakende satışlar, tüketim ve bireysel gelir (Bernanke, 1990) gibi diğer başka ekonomik değişkenler kullanmış olsa da, verilerin yetersizliği ve vade yapısının uyuşmazlığı nedeniyle bu değişkenler göz ardı edilmiştir.

Bu çalışma literatüre şu katkıları yapacaktır. Öncelikle, bildiğimiz kadarı ile, getiri farkı ve ekonomik aktivite ilişkisi alanında daha önceden yapılan bir panel veri analizi olmaması nedeniyle yapılacak olan ilk çalışmalardan biri olacaktır. İkinci olarak da, empirik olarak panel veri alanında son dönemlerdeki yeni uygulamaları ve yatay kesit bağımlılığını dikkate alacak ve regresyon tahminlerinde bulunacaktır. Örneğin, yatay kesit bağımlılığını dikkate alan birim kök testleri, eşbütünleşme testleri gibi. Son olarak da, bu çalışma, 2008 finansal krizinden sonra bu alanda yayınlanmış olan nadir yayınlardan biri olacaktır.

Tezin organizasyonu şu şekilde olacaktır:

Birinci bölüm OECD organizasyonu hakkında bilgi verecek ve bu kurumun dünya ekonomisi içindeki rolü belirtilecektir. İkinci bölümde ise, analizde kullanılacak değişkenlerin dönem boyunca nasıl bir değişim gösterdiği karşılaştırmalı olarak verilecektir. Üçüncü bölümde literatür taraması yapılmış ve getiri farkının ekonomik aktiviteler üzerindeki etkisi teorisi açıklanacaktır. Dördüncü bölümde değişkenler tanımlanacak tezin empirik metodolojisi verilecektir. Son olarak beşinci bölümde ise elde edilen sonuçlar verilecektir.

BÖLÜM I.

Bu bölümde OECD organizasyonunun dünya ekonomisindeki rolü ve önemi vurgulanmıştır. OECD kendisini şöyle tanıtmaktadır: fikirler üreten, ekonomik gelişmeler üzerinde araştırmalar yapan, üye ve üye olmayan devletlere tavsiyeler sunan bir örgüttür.

Bu organizasyon ilk olarak OEEC olarak kurulmuştur, yani Avrupa Ekonomi ve İşbirliği Teşkilatı. 2.Dünya Savaşı'ndan sonra Marshall Planı'nın bir parçası olarak gündeme gelmiştir. Ana amaç savaştan sonra sekteye uğrayan ticaretin gelişmesi ve ülkelerin ortaklaşa ekonomik kararlara varmasıdır.

OEEC öncelikle 18 ülkenin katılımıyla oluşturulmuştur. Bunlar: Avusturya, Batı Almanya, Belçika, Danimarka, Fransa, Yunanistan, İzlanda, İrlanda, Lüksemburg, Hollanda, Norveç, Portekiz, İsveç, Türkiye, İngiltere, Amerika Birleşik Devletleri ve Anglo-Amerikan Trieste Serbest Bölgesi'dir. Bugün itibariyle, kuruluşundan beri, yeni üye ülkelerin katılımı ile bu sayı 38 ülkeden oluşmaktadır.

Çalışmada OECD ülkelerinin genelde dünyanın en gelişmiş ülkelerinden oluştuğu bilindiği için bazı göstergeler karşılaştırma amacıyla dünya ekonomilerinin toplam değerleri dikkate alınmıştır.

Örneğin, önce nüfus baz alınırsa OECD ülkelerinin dünya nüfusu toplamı içindeki payı 2013 yılı itibariyle yaklaşık %17.5'tir. Bununla beraber tüm dünyadaki toplam ekonomik üretimin ise yaklaşık %64'ünü OECD ülkeleri gerçekleştirmektedir. 2014 yılı itibariyle dünyadaki toplam GSMH yaklaşık 77.8 Trilyon ABD Doları iken, bunun 50 Trilyon Dolarını OECD ülkeleri üretmektedir.

Öte yandan istihdam rakamlarına bakıldığında OECD ülkelerinde istihdam oranları %65.6 iken, dünya istihdam oranı ortalaması ise %59.7'dir. Bu rakamlar OECD ülkelerinin ekonomik büyüklük olarak ne kadar önemli olduğunu göstermektedir.

