THE EFFECT OF CHANGE IN MACROECONOMIC VARIABLES ON STOCK RETURNS IN SELECTED EMERGING MARKETS

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ÖZET

SEÇİLMİŞ GELİŞMEKTE OLAN PİYASALARDA MAKROEKONOMİK DEĞİŞKENLERİN HİSSE SENEDİ GETİRİSİNE ETKİSİ

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İktisat Anabilim Dalı, İngilizce

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Bu çalışmanın amacı, 2002:01—2019:12 yılları arasında gelişmekte olan piyasalarda (Brezilya, Rusya, Meksika, Şili, Türkiye, Kore ve Yunanistan) toplam talep, para politikası, petrol fiyatı, ekonomik politika belirsizliği ve jeopolitik risk belirsizliğinin hisse senedi getirileri üzerindeki etkilerini Otoregresif Dağıtılmış Gecikmeli Model (ARDL) ve bounds sınır testi yöntemlerini kullanarak araştırmaktır. Ampirik bulgular, Rusya, Şili ve Türkiye'de çalışmada kullanılan makroekonomik değişkenler ve hisse senedi getirileri arasında uzun dönem koentegrasyon ilişkisi olduğunu, ancak Brezilya, Meksika ve Kore'de ise kointegrasyon ilişkisi olmadığını göstermektedir. Çalışmanın bulguları ayrıca Şili, Türkiye, Kore ve Yunanistan'da hisse senedi getirilerinin uzun dönemde toplam talep değişikliklerine pozitif tepki verdiğini göstermektedir. Ayrıca, Brezilya, Rusya, Meksika ve Yunanistan'da petrol fiyatı değişikliklerinin hisse senedi getirileri üzerindeki etkisi uzun dönemde pozitif ve istatistiksel anlamlıdır. Ayrıca, Rusya, Meksika, Şili ve Türkiye için uzun dönemde para politikası oranlarının hisse senedi getirileri üzerindeki etkisi ise negatif ve istatistiksel anlamlıdır. Üstelik, ekonomi politikası belirsizliği değişiklikleri uzun dönemde Brezilya ve Rusya dışındaki ülkelerde hisse senedi getirilerini önemli ölçüde etkilemektedir. Bununla birlikte, geopolitik risk değişiklikleri uzun dönemde sadece Kore hisse senedi piyasasını negatif yönde etkilemektedir. Bulguların politika sonuçları sonuç bölümünde tartışılmaktadır.

Anahtar Sözcükler: Hisse Senedi Getirisi, Makroekonomik Değişkenler, Gelişmekte Olan Piyasalar, ARDL Modeli

ABSTRACT

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The aim of the study is to investigate the impacts of changes in aggregate demand, monetary policy rate, oil price, economic policy uncertainty and geopolitical risk variables on stock returns for seven emerging markets (Brazil, Russia, Mexico, Chile, Turkey, Korea, and Greece) by applying Autoregressive Distributed Lag (ARDL) methodology and bounds cointegration test covering the monthly period of 2002:01—2019:12. The findings show the evidence of long-run cointegration relationship between stock returns and macroeconomic variables used in the study for Russia, Chile, Turkey, and Greece but not for Brazil, Mexico, and Korea. The findings also show that stock returns significantly respond positively to aggregate demand changes for Chile, Turkey, Korea and Greece in the long run. In addition, the long-run positive impact of oil price changes on stock returns is significant for Brazil, Russia, Mexico and Greece. Further, in the long-run, monetary policy rate changes have significant negative impacts on stock returns for Russia, Mexico, Chile and Turkey. More so, economic policy uncertainty changes affect significantly on stock returns in the long run for all, except Brazil and Russia. Nevertheless, geopolitical risk changes significantly affect only the Korean stock market negatively in the long run. Policy implications of the findings are discussed in the conclusion section.

Keywords: Stock Returns, Macroeconomic Variables, Emerging Markets, ARDL Model

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08./06/2020

STATEMENT OF COMPLIANCE WITH ETHICAL PRINCIPLES AND RULES

I hereby truthfully declare that this thesis is an original work prepared by me; that I have behaved in accordance with the scientific ethical principles and rules throughout the stages of preparation, data collection, analysis and presentation of my work; that I have cited the sources of all the data and information that could be obtained within the scope of this study, and included these sources in the references section; and that this study has been scanned for plagiarism with "scientific plagiarism detection program" used by Anadolu University, and that "it does not have any plagiarism" whatsoever. I also declare that, if a case contrary to my declaration is detected in my work at any time, I hereby express my consent to all the ethical and legal consequences that are involved.

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SYMBOLS AND ABBREVIATIONS

α	: Alfa
β	: Beta
Δ, δ	: Delta
Γ, γ	: Gamma
ε	: Epsilon
η	: Eta
ϕ	: Phi
Σ, σ	: Sigma
ϑ	: Vartheta
θ	: Theta
μ	: Mu
λ	: Lambda
φ	: Varphi
ADF	: Augmented Dickey Fuller
ARDL	: Autoregressive Distributed Lag
ATHEX	: Greek Stock Index
BIST	: Turkish Stock Index
BVSP	: Brazilian Stock Index
CUSUM	: Cumulative Sums
CUSUMsq	: Cumulative Sum of square

DF : Dickey Fuller

ECT : Error Correction Term

EPU : Economic Policy Uncertainty

GEPU : Global Economic Policy Uncertainty

GPR : Geopolitical Risk

IGPA : Chilean Stock Index

INTR : Interest Rate

IPC : Mexican Stock Index

IPI : Industrial Production Index

KOSPI : Korean Stock Index

MOEX : Russian Stock Index

OECD : Organization for Economic Co-operation and Development

OILPB : Brent Oil Prices

PP : Phillips-Perron

SR : Stock Returns

ZAUR : Zivot-Andrews Unit Root

CHAPTER ONE

1. INTRODUCTION

1.1. Background

The relationship between financial progress and economic growth and development started being an important topic of discussion in the industrialized economies since the early 1970s. In the same way financial markets have become increasingly significant in emerging markets due to rapid transformation of emerging financial markets' strategy and organization, and the role emerging stock markets play as intermediary between stockholders and investors. It is not surprising that there exists a continuum of empirical literature exploring the nexus between economic growth and financial market progress in both emerging and advanced economies. This is because financial markets such as the stock markets are an essential feature of the economy, especially developing economies. Stock market performance is a yardstick for economic growth and development for every emerging market since it is a source of income for firms and individuals. These inflammable factors coupled with the rapid pace of development and change triggered the current overwhelming interest in understanding how macroeconomic variables affect stock returns by policy makers, investors, market agents, business press and academic researchers (Frimpong and Abayie, 2006). The dynamic interactions among macro factors including economic policy uncertainty, oil prices, industrial production, exchange rate, interest rate among others, can explain the behavior of stock returns (Yang et al., 2018). Accordingly, interests in understanding the impact of macroeconomic variables on the financial markets do not seize to escalate, especially in emerging economies whose financial markets are characterized by fragility.

As mentioned earlier, stock market-macroeconomic determinant relationships became an area of research in the 70s for developed economies and in the 80s for developing countries. The pioneers in this arena of research based on the asset pricing model and arbitrage pricing theory mainly focused on stock markets determinants such as liquidity, book-to-market ratio, market beta, and market size (Nelson, 1976; Shiller, 1980; Chen, 1991; Haugen and Baker, 1996; Datar, Naik and Radcliffe, 1998; Cauchie, Hoesli and Isakov, 2004). Apparently, Grossman and Shiller (1980) by including interest rate for the first time as a discount factor noticed that stock returns movement can better be justified by the movement of the real interest rate. Recently, the impact of economic variables such as industrial production, consumer price index, foreign direct investment, money supply, interest rate, oil prices, exchange rate, policy uncertainty, etc. are widely explored in the previous literature (Adam and Tweneboah, 2008; Kuwornu and Owusu–Nantwi, 2011; Issahaku, Ustarz and Domanban., 2013; Tiryaki, Erdogan and Ceylan, 2017; Kwofie and Ansah, 2018; Camilleri, Scicluna and Bai, 2019; Demir, 2019; Thorbecke, 2019; Bahmaani-Oskooee and Saha, 2019a). Apparently, these authors found fundamental relationship between stock returns and the macroeconomic determinants by assuming linear econometric models. Other studies investigated stock returns—macroeconomic variables asymmetric link, especially after Shin, Yu and Greenwood-Nimmo (2014) invented the Non-Linear Autoregressive Distributed Lag Model (NARDL) technique (see for example, Tiryaki, Erdogan and Ceylan, 2019; Kaya and Soybilgen, 2019; Anjum, Ghumro and Husain, 2017; Cuestas and Tang, 2017; Lee and Ryu, 2018; and Bahmaani-Oskooee and Saha, 2019b). They otherwise argued the effects macroeconomic variables on stock indices performance could be asymmetrical using data from different countries covering different time ranges. Though some of them found the evidence that macroeconomics variables such as interest rate, industrial production, exchange rate, money supply, to mention few, have asymmetric correlations with stock indices performance, some could not find asymmetrical relationship between stock returns and its determinants.

The empirical relations among stock market efficiency[1] and macroeconomic variables have been investigated numerously, however, there are contrasts and controversies in the findings presented by authors in this area of research. For example, contradictory evidence has been reported in extant literature regarding the impact of oil price changes on stock market efficiencies. Moreover, the news-based economic policy uncertainty (EPU) index (Baker, Bloom and Davis, 2016) and geopolitical risk (GPR) index (Caldara and Iacoviello, 2016) are the recently identified financial markets risk

[1] Stock market (indices) efficiency, stock market performance and stock returns or stock market returns are used alternatively used through research.

factors which have grabbed the real attention of researchers as well as the policy authorities and investors. Exploring the impact of these risk factors on stock indices performance have flourished since they were identified as such, especially for emerging countries. Owing to the relevancy of these variables in predicting stock market performance, evaluating the influence of these variables on emerging stock returns would be of great important. The industrial production and the interest rate are some of the well-studied macroeconomic determinants of stock market returns, to control for their effects, they are included in the study. The study invented a different approach towards the exploration of the relations among the macroeconomic variables and equity returns for transitory and emerging economies. The study differs from the previous studies in the sense that not just that the countries under study are categorized as oil-exporter and oil-importer, but also a different category of macroeconomic indicators[2] are investigated for different category of oil-exporter (Mexico, Russia, Brazil) and oil-importer (Chile, Turkey, Korea, and Greece) emerging markets, in an Autoregressive Distributed Lag (ARDL) perspective. This research therefore presents a contribution to the empirical literature by assessing whether oil-exporter and oil-importer emerging stock markets respond to oil price changes in the same manner. Also, the study compares the effects of the EPU and the GPR on stock returns in the selected advancing countries.

1.2. Problem Statement

The tendency of macroeconomic variables including industrial production, interest rate, global oil prices, the EPU and the GPR to affect the efficiency of financial market components such as the stock indices in an emerging economy has made a great concern to the policy authority, entrepreneurs, investors, and central bank officials, and it continues to be a contemporaneous issue in academic literature. Even though there exist continuum body of studies evaluating the impacts of these macroeconomic variables on stock returns in both developed and developing markets however, the need to conduct more research in this area does not seize to arise due to certain reasons which include: Firstly, financial markets do not seize to be “a cannot be” unit of the economic system, thus the financial markets are benchmark for economic growth and development. Secondly, econometric

[2] Macroeconomic variables and macroeconomic indicators are used alternatively throughout the research.

techniques are not free flaws, and there are controversies in the previous findings, hence investigating stock market—macroeconomic determinants nexus using different econometric techniques is crucial and would be of great contribution to the academic literature. Finally, scholars do not stop to analyze factors that drive financial markets, in doing so leads to the emergence of new financial markets determinants. For instance, Caldara and Iacoviello, (2018) constructed the geopolitical risk index; and Baker et al. (2016) constructed news-based economic policy uncertainty, whose impacts on stock returns have been investigated by few researchers yet, where these "newly-identified" risk factors have been found to possess an important effects on stock market efficiencies.

