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The Role of Oil & Stocks on Real Income Growth: Evidence from Major Stock Markets

Mustafa ELÇİN, Msc.
Customs & Tax Office, Famagusta, Northern Cyprus, Via Mersin 10, TURKEY. Email: mustafaelcin88@hotmail.com

ABSTRACT

This study investigates the long term relationship between output, oil price and stock market movements in the selected countries from different regions for comparison purposes such as Germany, Japan, Singapore, South Africa, Turkey, UK and USA. Using annual data from 1973 to 2010, empirical analysis shows that oil and stock markets are long term determinants in these countries. It is investigated that real income in these countries converges to its long term equilibrium level at reasonable levels through the channels of oil markets, stock markets, and business environment.

JEL Classifications: G10, E10, O11.

Keywords: Oil prices; Stock markets; Output; Bounds Tests; ECM.

1. INTRODUCTION

In a globalized world, understanding the relationship between oil shocks and the stock markets is an important issue. It is vital to study and understand the connection between oil prices, exchange rates, and developing stock market prices, due to the fact that as these developing economies continue to thrive, they will eventually have a greater impact on the global economy corroborated by Basher et al. (2012).

Papapetrou (2001) also suggest that while the majority of studies conducted have examined the links between the fluctuations of oil prices and economic activity, it is shocking to see that only a small number of researches have been conducted to examine the connection between the financial market and oil price shocks. The few studies that have been conducted on this topic have been limited to advanced industrial countries such as the United Kingdom, the United States, Japan, and Canada. This indicates that, the relationship between oil shocks and stock markets in emerging countries should be researched. Oil prices have risen and fallen severely within the last thirty years. To demonstrate, we can take a look at the 76% increase of oil prices between March 2007 and July 2008 in contrast to the 48% decrease in prices between July and October of 2008. Therefore, it makes sense to observe how oil prices influence the macro-economic variables. In numerous emerging and established countries, it has been proven that oil prices play a key role in economic activity as stated by Arouri and Fouguau (2009).
A growing demand for oil results in a boost in oil prices, given that no changes are made to the oil being supplied. The increased price then affects producers as well as customers, just like an inflation tax, by
1) Leaving less disposable income for consumers to spend on other commodities and services.
2) Increasing the costs of companies which are outside of the oil industry, yet instead of passing on the added cost to the customers, forcing companies to cut down from their profit and dividends which play an important role in stock prices.

As a result changes in oil prices have more of an effect on stock prices and profits in developing economies (Basher and Sadorsky, 2006). Also, the content of argument of Park and Ratti (2008) is that if sudden and extreme oil price changes are able to affect the real economy due to consumer and firm behavior, then these results should noticeably be reflected onto the world stock market. For these reasons, oil price changes should be carefully examined.

It was also observed by Hamilton (1983) that crude oil shocks played a major part in the recession in the US after the World War II. Subsequently, describing the relationship between crude oil prices and the macro-economy has been a theoretical and practical apprehension. It is known that there have been times when stock prices have had some dramatic changes. The sudden increase in crude oil prices between 1973 and 1974, the crash of the stock market in 1987, the invasion of Kuwait by Iraq towards the end of 1992, the currency disaster in East Asia in 1997, the terrorist attack on the U.S.A on September 11th, and most recently, the 2007-2008 rise in crude oil prices accompanied by the financial crises during these years are a few of many of such changes are simple examples which was illustrated by Aloui and Jammazi (2009).

The resulting situation is that the costs of factor inputs influencing many listed firms can be potentially affected by energy prices in general and particularly oil prices, which consequently influences the rise and fall of their stock prices just as corroborated by aloui and jammazi (2009).

The aim of this study is to investigate the long term relationship between real income, oil price movements and various stock indices such as within Frankfurt, Tokyo, Singapore, Johannesburg, Istanbul Stock Exchange, London and New York by using contemporary econometric methods.

The reason behind studying this subject is because there are many studies including the impact of oil prices on economic activities but there is little evidence on the joint impact of oil prices on stock markets on real income of countries. Therefore, studying this type of relationship would be an interesting research area.

Furhermore, many previous studies have focused on the developed and emerging markets; therefore, this thesis focuses on both developed and developing economies for comparison purposes. For this reason, this study is based on Frankfurt, Tokyo, Singapore, Johannesburg, Istanbul Stock Exchange, London and New York Stock Exchange Markets. Finally, this study is expected to be of great importance for businessman, scholars and politicians as it analyzes the relationship between oil shocks and stock markets and offers an economic analysis on this issue.

The present study is structured as follows: in section 2 theoretical and empirical literature is discussed. Data and methodology of econometric analysis is presented in section 3. Section 4 summarizes results of econometric analysis and in section 5 conclusion and some policy implications are discussed.

2. LITERATURE REVIEW

There are numerous studies in the literature that search the link between oil prices, stock markets, and the macro economies. This section will present a summary of previous works in the relevant literature.

Hamilton (1983) examines the relationship between the oil prices and macroeconomic variables. He mentions that changes in oil prices causes recession in American economy. Boyer and Filion (2007) evaluate the financial factors of the stock returns of Canadian oil and gas companies. They discover that the profit of the Canadian energy stock is in direct proportion with the return of the Canadian stock market. Between the years 1971-2008, Miller and Ratti (2009) examine the connection between world price of crude oil and international stock markets. During 1971-1980 and 1988-1999 a long-run relationship has been observed in six OECD countries. Miller and Ratti (2009) propose that over a longer period of time, the stock market indices are affected negatively by increases in oil prices.

Gronwald et al. (2009) investigate the consequences of oil price shocks on macroeconomic variables, like real GDP, inflation and the Kazakh economy's real exchange rates. The first key finding was that oil prices were determined by numerous factors, which causes a significantly instable economy. The second key finding was that all the macroeconomic variables included in the study of Gronwald et al. (2009) reacted negatively to the fall of oil prices. The final key finding was that there existed a relationship between the Kazakh oil market and its macroeconomy.

Papapetrou (2001) examines oil and real stock prices, interest rates, real economic activity and employment in order to figure out the connection between these elements for Greece who indicates that the changes in oil prices influence real economic activity and employment. Basher et al. (2012) examine the association between oil prices, exchange rates and developing stock market prices. Evidence has proven that a rise in developing stock prices cause increases in oil prices.

Aloui and Jammazi (2009) study the connection between crude oil shocks and stock markets. Stock markets of the UK, France, and Japan showed reasonable results when applied between January 1989 and December 2007. Two main forms of behavior were observed where the variance regime was relative to low mean/high variance for one, while the other to a high mean/low variance regime. These results demonstrate that the increase in oil prices play a major role in shaping the instability of stock returns as well as the likelihood of change across regimes.

Arouri and Nguyen (2010) attempt to investigate how oil and stock markets are related. Their results suggest that stock returns respond differently to oil price changes, mainly because of its dependence on the activity sector. Zhu et al. (2011) examine the approaches of threshold co-integration to understand the connection between stock markets and crude oil shocks from January 1995 to December 2009 for OECD panels, as well as non-OECD panels, resulting in the finding that crude oil prices and stock prices affect each other positively over a long period of time. Chen et al. (1986) examine the chances of improvements in macroeconomic variables being a risk that is then rewarded in the stock market. The conclusion they have arrived is that market portfolio is not valued independent from aggregate consumption.

Jones and Kaul (1996) examine to see whether changes in anticipated returns changes in real cash flow at present and in the future influence the international stock markets response to oil shocks. In the U.S and Canada, stock prices changes can be solely connected to the oil shocks and the influence of the shocks on real cash flow, for the postwar period. Huang et al. (1996) study the contemporary correlations the daily returns of future oil contracts to the daily to stock returns. During the 1980s, it is shocking to see that the correlation between oil future returns and other stock indexes are practically non-existent. However, a contemporary correlation and substantial one-day lead of oil futures returns seem to apply for specific oil stocks.

Sadorsky (1999) search the relationship of oil price shocks and stock market activity. He states vector auto regression outcomes prove that real stock returns are majorly influenced by oil prices and pile price volatility. Basher and Sadorsky (2006) examine what influence oil price changes have on a great set of developing stock market returns. The results they find prove that stock price returns in developing markets are influenced by oil price risk.