BÖLÜM II.

Bu bölümde finansal ve makro-ekonomik değişkenlerin OECD ülkeleri arasındaki araştırma dönemince göstermiş oldukları değişimler incelenmiştir.

Örneğin getiri farkı çoğu ülkeler için benzer hareketler gösterse de getiri farkının grafikte görüldüğü gibi özellikle 2008 krizi sonrası düşme eğilimi gösterdiği görülmektedir. Avrupa'da ekonomik sorun yaşayan bazı ülkelerde daha sert hareketler gözlemlenmiştir. Örneğin, 2008 krizinden en çok etkilenen Yunanistan, Portekiz ve İrlanda gibi ülkelerde kriz sonrası dönemde getiri farkı pozitif yönde gelişmiştir. Bunun nedeni ise bu ülkelerin kriz sonrasında ekonomilerini toparlayacakları varsayımıdır.

Kriz sonra ekonomilerin daralması sonucu faiz oranlarının merkez bankalarınca düşürülmesi, uzun vadeli faizlerin de düşmesine yol açmıştır. Düşen faizler Türkiye'de de gözlemlenmiştir. Borsa endeksleri tarafında ise hemen hemen tüm ülkelerde benzer hareketler göstermiş kriz döneminde yaklaşık olarak %50 ve %60 düzeylerinde gerilemeler yaşamıştır. Her ne kadar kriz sonrası endekslerde toparlanmalar görülse de, ekonmik problen yaşayan Yunanistan gibi ülkelein borsalarında toparlanma görülmemiştir.

M1 para arzı göstergesi ise yine tüm ülkeler için bir artışı ifade etmiştir. Bu durum normaldir, çünkü kriz sonrası bir çok ülkenin merkez bankası gerek faizleri düşürmesi ve gerekse varlık alım programlarıyla parasal genişlemeye gitmişler ve ekonomileri canlandırmak istemişlerdir.

Kriz döneminde büyük gerileme yaşayan sanayi üretimi sonraki dönemlerde eski seviyelerine kadar ulaşmıştır. Sanayi üretiminde kriz sonrası dönemde en iyi performans gösteren iki ülkeden bir Türkiye diğeri ise İrlanda devletidir. İşsizlik oranlarına bakıldığında sorunlu Avrupa ülkelerinde işsizlik müthiş seviyelere çıkmıştır. Tabi bu durum sanayi üretiminin ve genel anlamda ekonomilerinin küçülmesinden dolayı gerçekleşmiştir. Genel olarak kriz sonrasında işsizlikte düşüşler olsa da belli bir süre yatay seyretmiştir.

BÖLÜM III.

Bu bölümde öncelikle kullanılan değişkenler tanımlanmış, bunlar arasındaki ilişkiler incelenmiş ve getiri farkı ile ekonomik aktiviteler arasındaki ilişki için önceden yapılan literatür incelenmiştir. Estrella and Hardouvelis (1991) getiri farkını 10 yıllık tahvil faizleri ile 3 aylık hazine bonosu arasındaki fark olarak tanımlamıştır. Çoğu empirik bulgularda getiri farkının pozitif olması durumunda ekonomik büyümenin de bunu takip ettiğini göstermektedir. Ekonomik büyümeyi anlamak için getiri farkından başka farklı gösterge veya enstrümanlar da kullanılmıştır. Örneğin şirket tahvil faiz farkları (Papadamou and Siriopoulos, 2009), şirket karları (Ergungor, 2016) ve gecelik faizlerle hazine kağıtları faizleri arasındaki fark (Berument et al. 2014).

Az önce belirtildiği gibi son yıllarda yapılan bazı çalışmalar getiri farkının ekonomik aktiviteler arasındaki ilişkiyi baz alan çalışmalar Bernanke (1990), Estrella ve Hardouvelis (1991), Plosser ve Rouwenhorst (1994), Haubrich ve Dombrosky (1996), Estrella ve Mishkin (1997, 1998), Estrella et.al, (2003) Cuaresma et.al (2005) and Dotsey (1998). Likewise, Estrella ve Mishkin (1996), Kozicki (1997), Bernard ve Gerlach (1996) and Dueker (1997) gibi çalışmalar sadece ekonomik aktivite ilişkileri değil aynı zamanda ABD, Euro Bölgesi, Almanya ve Kanada gibi ülkelerde enflasyon ve resesyon gibi durumlarla ilişkilerini de araştırmışlardır.