1.3. Purpose of the Study

Particularly, this impulse of research started to flourish in emerging markets in the last few decades. Researchers used different econometric methodologies with different time ranges to explore the relations between stock market returns and macroeconomic variables. While some of the studies assumed linear models in evaluating the impacts of macroeconomic variables on stock indices performance, other researchers assumed nonlinear approaches. For example, researchers analyzed the correlation between stock returns and macroeconomic variables such as industrial production, interest rate, policy uncertainty, oil prices, the EPU, the GPR and so on, by applying various linear econometric techniques. In most cases authors report significant economic correlations between stock indices performance and macroeconomic factors in the considered countries (Adam and Tweneboah, 2008; Kuwornu and Owusu – Nantwi, 2011; Issahaku et al., 2013; Tiryaki et al., 2017; Kwofie and Ansah., 2018; Camilleri et al., 2019; Demir, 2019; Thorbecke, 2019; Bahmaani-Oskooee and Saha, 2019a among others). On the contrary, other studies adopted nonlinear models in establishing stock returns—economic variables relationship (Tiryaki et al., 2019; Kaya and Soybilgen, 2019; Lee and Ryu, 2018; Khan, Teng and Khan, 2019; Dhaoui, Goutte and Guesmi, 2018; Bahmaani-Oskooee and Saha, 2019b; Wei et al. 2019; among others). For instance, Tiryaki et al., (2019) discover asymmetric correlation of some chosen macroeconomic factors on stock indices performance in Turkey. In addition, Khan et al., (2019) report that a positive innovation on oil prices impacts negatively on the Shanghai stock indices performance while a negative innovation on oil prices has positive impact on the stock market. Finally, Bahmaani-Oskooee and Saha (2019b) introduced a nonlinear adjustment of policy uncertainty to their multivariate model and they found that not only policy uncertainty has the short-run and long-run impacts on stock returns, but also the short-run and long-run impacts are asymmetric in most of the countries in their studies. Even though Lee and Ryu (2018) argued that nonlinear model is appropriate for analyzing the linkages between stock indices performance and macroeconomic variables some of the researchers who employed nonlinear econometric techniques could not report meaningful asymmetric association between stock indices and macroeconomic indicators, including Hu et al. (2018). The existing literature reports contrasting evidence on the associations of some of the selected macroeconomic variables (global oil price changes) with stock indices efficiency. Due to the discrepancies in the evidence documented by previous studies, this study is designed to contribute into the symmetry economic literature by making comparative analysis on the relationship between stock returns and the selected macroeconomic variables (industrial production, global oil price, interest rate, economic policy uncertainty, and geopolitical risk) using sample data from oil-exporter and oil-importer emerging countries, with the ARDL methodology. Even though there are previous studies exploring the impact of macroeconomic indicators on stock market indices in emerging economies, none of them used the selected macroeconomic variables in this research for the selected developing markets. The study emulates Bahmaani-Oskooee and Saha (2019a) in terms of methodology, however, it differs in a manner that global oil price changes, and the geopolitical risk are incorporated into the model to see if they are significant risk factors of advancing stock markets.

1.4. Significance of the Study

- Knowing the relationship between emerging stock returns and the selected macroeconomics variables would enable governments of emerging countries to strategize about how and when to tap into the financial markets to collect the much-needed capital required to finance growth initiatives. Knowledge acquired from this research would aim to render investment strategies and as a guide for investors.
- Establishing the relationship between the selected variables and emerging stock returns would improve defined stock returns predictability performance in the

selected emerging economies-thus allowing investors to formulate better investment plans decisions.

- Knowledge on the impact each of the considered macroeconomic indicators has on emerging stock returns would help government agencies and private investors to make efficient, strategic, and sustainable growth choices-helps stockholders to make optimal returns on their investment portfolios. This also enables regulatory agencies to formulate recommendations and make informed decisions to maintain and establish a seamless stock market investing and trading environment based on reliable and time-tested basis in emerging countries.

1.5. Research Objectives

The purpose of this work is to analyze the empirical relationship between stock indices development macroeconomy indicators such as changes in aggregate demand (proxied by industrial production), changes in the monetary policy rate[3] (interest rate), oil price changes (Brent global oil prices), economic policy uncertainty (EPU), and events related to wars, terrorist attacks, domestic political tensions etc. (geopolitical risk). The objectives of the study are organized as general and specific.

1.5.1. General objective

The main objective of the study is to investigate and make a comparative analysis of effects of the selected macroeconomic variables on the stock market returns in two groups of emerging countries: oil-exporter, and oil-importer by employing the ARDL methodology developed by Pesaran, Shin and Smith (2001).

1.5.2. Specific objectives

1. The study aims to cast light on the linkages between oil price changes and oil-exporter and oil-importer emerging market stock markets.
2. The study investigates the impact of monetary policy changes on the selected emerging stock markets by using Pesaran et al. (2001) ARDL approach.
3. The research assesses the effects of policy uncertainty variations on stock returns in the selected emerging economies by using the ARDL approach.

[3] Monetary policy rate and interest rate are used interchangeable through the research.

4. The study also aims to explore the linkage between emerging stock returns and changes of geopolitical uncertainty in the ARDL perspective.

1.6. Research Variables and Countries

The research uses the ARDL framework to explore the associations of the pre-stated macroeconomic variables with stock indices in oil-exporter and importer emerging markets. The oil-exporter emerging markets are Brazil, Russia, and Mexico. Whereas the oil-importer countries are Chile, Turkey, South Korea, and Greece. Sample countries were determined based on the accessibility of data series on monthly frequencies for all the research variables. The study follows the previous literature and considers their relevance to the emerging stock indices and selected the following variables for the analysis.

- Stock returns (SR)
- Industrial production (IPI)
- Interest rate (INTR)
- Brent Oil prices (OILPB)
- Economic policy uncertainty (EPU)
- Geopolitical risk (GPR)

where stock prices are the variables on the left-hand side of the regression function and the rest of the variables are the explanatory variables. Stock markets are important part of every developing country's financial market. The study uses monthly stock prices of each of the countries under investigation. Growth in aggregate economic activity is accounted for, by the growth in industrial production. Economic theory postulates positive linkage between stock indices performance and growth of industrial production—an indicator for output growth. The IPI impact on the stock returns cannot be undermined, hence it is included in the model to control for its effects. The effects of interest rate are controlled for by including it to bring to light the influence of monetary policy rate changes on stock returns in the selected emerging markets. Since oil is an important input of production and controversies in the extant literature, changes in its price therefore could have influence on the movement of stock prices especially in developing countries. The EPU variable is a major risk factor for investors in both advanced and emerging countries, however, its impacts on stock market development and other macro divisions of the economy are intense in the developing economies, because emerging economies are more vulnerable and fragile. Finally, investigating the linkage between changes in the GPR index and emerging equity prices received enormous attention in the contemporary literature. The study therefore adopts the idea from the literature and applies it to different groups of emerging markets as a contribution to the literature. These macroeconomic variables have been chosen considering their impacts and the role they play in predicting stock returns, as it is a concern to decision makers, especially in developing countries. Hence, revealing the impacts these macroeconomic variables on emerging stock indices performance are crucial and beneficial to decision makers.

1.7. Assumptions of the Research

The underlying fundamental assumption of this research is that changes in industrial production, global oil price changes, monetary policy rate changes, variations in the EPU index, and changes in the geopolitical risk index, one way or another influence stock indices efficiencies regarding the 2002:01 to 2019:12 time frame, in the selected emerging economies. The research assumes the chosen macroeconomic indicators to have either favorable or detrimental effects on the efficiency of stock indices in the selected advancing economies.

1.8. Limitations of the Research

The research admits that there might be other endogenous and exogenous different factors that could influence the efficiency of stock indices in emerging economies, but due to time constraints and other circumstances out of hand, only changes in industrial production, global oil price changes, monetary policy rate changes, changes in the EPU index, and geopolitical risk index changes will be considered in the analysis, for the above mentioned advancing countries. Hence, the research is limited to specific macroeconomic indicators and specific advancing economies.

1.9. Organization of the Research

The remainder of the study is organized as follows. Chapter two presents detailed review of extant literature on stock returns and its determinant and theoretical background of the research. Chapter three explains data sources and description as well as the methodological approach of the study. In chapter four the research findings are reported and discussed. The summary of the study findings, conclusion and recommendations are presented in chapter five.

CHAPTER TWO

2. RELATED STUDIES AND THEORETICAL BACKGROUND

The interest in understanding the relationship between stock returns and macroeconomic variables started to flourish during the late 1970s. The study considers few of the earlier studies before the 2000s and later more focus is placed on studies conducted after the 2000s up to date. In general perspective, studies on the relationship between stock indices performance and macroeconomic determinants are considered. For the purpose of the study, a thorough variable-specific review of the literature is conducted. The literature review is organized as follows.

2.1. Stock Returns and Macroeconomic Variables

A study conducted by Nelson (1976) to assess the impact of inflation rate and monthly stock returns in the USA after World War II (1953-1974) revealed a negative correlation of both predictable and unpredictable inflation rate with stock indices performance. Similarly, Grossman and Shiller (1980) assess whether discount factors related information causes variability of stock prices using data from 1890 – 1979. The study shows stock price movements can be better justified in terms of real interest rate movements. Thus, real interest rate movements can be inferred from the marginal rate of substitution shown by consumption data. Also, Chen (1991) find by using U.S. data that stock market returns are projected based on some interpreted macroeconomic factors such as dividends price ratio, 30-day treasury bill, spread of default and growth rate in industrial production. In addition, Haugen, and Baker (1996) evaluate the effects of risk related factors such as price level, growth potential, liquidity, and the technical history of stock returns, on stock indices returns. They show the risk related factors are surprisingly accurate in predicting future relative returns on stocks using expected return factor models. They also note that the major determinant of expected returns on stocks is remarkably common to the world's largest equity market. Furthermore, Datar et al. (1998) assess the effects of liquidity on variation of stock returns after controlling for book- market- ratio, firm beta, firm size, and the January effect. The evidence identified volatility as a significant factor in explaining stock indices cross-sectional volatility after the well-known stock market determinants are being controlled for, and that there is pass through of the January effect throughout the year.

A detailed analysis by Laopodis (2013) explores the complex linkages between monetary policy and the stock market during Burns, Volcker, and Greenspan's three different currency regimes since the 1970s. The results show a disparity between the performance of the federal fund rate and the stock market reaction. Significant asymmetrical impacts of monetary policy on the stock market have often been noted across rising monetary regimes. However, there was no strong competitive partnership between monetary policy and the equity markets and in each of the three monetary regimes. Likewise, in selected four European countries, Camilleri et al. (2019) evaluate the correlation between stock returns and inflation, industrial development, and money supply. The results indicate a contemporary and lead-lag relationship between stock prices and the macro - economic variables, while differences have occurred across countries. Also, the study confirms no important correlation between the interest rate and stock indices, but the interaction between interest rates and money supply was a leading indicator of stock prices in three of the sampled countries. Suhaibu, Harvey and Amidu (2017) scrutinize the effect of monetary policy on stock indexes in 12 African countries. They find that monetary policy is having a positive impact on the stock markets in the 12 countries at the same time via the interest rate channel. They used the functions of the impulse responses to determine that money supply and real interest rates decline respectively in response to positive and negative stock market shocks, while inflation reacts positively to a negative stock market shock. Suhaibu et al. (2017) notice interest rate has greater impact on stock prices than money supply, thus, there is a bidirectional correlation between monetary policy and the returns on the stock market. Moreover, Abbas et al. (2019) analyze stock price volatility and rate of return, and macroeconomic factors such as industrial growth, money supply, interest rates, inflation, oil prices and exchange rates. The empirical results reveal strong correlations between the G-7 stock market returns and volatility, and the considered collection of underlying macroeconomic variables including industrial output, money supply, interest rates, inflation, oil prices, and exchange rate. Additionally, Yang et al. (2018) evaluate the impact of macroeconomic shocks on Korean stock returns. The results indicate supply shocks negative effects on stock returns while demand shocks impact positively on the Korean stock returns. Thus, demand shocks have more effect on stock returns than the supply shocks. Kao, Shuang, and Ku (2018) explores the non-linear correlation between the S&P 500 VIX Futures index in both return-volume and volatility-volume relations. The findings show that in both the contemporary and a lead-lag relation between volume and volatility rate return, the threshold effects occur. From trading volume to returns and return volatility, the delayed impact of one-trading-day lag through to three-trading-day-lag exists.

A study done by Adjasi, Harvey and Agyapong (2008) regressed stock-market returns on exchange-rate, consumer price index, money supply, treasury bill prices, inflation rate and trade deficit. The analysis finds a persistence of uncertainty in the nebula of macroeconomic variables; current period rates influence future forecast rates. A positive relation has also been reported between inflation and volatility on the stock market. The analysis finds a negative association between stock returns exchange rate volatility and trade deficit. Gyamfi (2018) analyze return predictability of two different indices in the Ghanaian stock market. The results indicate that in all three tests the GSEALSH[4] index was more highly predictable than the GSE FSI index. Cauchie et al. (2004) obtained results from their study showing statistical factors yield a better representation of the determinants of stock returns than macroeconomic variables. According to their findings stock returns are influenced by both global and local economic conditions. In addition, Hung, Azad, and Fang (2014) discuss the intertemporal pricing efficiency of stock return determinants over and beyond financial crises. They investigate the effects variables on stocks of size, book – to – market ratio, momentum, liquidity and higher – order systemic co-shift. The findings indicate that the market beta plays a significant role in evaluating the cross section of stock returns during the non-crisis periods. Size, value, momentum, and liquidity are also correlated with the cross-stock return component. However, the study notes that most of the variables analyzed lose their explanatory power during crisis times, indicating that their utility for investment purposes is reduced when financial markets encounter episodes of crises.

[4] GSEALSH represents all share index of the Ghanaian stock market, whilst GSE FSI represents the financial index of the Ghanaian stock exchange market.