Bittlingmayer (2006) finds negative connection between oil prices and U.S. equity prices that may be the result of the stock market's response to the involvement of the U.S's participation in the war in the Middle East as opposed to higher oil prices. Since 1996 Jones et al. (2003) search the influences of the oil price shocks the economy. They suggest that there is a nonlinear relationship between oil price shocks and GDP.

It is clearly seen that results on the debate between output, oil markets, and stock markets are mixed that vary across countries, markets, methodology employed, and data used.

3. DATA AND METHODOLOGY

The statistics used in this study are annual figures for the period of 1973-2010 and the variables used in the study are real gross domestic product (rGDP), real industry value added (rIND), crude oil prices (OIL) and stock price indices (SI) for Germany, Japan, Singapore, South Africa, Turkey, UK, and USA. The data for stock prices was congregated from Data Streem program (version 5.1). On the other hand, rGDP, rIND and OIL prices were gathered from website of World Bank (2012). Real GDP, real IND, and oil figures are in constant 2000 US$.

In this study, there are three types of analysis were employed. First of all, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were undertaken to test for unit roots of the rGDP, rIND, OIL and SI. Second bounds tests were employed to investigate possible long-run equilibrium association among RGDP and its probable determinants such as rIND, OIL and SI. Finally, error correction models have been estimated in order to estimate short term coefficients and error corrections in addition to long term coefficients.

There are lots of studies that emphasis on the determinants of real GDP in the countries. The current study suggests that rIND, OIL, and SI might be determinants of real GDP in the case of seven countries.

So, in this study the functional connection can be presented as follows:

RGDP=f (rIND, OIL, SI) (1)

Where real gross domestic product (rGDP) is a function of real industry value added (rIND), OIL and stock price indices (SI). Since oil and stock index variables interact with real income also through the channels of industry sectors, industrial value added is also added to the above functional relationship as advised in the literature.

The functional connection in equation (1) can be identified in logarithmic form in the subsequent model to seizure growth influences as cited earlier:

$$\ln rGDP_t = \beta_0 + \beta_1 \ln rIND_t + \beta_2 \ln OIL_t + \beta_3 InSI_t + \varepsilon_t \qquad (2)$$

Where at period t, ln rGDP is the natural logarithm of the real gross domestic product; ln rIND is the natural logarithm of the real industry value added variable; ln OIL is the natural logarithm of oil prices; ln SI is the natural logarithm of stock price indices and ε is the error term. The coefficients of β_1, β_2 and β_3 give us elasticity of rIND, OIL, SI (Katırcıoğlu, 2010).

According to Katırcıoğlu (2010), there is a presumption that the dependent variable from equation (2) might not be regulated to its long term equilibrium value by the involvement of any its factors. Hence the speed of adjustment for lnrGDP can be gained by evaluating the error-correction equation model which is shown below:

$$\Delta \ln rGDP_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta \ln rGDP_{t-j} + \sum_{i=0}^{n} \beta_2 \Delta \ln rIND_{t-j} + \sum_{i=0}^{n} \beta_3 \Delta \ln OIL_{t-j} + \sum_{i=0}^{n} \beta_4 \Delta \ln SI_{t-j} + \beta_5\ \varepsilon_{t-1} + u_t \qquad (3)$$

Where Δ attitudes for a change in lnrGDP, lnrIND, lnOIL, lnSI and ε_{t-1} is the coefficient of error correction term, which is predicted in equation (2). ECT in equation (3) demonstrates how the speed of instability situated between the short and long run values of the lnrGDP is supposed to remove each period. It is estimated that the sign of ECT is negative.

3.1. Unit Root Test

Econometric theory proposes that variables in equation (2) are stationary. Therefore, this is known as the variables integrated of order zero as well. However, variables may be stationary at their first difference, I (1). Instead, evaluating regression models, for instance in equation (2) are not seemed to be strong as long as the variable are not stationary (Gujarati, 2003). The ADF (Augmented Dickey-Fuller) and (Phillips-Perron) tests for unit roots are employed in order to test the stationary nature of the variables (Phillips and Perron 1988; Dickey and Fuller 1981).

Furthermore, which is submitted by Enders (1995), entirely the tests for unit roots in the case of ADF and PP tests are carried out by commencing from the most common model (which includes trend and intercept) to the most confined model (including without trend and intercept). This method enables the researches to understand whether including trend and intercept factors will vary for the stationary habit of the variables or not.

3.2. The ARDL Approach

Wholly the economic processes have been carried out to realize if determinants are in long-run connection and if they have an influence on another in long run. What is more, there is long-run relationship, where the determinants are stationary at their level forms; whereas, if they are stationary their first and second differences, then their long-run correlation are presumed to be reduced altered to short term variables. Nevertheless, it still has a probability to be in that position. Thus, further research must have been carried out to test for long term connection amongst the variables. There are many variable methods so as to estimate whether it is long-run relationship or not. With respect to, Engel and Granger (1987) and Johansen (1988) and Johansen and Juselius (1991) co-integration tests, alleged that the determinants are needed to be integrated of the same order interesting for long-run relationship. Further steps cannot be applied in the long term period when the variables are not in the same order. For this reason, it enables to the researches to evaluate variables only for the short term period (Katırcıoğlu, 2009).

Instead, the alternative attitude to Engel and Granger (1987) and Johansen (1988) and Johansen and Juselius (1991) variety co-integration tests have been established by Peseran et al. (2001) in order to test long-run association among the variables. The fundamental feature of the bounds test is that the dependent variable shall be definitely integrated of order one, I(1).

In this thesis ARDL approach was used in the bounds test. So as to investigate for the long term connection among real gross domestic product, real industry value added, oil prices and stock price indices in seven countries; Germany, Japan, Singapore, South Africa, Turkey, UK, US. This ARDL method, which was established by Peseran et al. (2001), can be used when the independent variables are irrespective. The subsequent error correction model for assessing long term correlation is shown below in the ARDL model:

$$\Delta \ln rGDP_t = a_{0Y} + \sum_{i=1}^{n} b_{iY}\, \Delta \ln rGDP_{t-i} + \sum_{i=0}^{n} c_{iY}\, \Delta \ln rIND_{t-i} + \sum_{i=0}^{n} d_{iY}\, \Delta \ln OIL_{t-i} + \sum_{i=0}^{n} e_{iY}\, \Delta \ln SI_{t-i} + \sigma_{1Y} \ln rGDP_{t-1} + \sigma_{2Y} \ln rIND_{t-i} + \sigma_{3Y} \ln OIL_{t-1} + \sigma_{4Y} \ln SI_{t-i} + \varepsilon_{1t} \qquad (4)$$

In equation (4), Δ is the difference operator, lnrGDPt is the natural logarithm of dependent variable, real gross domestic product, lnrINDt, lnOILt, lnSIt are the natural logarithms of independent variables of IND, OIL and SI.

The F-test is employed to test the validity of equation (4); when F-test confirms the overall significance of equation (4), then the long-run link between rGDP and its elements in equation (4) as also confirmed (See Pesaran et al., 2001). In equation (4), when lnrGDP is dependent, the null hypothesis of no long term correlation is $H_0: \sigma_{1Y} = \sigma_{2Y} = \sigma_{3Y} = \sigma_{4Y} = 0$ and the alternative hypothesis of having long term connection is $H_1: \sigma_{1Y} \neq \sigma_{2Y} \neq \sigma_{3Y} \neq \sigma_{4Y} \neq 0$. According to Peseran et al. (2001) there are five different situations so as to evaluate equation (4). In this study, scenarios III, IV and V will be employed in F-test.

3.3 Error Correction Model

Once long term relationship is obtained in equation (4), long term coefficients from in equation (2) should be also estimated. Thenafter, short term coefficients plus error correction term are estimated. Consequently, the error correction model (ECM) for equation (2) under the ARDL method can be proposed as:

$$\Delta \ln rGDP_t = \Delta\beta_0 + \sum_{j=1}^{p-1} \Phi_j\, \Delta \ln rGDP_{t-i} + \sum_{i=1}^{k} \beta_{i0}\, \Delta \ln X_{it} + \sum_{i=1}^{k} \sum_{j=1}^{q-1} \beta_{ij}\, \Delta X_{i,t-j} + \varphi \Delta Z_t + \gamma(1,p) ECT_{t-1} + u_t \qquad (5)$$

4. EMPIRICAL RESULTS

In this section, we are going to analyze the stationary nature of our variables under the ADF and PP approaches for unit roots. These will be examined individually for each country.