Getiri farkı ile ekonomik aktiviteler arasında her zaman pozitif bir ilişki olmayabiliyor Bernanke (1990). Yazar bu ilişkinin Amerika'da bazı dönemlerde kaybolduğunu ifade etmektedir. Diğer yandan bu ilişkinin her zaman pozitif olmadığını bulan araştırmalarda mevcuttur. Özellikle bu durum gelişmekte olan veya az gelişmiş ülkeler için daha genel bir durum olarak ortaya çıkmaktadır. Örneğin, Telatar et.al (2003) ; Omay (2008) Berüment et. al, (2014) Türkiye için, Gupta et.al (2013) Hindistan için, Papadamou (2009) Macaristan için yapılan çalışmalar. Nickel (2011) ise bu durumun olmasının şu nedenlerden kaynaklanıyor olabileceğini belirtmiştir. Bu ülkelerde finansal sistemin ve sermaye piyasalarının iyi işlemediği ve politik bir takım risklerden dolayı olduğunu belirtmiştir. Bu yüzden bu ülkeler daha uzun vadeli borçlanmaya gidememişlerdir.

Bu çalışmanın amacı uzun dönemli ilişkiyi aramak olduğu için diğer seçilen finansal değişken uzun vadeli devlet tahvil faizleridir. Kısa vadeli faizler parasal şoklara oldukca duyarlıdır. Her ne kadar uzun vadeli faizler bundan etkilense de etkilenme derecesi düşüktür. Ayrıca uzun vadeli faizler deki yükselmeler ya gelecekteki ekonomik büyümenin olumlu olacağı beklentisinden veya da yükselen bir enflasyon beklentisinden kaynaklanabilir. Böyle bir durumda uzun vadeli faizlerin yüksek olması getiri eğrisini genişletecek etki yapacaktır.

Borsa endekslerindeki hareketler ekonomik aktivitelerin yönünü belirlemede öncül bir finansal gösterge olduğu düşünülmektedir. Örneğin, Chan (2003) finansal piyasaların geleceğe baktığını ve borsaların gelen her yeni haberi fiyatladığına inanmaktadır. Yine yapılan çalışmalarda Cozier ve Tkacz (1994), Valadkhani (2004) ekonomik büyümeyle Borsa endeksleriyle pozitif ilişkiler bulmuştur. Türkiye için yapılan bir çalışmada Borsa endeksinin enflasyon, döviz kuru ve faizler arasında negatif bir ilişki bulmuştur (Cankal, 2015).

M1 para arzı da değişken olarak bir çok çalışmada ekonomik aktiviteler ile olan ilişkiye bakmak için kullanışmıştır. Mishkin (1995) çalışmasında getiri farkının yanında M1 para arzını para politikası aracı yerine kullanmıştır. Aynı şekilde Berüment vd. (2014) M1'i hem likidite ölçüsü olarak hem de toplam para miktarı olarak göz önüne almıştır. Para arzının gerisindeki rasyonellik şudur: Para arzı arttıkça faizlerde gerileme olacaktır. O halde faizlerdeki gerilemeler de ekonomik etkinlikler için avantajlı olacak ve büyümeye katkı yapacaktır. Para tabanına bağlı olarak kısa vadeli faizler hızlı reaksiyon verebilir. Bu yüzden kısa vadeli fazilerdeki artış uzun vadeli faizlerden hızlı olacağı için getiri farkı kapanacaktır. Tabi belirtilen bu durum kısa dönem için geçerlidir.

Para arzının artması, borç verilecek fonların faiz maliyetlerini düşürecektir ve iş çevreleri düşen maliyetlerden dolayı kullanın için daha fazla fon elde edecektir. Bu yüzden para arzı sanayi üretimini artırıcı, işssizliği düşürücü etki yapacaktır. Böyle bir durumda ise fazla paranın piyasada olması ve ekonominin canlanması beraberinde enflasyonu tetikleyecek ve enflasyonda artış olacaktır.

BÖLÜM IV.