Adam and Tweneboah (2008) innovate a study on the impact of macroeconomic variables on stock price movement in Ghana. The analysis analyzes long-term and short-term complex relationships between stock index and macro factors, including foreign direct investment, treasury note rate, consumer price index and the exchange rate. The finding suggests that exchange rate and inflation have an impact on short-term share prices while interest rate and inflation have a significant effect on long-term share market indices. John (2018) attempts to explain the effects of money supply, interest rate, inflation, and exchange rate on stock returns. The results show money supply has positive effects on stock returns while inflation has no statistically significant effect on performance of the stock markets; interest rates has negative effects on performance of stock market. The study also reported unidirectional causality ranging from money supply and exchange rates to stock market performance. Ndlovu et al. (2018) examine the impact on stock returns of factors such as money supply, inflation, interest rate and exchange rate. The analysis shows that interest rates, money supply and inflation have a positive long-run relation to stock indices. The research findings also indicate exchange rate has an inverse long-run impact on equity prices. Kurwornu and Victor (2011) have established a significant relationship between stock market returns and some macroeconomic factors. The findings show that the treasury bill, inflation rate, and the exchange rate seem to have an impact on the returns of stock market. The findings also show that the consumer price index has a favorable substantial effect on stock returns, and exchange rate and the treasury bills have significant negative effects on stock market returns. The findings further show that the price of crude oil has no significant effect on the share indices performance in Ghanaian market. In their research report, Musah, Acquah and Adjei (2019), as measures of success of Ghanaian stock indices, analyze the characteristics of bank scale, monetary economic growth, money supply, and external debt. The findings show that Ghana's corporate bond market is growing considerably by its scale, money supply, external debt, and economic growth. The findings also show the extent of economic growth and budget deficiency are major predictors of government bonds market size in Ghana. Issahaku et al. (2013) conducted a study on the impacts of inflation, money supply, interest rate and foreign direct investment on stock returns for Ghana. The results document stocks return and economic indicators such as inflation, money supply and foreign direct investment interact significantly over the long term. The findings also show the fundamental impact of interest rate, inflation, and money supply on stock prices in Ghana. Zare and Azali (2015) aims to examine the interaction of monetary policy, aggregate consumption, and stock market prices for Malaysia. The research results endorse the cointegration of the monetary policy (interest rate) and share price relationships. In addition, asymmetrical correlation between aggregate consumption and property price indices with monetary policy is to speed up the adjustment in asset prices if they fall below long-term values.

Asamoah, Agana and Sakyi (2016) assess the linkage between interest rates and stock indices performance in Ghana by regressing stock market capitalization on , 91 treasury bill rate, 182 treasury bill rate and 1-year treasury bill rate, inflation rate, and exchange rate. The results revealed that stock market capitalization is improved by the long-run interest rate, while the opposite is true for the short-run. The research has also shown that long-term interest rates have greater effect on the capitalization of the stock market than short-term interest rates. However, in the short run, the long-term interest rate has the least impact on the capitalization of the stock market. Similarly, Kwofie and Ansah, (2018) examine the impact of exchange rate and inflation on market return in Ghana with cointegration test. The research shows that inflation only has a huge effect on the stock market in Ghana in the medium to long term. There was also a significant short-run and long-run relationship between exchange rates and stock market returns. Tiryaki et al. (2017) evaluate the causal link between selected domestic and foreign macroeconomic variables and monthly data from Turkish stock market. The research findings indicate statistically positive correlation of industrial production index, consumer price index, current account to export ratio, real effective exchange rate, S&P500, and world oil price index with stock returns; and significant negative correlation of interest rate differential with stock returns in Turkey. Furthermore, Demir (2019) in his study reports the connection between stock indices and macro indicators such as relative value of domestic currency, the portfolio investment, FDI, economic growth, interest rate and crude oil prices. He shows economic indicators such as economic growth, the relative value of domestic currency, portfolio investment and FDI have favorable effects on the stock market index while interest rates and crude oil prices have detrimental effects on stock market performance.

A group of studies also attempted, from an asymmetric perspective, to investigate the association between stock returns and macroeconomic variables. Some of these studies include Tiryaki et al. (2019) who examine the asymmetric correlation of real industrial exchange rate, industrial production, and on-reserve money supply with monthly data sampled from Turkey. The findings suggest a non-linear correlation of industrial output, money supply and real exchange rate on the performance of stock indices, but the non-linearities are greater after the 2002 subsample compared to the overall sample period. Similarly, Kaya and Soybilgen (2019) examine the asymmetrical associations of the exchange rate, production, and the interest rate on Turkish stock index performance using monthly data in Turkey. The research findings indicate that exchange rate, industrial production, and interest rate have non-linear correlations on the prices of Turkish stocks. Also, Cheah, Yiew and Fatt Ng (2017) evaluate the non-linear nexus between Malaysian stock returns and macroeconomic indicators including money supply, inflation exchange rate, and production. The study findings report cointegration associations between the studied variables; and thus, exchange rate correlates with stock returns asymmetrically in both the short-term and the long-term. Anjum et al. (2017) explore the linearity and non-linearity of exchange rate correlations with stock returns using sampled data from Germany. They conclude the correlation of exchange rate with stock returns in Germany is non-linear and thus, the correlations are associated with only devaluations. Cuestas and Tang (2017) scrutinize the non-linear impacts of exchange rate on monthly Chinese stocks and they provide evidence showing a quick non-linear associations of exchange rate in the cross-industry Chinese monthly stocks as results of discrepancies in the trade balance and industry ownership type. In the same way, Lee, and Ryu (2018) examine the non-linear effects of macroeconomic shocks such as changes in the real interest rate, price levels and the real exchange rate on stock returns for Korea. They argue that non-linear models are appropriate for studying stock returns-macro determinants nexus since they were able to document significant results for the studied variables with only the non-linear model. Finally, Bahmaani-Oskooee and Saha (2019b) introduce a nonlinear adjustment of policy uncertainty to their multivariate model and they found that not only policy uncertainty has short-run and long-run impacts on stock returns, but also the short- and long-term impacts are asymmetric in most of the countries in their study.

2.2. Stock Returns and Industrial Production

Several studies use various economic indicators to investigate the relationship between stock returns and production growth. Industrial production index is the most widely used indicator to represent production growth. The measure of industrial output defines the level of production within an overall economy. Industrial production growth has directly proportional linkage with the real aggregate economic activity as well as stock market efficiency. The direct positive correlation between stock market performance and real aggregate activity is evidenced (Fama, 1981; Lee, 1992). Chen, Roll and Ross (1986) demonstrate that the rate of growth in industrial output is one of the macroeconomic factors on which prediction of stock returns is dependent. Tiryaki et al. (2017) report positive linkage between IPI and stock indices efficiency in Turkey. Similarly, Camilleri et al. (2019) find positive bidirectional causal correlation between stock returns efficiency and output development using data from European countries. A research done by Musah et al. (2019) gives an evidence showing economic development and budget deficit have significant favorable effects on the bond market efficiency in Ghana. Also, Demir (2019) uses the ARDL model to demonstrate that economic growth in Turkey has positive association with stock market indices efficiency. In addition, Abbas et al. (2019) find in their research work that there are strong interactions between stock market returns and volatility and industrial production. In contradiction with the pre-mentioned evidence, a group of other studies look at the relations between growth in aggregate economic production and stock index efficiency in a disparate perspective by adopting non-linear models. For instance, Tiryaki et al. (2019) find that growth in aggregate production has an asymmetric impact on the Turkish stock returns. Thus, positive changes in IPI have favorable increasing effects on the stock index efficiency and negative changes adversely impact stock returns. Kaya and Soybilgen (2019) similarly report the same results about the non-linear association of increased aggregate production on the efficiency of Turkish stock market.

2.3. Stock Returns and Interest Rate

The most widely used monetary policy tool by policy decision makers is the interest rate. Stock prices are affected by monetary policies both in advanced and emerging countries. Monetary policy decisions of central banks shape economic agents' decisions about expectations of interest rate and inflation in an economy because of this, interest rates are included in almost each study that attempts to identify the association between stock returns and macroeconomic factors. Interest rates will influence equity prices through two channels according to Lobo (2000). Firstly, by influencing the rate at which the company's cash flows must be capitalized, and secondly by changing potential cash flow expectations. In the empirical literature the relationship between interest rate and share prices is widespread. According to Gjerde and Sattem (1999), as opposed to other macroeconomic variables, the relation between interest rate and stock return is less clear. A research done by Sadorsky (1999) found that the interest rate has a substantial and statistically important effect on stock returns.

Kaya and Soybilgen (2019) show that economic factors such as the interest rate have asymmetric association with the Turkish stock market performance. Demir (2019) evaluates the relations between stock index efficiency and indicators of macroeconomy in Turkey. He reports negative statistically significant relations between the interest rate and stock index efficiency. Asamoah et al. (2016) use three separate Treasury Bills maturity periods (91 days, 182 days, and 1 year) in Ghana to analyze the effect of interest rates on the capitalization of Ghana's financial markets. They find in the long run the long-term interest rate has greater effect on the capitalization of the stock market than the short-term interest rate, in the short run however, the effects of the short-term interest rate on market capitalization are greater. Alam and Uddin (2009) assess the relations interest rate with stock returns in both advanced and emerging countries by using panel approach. The study indicates in all the sampled countries, interest rates are found to impact share prices negatively and statistically significant. Thus, for six of the examined countries (Malaysia, Japan, Bangladesh, South Africa, Italy, and Colombia), a significant negative correlation between changes in the policy rate and changes in share prices was also recorded. Ahmed, Rehman, and Raoof (2010) have used multiple regression methods to examine the correlation of the interest rate with stock indices performance in Pakistan. Their study reveals the interest rate has negative significant correlation with share prices. Hamrita and Trifi (2011) explore the relations among interest rate, the rate of exchange and stock index. The study shows the correlation between the interest rate and the stock index differs significantly from zero only in the largest scale, that is 4-5, which lead to longer horizons. The research provides the evidence that interest rate returns are leading returns on the stock market. Kurwornu and Victor (2011) examine the stock returns-interest rate nexus, together with other macroeconomic variables. They discover that the treasury bills negative significant association of interest rate on the returns of equity markets. Similarly, in the case of Nigeria, John (2018) finds that the interest rate has negative association with stock indices performance. The connection between stock returns and interest rates in industrialized and developing countries is studied by Assefa, Esqueda and Mollick (2017). They provide proof that interest rates are a significant determinant of stock returns in industrialized markets whereas the foreign equity index is the main determinant of stock returns in emerging economies.

Contrary, in 12 African nations, Suhaibu et al. (2017) scrutinize the impact of monetary policy on asset returns. The research reveals monetary policy has a contemporary impact on asset returns across the interest rate system for all the countries studied. Therefore, the interest rate corresponds favorably to the share prices of the 12 countries. In the attempt to evaluate the correlation between macroeconomic variables and stock indices in South Africa, Ndlovu et al. (2018) noticed that the interest rate is positively correlated with stock index performance. Like Ndlovu et al. (2018) and Suhaibu et al. (2017), Adam and Tweneboah (2008) in the case of Ghana find also positive causal correlation effect rate of interest and stock index performance, but they mention that interest rate explains little of the changes of stock prices in the sample. Using data from the Chinese stock index market, Hu et al. (2018) assess the impact of fiscal and monetary policy on stock markets performance. They report that fiscal policy has great and negative contemporaneous connections with progress of the stock index efficiency, while the effect of monetary policy on stock market success differs based on public policy. Chinese monetary and fiscal policy has an important and immediate beneficial impact on stock market movement regarding the lagged variables. Meanwhile the connection between the two policy strategies plays an essential role in understanding the stock market index growth. Conversely, Lee (1992) could not report any significant connection of interest rate with stock indices. Similarly, Camilleri et al. (2019) fail to document any significant causal linkage between the interest rate and stock indices when the researchers investigated the links between economic variables in four countries in the Euro area. The study however mentions that the interactions between aggregate money supply and interest rate is a leading predictor stock indices performance in three of the sampled countries. Laopodis (2013) in the USA explores the linkage between stock returns and monetary policy under three different monetary regimes. A disconnection between federal fund rate and stock returns was reported. However, monetary policy is proved to have asymmetric association with the stock market throughout each monetary regime. Nevertheless, no clear dynamic relationship was reported between monetary policy and stock indices efficiency.

As it can be seen from the previous literature, the relations between interest rate and stock returns is not certain. Authors find contrasting results regarding the nexus between interest rate and stock indices efficiency. In the nutshell, Demir (2019), Asamoah et al. (2016), Alam and Uddin (2009), Hamrita and Trifi (2011), Kurwornu and Victor (2011) etc. find negative association of interest rate with stock prices. On the other hand, Ndlovu et al. (2018), Suhaibu et al. (2017), Adam and Tweneboah (2008) and Hu et al. (2018), report positive correlations between interest rate and stock indices. Conversely, researchers such as Lee (1992), Camilleri et al. (2019) and Laopodis (2013) could not find any meaningful connections of the rate of interest with stock markets efficiency. This could be because of differing monetary policy stance of every country.