Table 1: ADF and PP Tests for Unit Root (Germany)

Statistics (Level)	ln OİL	Lag	ln RGDP	Lag	ln RİND	lag	In SI	Lag
τ_T (ADF)	-3.022	(0)	-1.437	(0)	-3.196	(0)	-2.764	(0)
τ_μ (ADF)	-3.161**	(0)	-1.581**	(0)	-1.529	(0)	-0.986	(0)
τ (ADF)	0.796	(0)	5.402	(0)	0.806	(0)	2.112	(0)
τ_T (PP)	-3.128	(3)	-1.060	(7)	-3.090	(4)	-2.764	(0)
τ_μ (PP)	-3.195**	(3)	-2.825***	(14)	-1.285	(7)	-0.951	(3)
τ (PP)	0.796	(0)	6.281	(6)	1.802	(13)	2.444	(3)
Statistics (First Difference)	Δ ln OİL	Lag	Δln RGDP	Lag	Δln RİND	lag	In SI	Lag
τ_T (ADF)	-7.234*	(0)	-5.335	(0)	-6.058*	(0)	-6.233*	(0)
τ_μ (ADF)	-7.464*	(0)	-5.089*	(0)	-6.107*	(0)	-6.306*	(0)
τ (ADF)	-7.445*	(0)	-3.164*	(0)	-6.066*	(0)	-5.602*	(0)
τ_T (PP)	-7.243*	(1)	-7.354*	(16)	-7.962*	(11)	-6.347*	(4)
τ_μ (PP)	-7.468*	(1)	-5.011*	(7)	-7.349*	(10)	-6.430*	(4)
τ (PP)	-7.457*	(1)	-3.090*	(1)	-6.206*	(6)	-5.596*	(2)

Table 1 present unit root test results for Germany for the period 1973-2010. Oil and rGDP seem to be non-stationary both in ADF and PP tests when intercept and trend are included. But when trend is omitted and intercept is included, then, oil and rGDP become stationary; this is because the null hypothesis of a unit root can be rejected at alpha=0.05 for oil in ADF and PP tests and also for rGDP in ADF test. In PP test, the null hypothesis can be rejected at alpha=0.10 for rGDP. Since trend is observed in real income of Germany when plotted, it is clearly seen that trend should not be eliminated from unit root tests. Therefore, real GDP of Germany in fact is non-stationary (See Enders, 1995). Secondly, rIND and SI, on the other hand, seem to be all non-stationary in all of three scenarios of ADF and PP tests, this is because, the null hypothesis of a unit root cannot be rejected in the case of rIND and SI of Germany. But, they become stationary at first differences, their first difference is stationary. If we summarize, oil prices in Germany are integrated of order zero, I(0), while real GDP, real industrial value added and stock index are integrated of order one, I(1), in the case of Germany.

Table 2: ADF and PP Tests for Unit Root (Japan)

Statistics (Level)	ln OİL	Lag	ln RGDP	Lag	ln RİND	Lag	In SI	Lag
τ_T (ADF)	-2.107	(0)	0.180	(0)	-1.190	(0)	-1.834	(1)
τ_μ (ADF)	-2.015	(0)	-3.122**	(0)	-1.522	(0)	-2.375	(1)
τ (ADF)	0.892	(0)	2.740	(1)	1.942	(0)	0.949	(0)
τ_T (PP)	-2.290	(3)	0.058	(1)	-1.184	(1)	-1.322	(3)
τ_μ (PP)	-2.164	(3)	-2.767***	(2)	-1.522	(0)	-1.861	(3)
τ (PP)	0.971	(1)	3.705	(4)	1.951	(1)	0.949	(0)
Statistics (First Difference)	Δ ln OİL	Lag	Δln RGDP	Lag	Δln RİND	Lag	In SI	Lag
τ_T (ADF)	-7.556*	(0)	-5.094*	(0)	-5.842*	(0)	-4.915*	(0)
τ_μ (ADF)	-7.639*	(0)	-3.647*	(0)	-5.517*	(0)	-4.639*	(0)
τ (ADF)	-7.619*	(0)	-1.119	(2)	-4.942*	(0)	-4.471*	(0)
τ_T (PP)	-7.556*	(0)	-5.075*	(2)	-5.826*	(1)	-4.853*	(6)
τ_μ (PP)	-7.631*	(1)	-3.661*	(2)	-5.512*	(1)	-4.623*	(3)
τ (PP)	-7.587*	(2)	-2.003**	(2)	-5.053*	(3)	-4.486*	(1)

Table 2 present unit root test results for Japan for the period 1973-2010. Real GDP seem to be non-stationary both in ADF and PP tests when intercept and trend are included. But when trend is omitted and intercept is included, then, rGDP become stationary; this is because the null hypothesis of a unit root can be rejected at alpha=0.05 in ADF test, in PP test the null hypothesis of a unit root can be rejected at alpha=0.10. Since again trend is observed in real income of Japan when plotted, it is seen that trend should not be eliminated from unit root tests. Therefore, real GDP of Japan is also non-stationary (See Enders, 1995). Secondly, oil, rIND and SI, on the other hand, seem to be all non-stationary in all of three scenarios of ADF and PP tests, this is because, the null hypothesis of a unit root cannot be rejected in the case of oil, rIND and SI of Japan. But, they become stationary at first differences, their first difference is stationary. If we summarize, all of the variables in the case of Japan including real GDP is integrated of order one, I(1).

Table 3: ADF and PP Tests for Unit Root (Singapore)

Statistics (Level)	ln OİL	lag	ln RGDP	Lag	ln RİND	lag	In SI	Lag
τ_T (ADF)	-2.521	(0)	-1.467	(0)	-2.700	(0)	-7.080*	(0)
τ_μ (ADF)	-2.579	(0)	-1.095	(0)	-0.819	(0)	-1.749	(2)
τ (ADF)	0.819	(0)	10.875	(0)	6.385	(0)	0.619	(2)
τ_T (PP)	-2.707	(3)	-1.592	(1)	-2.706	(3)	-7.037*	(4)
τ_μ (PP)	-2.719***	(3)	-1.113	(2)	-1.115	(10)	-5.893*	(4)
τ (PP)	0.877	(1)	10.176	(1)	8.025	(7)	0.221	(6)
Statistics (First Difference)	Δ ln OİL	lag	Δln RGDP	Lag	Δln RİND	lag	In SI	Lag
τ_T (ADF)	-7.380*	(0)	-4.856*	(0)	-4.870*	(0)	-11.230*	(1)
τ_μ (ADF)	-7.559*	(0)	-4.829*	(0)	-5.019*	(0)	-11.409*	(1)
τ (ADF)	-7.557*	(0)	-0.727	(2)	-2.574**	(0)	-11.461*	(1)
τ_T (PP)	-7.423*	(1)	-4.712*	(3)	-4.627*	(10)	-15.632*	(4)
τ_μ (PP)	-7.584*	(1)	-4.848*	(1)	-4.872*	(9)	-15.915*	(4)
τ (PP)	-7.578*	(2)	-1.454	(1)	-2.574**	(0)	-15.767*	(4)

Table 3 present unit root test results for Singapore for the period 1973-2010. Oil seems to be non-stationary both in ADF and PP tests when intercept and trend are included. But when trend is omitted and intercept is included, then, oil become stationary; this is because the null hypothesis of a unit root can be rejected at alpha=0.10 in PP test. Secondly, SI seems stationary in ADF and PP tests when intercept and trend are included. The null hypothesis of a unit root can be rejected at alpha=0.01. Thirdly, rIND and rGDP, on the other hand, seem to be all non-stationary in all of three scenarios of ADF and PP tests, this is because, the null hypothesis of a unit root cannot be rejected in the case of rIND and rGDP of Singapore. But, they become stationary at first differences, their first difference is stationary. If we summarize, oil prices and stock index are integrated of order zero, I(0), while real industrial value added and real GDP are integrated of order one, I(1), in the case of Singapore.