Bu bölümde söz konusu araştırmaya yönelik kullanılacak olan değişken seti ve ekonometrik yöntemler kullanılmıştır. Öncelikle değişkenlerin doğal logaritması alınıp varyanslarının daha stabil bir hale gelmesi sağlanmıştır.

Tez konusu değişkenler arası uzun dönemli ilişkiyi bulmak olduğu için öncelikle değişkenler arası eşbütünleşme analizi yapılacak ve daha sonra eşbütünleşmenin bulunması durumunda ise panel tahmin yöntemleri ile ilişkiyi gösteren katsayılar bulunacaktır. Eşbütünleşmenin gerçekleşebilmesi için analizde kullanılacak tüm değişkenlerin birinci dereceden farkları alındığında durağan seriler I(1) haline gelmesi gerekir. Eğer değişkenler seviyelerinde I(0) durağan bir yapıya sahip olursa eşbütünleşme analizi gerçekleşemez, yani uzun dönemde değişkenler birlikte hareket etmemiş sayılır.

Bu bağlamda, kullanılan değişkenlerin seviyelerinde ya da birinci farkları alındığında durağan olup olmadıklarını çeşitli birim kök testleri ile sınanabilmektedir. Bu tezde iki çeşit panel birim kök testleri uygulanacaktır. Birinci jenerasyon testi denilen testler yatay kesit bağımlılığını dikkate almayan testlerdir. Bunlar; Levin, Lin and Chu (LLC) Test, Im, Pesaran and Shin (IPS) test, Hadri LM unit root test, Maddala & Wu (M&W) testtir. İkinci jenerasyon panel birim kök testleri de paneldeki birimleri arası yatay kesit bağımlılığını dikkate alan panel birim kök testleridir. Bu durumda ise kullanılan testler şunlardır; Pesaran’s (2007) Cross-Sectionally Augmented Dickey-Fuller (CADF), Hadri and Kurozumi Augmented Panel KPSS (2012)Test ve Im, Lee and Tieslau (ILT) testleridir. Söz konusu testlerden elde edilen verilere göre analizde kullanılan tüm değişkenler seviyelerinde durağan olmayıp, sadece birinci dereceden farkları alındığında durağan hale gelebilmektedir. Elde edilen sonuçlara göre birinci dereceden durağan olağan bu seriler için eşbütünleşme analizinin uygulanması uygun olacaktır.

Analizde öncelikle, birim kök testlerinde olduğu gibi, iki tür eşbütünleşme testleri kullanılacaktır. Yani yatay kesit bağımlılığını dikkate almayan testler ve yatay kesit bağımlılığını dikkate alan yeni nesil eşbütünleşme testleri.

İlk kullanılan eşbütünleşme testleri Westerlund's Error Correction Model (ECM) (2007) vePedroni (2004) Cointegration Testleridir. Bu testler yatay kesit bağımlılığını dikkate almayan geleneksel eşbütüleşme testleridir. Sonuçlara bakıldığında hemen hemen her iki analizde benzer sonuçlar vermektedir. Analizde, sanayi üretimi ile finansal değişkenler arasında eşbütünleşmenin olduğu, yani uzun dönemli bir ilişkinin varlığı tespit edilmiştir. Ancak kullanılan yöntem sonuçlarına göre tüketici fiyat endeksi ve finansal göstergeler arasında ise kısmi bir eşbütünleşme göze çarpmaktadır. Işsizlik oranları ile finansal değişkenler arasında ise bu sonuçlara göre herhangi bir ilişki bulunamamıştır.

Uzun dönemli ilişki için kullanılan eşbütünleşme testlerinin ikinci kısmı ise yatay kesit bağımlılığını dikkate alan analizlerdir. Bu kapsamda kullanılan yöntemler ise Westerlund and Edgerton (2007) LM Cointegration test ve Westerlund Multi-Structural Break Cointegration Test (2006)'tir. Ikinci test değişkenlerdeki yapısal kırılmaları da dikkate almaktadır. Yatay kesit bağımlılığını dikkate alan eşbütünleşme test sonuçlarına göre tüm analizde yer alan tüm bağımlı değişkenler, yani sanayi üretimi, tüketici fiyat endeksi ve işsizlik oranları ile finansal değişkenler arasındaki uzun dönemli bir ilişkinin varlığı bulunmuştur.