2.4. Stock Returns and Global Oil Prices

Theoretically, oil prices influence equity indices by five channels, asset valuation channel, uncertainty channel, fiscal channel, monetary channel, and system of production (Degiannakis, Filis and Arora, 2018). Lately, several statistical findings have been provided to support the theoretical process of transmission of oil price movements to the market returns. Among others, the following are the contemporary literature on the relations between oil price movements and stock market returns. Sadorsky (1999) studied the interaction between oil prices, interest rates, and returns on stocks. A significant negative influence of oil price shock on market return of stocks was reported. More recent literature involves Hu et al. (2018) reporting that Chinese financial sector is greatly influenced by both short-run and long-run demand-side oil price shock, but the supply-side oil price shock is an exemption. Kang and Ratti (2013) are also evaluate the impact of oil price spike, the EPU and stock returns with the U.S. data. The study indicates the adverse impacts of policy instability on the U.S. equity markets may be exacerbated by a strong demand-specific shock from the oil sector. Dhaoui et al. (2018) also evaluate the impact of oil price fluctuations, short-term interest rates and actual industrial output growth on stock yields in petroleum-exporter and petroleum-importer countries. The study findings indicate actual industrial output growth, short-term interest rate and oil price fluctuations in the long run have non-linear consequences on asset markets returns in Poland, the U.S.A. and Austria. In Japan and Korea, short-term interest rates and oil price fluctuations have non-linear influence on stock rates of return; in Germany, actual economic production growth has asymmetric consequences on stock rate of returns.

Degiannakis, Filis, and Floros (2013) examine the linkages between oil price volatility and returns of industrial market indices in 10 European countries. They note that the supply-side oil shock contributes to weak to modest correlations; precautionary demand-side oil price shocks almost lead to nil correlation and the overall oil price shocks trigger major positive or negative shifts in the correlation rates. Filis (2010) uses monthly data to assess the connection between cyclical behavior of macroeconomic variables for Greece. The results indicate an adverse impact of oil prices on stock returns in Greece. Dhaoui and Saidi (2015) discuss the interaction across the oil prices and stock prices in specified OECD countries. The find that both the supply-side oil price shock and the demand-side oil price shock have an influence on stock earnings in the aggregate oil importing OECD countries, the effect in the oil exporting economic systems is encouraging and positive. Basher et al. (2017) investigate the effects of oil shocks on stock markets in oil-exporting nations. They recognize that shocks in flow of oil demand have a statistically important positive influence on stock returns in oil producing countries. Thorbecke (2019) describes the conjunction of U.S. oil market prices and stock returns before and after the Shale revolution. The study notes that, before Shale 's boom, oil shocks were caused by both supply and demand side influences, while they had a detrimental effect on the stock market, but the effect was marginal. Thus, the influence of oil shocks since the Shale revolution had positive results but only demand-driven shocks is statistically relevant.

Also, Kwon (2019) discusses the connection between the U.S. policy risk on developing markets' asset returns. The research suggests that shocks in the precautionary demand for oil and the U.S. policy uncertainty have a substantial adverse influence on the efficiency of emerging stocks and therefore, aggregate demand shock leads to a sustained increase in share prices. More so, Wen, Bouri and Cheng (2019) address the global oil-stock market reliance in a broad variety of chosen advancing economies. The results reinforce the generally positive connection within the crude oil and the emerging global stock market relations. The statistical findings suggest that oil return variability, country-specific adjustments and the U.S. economic policy instability have favorable influences on oil-stock reliance. El-Chaarani (2019) scrutinizes the effect of oil price volatility on stock market indices in six countries of the Gulf Cooperation Council (GCC). The findings confirm many asymmetrically causal links of oil prices (positive/negative) with stock market returns in certain GCC countries. Negative oil price fluctuations have a substantial influence on equity market returns than overly positive oil price fluctuations for some countries. The research findings further suggest that the presence of global uncertainty renders financial markets more vulnerable to adverse changes in oil prices. Tchatoka, Masson and Parry (2019) explore the link between oil price shocks and stock returns in oil exporter and importer countries by conducting baseline and extended period estimation. A large negative oil price shock can raise stock returns for China, Japan and India in the baseline period as reported by Tchatoka et al. (2019). They further report stocks doing well when there is a major positive oil price shock in both oil-exporting countries and moderately oil-user countries, and for China and India too, in the extended period. Siddiqui et al. (2019) assess the connections of oil prices with returns performance of stock exchange in Gulf Cooperation Countries (GCC) and global oil importers during the 2014-16 oil price crash. The researchers notice adverse oil market price adjustments have greater influence on equity returns in oil exporting countries than they did in the pre-slump period, whereas positive oil price adjustments have a greater impact on oil importers. Siddiqui et al. (2019) also noticed a shift in inter-temporary symmetry and an improvement in the pace of equity prices adaptation during a recession, both for importers and exporters of petroleum in GCC countries. Moreover, Khan et al. (2019) carried out a work on the no-linear consequences of oil price spike on the stock market in Shanghai. The results confirm that while positive oil shocks have damaging consequences on stock indices performance, negative shocks appear to have favorable consequences on Shanghai stock market efficiency, both in the short run and in the long run.

2.5. Stock Returns and Economic Policy Uncertainty

Economic policy uncertainties can be described as ambiguity in economic policymakers' decisions affecting economic agents' decisions, such as demand, expenditure, investments, borrowing etc. (Wu, Liu, and Hsueh, 2016). Bittlingmayer (1998) notes, though the causal link between volatility and output declines may be uncertain, thus slumps may cause volatility and volatility may cause slumps, or both could be the result from some other more obvious exogenous variables, and such variables could be economic policy uncertainty. That is, slumps and volatilities in output and turbulences in equity prices could be storming from uncertainties in economic policy. The study reviewed empirical literature explaining the relationship between policy uncertainty and stock market efficiency. For instance, Brogaard and Detzel (2015) evaluate the impact of economic policy instability on the US share prices. They consider that a unit change in standard deviation from the EPU volatility contributes to an improvement in the expected three-month irregular return on equity by %1.5. They also note that alterations in the EPU contribute to a large negative portfolios risk premium. In addition, Gulen and Ion (2016) investigate the relationship between corporate investment and the EPU—a news-based policy uncertainty index by separating between investment uncertainties at firm level and concern about the overall level of uncertainty associated with potential policy and regulatory reforms. They report that policy risk depresses corporate future investment in a nonuniform way in the cross-section, such that firms with higher investment irreversibility being significantly stronger than companies which rely more on public expenditure. Political turmoil thereby depresses capital investment due to delays owing to irreversibility of the investment projects. In addition, Kang and Ratti (2013) and Kang and Ratti (2015) demonstrate the influence of the EPU on stocks yields is affected by oil price changes. Positive oil demand shocks therefore intensify policy instability, culminating the detrimental impact of policy risk on stock returns. Also, Wu et al. (2016) investigate the relation between stock indices performance and uncertainty in policy makers' decisions by using bootstraps panel granger causality in nine OECD countries. They show that not all in the sampled countries that policy uncertainty affects stock returns, policy announcement does not always lead to stock returns volatilities. Li, Balcilar, Gupta, and Chang (2016) addresses the linkage of Chinese stock and Indian stocks with policy instability. The researchers just only confirm poor yet bidirectional causality between policy instability and share prices in several sub-periods analysis, yet not over the overall studied span. Antonakakis, Chatziantoniou and Filis (2013) look at the time-varying connection between the US policy instability, asset returns and expected volatility. The findings indicate that weakening capital-market performance is induced by an increase in conditional volatility in the equity sector through elevated policy instability. They also state that elevated policy instability variance has adverse effects on capital market performance and policy instability.

Yang and Jiang (2016) evaluate the link between ambiguity in policy decisions and return on stocks for China. The research findings demonstrate a significant connection between returns on stocks and uncertainty in the economic policy. Arouri et al. (2016) assess the connection between U.S. government uncertainty and stock price. The survey results reveal a strong negative association between the U.S. EPU and share prices. Sum (2013) evaluates the contagion of U.S. economic instability on five Asian countries' stock indices. The findings indicate that stock gains in the five ASEAN states react adversely to adjustment in policy instability - hence the US policy instability has a detrimental effect on the five countries' stock indices. In an attempt to evaluate the association of uncertainty of the economic policy, exchange rate, industrial production growth and money supply with stock indices efficiency for 13 countries, Bahmaani-Oskooee and Saha (2019a) report only short-run consequences of the EPU on stock indices performance for those nations. Hillier and Loncan (2019) look at the effects of political chaos on Brazil's stock market during the sequence of abrupt political turmoil and equity market collapse in 2017. The results reveal that the fear of policy uncertainty shock significantly had consequential affected the financial market in Brazil. Political ties and exposure to international capital are therefore drivers in channeling political risk to asset markets, rising share costs in periods of political uncertainty. For emerging countries, Choi, and Shim (2019) tried to assess the impact of uncertainty spikes (economic policy unrest and financial uncertainty) on economic general activity. The research suggests that shocks from financial instability demonstrate much greater and important effect on economic operation (output) than instability from economic policy for all countries but China. Hoque, Wah and Shah Zaidi (2019) attempt to explain the economic consequences of global economic uncertainty, oil price and geopolitical risk shocks on stock indices performance for Malaysia. They report the global EPU has adverse consequences on overall stock indices performance and are amplified by influences of geopolitical risk increases. Hoque and Zaidi (2019) research the influence of ambiguity of global economic policy on the successful performance of Malaysian financial markets, and the findings reveal negative and asymmetric impact of the global policy unrest on stock indices performance.

2.6. Stock Returns and Geopolitical Risk

Entrepreneurs, market investors and central banks find geopolitical risk (GPR) to be core factors in the determination of investment decisions and volatility of the capital market especially in emerging economies (Caldara and Iacoviello, 2018). This is because high geopolitical threats result in a downturn in economic production, lower stock yields and transfer of capital flows away from developing markets and to developed markets (Caldara and Iacoviello, 2018). They also note that both The Central Bank European (April 2017) and International Monetary Fund (IMF) (October 2017) listed geopolitical risk as one of the important economic outlook threats. In addition, Cheng, and Chiu (2018) find in their empirical analysis that shocks to the GPR have a significant adverse effect on the business cycles for developing economies. Thus, the average share of variation in output explained by shocks to the GPR is between 13% and 22%. With this respect, several researchers make efforts in the evaluation of the relations between the GPR and stock indices performance. For instance, Apergis et al. (2017) study results indicate that the GPR does not do well in stock returns predictability, it does however, predict the return volatility of %50 of the defense companies' stocks. Balcilar et al. (2018) conduct research in BRICS countries to investigate the GPR-BRICS stock market link using nonparametric causality-in-quantile tests. They find evidence that the GPR affects BRICS stock market volatilities but not returns, thus the GPR is a driver of bad volatility in the BRICS stock markets. Similarly, Rawat and Arif (2018) provide evidence supporting Balcilar et al. (2018) that the impact of the GPR on BRICS stocks differ from country to country. Rawat and Arif (2018) notice that the Brazilian and the Russian stock market are found to be more responsive to the GPR shocks than the remaining BRICS markets. Also, Plakandaras, Gogas and Papadimitriou (2018) assess the association of the GPR with financial markets in fourteen advancing markets. They fail to report statistically significant evidence on the relations between the fourteen emerging stock index efficiency and the GPR. Thus, the GPR only has transitory influence on stock indices. Das, Kannadhasan and Bhattacharyya (2019) by using causality-in-quantile test study the U.S. based EPU, GPR and Financial Stress (FS) shocks' links with twenty-eight emerging market stocks. The study observes that EPU, GPR and FS have a more stable effect on mean rather than variance in returns. Thus, these shocks are more affecting the emerging stocks in terms of price risk rather than the risk of variance. Also, using a panel approach, Bouras et al. (2019) explore the link between the GPR and fourteen emerging market stock market returns and volatilities. The study reports that country specific GPR does not influence stock returns in those emerging economies. However, they find that global GPR has greater influence on the fourteen emerging stock returns and volatilities than country specific GPR has, thus illustrating the predominance of global shocks. Similarly, Hoque et al. (2019) explain the empirical association of the Malaysian stock market with the global GPR and certain other economic determinants. The study reports insignificant long-run negative consequences of the global GPR on the Malaysian stock index performance and insignificant positive link between the former and the latter in the short run.

2.7. Theoretical Background

The study adopts the real business cycles theory. The business cycles refer to cyclical patterns of aggregate economic activity occurring at a point in time, which are felt by almost every sector of the economy (Abel, Bernanke and Croushore, pp 306-318, 2014). The process entails general developments that occur in several economic activities at about the same time, followed by similar general recessions, contractions and revivals which converge into the next period's growth stage (Abel et al., pp 306-318, 2014). Economic variables may move alongside with a business cycle, or movements may occur in opposite direction of the cycle for some economic variables, or some economic variables may not respond to ups and downs occurring in the business cycles – theorist describe these three phenomena as pro-cyclic, counter-cyclic and acyclic respectively. For instance, output and employment in many industries have pro-cyclic relations with business cycles during expansion and contraction, but sensitivity may differ from industry to industry. Also, certain economic indicators such as cost, productivity, investment, and public expenditures also have consistent and predictable behavioral patterns across the span of business cycles. That is, economic variables could be coincidental, leading or lagging with respect to the business cycles (Abel et al., pp 306-318, 2014). The theory postulates po-cyclic and coincidental relations of stock returns and cyclical movements of aggregate economic activity.