Table 4: ADF and PP Tests for Unit Root (South Africa)

Statistics (Level)	ln OİL	lag	ln RGDP	lag	ln RİND	Lag	In SI	lag
τ_T (ADF)	-1.523	(0)	-1.161	(1)	-1.779	(0)	-1.996	(2)
τ_μ (ADF)	-2.757***	(0)	-0.696	(1)	0.591	(0)	-2.336	(2)
τ (ADF)	-1.700***	(0)	0.515	(1)	1.891	(0)	-0.794	(0)
τ_T (PP)	-1.393	(6)	-1.101	(3)	-1.683	(7)	-1.700	(2)
τ_μ (PP)	-2.757***	(0)	-0.868	(3)	0.841	(6)	-2.153	(1)
τ (PP)	-1.655***	(3)	0.252	(3)	1.902	(3)	-0.794	(0)

Statistics (First Difference)	Δ ln OİL	lag	Δln RGDP	lag	Δln RİND	Lag	In SI	lag
τ_T (ADF)	-4.419*	(1)	-3.399***	(3)	-4.781*	(0)	-0.359	(1)
τ_μ (ADF)	-5.221*	(0)	-3.139**	(0)	-4.590*	(0)	-0.522	(1)
τ (ADF)	-5.107*	(0)	-3.159*	(0)	-4.059*	(0)	-2.843*	(0)
τ_T (PP)	-8.658*	(13)	-3.839**	(7)	-7.391*	(22)	-2.538	(0)
τ_μ (PP)	-5.248*	(3)	-3.139**	(0)	-4.545*	(6)	2.637***	(0)
τ (PP)	-5.137*	(3)	-3.159*	(0)	-4.059*	(0)	-2.843*	(0)

Table 4 present unit root test results for South Africa for the period 1981-2010. Oil seems to be non-stationary both in ADF and PP tests when intercept and trend are included. But when trend is omitted and intercept is included, then, oil become stationary; this is because the null hypothesis of a unit root can be rejected at alpha=0.10 in ADF and PP tests. Secondly, rGDP, rIND and SI, on the other hand, seem to be all non-stationary in all of three scenarios of ADF and PP tests, this is because, the null hypothesis of a unit root cannot be rejected in the case of rGDP, rIND and SI of South Africa. But, they become stationary at first differences, their first difference is stationary. If we summarize, oil prices is integrated of order zero, I(0), while real GDP, real industrial value added and stock index are integrated of order one, I(1), in the case of South Africa.

Table 5: ADF and PP Tests for Unit Root (Turkey)

Statistics (Level)	ln OİL	lag	ln RGDP	lag	ln RİND	Lag	In SI	Lag
τ_T (ADF)	0.102	(0)	-2.665	(0)	-2.509	(0)	-5.003*	(0)
τ_μ (ADF)	-3.028**	(0)	-0.501	(0)	-0.789	(0)	-3.098**	(0)
τ (ADF)	-5.261*	(0)	2.157	(0)	3.082	(0)	0.850	(1)
τ_T (PP)	0.102	(0)	-2.696	(1)	-2.578	(1)	-5.003*	(0)
τ_μ (PP)	-2.655***	(2)	-0.501	(0)	-0.789	(0)	-36.117**	(2)
τ (PP)	-4.349*	(2)	2.434	(1)	3.082	(0)	1.797	(5)
Statistics (First Difference)	**Δ ln OİL**	**lag**	**Δln RGDP**	**lag**	**Δln RİND**	**Lag**	**In SI**	**Lag**
τ_T (ADF)	-3.804**	(0)	-5.246*	(0)	-4.459**	(0)	-4.418**	(4)
τ_μ (ADF)	-2.422	(0)	-5.388*	(0)	-4.584*	(0)	-4.159*	(4)
τ (ADF)	-1.958**	(0)	-4.291*	(0)	-3.289*	(0)	-7.394*	(0)
τ_T (PP)	-3.763**	(4)	-5.246	(0)	-4.459**	(0)	-17.891*	(14)
τ_μ (PP)	-2.422	(0)	-5.388*	(0)	-4.584*	(0)	-14.959*	(12)
τ (PP)	-1.840***	(4)	-4.345*	(2)	-3.307*	(2)	-9.529*	(7)

Table 5 present unit root test results for Turkey for the period 1988-2010. Oil seems to be non-stationary both in ADF and PP tests when intercept and trend are included. But when trend is omitted and intercept is included, then, oil become stationary; this is because the null hypothesis of a unit root can be rejected at alpha=0.05 in ADF test, in PP test the null hypothesis of a unit root can be rejected at alpha=0.10. Secondly, SI seems stationary in ADF and PP tests when intercept and trend are included. The null hypothesis of a unit root can be rejected at alpha=0.01. Secondly, rGDP and rIND, on the other hand, seem to be all non-stationary in all of three scenarios of ADF and PP tests, this is because, the null hypothesis of a unit root cannot be rejected in the case of rGDP, rIND of Turkey. But, they become stationary at first differences, their first difference is stationary. If we summarize, oil prices and stock index are integrated of order zero, I(0), while real GDP and real industry value added are integrated of order one, I(1), in the case of Turkey.

Table 6 present unit root test results for UK for the period 1978-2010. Real GDP seem to be Stationary; this is because the null hypothesis of a unit root can be rejected at alpha=0.05 in ADF test when intercept and trend are included. But, this is not confirmed by the PP test. It is advised that the PP test is superior to the ADF test due to autocorrelation problems (Enders, 1995). Therefore, finding from the PP test will be taken into consideration in this thesis. Secondly, Oil, rIND and SI, on the other hand, seem to be all non-stationary in all of three scenarios of ADF and PP tests, this is because, the null hypothesis of a unit root cannot be rejected in the case of oil, rIND and SI of UK. But, they become stationary at first differences, their first difference is stationary. If we summarize, all of the variables in the case of the UK including real GDP is integrated of order one, I(1).

Table 6: ADF and PP Tests for Unit Root (UK)

Statistics (Level)	ln OİL	lag	ln RGDP	lag	ln RİND	lag	In SI	Lag
τ_T (ADF)	-1.298	(0)	-3.777**	(1)	-0.599	(0)	-1.738	(0)
τ_μ (ADF)	-1.329	(0)	-0.467	(1)	-1.415	(0)	-1.778	(0)
τ (ADF)	0.414	(0)	2.194	(1)	1.217	(0)	1.746	(0)
τ_T (PP)	-1.330	(2)	-2.083	(2)	-0.903	(1)	-1.719	(1)
τ_μ (PP)	-1.477	(3)	-0.435	(2)	-1.425	(1)	-2.080	(5)
τ (PP)	0.462	(1)	4.399	(2)	1.217	(0)	1.939	(3)
Statistics (First Difference)	Δ ln OİL	lag	Δln RGDP	lag	Δln RİND	lag	In SI	Lag
τ_T (ADF)	-6.653*	(0)	-3.089	(0)	-4.198**	(0)	-5.749*	(4)
τ_μ (ADF)	-6.498*	(0)	-3.142**	(0)	-4.189*	(0)	-5.910*	(0)
τ (ADF)	-6.603*	(0)	-2.111**	(0)	-4.134*	(0)	-5395*	(0)
τ_T (PP)	-6.880*	(3)	-3.112	(2)	-4.100**	(4)	-8.329*	(7)
τ_μ (PP)	-6.512*	(1)	-3.170**	(2)	-4.181*	(3)	-5.943*	(3)
τ (PP)	-6.621*	(1)	-2.159**	(1)	-4.191*	(1)	5.395*	(2)

Table 7 present unit root test results for US for the period 1973-2010. Real IND seem to be Stationary; this is because the null hypothesis of a unit root can be rejected at alpha=0.10 in ADF test when intercept and trend are included. This is again not confirmed by the PP test. Secondly, oil, rGDP and SI, on the other hand, seem to be all non-stationary in all of three scenarios of ADF and PP tests, this is because, the null hypothesis of a unit root cannot be rejected in the case of oil, rGDP and SI of US. But, they become stationary at first differences, their first difference is stationary. If we summarize, all of the variables in the case of the USA including real industry value added is integrated of order one, I(1).