Tez analizinde ayrıca panelde yer alan birimlerinin katsayılarının homojen olup olmadığını ve yatay kesitler arasında bağımlılık olup olmadığı da test edilmiştir. Homojenlik için Pesaran and Yamagata (2008) testi kullanılmış ve her birime ait katsayıların heterojen olduğu bulunmuştur. Ayrıca Pesaran (2004) Cross-Section Dependency testi (CD) ile de yatay kesitler arasındaki bağımlılık test edilmiş ve bulunan sonuçlara göre de yatay kesit bağımlılığı sorunu görülmüştür. Ki, günümüz ülke ekonomilerinde böyle bir durumun çıkması da gayet normaldir. Özellikle OECD ülkelerinin birbirileri ile olan ticari işlemleri ve sermaye ve finansal piyasalarının birbirleriyle olan entegrasyonu bağımlılık yaratması kaçınılmazdır.

Bir sonraki aşama ise, panel tahmin yönteminin kullanılarak uzun dönemli ilişkide katsayıların tahmin edilmesidir. Bu analiz için en uygun yöntem Pesaran'ın ARDL yönteminde PMG (Pooled Mean Group) tahmincisi seçilmiştir. ARDL yönteminin en avantajlı yanı değişkenlerin seviyelerinde veya birinci dereceden farkları alındığında durağan olup olmadıkları çok önemli değildir. Yani her iki durumda da analizi test edebilecek bir analiz yöntemidir.

ARDL modeline göre getiri farkı ile sanayi üretimi arasında uzun dönemli pozitif bir ilişki ortaya çıkmıştır. Bu sonuç literatür ile aynı yöndedir. Yine sonuçlara göre borsa endekleri ve uzun dönemli faizler arasında anlamlı bir ilişki bulunmuştur. Borsa endekleri ile sanayi üretimi arasında tahmin edildiği gibi pozitif bir ilişki bulunmuştur. Uzun vadeli faizler tarafında ise negatif bir ilişkinin bulunması da literatür ile benzer sonuçlar vermiştir. Öte yandan, M1 para arzı ile sanayi üretimi arasında ise herhangi bir ilişki bulunamamıştır. Bu sonucun çıkması gayet normaldir. Çünkü, 2008 finnasal krizinden sonra özellikle de son yıllarda dünyadaki önemli merkez bankaları ekonomilerini canlandırmak için piyasaya geleneksel olmayan yöntemlerle (varlık alım programları gibi) ve düşük faiz politikalarıyla büyük miktarlarda para arzı sunmuşlardır. Fakat, merkez bankalarının hem düşük faiz politikaları hem de para arzını artırıcı önlemleri ekonomik büyümeyi istenilen seviyelere getirmediği görülmektedir. Bulunan sonuç Stiglitz'in (2016) bulguları ile paraleldir.

Tüketici fiyat endeksi finansal değişkenler arasındaki ilişki ise yine anlamlı çıkmıştır. Getiri farkı ile fiyat endeksi ilişkisi negatif bulunmuştur. Bu literatüre ters bir sonuç gibi algılansa da son dönemlerdeki gelişmiş ülkelerdeki deflasyon baskısı düşünüldüğünde "Yeni Normal Ekonomi" bağlamında normal bir sonuç olarak karşımıza çıkabilmektedir. Yine getiri farkı ile işsizlik oranları arasındaki ilişki ise anlamsız bulunmuştur.

Son olarak yapılan nedensellik testine göre de hemen hemen tüm ekonomik aktiviteler ile finansal değişkenler arasında çift taraflı etkileşim bulunmuştur.

Sonuç olarak, getiri farkı ile ekonomik aktiviteler arasındaki uzun dönemli ilişkiyi bulmak için kullanılan tüm yöntemler ile daha önce bulunan sonuçlar arasında benzer sonuçlar bulunmuştur. En önemli farklı bulgu ise M1 para arzında yaşanmıştır. Bunun gerekçesi ise yukarı da anlatılmıştır.

Her ne kadar getiri farkı bazı dönemlerde ekonomik aktiviteleri açıklama gücü düşse de OECD ülkeleri örneğinde olduğu gibi hala önemli bir gösterge olarak karar vericilere yol gösterebilmektedir.