The growth in the industrial production determines the level of output growth and hence production booms coincide with bubbles in aggregate economic activity. Hamilton and Lin (1996) argued that the abrupt changes in real output is subjected to changes in the average value associated with economic downturns, and therefore economic recessions are the primary factor causing perturbations in stock-return volatility. Since industrial production growth is a simple measure of the rises and falls of aggregate activity, growth usually occur roughly simultaneously with boom and bust cycles in aggregate output growth. The industrial production growth is therefore a coincidental factor and a procyclical variable with respect to the aggregate economic activity, Abel et al. (2014, p. 317). In this respect, industrial production rises during a boom in aggregate economic activity, this implies that the industrial production impacts stock returns positively, hence procyclical relations.

Interest rates are among the main economic determinants directly linked to economic growth. The interest rate is known to be the cost of capital, i.e. the fee offered for the use of cash over a length of time. From the point of view of the borrower, the interest rate is the cost incurred for using a borrowed money. From the lender's perspective, the rate of interest is the earnings from lending money to borrowers (Alam and Uddin, 2009). In the traditional classical view of the transmission mechanism, interest rates have an impact on economic growth by affecting various relative prices in the economy. The increase in the interest rate affects the decision of investors by influencing fixed investment through the cost of capital being used, thereby increasing the expected return on investment projects, and therefore reducing business investment. (Bean, Larsen and Nikolov, 2002). As a result, reduced business investment tends to lower equity and share returns and thus lower stock market efficiency. Indeed, real changes in interest rates impact both stock index efficiency and inflation, and the stock market reacts reliably to changes in oil prices. In addition, inflation and stock returns are strongly (and negatively) correlated in response to interest-rate changes, and interest-rate innovations are responsible for a considerable portion of the covariance between the two variables (Balduzzi, 1995). In addition, Fama (1981) notes that measurements of inflation and expected inflation as well as real stock returns are strongly linked to future real activity. Fama found strong adverse association of real stock indices performance and expected and unexpected inflation. Furthermore, Grossman and Shiller (1980) argued that real stock indices efficiency together with real returns of other assets subjected to real stable dividends will increase significantly over periods of very high interest rates paid on the respective assets. Nevertheless, Mishkin (2013, p 188) mentioned that the policy rate can affect stock prices in two different ways. First, when central banks lower interest rates the returns on alternative assets such as bonds reduce, in this case investors are likely to accept a lower required rate of returns on investments in stocks, contributing to higher share prices. Secondly, lowering the interest rate by the central bank is likely to boost the economy, so as the growth rate dividends, rise in dividends cause stock prices to increase. Also, if interest paid on deposits is higher economic agents will prefer to enjoy the high interest payments. Hence, demand for equity and shares will decrease and as a result decrease in stock performance. Meanwhile, interest rates can also affect the stock performance through the bank lending channel. According to Bean et al. (2002), the provision of loans by financial institutions can be affected by central banks by changing the amount of rudimentary base money, thereby increasing the cost of capital to bank-dependent borrowers. Due to the high cost of capital for investors, new investment projects cannot be initiated. This in turn results in the low performance of stock indices of the firms in question.

Stock indices efficiency and the aggregate economic activity co-move together (Abel et al., 2014, p 318). This means that the association of stock prices with oil price changes could be inferred from the relation of oil prices with production growth. The theoretical literature shows that the correlation of oil price movements with stock indices performance varies depending on the net earnings of companies or nations in the oil market—that is, oil user or producer. Jones, Leiby and Paik (2004) indicate that oil price changes could impact output growth negatively. Degiannakis et al. (2018) mention that stock indices performance is influenced by factors that might change the expected flow of cash or discount rate, such as oil price changes. Thus, changes in oil prices will alter the future cash flow of a company either positively or negatively, depending on if the company is an oil-consumer or an oil-producing company (Oberndorfer, 2009; Mohanty and Nandha, 2011). The channel of transmission of oil price changes to stock indices performance could also occur via stock valuation channel, uncertainty channel, fiscal channel, monetary channel, and output channel (Degiannakis et al., 2018). In the nutshell, to determine whether a change in oil price has countercyclical, procyclical or acyclical influence on stock market indices efficiency depends on the nature of the transmission channel and relies on if the firm or country is an oil producer or an oil user. For instance, oil price changes could have a procyclical consequence on the stock indices returns in an oil exporting country. Thus, a positive increase in oil prices in an oil-exporting country will increase revenues by transferring funds from oil-importer countries, which will result in increased expenditure, investment and consumption through increased revenues of economic agents, and eventually increases aggregate economic activity (Bjørnland, 2009; Jiménez-Rodríguez and Sánchez, 2005). A rise in productivity of firms and consumption of individuals lead to an increase in firms' profits. In the end, there will be a boom in stock prices, the positive relationship indicates a procyclical influence of positive changes in oil price on stock indices returns in an oil exporter nation. However, this only occurs if the income effect of increased oil prices counterbalances the cost effect (Degiannakis et al., 2018). Mostly on contrary, a positive change in petroleum prices causes the transfer of wealth from oil-importer countries to oil-exporter markets. High cost of production triggered by positive spikes of fuel price leads to increase in consumer prices which will result in lower demand in the entire economy. Lower aggregate demand results in low profits and future cash flow of producers will be affected, prices of equity and shares go down as a result, and consequently, stock market efficiency decreases (Jones et al., 2004). This shows countercyclical consequence of positive oil changes on oil-importer stock indices performance. However, it should not be forgotten to acknowledge the fact that oil price changes might have an impact on stock indices given the dilemma they generate in the financial world, based on the type of the shock—that is supply side or demand side shocks (Filis, Degiannakis and Floros. 2011). High oil price increases uncertainty in the real economy by having negative effects on inflation, output, and consumption. Irreversible investment of the firms will reduce because of high prices of oil and therefore, a reduced in future expected cash flows. In addition, households will cut down their demand for durable goods and save instead due to the uncertainty in the economy caused by high positive oil prices. The postponing of both consumption and investment decisions dampen economic activities and output growth and thereby dampening stock market performance. This depicts the uncertainty channel of transmission of the effect changes in fuel prices on stock indices performance. In the monetary channel of transmission, high cost of production because of increased oil prices will be reflected in consumer prices, thus increasing the inflation rate, which in turn leads to higher expected inflation. Central banks are likely to increase short-term interest as a measure to curb the soaring inflation rates. High interest rates discourage economic agents from borrowing to finance investment projects. Consequently, consumption and investment fall, hence, dampens stock returns. According to Degiannakis et al. (2018) oil prices could also affect stock prices through government expenditure. Thus, a positive oil price leads to an increase in government revenue in an oil-exporter country. If oil revenue is being used to finance infrastructure, government expenditure will increase. In a case where government expenditure is a complement to private consumption, aggregate consumption will increase in the economy, which will result in an increase in profits of firms, thus stock prices increase. On the other hand, if government expenditure is a substitute to private consumption which will lead to crowding out effect in an economy. Private investment decreases because of the crowding out effect by government expenditure. These developments impact stock market performance negatively in an oil-exporter country.

Stock returns have a procyclical relationship with aggregate economic activity and for that matter output growth. Hasbrouck (1984) provides evidence that output growth leads to higher returns on existing capital and higher capital investment, higher capital investment in turn leads to high profits of firms which is shown to be positively linked to returns on stocks.

Table 2.1 *Summary of the theoretical relationship between stock returns and variables in the analysis*			
Variable	Direction	Timing	Explanation
Industrial Production	Procyclical	Coincidental	During times of aggregate economic bubbles production increases. An increase in industrial output would lead to higher stock returns in the future.
Interest Rate	Countercyclical or Procyclical	Leading	According to Mishkin (2013) at low interest rates on alternative assets such as bonds, investors are willing to accept lower returns on investments in stocks, hence increases stock prices. Chen et al. (1986) found that stocks bear a negative risk-premium regarding shifts in long-run real interest rates.
Oil Price	Procyclical or Countercyclical	Leading	Oil prices lead stock prices. It increases cost production for an oil-user firms or countries. In this case profits of firms reduce; thus, dividends decrease. Hence, stock prices decrease. An oil producing firm or an oil-exporter country benefits from high oil prices and therefore, boosting stock prices.
Economic Policy Uncertainty	Countercyclical	leading	The theory postulates negative correlation of instability of economic policy with stocks indices performance. When political instability is high, stock yields are lower, and vice-versa. Christou et al. (2017) argue that uncertainty over economic policy serves as a leading indicator for stock indices performance and for other indicators in an economy.
Geopolitical risk	Countercyclical	Leading	This is because high geopolitical threats result in a downturn in economic production, lower stock yields and transfer of capital flows away from developing markets and to developed market (Caldara and Iacoviello, 2018). changes in the GPR are known to have a detrimental effect on real operations, as well as a flight of invested capital to safety, thus firms react to geopolitical risks by reducing capital investments and this effect is more pronounced for companies with more irreversible investment and foreign operations, Dissanayake, Mehrotra and Wu (2018).

Hence, economic variables causing detrimental effects on output growth would affect stock returns negatively. Bittlingmayer (1998) mentions both political and economic policy uncertainty may cause slumps in aggregate economic activity. This portrays an idea about the threat of ambiguity of uncertainty on economic policy to stock indices performance. Gulen and Ion (2016) noted uncertainty of economic policy decisions depresses business investment, decrease in corporate investment in turn depresses output, hence a decrease in aggregate economic. With procyclical relations between stock returns and aggregate economic activity, together with Bittlingmayer (1998) argument, theoretically, the uncertainty in policy makers' decisions could cause a counter-cyclical effects on stock returns and volatility. In addition, surges in fuel prices and economic policy risks are interlinked and have detrimental influences on the yields and volatilities of stocks. That is, fluctuations in oil prices and the EPU have an influence on stock indices by influencing planned future profits and financing costs. Higher oil prices, driven by increased global aggregate oil demand, could be related better to uncertainty about economic policy. As a result, oil price increases due to preventative demand for crude oil in anticipation of oil shortages are characterized by increased economic policy uncertainty, Kang and Ratti (2013)

Events such as war, terrorist attacks, political strains within or across countries boundaries and inter-country conflicts constitute the geopolitical risk (GPR). These events which have detrimental impact on the business cycle and real activity, are of great worry for entrepreneurs, market participants, central bank officials and the business press (Caldara and Iacoviello, 2018; Dissanayake et. al., 2018). In the construction of 'uncertainty trinity' theory by Carney (2016) which include geopolitical, economic, and political risks as variables posing negative impacts on economic activities. Hence, the geopolitical risk counter-effect the business cycles, thus increase in geopolitical uncertainties would lead to decrease in aggregate economic activities. In turn, depressed aggregate economic activities lead to poor performance of stock returns as results of flow of capital from emerging market to advanced markets due to high vulnerability of former to geopolitical risks, and reduction in corporate investment. Positive changes in the GPR are known to have a detrimental effect on real operations, as well as a flight of invested capital to safety, thus firms react to geopolitical risk by reducing capital investments and this effect is more pronounced for companies with more irreversible investment and foreign operations.

2.8. Research Questions and Hypotheses

2.8.1. Research questions

1. Do oil price changes have significant positive or negative correlation with advancing oil-exporter economies' stock indices efficiency?
2. Do oil price changes have significant positive or negative relationship with emerging oil-importer stock indices efficiency?

3. Are there differences in reaction of stock indices returns to changes of oil prices in oil-exporter and oil-importer emerging countries?
4. Do changes in the EPU have significant negative effect on emerging stock indices efficiency?
5. Are there short-run and long-run relations between the chosen macroeconomic variables (industrial production, interest rate, Brent global oil price, policy uncertainty and geopolitical risk) and stock indices returns in the selected advancing markets?
6. Do variations of monetary policy rate have significant positive or negative relations with stock indices efficiency in the selected advancing countries?
7. Do changes in the GPR have significant or insignificant detrimental consequences on stock market performance in the selected emerging economies?

2.8.2. Hypotheses

2.8.2.1. *Null hypothesis*

1. Global oil price changes have significant positive relationship with stock indices efficiency in the oil-exporter advancing market.
2. Global oil price changes have significant negative correlation with oil-importer emerging stock market efficiency.
3. There are differences in reaction of stock indices efficiency to changes of oil price in oil-exporter and oil-importer advancing countries.
4. Changes in the EPU have significant negative relations with emerging stock indices efficiency.
5. There are short-run and long-run relations between the chosen macroeconomic variables (industrial production, interest rate, Brent global oil price, policy uncertainty and geopolitical risk) and stock indices returns in the selected advancing markets.
6. Monetary policy rate changes have significant negative relations with the selected emerging stock indices efficiency.
7. Geopolitical risk has significant detrimental consequences on stock indices efficiency in the selected advancing economies.