Table 7: ADF and PP Tests for Unit Root (US)

Statistics (Level)	ln OİL	Lag	ln RGDP	lag	ln RİND	lag	In SI	Lag
τ_T (ADF)	-2.364	(0)	-2.640	(1)	3.238***	(1)	-2.402	(0)
τ_μ (ADF)	-2.364	(0)	-0.911	(0)	-0.440	(0)	-0.751	(0)
τ (ADF)	0.548	(0)	3.581	(1)	2.515	(2)	2.370	(0)
τ_T (PP)	-2.578	(3)	-1.719	(1)	-2.689	(2)	-2.470	(2)
τ_μ (PP)	-2.569	(3)	-0.894	(4)	-0.454	(4)	-0.700	(3)
τ (PP)	0.548	(0)	6.478	(3)	1.903	(4)	2.939	(3)
Statistics (First Difference)	Δ ln OİL	Lag	Δln RGDP	lag	Δln RİND	lag	In SI	lag
τ_T (ADF)	-7.867*	(0)	-4.456*	(1)	-5.143*	(1)	-3.347***	(5)

τ_μ (ADF)	-8.000*	(0)	-4.223*	(1)	-5.219*	(1)	-7.593*	(0)
τ (ADF)	-8.108*	(0)	-2.253**	(0)	-4.043*	(0)	-1.134	(5)
τ_T (PP)	-7.867*	(0)	-4.495*	(6)	-4.172**	(8)	-9.399*	(6)
τ_μ (PP)	-8.027*	(1)	-4.345*	(4)	-4.269*	(8)	-7.775*	(3)
τ (PP)	-8.130*	(2)	-2.253**	(0)	-3.970*	(3)	-6.053*	(3)

Tables 1 through 7 reports the ADF and, the PP test results for stationary in the series selected. The results have provided mixed results between ADF and the PP tests in several variables. In other words, the test results from the PP tests further confirm the ADF test indicating all data series are integrated of order one except RGDP in Germany, Japan and the UK, SI in Singapore and Turkey, OIL in South Africa, Singapore, Germany and Turkey, and RIND in the US. The inspection of the relevant variables confirms the view that the other variables in question are all non-stationary in levels but stationary in first differences. It is worth emphasizing that final decision on the stationary nature of the variables under consideration has been given based on the PP tests as advised in the relevant literature (Katircioglu, 2009; Enders, 1995). Furthermore, it is very essential to note again that, further analyses including the ARDL estimations for level relationships and error correction models should be carried out for those models whose dependent variables are integrated of order one, I (1) (see Pesaran et al 2001). When our results are checked, it is seen that we have already satisfied this condition.

Unit root tests results indicate that findings provide mixed evidence of the order of integration for co-integration tests ahead. Therefore, classical co-integration approaches such as Engel and Granger (1979) and Johansen (1990) as well as Johansen and Juselius (1991) cointegration tests cannot be adopted in this case. We must then turn to conduct bounds test for a level relationship suggested by Pesaran et al. (2001). The critical value bounds for this test are estimated by Pesaran et al. (1996a) and are summarized as “a, b, and c” in columns F_{III}, F_{IV} and F_V of Tables 8 through 15. Columns F_{III}, F_{IV} and F_V give computed F-statistics for each model across the countries. Three scenarios have been used in this thesis in order to test for long term relationship as formulated in equation (4) and proposed by Pesaran et al. (2001): F_{IV} stands for the F statistic of the model with unrestricted intercept and restricted trend, F_V stands for the F statistic of the model with unrestricted intercept and trend, and F_{III} stands for the F statistic of the model with unrestricted intercept and no trend.

In Tables 8 through 15 if F-statistics exceeds the upper bound of critical value band, we reject the null of $H_0: \sigma_{1Y} = \sigma_{2Y} = \sigma_{3Y} = \sigma_{4Y} = 0$ (no long run relationship between the variables in the model used in this thesis). The evidence suggest that there exists a long run relationship in the model whereas real GDP is dependent, real industry value added (rIND), stock indices (SI) and oil prices (oil) are independent variables. Results suggest that there exists a long run relationship in the relevant model for Germany, Japan, Singapore, and South Africa. However, the model provides a long run relationship for Turkey without stock indices (SI) and real industry value added (rIND). In the case of the USA and the UK we did not obtain any long run relationship. This is stage one which is necessary step to check whether there exists a long run relationship between the variables under investigation which is tested by computing F-statistics for the significance of the lagged levels of the variables in the error correction form of the underlying ARDL model. The F-statistics confirms that there is a co-integrating relationship based on the model under inspection. In the next step tables of bounds tests and their detailed interpretations are provided.

Table 8: The Bounds Test for Level Relationships (Germany)

	With Deterministic Trends			Without Deterministic Trend		
Variables	F_{IV}	F_V	t_V	F_{III}	t_{III}	Conclusion
						H_0 Rejected
p = 1	9.038c	7.224b	-3.077a	11.539c	-5.833c	
2	3.740a	4.103a	-3.469c	4.878a	-4.069c	

3	1.656a	1.494a	-2.394a	2.173a	-2.508a	
4	2.173a	2.711a	-2.189a	2.450a	-2.453a	

Note: a denotes that computed value falls below lower limit of critical values; b denotes that computed value falls within the lower and upper of critical values; c denotes that computed value falls above the upper limit of critical values.

Table 8 gives bounds test results for Germany. It is seen that the null hypothesis of no level relationship can be rejected according to F_{IV} (at lag1) and F_{III} (at lag1) scenarios. This is because computed F values are higher than upper critical values. On the other hand, the null hypothesis of no level relationship can neither be rejected nor accepted in F_V scenario; test is inconclusive in this case since F-value falls between lower and upper critical values. To summarize, results of bounds tests confirm the existence of long term relationship between RGDP and its regressors (RIND, SI and OİL) in the case of Germany according to F_{III} and F_{IV} scenarios.

On the other hand, application of t-test shows that deterministic trend restrictions will be needed in estimating all of the ARDL models since there are significant t ratios in F_V and F_{III} scenarios (please see Peseran et al., 2001).

Table 9: The Bounds Test for Level Relationships (Japan)

	With Deterministic Trends			Without Deterministic Trend		
Variables	F_{IV}	F_V	t_V	F_{III}	t_{III}	Conclusion
						H_0 Rejected
p = 1	13.961c	3.007a	2.130a	13.401c	-0.574a	
2	3.491a	1.247a	1.190a	3.869a	-0.012a	
3	1.364a	0.308a	0.145a	1.773a	-0.408a	
4	2.032a	0.321a	0.921a	2.204a	-0.316a	

Note: a denotes that computed value falls below lower limit of critical values; b denotes that computed value falls within the lower and upper of critical values; c denotes that computed value falls above the upper limit of critical values.

Table 9 gives bounds test results for Japan. It is seen that the null hypothesis of no level relationship can be rejected according to F_{IV} (at lag1) and F_{III} (at lag1) scenarios. This is because computed F values are higher than upper critical values. On the other hand, the null hypothesis of no level relationship cannot be rejected in F_V scenario. This is because computed F values are below than lower critical values. To summarize, results of bounds tests confirm the existence of long term relationship between RGDP and its regressors (RIND, SI and OİL) in the case of Japan according to F_{IV} and F_{III} scenarios.

On the other hand, application of t-test shows that deterministic trend restrictions will not be needed in estimating all of the ARDL models since there are not significant t ratios in F_V and F_{III} scenarios (See Pesaran et al., 2001).

Table 10: The Bounds Test for Level Relationships (Singapore)

	With Deterministic Trends			Without Deterministic Trend		
Variables	F_{IV}	F_V	t_V	F_{III}	t_{III}	Conclusion
						H_0 Rejected
p = 1	5.515c	5.354a	-2.853a	3.198a	-0.191a	
2	2.157a	2.049a	-2.240a	0.821a	0.017a	
3	1.155a	1.466a	-1.518a	0.749a	0.533a	
4	2.029a	2.162a	-2.415a	0.295a	0.235a	

Note: a denotes that computed value falls below lower limit of critical values; b denotes that computed value falls within the lower and upper of critical values; c denotes that computed value falls above the upper limit of critical values.

Table 10 gives bounds test results for Singapore. It is seen that the null hypothesis of no level relationship can be rejected according to F_{IV} (at lag1) scenario. This is because computed F value is higher than upper critical value. On the other hand, the null hypothesis of no level relationship cannot be rejected in F_V and F_{III} scenarios. This is because computed F values are lower than critical values. To summarize, results of bounds tests confirm the existence of long term relationship between RGDP and its regressors (RIND, SI and OİL) in the case of Singapore according to F_{IV} scenario.