2.8.2.2. *Alternative hypothesis*

1. Global oil price changes have a significant adverse consequence on stock indices efficiency in oil net-exporter advancing economies.
2. Global oil price changes have significant favorable influence on stock indices efficiency in oil-importer advancing countries.
3. There are no differences in reactions of stock indices efficiency to changes of global oil price in oil-exporter and oil-importer advancing countries.
4. Changes in the EPU have insignificant adverse influence on emerging stock indices efficiency.
5. There are no short-run and long-run relations between the chosen macroeconomic variables (industrial production, interest rate, Brent global oil price, policy uncertainty and geopolitical risk) and stock indices returns in the selected advancing markets.
6. Monetary policy rate variations have significant positive relations with stock market indices efficiency in the selected advancing markets.
7. Changes in the GPR has insignificant negative consequences on stock indices performance in the selected advancing economies.

CHAPTER THREE

3. DATA DESCRIPTION AND ECONOMETRIC METHODOLOGY

This section explains data characteristics and sources, reports the descriptive statistics of variables in the analysis, gives theoretical background of unit root tests processes utilized in the study and specifies the ARDL methodology and the error correction model.

3.1. Data Description and Sources

In this study stock returns (SR) is represented by the stock index of each country in the sample as the dependent variable (BVSP for Brazil; MOEX for Russia; IPC for Mexico; IGPA for Chile; BIST for Turkey; KOSPI for Korea and ATHEX for Greece), while industrial production (IPI), monetary policy rate (INTR), Brent global oil prices (OILPB), economic policy uncertainty (EPU) and geopolitical risk (GPR) are the explanatory variables. The study uses secondary monthly data over the period 2002:01 – 2019:12 (216 dataset) for all the countries in the research. The study range is limited to this range to reduce the consequence of structural breaks due to policy reforms, financial deregulations, and economic crises in the sample range. Brent global oil prices (OILPB) data is extracted from FRED (Federal Reserve Economic Data), St. Louis Fed. IPI data series for five countries in the sample (Brazil, Russia, Turkey, Korea and Greece) are extracted from OECD Key Short-Term Economic Indicators (KSEI) Dataset, which were seasonally adjusted and (2015=100) indexed; IPI time series data for Mexico was obtained from Bank of Mexico (BM), which was also seasonally adjusted and (2013=100) indexed; and finally IPI data for Chile was obtained from Bank of Chile database, (2013 index=100) and seasonally adjusted . Data series for INTR were sourced from OECD Monthly Monetary and Financial Statistics (MEI) for all the countries in the analysis. Time series data for the EPU and the GPR variables are extracted from the policy uncertainty data website (https://www.policyuncertainty.com/). The EPU for all countries are the news-based EPU index constructed by following the same approach as Baker et al. (2016) did for the United States in “Measuring Policy Uncertainty’’. For the fact that country specific EPU data is unavailable for Turkey, the global economic policy uncertainty (GEPU) index is used as a proxy for Turkey’s EPU. The GEPU Index is constructed by Davis (2016) using GDP-weighted average of national EPU indices for 21 major economies in the world. Tukey’s policy uncertainty could be well represented by GEPU compared to the U.S policy uncertainty index as was in the case of Tiryaki and Tiryaki (2019). The GPR is news-based computed by Caldara and Iacoviello (2016). Caldara and Iacoviello indices contain a broader range of geopolitical events such as terror attacks, military threats, war risks, Middle East tensions and hence entail broader range of exogeneous variables (Balcilar et al., 2018). Validity and reliability of the data collected were ensured. The details about the stock indices the study used are summarized in the table below.

Table 3.1 *Description of stock indices data in the sampled countries*

Market	Index symbol	Components	Source
Brazil	BOVESPA (BVSP)	73	Investing.com/World and sector Indices
Russia	MOEX RUSSIA (IMOEX)	46	Investing.com/World and sector Indices
Mexico	S&P/BMV IPC (MXX)	35	Investing.com/World and sector Indices
Chile	S&P CLX IGPA (APCLXIGPA)	63	Investing.com/World and sector Indices
Turkey	BIST 100 (XU100)	100	Investing.com/World and sector Indices
Korea	KOSPI (KS11)	790	Investing.com/World and sector Indices
Greece	FTSE/ATHEX Large Cap (ATF)	20	Investing.com/World and sector Indices

*Note: The table is a summary of the description of the stock indices used for the analysis, as the dependent variable in the model. Components indicate the number of total firms listed under the corresponding index.

3.2. The Unit Root Testing Approaches

The unit root test is the natural starting of econometric estimation. Economic variables are stochastic in nature. Unit root refers to the situation of non-stationarity of economic time series. A stationary process is one with constant deterministic trend with mean and variance as constant. A unit root or non-stationary variable are therefore those whose means and variances vary over time. In other words, a series is said to have a unit root if it attains stationarity after it has been first-differenced. Thus, a non-stationary series can occur if any of these conditions is violated (Iddrisu, 2018). In economics, researchers use different unit root tests approaches to determine order of integrations of series in their work. Such of these approaches include Dickey Fuller (1979) (DF) test, Augmented Dickey Fuller (1981) (ADF) test, Phillips-Perron (1988) (PP) test, Kwiatkowski, Phillips, Schantz, and Shin (KPSS) (1992), NG Perron test etc. In this study the ADF and the PP tests are utilized to determine the stationarity and constant mean and variances of variables in the research (SR, IPI, INTR, OILPB, EPU and GPR).

The auto-regressive mechanism simply means the inclusion of uncontrolled regressor lag values in a regression process (Nkoro and Uko, 2016). The assumption of the AR(1) model, according to Asteriou and Hall (2016), is that the time series Y_t is usually determined by the values of the preceding period. What happens in time t, therefore, depends highly on what happens in time t-1, and what happens in time t+1 depends on what happens in time t. Provided the model below is a random walk model.

$$Y_t = \phi Y_{t-1} + e_t \tag{3.1}$$

where e_t is white noise and distributed normally and has a zero mean and a unit variance, meaning $e_t \sim (0, \sigma^2)$. Hence, $E(Y_t) = 0$ *and* $var(Y_t) = \frac{1}{(1-\phi^2)}$. In eq. (3.1) regarding the parameter ϕ, there are three cases involved.

(i) $|\phi| < 1$ implies the series is stationary,

(ii) $|\phi| > 1$ indicates Y_t series will explode and

(iii) $|\phi| = 1$ means the Y_t the series is non-stationary.

Therefore, if the first difference $(Y_t - Y_{t-1})$ is stationary, the time series Y_t is said to have a unit origin (Glynn, Perera and Verma, 2007). If time series Y_t has a unit root, there is no tendency to return to the long-run deterministic trend path, with the variance and mean depending on time variations (Glynn et al 2007). Random shocks influence series with unit root, thus, if such a series is used in regression analysis it may lead to misleading results because it follows a random walk process (Nkoro and Uko, 2016). In this study, the standard unit root tests; ADF and PP tests together with structural unit root test (Zivot-Andrews test) are utilized to determine the order of integration of the variables under discussion in order to avoid the pre-mentioned regression problems.

3.2.1. The Augmented Dickey Fuller (ADF) test

Dickey and Fuller (1981) developed the Augmented Dickey Fuller test.

$$\Delta Y_t = \lambda Y_{t-1} + \sum_{i=1}^{n} \vartheta_i Y_{t-1} + \mu_i \tag{3.2}$$

$$\Delta Y_t = a_0 + \lambda Y_{t-1} + \sum_{i=1}^{n} \vartheta_i Y_{t-1} + \mu_i \quad (3.3)$$

$$\Delta Y_t = a_0 + a_1 t + \lambda Y_{t-1} + \sum_{i=1}^{n} \vartheta_i Y_{t-1} + \mu_i \quad (3.4)$$

where a_0 is the intercept, μ_i is a white noise error term, Δ is the difference operator and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2}), \Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$, and so on. The number of lags to be included is determined empirically. To ensure that the error term is not serially correlated, enough lags should be included to obtain an unbiased estimate of the coefficient of Y_{t-1}, λ. In the ADF check the Y_{t-1} coefficient is evaluated. That is, the research tested the null hypothesis; $\lambda = 0$; implies the Y_t series has a unit root (non-stationary), against the alternative hypothesis; $\lambda < 0$ implies the Y_t The series has no unit root (stationary). This test follows the same asymptotic distribution as the DF test. The null hypothesis cannot be rejected if the critical value is more than the measured statistic value of the ADF test, therefore the variable is non-stationary. The null is otherwise rejected, if the computed ADF test figure is less than the critical table figure, indicating the mean and variances are not constant.

3.2.2. Phillips-Perron (PP) test

Phillips and Perron (1988) developed the PP test as a nonparametric statistical method for solving the problems of autocorrelation in error terms without adding lagged terms of difference as in the ADF tests (Gujarati and Porter, 2009, p.758). The PP test is trend-stronger than the ADF test in the trendy sequence and series. It follows the same asymptotic distribution as the test statistic of the ADF test. And this accounts for the explanation that this study employs both measures of stationarity. The representation of the PP test is as follows.

$$\Delta Y_t = a_0 + \delta Y_{t-1} + a_1(t - \tfrac{T}{2}) + \mu_i \quad (3.5)$$

where a_0 is the constant and T; is the total number of observation figures. The following hypotheses are tested using Mackinnon (1996) table critical values in the PP test.

$H_0;\ \delta = 0$, the series has a unit root (non-stationary)

$H_1;\ \delta < 0$, the series has no unit root (stationary)

The H_0 hypothesis is rejected if the computed PP test statistical value is greater than the table critical table value. Otherwise the null hypothesis is failed to be rejected.

3.2.3. Zivot-Andrews Unit Root (ZAUR) test

A common issue with traditional unit root testing — for example DF, ADF and PP testing are that structural breaks are not possible to be included endogenously. To eliminate the possibility of spurious rejection of the unit root null hypothesis, it is necessary to examine the series with unit root testing approach which allows the endogenization of structural break in the process. Thus, in the existence structural break in series, the ADF and the PP are biased in the rejection of the unit root null hypothesis. According to Perron (1989), the traditional ADF approaches to unit root testing are skewed against non-rejection of the null hypothesis amid a systemic break in the series. Based on the argument put forward by Perron (1989), Waheed, Alam and Ghauri (2006) say that the power to reject a unit root null decreases as an exogenous phenomenon when the stationary alternative is accurate, and a structural break is ignored. It is also important to mention here that in the existence of structural breaks, the traditional unit root tests, such as DF, ADF, Phillips-Perron tests are not applicable. In view of this, there is the need to use the other important test streams that incorporate different types of structural breaks, such as the Zivot and Andrews (1992) test for one endogenous break in mean and one break in trend. The technique designed by Zivot and Andrews is used for evaluating unit root null against the opposing break-stationary hypothesis. Zivot and Andrews (1992) invented three different Formulae to test the stationarity hypothesis in the existence of one structural break in the series.

$$\Delta y_t = c + \alpha y_{t-1} + \beta t + \gamma DU_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t \quad \text{(Formula A)}$$

$$\Delta y_t = c + \alpha y_{t-1} + \beta t + \theta DT_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t \quad \text{(Formula B)}$$

$$\Delta y_t = c + \alpha y_{t-1} + \beta t + \gamma DU_t + \theta DT_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t \quad \text{(Formula C)}$$

Where DU_t is the intercept dummy indicator variable for the mean change occurring at each possible break date (TB), whereas DT_t t is the corresponding trend shift variable (slope dummy); c is the constant and ε_t is the error term. Generally

$$DU_t = \{1.....if\ t > TB\ 0....otherwise \quad and$$

$$DT_t = \{t - TB.....if\ t > TB\ 0..........otherwise$$

To test a unit root null against the break-stationary alternative, Zivot and Andrews developed Formulae A, B, and C. Formula A, which allows just one-time adjustment in series level; Formula B, which allows for a one-time change in trend slope function; and Formula C, which integrates one-time changes in series level and trend slope function (Waheed et al. 2006). The null hypothesis in all three models is $\alpha = 0$, meaning that the { y_t} sequence contains a unit root with a drift that prevents any structural break, while the alternative $\alpha < 0$ hypothesis is that the series is a trend-stationary cycle with a one-time break occurring at an arbitrary time point (Waheed et al. 2006).

3.3. Model Specification

3.3.1. The Autoregressive Distributed Lag (ARDL) model

The ARDL model must be specified based on the study objective. The ARDL model consists of a response variable regressed in previous response variable figures and one or more explanatory variables from previous and current figures. The ARDL model is a very useful tool for testing for the presence of long run cointegration relationships between economic variables. Cointegration exists when economic series share a common stochastic trend by responding to shocks together, which are eliminated by long-run relationships with their linear combinations, (Granger and Yoon, 2002). There will not be cointegration if economic variables do not respond to shocks together. One advantage of the ARDL model is that it helps to determine the real effects of any policy variables because of variations across time span by the inclusion of lag variables in the model. The ARDL (p, q) model can be specified as follows:

$$\Phi(L)y_t = \eta + \mathrm{r}(L)x_t + u_t \tag{3.6}$$

with

$$\Phi(L) = 1 - \Phi_1 L - \cdots . \Phi_p L^p, \tag{3.7}$$

$$\mathrm{r}(L) = \mathrm{r}_0 - \mathrm{r}_1 L - \ldots - \mathrm{r}_q L^q. \tag{3.8}$$

Hence, the general ARDL $(p, q_1, q_2 \dots q_k)$ model can be represented as:

$$\Phi(L)y_t = \eta \ + \Gamma_1(L)x_{1t} + \Gamma_2(L)x_{2t} + \Gamma_3(L)x_{3t} + \Gamma_k(L)x_{kt} + \varepsilon_t \tag{3.9}$$

Using the lag function L applied to each vector variable, it is convenient for $L^k y = y_{t-k}$ to define the lag polynomial Φ(L,p) and the polynomial vector r(L,p). If ε_t is a white noise stochastic process or more generally is stationary and uncorrelated to x_t, $x_{t-1}, \dots and\ y_t$, $y_{t-1}, \dots$., the ordinary least square method can be used to estimate the ARDL model to obtain efficient, biased and consistent results (see Nkoro and Uko, 2016). Assuming a bivariate regression model with variables y and x;

$$y_t = \vartheta + \delta x_t + \varepsilon_t \tag{3.10}$$

where $y_t =$ dependent variable and x_t = independent variable, a vector regressor; ϑ is the intercept; δ is coefficient and ε_t is the disturbance term. In $ARDL$ (1,1) linear model specification in an unrestricted form, eq. (3.10) can be represented in eq. (3.11) as.

$$\Delta y_t = \vartheta + \theta_0 y_{t-1} + \delta_0 x_{t-1} + \sum_{i=1}^{p} \delta_1 \Delta x_{t-1} + \sum_{i=1}^{p} \theta_1 \Delta y_{t-1} + \varepsilon_t \tag{3.11}$$

where θ_0 and δ_0 are long-run coefficients; δ_1 and θ_1 are the short-run adjustment parameters; Δ is the change operator ε_t is the disturbance term or the error correction term. The error term is assumed to have constant variance and zero mean and serially uncorrelated. This implies that at each time t.

$$E(\varepsilon_t) = \varepsilon_{t-1} = \varepsilon_{t-2} = \dots = 0$$

$$E(\mathcal{E}_t^2) = E(\mathcal{E}_{t-1}^2) = E(\mathcal{E}_{t-2}^2) = \dots = \sigma^2$$

$$E(\mathcal{E}_t \mathcal{E}_{t-p}) = E(\mathcal{E}_{t-i} \mathcal{E}_{t-i-p}) = E(\mathcal{E}_{t-j-i} \mathcal{E}_{t-j-i-p}) = \dots = 0, for\ all\ \varepsilon_t.$$

3.3.2. The dynamic multiplier effect of the ARDL model

The dynamic multiplier effect of the ARDL model could be derived from the polynomial function below as in y_t;

$$y_t = (\ 1 + \gamma_1 + \gamma_1^2 + \dots)c + (1 + \gamma_1 p + \gamma_1^2 p^2 + \dots)(\alpha_0 x_t + \alpha_1 x_{t-1} + \mathcal{E}_t) \tag{3.12}$$

Eq. (3.12) manifests the present values of y_t depends on x's present and lag values. The present dynamic multiplier effect can be derived from eq. (3.12) as.

$$\frac{\Delta y_t}{\Delta x_t} = \alpha_0 \tag{3.13}$$

After one lag period the multiplier effect can be represented as.

$$\frac{\Delta y_{t+1}}{\Delta x_t} = \alpha_1 + \gamma_1 \alpha_0 \tag{3.14}$$

And two lag periods the impact could be given as.

$$\frac{\Delta y_{t+2}}{\Delta x_t} = \gamma_1 \alpha_1 + \gamma_1^2 \alpha_0 \tag{3.14}$$

The dynamic multiplier impact (long-term) is shown as: $\Delta\alpha_0 + \alpha_1 1 - \gamma_1 \, where \, |\gamma_1| < 1$

3.3.3. The ARDL error correction model

By re-parametrizing and replacing $y_t \, and \, x_t$ with $y_{t-1} + \Delta y_t$ and $x_{t-1} + \Delta x_t$ respectively, the eq. below is obtained.

$$\Delta y_t = c + \alpha_0 \Delta x_t - (1 - \gamma_1) y_{t-1} + (\alpha_0 + \alpha_1) x_{t-1} + \varepsilon_t \tag{3.15}$$

Rearranging Eq. (3.15) will give as in Eq. (3.16).

$$\Delta y_t = \alpha_0 \Delta x_t - (1 - \gamma_1) \left[y_{t-1} - \frac{c}{1-\gamma_1} - \frac{\alpha_0 + \alpha_1}{1-\gamma_1} x_{t-1} \right] + \varepsilon_t \tag{3.16}$$

Eq. (3.16) is regarded as the error correction model. Δy_t is characterized by two elements. Firstly, the components roughly proportional to Δx_t (short-term link between $y_t \, and \, x_t$). Secondly, the partial adjustment of the deviation from y_{t-1} from the symmetric value in relation with x_{t-1}.

3.3.4. Conditions for the application of the ARDL model.

The ARDL framework is usable under the below outlined conditions.

- The ARDL model is suitable irrespective of the order the variables are integrated, or where we have a combination of variables I(0) and I(1). It helps to prevent the pre-testing limitations of traditional cointegration analysis involving the situation where the variables must either be I(0) or I(1). Therefore, the bound cointegration testing process does not require pre-testing of the variables included in the unit root model and is stable when the underlying variables have a single long-term relationship.
- If the F-statistics (Wald Test) indicates the existence of a single long-term equation and the sample size is small or finite, the error correction representation of the ARDL is relatively more efficient.
- The ARDL approach would fail to give a reliable outcome if there are multiple cointegration relations. Hence, an alternative approach such as Johansen and Juselius (1990) can be employed.
- If the trace or maximum uniqueness or Wald test F-statistics defines a cointegration relationship between the variables, the ARDL model could be used instead of the Johansen Juselius (1990) method.

3.3.5. Advantages of the ARDL approach

The advantages of the ARDL model over alternative models are summarized as follows.

- Applying the ARDL model mitigates the problem of endogeneity since respective variables stand as a single equation, and since the technique is free from serially correlated residuals.
- The ARDL procedure can distinguish between dependent and explanatory variables when there is a single long-term relationship. In other words, the ARDL approach assumes that there is only one reduced form equation linkage between the dependent variable and the exogenous variables (Pesaran et al., 2001).
- The key benefit of this approach is the recognition of cointegrating vectors in which various cointegrating vectors are present (Nkoro and Uko, 2016).
- The error correction model can be extracted from the ARDL model through a simple linear transformation that combines short-run changes with long-run equilibrium,

without losing long-run information. Consequently, the associated error correction model takes many lags for different modeling systems to capture the generating process of data in general.

- The ARDL technique is applicable if research variables are I(0) or I(1), or a combination of I(0) and I(1) variables, unlike in vector autoregressive and vector error correction models where the variables have to be purely either 1(0) or I(1).

3.3.6. Cointegration modelling

Cointegration analysis is used to avoid the appearance of a misleading outcome through the usage of non-stationary results. This approach enables the distinction of short-term and long-term relationships between study variables. In the event where the variables are found to have a unit root and to have the same integration order, this technique illustrates the existence of long-term symmetry association among the variables in the research. One additional causal term (error correction term) provided to influence the other variables in one of the variables cointegration processes (Iddrisu, 2018). Another essential aspect of this methodology is its restricting effects on the parameters, and a thorough accounting of these limiting effects may improve the efficiency of estimating. The notable examples of cointegration strategies include Engle and Granger (1987), Johansen and Juselius (1990), Charemza and Deadman (1992), Inder (1993), Pesaran et al., (2001) ARDL cointegration test and so on. In this research, the ARDL approach to cointegration by Pesaran et al. (2001) would be adopted to investigate short-run and long-run dynamics of the relationship between the stock index of each country and the independent variables, and to establish the link between the variables.

3.3.7. The ARDL model specification

The main ideal goal of the study is to make a comparative analysis of emerging stock markets—macroeconomic determinants (growth in industrial production, policy or interest rate, Brent global crude oil price, economic policy uncertainty and geopolitical risk) link in selected seven emerging markets for which the data was available for all the variables. The research utilizes the model Autoregressive Distributed Lag (ARDL), developed by Pesaran and Shin (1999) and amended by Pesaran et al. (2001). Stock return is the dependent variable and the independent variables are industrial production, interest rate, global Brent oil price, uncertainty in economic policy and geopolitical risk. In the following function the associations between stock returns and the selected macroeconomic determinants may well be represented:

$$SR = f\ (IPI, INTR, OILPB, EPU, GPR) \tag{3.17}$$

where SR = stock returns; f denotes function relating stock prices to its macroeconomic determinants; IPI = industrial production; $INTR$ = interest rate; $OILPB$ = Brent global oil price; EPU = economic policy uncertainty; and GPR = geopolitical risk. To reduce the problems of trends, heteroscedasticity and serial correlation in the time series data, natural logarithms of each variable are taken. Eq. (3.18) is adopted from the extant literature (Bahmaani-Oskooee and Saha, 2019a; Tiryaki et al., 2017; Hoque et al., 2019) and being modified by adding LEPU and LGPR.

$$LSR_t = \beta_1 + \beta_2 LIPI\ _t + \beta_3 INTR_t + \beta_4 LOILPB + \beta_5 LEPU + \beta_6 LGPR\ \ + u_t \tag{3.18}$$

where L represents the natural logarithm, the variables remained as they were defined before, β_1 is the constant of intercept, and β_2, β_3, β_4, β_5 and β_6 are the long-run parameters to be estimated, and u_t is the disturbance term which is assumed normally distributed. The above model is estimated in an $ARDL$ perspective to get the long-term link between the stock returns and the variables in this research. The study follows Pesaran and Shin, (1999) and Pesaran et al (2001) and obtains Eq. (3.19) – the dynamic $ARDL$ model entailing both the adjustment parameters for the short term and the long term.

$$\Delta LSP_t = a_0 + \sum_{i=1}^{p} a_{1i}\Delta LSP_{t-i} + \sum_{i=1}^{q_1} a_{2i}\Delta LIPI_{t-i} + \sum_{i=1}^{q_2} a_{3i}\Delta INTR_{t-i} + \sum_{i=1}^{q_3} a_{4i}\Delta LOILPB_{t-1} + \sum_{i=1}^{q_4} a_{5i}\Delta LEPU_{t-i} + \sum_{i=1}^{q_5} a_{6i}\Delta LGPR_{t-i} + b_{1i}LSP_{t-1} + b_{2i}LIPI_{t-1} + + b_{3i}INTR_{t-1} + b_{4i}LOILPB_{t-1} + b_{5i}LEPU_{t-1} + b_{6i}LGPR_{t-1} + e_{1t} \tag{3.19}$$

where, a_0 is the constant of intercept, p denotes the optimal lag number for the dependent variable, $q_{1\,,}q_{2,}q_3\ q_4$ and q_5 denotes the optimal lag numbers for the regressors, b_{1i}, b_{2i}, b_{3i}, b_{4i}, b_{5i} and b_{6i} are long-run parameters, a_{1i}, a_{2i}, a_{3i}, a_{4i}, $a_{5i}$and a_{6i} are the short-run adjustment parameters, e_{1t} is the disturbance term and Δ is the difference operator.

The ARDL cointegration technique is utilized to establish the presence of long-term association among stock indices performance and the chosen macroeconomic variables in the analysis. This approach relies on the Wald-test, where the long-term parameters ($b_{1i} - b_{6i}$) are tested under the null hypothesis: $b_{1i} - b_{6i} = 0$, against the alternating hypothesis: $b_{1i} - b_{6i} \neq 0$. The 'no cointegration' null hypothesis for the F-test is being conducted, and the alternating explanation is that cointegration occurs among the variables in the research. The restricting distribution of the F-test is completely non-standard based on the 'no cointegration' null hypothesis between the variables under study. Two critical basic values are acquired using the ARDL cointegration test method. The bottom critical value presupposes that all variables of research are I(0), implying that there is no cointegration relationship among the variables of research. The uppermost critical value implies that all the experimental variables included in the analysis are I(1), thereby suggesting the cointegration of the variables. If the measured Wald test statistic value surpasses the critical uppermost value, then the null hypothesis is discarded. At the contrary to it, if the Wald test statistic value falls below the critical value at the bottom, then the null cannot be discarded. Finally, if the calculated Wald-statistics lies between the critical values of the bottom and the uppermost, then the outcomes are uncertain.