On the other hand, application of t-test shows that deterministic trend restrictions will not be needed in estimating all of the ARDL models since there are not significant t ratios in F_V and F_{III} scenarios (please see Pesaran et al., 2001).

Table 11: The Bounds Test for Level Relationships (South Africa)

	With Deterministic Trends			Without Deterministic Trend		
Variables	F_{IV}	F_V	t_V	F_{III}	t_{III}	Conclusion
						H_0 Rejected
p = 1	8.138c	1.322a	-0.741a	9.028c	-0.116a	
2	4.375a	1.353a	-0.659a	7.119c	-0.011a	
3	2.825a	0.642a	-0.238a	3.563a	-0.844a	
4	16.680c	0.996a	-1.435a	22.879c	-4.134a	

Note: a denotes that computed value falls below lower limit of critical values; b denotes that computed value falls within the lower and upper of critical values; c denotes that computed value falls above the upper limit of critical values.

Table 11 gives bounds test results for South Africa. It is seen that the null hypothesis of no level relationship can be rejected according to F_{IV} (at lag1 and 4) and F_{III} (at lag1,2 and 4) scenarios. This is because computed F values are higher than upper critical values. On the other hand, the null hypothesis of no level relationship cannot be rejected in F_V scenario. This is because computed F values are lower than critical values. To summarize, results of bounds tests confirm the existence of long term relationship between RGDP and its regressors (RIND, SI and OİL) in the case of Sauth Africa according to F_{IV} and F_{III} scenarios.

On the other hand, application of t-test shows that deterministic trend restrictions will not be needed in estimating all of the ARDL models since there are not significant t ratios in F_V and F_{III} scenarios (please see Peseran et al., 2001).

Table 12: The Bounds Test for Level Relationships (Turkey)

	With Deterministic Trends			Without Deterministic Trend		
Variables	F_{IV}	F_V	t_V	F_{III}	t_{III}	Conclusion
						H_0 Rejected
p = 1	7.671c	9.346c	-5.091c	10.688c	-5.216c	

2	2.522a	3.238a	-2.423a	3.108a	-2.269a	
3	2.588a	2.855a	-1.652a	3.020a	-1.462a	
4	1.684a	2.159a	-0.958a	1.951a	-0.394a	

Note: a denotes that computed value falls below lower limit of critical values; b denotes that computed value falls within the lower and upper of critical values; c denotes that computed value falls above the upper limit of critical values.

Two models have been tested in the case of Turkey. Table 12 gives bounds test results for Turkey where regressors are industy and oil prices. It is seen that the null hypothesis of no level relationship can be rejected according to F_{IV} (at lag1), F_V (at lag1)and F_{III} (at lag1) scenarios. This is because computed F values are higher than upper critical values. To summarize, results of bounds tests confirm the existence of long term relationship between RGDP and its regressors (RIND and OİL) in the case of Turkey according to F_{IV}, F_V and F_{III} scenarios.

On the other hand, application of t-test shows that deterministic trend restrictions will be needed in estimating all of the ARDL models since there are significant t ratios in F_V and F_{III} scenarios (See Pesaran et al., 2001).

Table 13: The Bounds Test for Level Relationships (Turkey)

	With Deterministic Trends			Without Deterministic Trend		
Variables	F_{IV}	F_V	t_V	F_{III}	t_{III}	Conclusion
						H_0 Accepted
p = 1	2.336a	2.543a	-2.716a	1.945a	-2.096a	
2	1.144a	1.447a	-0.944a	1.098a	-0.057a	
3	2.254a	2.010a	-1.752a	1.587a	-0.186a	
4	0.837a	0.856a	-0.565a	1.223a	-0.113a	

Note: a denotes that computed value falls below lower limit of critical values; b denotes that computed value falls within the lower and upper of critical values; c denotes that computed value falls above the upper limit of critical values.

On the other hand, Table 13 gives bounds test results for Turkey where regressors are oil prices and stock market index. It is seen that the null hypothesis of no level relationship cannot be rejected according to F_{IV}, F_V and F_{III} scenarios. This is because computed F values are lower than critical values. To summarize, results of bounds tests disapprove the existence of long term relationship between RGDP and its regressors (OİL and SI) in the case of Turkey.

Application of t-test shows that deterministic trend restrictions will not be needed in estimating all of the ARDL models since there are not significant t ratios in F_V and F_{III} scenarios (See Pesaran et al., 2001).

Table 14: The Bounds Test for Level Relationships (UK)

	With Deterministic Trends			Without Deterministic Trend		
Variables	F_{IV}	F_V	t_V	F_{III}	t_{III}	Conclusion
						H_0 Accepted
p = 1	2.426a	1.784a	0.274a	2.866a	-1.162a	
2	1.215a	1.141a	-0.125a	1.569a	0.256a	
3	1.181a	1.458a	-0.548a	1.323a	0.213a	
4	3.068a	3.768a	-0.133a	4.292a	-0.505a	

Note: a denotes that computed value falls below lower limit of critical values; b denotes that computed value falls within the lower and upper of critical values; c denotes that computed value falls above the upper limit of critical values.

Table 14 gives bounds test results for UK. It is seen that the null hypothesis of no level relationship can be accepted according to F_{IV}, F_V and F_{III} scenarios. This is because computed F values are lower than critical values. To summarize, results of bounds tests disapprove the existence of long term relationship between RGDP and its regressors (RIND, OİL and SI) in the case of UK according to $F_{IV,}$ F_V and F_{III} scenarios.

On the other hand, application of t-test shows that deterministic trend restrictions will not be needed in estimating all of the ARDL models since there are not significant t ratios in F_V and F_{III} scenarios (See Pesaran et al., 2001).

Table 15: The Bounds Test for Level Relationships (US)

	With Deterministic Trends			Without Trend	Deterministic	
Variables	F_{IV}	F_V	t_V	F_{III}	t_{III}	Conclusion
						H_0 Accepted
p = 1	3.040a	2.418a	-1.191a	3.926a	-3.375a	
2	2.397a	1.239a	-1.217a	3.095a	-2.289a	
3	2.366a	1.025a	-0.835a	3.113a	-2.268a	
4	1.884a	1.356a	-1.046a	2.535a	-2.503a	

Note: a denotes that computed value falls below lower limit of critical values; b denotes that computed value falls within the lower and upper of critical values; c denotes that computed value falls above the upper limit of critical values.

Table15 gives bounds test results for US. It is seen that the null hypothesis of no level relationship can be accepted according to F_{IV}, F_V and F_{III} scenarios. This because computed F values are below than lower critical values. To summarize, results of bounds tests disapprove the existence of long term relationship between RGDP and its regressors (RIND, OİL and SI) in the case of US according to $F_{IV,}$ F_V and F_{III} scenarios.

On the other hand, application of t-test shows that deterministic trend restrictions will not be needed in estimating all of the ARDL models since there are not significant t ratios in F_V and F_{III} scenarios (See Pesaran et al., 2001).

Several methods are available for conducting the co-integration test. The most commonly conducted methods including the residual based Engle-Granger (1987) test, the maximum likelihood based Johansen (1988) and Johansen Juselius (1990) tests. Due to the low power and other problems associated with these methods, the OLS based autoregressive distributed lag (ARDL) approach to co-integration has become popular in recent years. The main advantage of ARDL modeling lies in the fact that it can be applied irrespectively of whether the regressors are I(0) or I(1). This explains that the estimation strategy avoids the problems associated with standard co-integration analysis which requires the classification of the variables into I(0) and I(1).

The other advantage of the approach is that the model takes sufficient numbers of lags to capture the data generating process in general to specific modelling framework. This also gives us a chance to drive a dynamic error correction model from ARDL. The ARDL approach keeps the long-run information and avoids problems resulting from non-stationary time series data (Laurenceson and Chai, 2003).

In stage two, we estimate the coefficients of the long run relationships and find their error correction mechanism. Tables 16 through 24 indicate that long-run estimates as well as short-run estimates. Tables 16 through 24 report long run coefficients and the short run dynamics with the error correction terms (coefficients) of the relevant model.

Table 16: The ARDL Error Correction Model for RGDP (Germany)

Regressor	Coefficient	Standard Error	p-value
$\Delta lnrgdp_{t-1}$	0.1559	0.0445	0.0081
$\Delta lnrgdp_{t-2}$	0.3015	0.0470	0.0002
$\Delta lnrgdp_{t-3}$	0.1113	0.0474	0.0469
$\Delta lnrgdp_{t-4}$	-0.3637	0.0422	0.0000
$\Delta lnoil$	-0.0084	0.0010	0.0000
$\Delta lnoil_{t-1}$	-0.0407	0.0027	0.0000
$\Delta lnoil_{t-2}$	-0.0285	0.0028	0.0000
$\Delta lnoil_{t-3}$	-0.0121	0.0016	0.0001
$\Delta lnoil_{t-4}$	-0.0101	0.0011	0.0000
$\Delta lnoil_{t-5}$	-0.0068	0.0009	0.0001
$\Delta lnrind$	0.4918	0.0078	0.0000
$\Delta lnrind_{t-1}$	-0.3318	0.0252	0.0000
$\Delta lnrind_{t-2}$	-0.4416	0.0319	0.0000
$\Delta lnrind_{t-3}$	-0.3537	0.0330	0.0000
$\Delta lnrind_{t-4}$	-0.0809	0.0203	0.0041
$\Delta lnrind_{t-5}$	-0.0505	0.0161	0.0141
$\Delta lnsi$	0.0086	0.0010	0.0000
$\Delta lnsi_{t-1}$	-0.0879	0.0062	0.0000
$\Delta lnsi_{t-2}$	-0.0660	0.0053	0.0000
$\Delta lnsi_{t-3}$	-0.0415	0.0039	0.0000
$\Delta lnsi_{t-4}$	-0.0368	0.0024	0.0000
$\Delta lnsi_{t-5}$	-0.0130	0.0026	0.0013
C	-0.0038	0.0007	0.0006
$ECMT_{t-1}$	-0.8559	0.0538	0.0000

Adj. R^2= 0.997925,
S.E. of Regr. = 0.000867,
AIC = -11.14928, SBC = -10.04998,
F-stat. = 649.2529, F-prob. = 0.000,
D-W stat. = 2.879102

Table 17: Level Equation with Constant and Trend (Germany)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGOİL	0.0342	0.0048	7.1209	0.0000
LOGRIND	0.9627	0.0414	23.2437	0.0000
LOGSİ	0.1319	0.0092	14.2808	0.0000
C	-16.9812	1.1374	-14.9287	0.0000

In the short run, Table 16 illustrates the results of error correction model for short run coefficients and speed of adjustment. All variables in the case of Germany are found statistically significant at and error correction term is -0.8559 which is statistically significant and negative as expected. This means that real GDP converge to its long run equilibrium level at 85.59 percent by contribution of real industry value added (rIND), stock indices (SI) and oil prices (oil). This model shows that there exists no problem in terms of R2 scores, F-value as well as Durbin-watson statistic (i.e autocorrelation problem). (At lag 0, if oil prices increase by 1%, GDP will decrease by 0.0084%. At lag 1, if oil prices increase by 1%, GDP will decrease by 0.0407%. At lag 2, if oil prices increase by 1%, GDP will decrease by 0.0285%. At lag 3, if oil prices increase by 1%, GDP will decrease by 0.0121%. At lag 4, if oil prices increase by 1%, GDP will decrease by 0.0101%. At lag 5, if oil prices increase by 1%, GDP will decrease by 0.0068%. At lag 0, if rIND increases by 1%, GDP will increase by 0.4918%. At lag 1, if rIND increases by 1%, GDP will decrease by 0.3318%. At lag 2, if rIND increases by 1%, GDP will decrease by 0.4416%. At lag 3, if rIND increases by 1%, GDP will decrease by 0.3537%. At lag 4, if rIND increases by 1%, GDP will decrease by 0.0809%. At lag 5, if rIND increases by 1%, GDP will decrease by 0.0505%. At lag 0, if SI increases by 1%, GDP will increase by 0.0086%. At lag 1, if SI increases by 1%, GDP will decrease by 0.0879%. At lag 2, if SI increases by 1%, GDP will reduce by 0.0660%. At lag 3, if SI increases by 1%, GDP will decrease by 0.0415%. At lag 4, if SI increases by 1%, GDP will decrease by 0.0368%. At lag 5, if SI increases by 1%, GDP will decrease by 0.0130%). In the case of Germany, long-run coefficients are statistically significant. This means that real industry value added (rIND), stock indices (SI) and oil prices (oil) have positive impact on real GDP. In the long-run, as can be seen from table 17, if oil prices increase by 1%, GDP will increase by 0.0342%. If rIND increases by 1%, GDP will increase by 0.9627%. If SI increases by 1%, GDP will increase by 0.1319%.

Table 18: The ARDL Error Correction Model for RGDP (Japan)

Regressor	Coefficient	Standard Error	p-value
$\Delta lnrgdp_{t-1}$	0.0736	0.0492	0.1456
Δlnoil	-0.0044	0.0045	0.3359
Δlnrind	0.3189	0.0293	0.0000
Δlnsi	-0.0043	0.0044	0.3426
C	-0.0010	0.0020	0.6222
$ECMT_{t-1}$	0.1002	0.0132	0.0000

Adj. R^2= 0.943595,
S.E. of Regr. = 0.005879,
AIC = -7.283810, SBC = -7.191695,
F-stat. = 118.1021, F-prob. = 0.000,
D-W stat. = 1.840837

Table 19: Level Equation with Constant and Trend (Japan)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGOİL	-0.0217	0.0317	-0.6864	0.4971
LOGRIND	1.5301	0.6479	2.3616	0.0241
LOGSİ	-0.1128	0.1013	-1.1139	0.2731
C	-13.5735	17.7575	-0.7643	0.4499

To evaluate the same results (Table 18 and 19) for Japan in the long run, the evidence shows that real industry value added is the only variable being statistically significant so there is a real industry value added impact on Real GDP whereas the same variable is statistically significant in the short run period. In short-run, if rIND increases by 1%, GDP will increase by 0.3189%. In long-run, if rIND increases by 1%, GDP will increase by 1.5301%. However error correction term does not work since it is positive. This suggests that income does not converge to its long term level through its regressors in the case of Japan. But, the model shows that there exists no problem in terms of R2 scores, F-value as well as Durbin-Watson statistic (i.e autocorrelation problem).

Table 20: The ARDL Error Correction Model for RGDP (Singapore)

Regressor	Coefficient	Standard Error	p-value
$\Delta lnrgdp_{t-1}$	0.9123	0.1432	0.0001
$\Delta lnrgdp_{t-2}$	-0.1438	0.1465	0.3493
$\Delta lnrgdp_{t-3}$	0.0601	0.1334	0.6617
$\Delta lnrgdp_{t-4}$	1.0260	0.1674	0.0001
$\Delta lnoil$	0.0620	0.0124	0.0005
$\Delta lnoil_{t-1}$	0.0004	0.0073	0.9500
$\Delta lnoil_{t-2}$	-0.0080	0.0070	0.2772
$\Delta lnoil_{t-3}$	-0.0201	0.0068	0.0150
$\Delta lnoil_{t-4}$	-0.0358	0.0071	0.0005
$\Delta lnrind$	0.4256	0.0422	0.0000
$\Delta lnrind_{t-1}$	-0.7686	0.0965	0.0000
$\Delta lnrind_{t-2}$	-0.1089	0.0853	0.2306
$\Delta lnrind_{t-3}$	-0.2292	0.0760	0.0130
$\Delta lnrind_{t-4}$	-0.4477	0.0806	0.0002
$\Delta lnsi$	0.0458	0.0079	0.0002
$\Delta lnsi_{t-1}$	0.0371	0.0090	0.0022
$\Delta lnsi_{t-2}$	0.0601	0.0093	0.0001
$\Delta lnsi_{t-3}$	0.0778	0.0125	0.0001
$\Delta lnsi_{t-4}$	0.0706	0.0088	0.0000
C	0.0114	0.0101	0.2839
$ECMT_{t-1}$	-0.6431	0.0956	0.0001

Adj. R^2= 0.977854,
S.E. of Regr. = 0.005996,
AIC = -7.172046, SBC = -6.200635,
F-stat. = 67.23285, F-prob. = 0.000,
D-W stat. = 2.653100

Table 21: Level Equation with Constant and Trend (Singapore)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGOİL	-0.051293	0.018596	-2.758277	0.0095
LOGRIND	0.830617	0.394823	2.103771	0.0433
LOGSİ	-0.037933	0.127148	-0.298258	0.7674
C	5.187638	8.170990	0.634885	0.5300

In the case of Singapore in Table 21, the long-run coefficients of real industry value added (rIND), and oil prices (OIL) are statistically significant. This means that real industry value added (rIND) and oil prices (OIL) have an impact on real GDP. If rIND increases by 1%, GDP will increase by 0.8306%. If oil prices increases by 1%, GDP will reduce by 0.05129%. In the short run, Table 20 illustrates the results of error correction model for short run coefficients and speed of adjustment. Most variables in the case of Singapore are found statistically significant at 1 percent level and error correction term is -0.6431 which is statistically significant as expected. This means that real GDP converge to their long run equilibrium level at 64.31 percent by contribution of real industry value added (rIND), stock indices (SI) and oil prices (oil). This model shows that there exists no problem in terms of R2 scores, F-value as well as Durbin-Watson statistic (i.e autocorrelation problem).(At lag 0, if oil prices increase by 1%, GDP will increase by 0.0620%. At lag 3, if oil prices increase by 1%, GDP will reduce by 0.0201%. At lag 4, if oil prices increase by 1%, GDP will reduce by 0.0358%. At lag 0, if rIND increases by 1%, GDP will increase by 0.4256%. At lag 1, if rIND increases by 1%, GDP will reduce by 0.7686%. At lag 2, if rIND increases by 1%, GDP will reduce by 0.1089%. At lag 3, if rIND increases by 1%, GDP will reduce by 0.2292%. At lag 4, if rIND increases by 1%, GDP will reduce by 0.4477%. At lag 0, if SI increases by 1%, GDP will increase by 0.0458%. At lag 1, if SI increases by 1%, GDP will increase by 0.0371%. At lag 2, if SI increases by 1%, GDP will increase by 0.0601%. At lag 3, if SI increases by 1%, GDP will increase by 0.0778%. At lag 4, if SI increases by 1%, GDP will increase by 0.0706%).

For the results of South Africa in Table 23, the long-run coefficients of real industry value added is only statistically significant. This means that real industry value has an impact on real GDP. If rIND increases by 1%, GDP will increase by 0.7582%. In the short run, Table 22 illustrates the results of error correction model for short run coefficients and speed of adjustment. Most variables in the case of South Africa are found statistically significant at 1 percent level and error correction term is -0.3238 which is statistically significant as expected. This means that real GDP converge to their long run equilibrium level at 32.38 percent by contribution of real industry value added (rIND), stock indices (SI) and oil prices (oil). This model shows that there exists no problem in terms of R2 scores, F-value as well as Durbin-Watson statistic (i.e autocorrelation problem). (At lag 0, if oil prices increase by 1%, GDP will reduce by 0.0073%.

Table 22: The ARDL Error Correction Model for RGDP (South Africa)

Regressor	Coefficient	Standard Error	p-value
$\Delta lnrgdp_{t-1}$	-0.5488	0.0796	0.0000
$\Delta lnrgdp_{t-2}$	-0.4418	0.0773	0.0002
$\Delta lnoil$	-0.0073	0.0028	0.0281
$\Delta lnoil_{t-1}$	-0.0360	0.0036	0.0000
$\Delta lnoil_{t-2}$	-0.0459	0.0043	0.0000
$\Delta lnoil_{t-3}$	-0.0265	0.0038	0.0000
$\Delta lnrind$	0.5613	0.0301	0.0000
$\Delta lnrind_{t-1}$	0.4945	0.0529	0.0000
$\Delta lnrind_{t-2}$	0.5448	0.0688	0.0000
$\Delta lnrind_{t-3}$	0.2137	0.0377	0.0002
$\Delta lnsi$	0.0052	0.0022	0.0424
$\Delta lnsi_{t-1}$	0.0041	0.0026	0.1430
$\Delta lnsi_{t-2}$	0.0171	0.0024	0.0000
$\Delta lnsi_{t-3}$	0.0168	0.0027	0.0001
C	0.0013	0.0017	0.4633
$ECMT_{t-1}$	-0.3238	0.0250	0.0000

Adj. R^2= 0.988140,
S.E. of Regr. = 0.002696,
AIC = -8.719031, SBC = -7.944818,
F-stat. = 139.8641, F-prob. = 0.000,
D-W stat. = 2.018407

Table 23: Level Equation with Constant and Trend (South Africa)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGOİL	0.0456	0.0304	1.5004	0.1455
LOGRIND	0.7582	0.3406	2.2255	0.0349
LOGSİ	0.0260	0.0167	1.5579	0.1313
C	-10.8389	7.9267	-1.3673	0.1832

At lag 1, if oil prices increase by 1%, GDP will reduce by 0.0360%. At lag 2, if oil prices increase by 1%, GDP will reduce by 0.0459%. At lag 3, if oil prices increases by 1%, GDP will reduce by 0.0265%. At lag 0, if rIND increases by 1%, GDP will increase by 0.5613%. At lag 1, if rIND increases by 1%, GDP will increase by 0.4945%. At lag 2, if rIND increases by 1%, GDP will increase by 0.5448%. At lag 3, if rIND increases by 1%, GDP will increase by 0.2137%. At lag 0, if SI increases by 1%, GDP will increase by 0.0052%. At lag 1, if SI increases by 1%, GDP will increase by 0.0041%. At lag 2, if SI increases by 1%, GDP will increase by 0.0171%. At lag 3, if SI increases by 1%, GDP will increase by 0.0168%).

Table 24: The ARDL Error Correction Model for RGDP (Turkey)

Regressor	Coefficient	Standard Error	p-value
$\Delta lnrgdp_{t-1}$	0.1482	0.0506	0.0110
$\Delta lnrgdp_{t-2}$	0.0722	0.0412	0.1014
Δlnoil	0.0102	0.0046	0.0457
Δlnrind	0.6453	0.0275	0.0000
C	0.0036	0.0030	0.2518
$ECMT_{t-1}$	-1.3695	0.2589	0.0001

Adj. R^2= 0.978243,
S.E. of Regr. = 0.007286,
AIC = -6.762443, SBC = -6.463723,
F-stat. = 171.8525, F-prob. = 0.000,
D-W stat. = 2.358264

Table 25: Level Equation with Constant and Trend (Turkey)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGOİL	0.0108	0.0018	5.9416	0.0000
LOGRIND	0.5832	0.0384	15.1602	0.0000
C	-6.3532	0.9387	-6.7677	0.0000

Finally, for the results of Turkey in Table 24, the error correction term does not work since it higher than 1, although the model shows that there isn't exists any problem in terms of R2 scores, F-value as well as Durbin-Watson statistic (i.e autocorrelation problem). In the case of Turkey, long-run coefficients are statistically significant. This means that real industry value added (rIND) and oil prices (oil) have positive impact on real GDP. In the long-run, as can be seen from table 25 if oil prices increase by 1%, GDP will increase by 0.0108%. If rIND increases by 1%, GDP will increase by 0.5832%.

5. CONCLUSION

Results of the present studies generally proved statistically significant impact of oil and stock markets on output growth in the selected economies except UK and USA. Results of this thesis have also shown that it is only Germany among the other sample countries where oil price and stock market variables depict positive long term impact on real income growth and enable real income to converge to its long term equilibrium level as high as 85.59%. When the impact of industrial value added in Germany is also taken into consideration, these findings are consistent with realities that Germany is now the most powerful, productive, and efficient economy in the Europe and one of the most in the world.

Results of the present study suggest that countries need to benefit from oil and stock markets more effectively except Germany. Oil production and consumption should be well managed and made more efficient out of its allocation for the economy. This research has also shown that industrial value added does not sufficiently contribute to the income of countries other than Germany. Allocation of resources and its management should be also done very carefully in the industrial sector of those countries under consideration. Finally, stock market investments should be encouraged in those countries except again Germany. It is seen that stock markets also do not sufficiently contribute to the income of those countries.

Further research is recommended to scholars to employ alternative models using larger data spans and more countries as these will be possible based on data availability. This thesis has only focused on the impact of stock and oil markets on real income of selected countries. Further models, can be estimated under trivariate systems in order to extend the results of this study. Finally, this thesis has used annual data in empirical analysis. Further analyses can be replicated by using smaller frequencies such as quarterly data in order to gain from the number of observations and for comparison purposes.

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