By modifying Eq. (3.19), the ARDL short-run and error correction model (Pesaran et al., 2001) can be specified as:

$$\Delta LSP_t = a_0 + \sum_{i=1}^{p} a_{1i}\Delta LSP_{t-i} + \sum_{i=1}^{q_1} a_{2i}\Delta LIPI_{t-i} + \sum_{i=1}^{q_2} a_{3i}\Delta INTR_{t-i} + \sum_{i=1}^{q_3} a_{4i}\Delta LOILPB_{t-1} + \sum_{i=1}^{q_4} a_{5i}\Delta LEPU_{t-i} + \sum_{i=1}^{q_5} a_{6i}\Delta LGPR_{t-i} + \varphi ect_{t-1} + \varepsilon_t \tag{3.20}$$

where LSR, LIPI, INTR, LOILPB, LEPU and LGPR still maintain their previous definitions. a_0 is the drift element of the model. $a_{1i} - a_{6i}$ are the short-run adjustment components. ε_t is the white-noise error term. φ is the error correction term (ect_{t-1}) coefficient, the component that measures the brisk speed of adjustment which is supposed to be negative and should be between -1 and 0. Again, φ is the parameter measuring the swift speed of adjustment in the long-run when there is a disequilibrium in the system during the short-run. It shows the degree of correction of the model's disequilibrium, i.e. the point at which any instability in the lag period is resolved in ΔLSP_t. If φ is positive implies a divergence and if negative it implies convergence in the long period. If the computed ect_{t-1} coefficient (φ) is -1 indicates 100 percent of the correction occurs within each period. If it is -0.5 shows 50 percent of the correction takes place in each time frame. However, in the case where the coefficient (φ) is 0 means that no correction occurs and assertion that a long-term cointegration relationship occurs does not make any statistical sense.

CHAPTER FOUR

4. EMPIRICAL FINDINGS AND DISCUSSIONS

In this chapter, the descriptive statistics and the unit root test results are interpreted and discussed. The long-run, short-run and the error correction estimates are presented and discussed, and finally, the robustness check analysis results are also presented and discussed in this chapter.

4.1. Descriptive Statistics Results

Table 4.1 and table 4.2 present the descriptive statistics of stock indices, industrial production, interest rate, oil price, economic policy uncertainty and geopolitical risk for oil-exporter and oil-importer countries, respectively. For oil-exporter countries all the variables display positive skewness except stock index and industrial production index variables which have negative skewness (only Brazil stock index variable is positively skewed). Positive skewness implies majority of observations are occurring above the sample mean and negative skewness implicates majority of observations are occurring below the sample mean. The J-B statistics and the associated probabilities for all variables except stock index variables for Brazil and Russia are significant indicating non-normal distribution of data observations. This could be because of outliers in the observations, because both the results for skewness and kurtosis implicate normal distribution for majority of the variables.

For oil importing countries, all the variables except stock indices and industrial production for Chile and Korea, are positively skewed, indicating that the probability of increment is higher than the probability decrement-thus more observation values occur higher than the sample mean, and the negative skewed variables implies the probability of decreasing of observations is higher than the probability of increasing- that is, more observation values occur below the sample mean. The kurtosis results for most of the variables show platykurtic (less than three)—a sign of normally distributed observations. The Jarque-Bera statistics and the related probability figures are statistically significant for all variables but interest rate for Chile, mirroring violation of normal distribution, even though in most cases the variables are platykurtic and normally skewed.

Table 4.1 *Descriptive statistics for oil-exporter countries*

Brazil	BVSP	IPI	INTR	OILPB	EPU	GPR
Mean	51562.36	101.3936	12.64352	68.88302	158.1293	104.5436
Median	53935.76	99.80732	11.87500	64.44758	135.2713	101.1717
Max.	116695.0	115.6069	26.50000	124.7290	484.4134	246.4367
Min.	8950.753	85.21883	4.500000	19.22311	20.11843	48.68156
Std. Dev.	22809.57	8.446824	4.707268	28.36541	87.69548	27.56117
Skewness	0.120541	-0.024494	0.805637	0.292859	1.583941	1.091459
Kurtosis	2.960817	1.795361	3.527162	2.013225	5.488122	5.952166
J-B Stat.	0.536905	13.08199	25.86694	11.85112	146.0360	121.3237
Prob.	0.764562	0.001443	0.000002	0.002670	0.000000	0.000000
Russia	MOEX	IPI	INTR	OILPB	EPU	GPR
Mean	1423.216	91.94970	10.52083	68.88302	144.5495	106.5754
Median	1461.748	94.46467	10.00000	64.44758	122.8190	100.7155
Max.	3059.486	110.9146	25.00000	124.7290	493.3675	230.1397
Min.	247.7143	64.00375	5.250000	19.22311	11.23122	46.03402
Std. Dev.	642.6903	12.12180	4.377283	28.36541	83.44834	28.81805
Skewness	-0.008738	-0.544703	1.202024	0.292859	1.210472	0.857841
Kurtosis	2.574568	2.475205	4.525466	2.013225	4.799864	3.959746
J-B Stat.	1.631681	13.15993	72.95842	11.85112	81.90434	34.78209
Prob.	0.442267	0.001388	0.000000	0.002670	0.000000	0.000000
Mexico	IPC	IPI	INTR	OILPB	EPU	GPR
Mean	31370.08	97.91853	4.258611	68.88302	76.26493	111.2082
Median	35899.01	99.04290	4.305000	64.44758	63.12834	107.2356
Max.	50969.04	106.2216	6.840000	124.7290	472.1723	224.4149
Min.	5775.448	85.93520	2.110000	19.22311	9.356223	61.98591
Std. Dev.	14078.25	5.472957	1.325244	28.36541	54.98696	24.67505
Skewness	-0.516067	-0.485236	0.071965	0.292859	3.244440	1.223636
Kurtosis	1.882920	2.093898	1.793383	2.013225	19.19232	5.877093
J-B Stat.	20.81851	15.86552	13.28977	11.85112	2738.670	128.4012
Prob.	0.000030	0.000359	0.001301	0.002670	0.000000	0.000000

Note*: The probability values are associated with Jaque-Bera statistics which is Chi-square distribution of degree of freedom 2 for normal distribution.

Table 4.2 *Descriptive statistics for oil-importer countries*

Chile	IGPA	IPI	INTR	OILPB	EPU	GGPR
Mean	16556.40	88.79186	3.647083	68.88302	105.8998	106.7630
Median	18358.69	89.00694	3.340000	64.44758	99.19383	87.32907
Max.	29745.21	115.0785	8.260000	124.7290	258.6683	471.1805
Min.	4589.123	59.50526	0.410000	19.22311	33.30978	39.68129
Std. Dev.	6644.142	16.56329	1.626321	28.36541	44.19014	62.96629
Skewness	-0.171917	-0.167163	0.309983	0.292859	0.960845	2.463743
Kurtosis	1.976365	1.762575	3.092139	2.013225	3.697542	12.31361
J-B Stat.	10.49445	14.78694	3.535634	11.85112	37.61509	999.2116
Prob.	0.005262	0.000615	0.170705	0.002670	0.000000	0.000000
Turkey	BIST	IPI	INTR	OILPB	GEPU	GPR
Mean	57634.12	79.35404	14.48047	68.88302	125.5898	121.2923
Median	57742.19	76.59362	9.250000	64.44758	115.6620	116.6867
Max.	117168.9	119.9900	59.00000	124.7290	349.2524	230.1078
Min.	8977.780	40.79660	1.500000	19.22311	51.68760	48.20058
Std. Dev.	29489.37	22.66524	11.99131	28.36541	52.98772	37.27581
Skewness	0.030697	0.153712	1.742798	0.292859	1.080359	0.561342
Kurtosis	1.983521	1.802119	5.769144	2.013225	4.237037	2.784080
J-B Stat.	9.332998	13.76485	178.3578	11.85112	55.79068	11.76338
Prob.	0.009405	0.001026	0.000000	0.002670	0.000000	0.002790
Korea	KOSPI	IPI	INTR	OILPB	EPU	GPR
Mean	1658.228	86.44586	2.859167	68.88302	139.6200	112.3174
Median	1886.716	95.55254	2.750000	64.44758	129.1682	103.9767
Max.	2561.980	111.3907	5.220000	124.7290	596.5293	302.4412
Min.	528.4595	50.82876	1.220000	19.22311	40.48167	37.70121
Std. Dev.	527.6025	17.93316	1.186438	28.36541	67.02154	40.95662
Skewness	-0.596224	-0.521889	0.251483	0.292859	2.342843	1.349105
Kurtosis	2.165346	1.794618	1.815450	2.013225	13.38893	5.684163
J-B Stat.	19.06723	22.88174	14.90519	11.85112	1168.970	130.3656
Prob.	0.000072	0.000011	0.000580	0.002670	0.000000	0.000000
Greece	ATHEX	IPI	INTR	OILPB	EPU	GGPR
Mean	8935.016	120.3773	1.178389	68.88302	121.0889	106.7630
Median	6986.436	111.7603	0.402800	64.44758	108.6800	87.32907
Max.	27810.62	149.2135	4.298900	124.7290	324.8236	471.1805
Min.	249.4377	94.78152	-0.464200	19.22311	14.44481	39.68129
Std. Dev.	7647.145	18.17954	1.503730	28.36541	58.09947	62.96629
Skewness	0.886402	0.247369	0.621842	0.292859	0.982550	2.463743
Kurtosis	2.612669	1.344484	1.942851	2.013225	3.769453	12.31361
J-B Stat.	29.63573	26.86949	23.97882	11.85112	40.08311	999.2116
Prob.	0.000000	0.000001	0.000006	0.002670	0.000000	0.000000

Note*: The probability values are associated with Jaque-Bera statistics which is Chi-square distribution of degree of freedom 2 for normal distribution.

4.2. Unit Root Test Results

The study employs the ADF and the PP tests as the conventional unit root test alongside the structural ZAUR test to determine the level of integration of the variables in the study. The ADF test is chosen because it is widely used in the empirical literature for the reason being that it corrects high order autocorrelation problems by including enough lags of the dependent variable on the right side of the regression function. The PP test is used to complement the ADF test because it is more powerful than the latter if there exists a trend in the series. With the Model with drift (constant) and drifting model of deterministic pattern (constants and trend), Eq. (3.3) and Eq. (3.4) are utilized in exploring the level of integration of the series in all the case of ADF and PP, while model A and C are used in the ZAUR test. Perron (1989), Glynn et al. (2007) and Waheed et al. (2006) argue that, in the event of structural break in time series the traditional unit root tests such as ADF and PP are highly fragile in spuriously rejecting the unit root null hypothesis. In view of this, the ZAUR test is used to complement and confirm the results reported from the ADF and PP conventional unit root tests.

The ADF test is applied under the assumptions of constant and constant and trend for all the series for the sampled countries. Maximum of 14 lags are imposed and the optimal order of lag is determined by Schwarz Information Criterion (SIC) for each series. In table 4.3 the ADF test results are reported for oil-exporter emerging countries from the sample countries. The null hypothesis ($\lambda = 0$) is failed to be rejected for the natural logarithm of stock price (LSP), Brent oil prices (LOILPB) and the industrial production index (LIPI) at 5% significance level for all oil-exporter emerging countries. These series attained stationarity after the first differencing, hence they are order one, I(1) series. For the natural logarithm of economic policy uncertainty (LEPU) and the geopolitical risk index (LGPR) for all oil-exporter sampled countries are level stationary series. For Russia, the interest rate (INTR) is an I(0) series. However, for Mexico and Brazil, INTR is an I(1) variable.

In table 4.4 the ADF test outcomes are reported for oil-importer emerging countries in the sample. The natural logarithm of stock index variables (LSP), Brent oil prices (LOILPB) and industrial production index (LIPI) attained stationarity after they have been first-differenced, hence integrated of order one, I(1). LEPU and the LGPR series are I(0) for all oil-importer countries in the sample. For Turkey and Chile, the policy rate (INTR) is an I(0) series. However, for the remaining importer countries (Greece and Korea) INTR is the I(1) variable.

Table 4.3 *ADF unit root test results for oil-exporter countries*

Variable	Level (*Constant*)	Level (*Constant and Trend*)	1st Difference (*constant*)	1st Difference (*Constant and Trend)*	Decision
Brazil					
LBVSP	-1.597459	-1.823922	-12.95082***	-12.93324***	I(1)
LIPI	-2.267022	-2.024940	-17.12977***	-17.21777***	I(1)
INTR	-1.908557	-3.199869*	-5.257294***	-5.249648***	I(1)
LOILPB	-2.738117	-2.475015	-10.89955***	-10.96643***	I(1)
LEPU	-4.179669***	-8.850995***	c	c	I(0)
LGPR	-8.994603***	-9.084695***	c	c	I(0)
Russia					
LMOEX	-2.241881	-2.724217	-11.55235***	-11.58196***	I(1)
LIPI	-2.220198	-2.500050	-15.07502***	-15.18733***	I(1)
INTR	-3.429748**	-3.139881*	-10.79521***	-11.01284***	I(0)
LOILPB	-2.738117	-2.475015	-10.89955***	-10.96643***	I(1)
LEPU	-4.054084***	-12.13541***	c	c	I(0)
LGPR	-3.897738***	-4.197877***	c	c	I(0)
Mexico					
LIPC	-2.384570	-0.833358	-13.13736***	-13.42548***	I(1)
LIPI	-2.196573	-1.835891	-17.63840***	-17.74819***	I(1)
INTR	-1.895955	-1.445891	-9.674230***	-9.801840***	I(1)
LOILPB	-2.738117	-2.475015	-10.89955***	-10.96643***	I(1)
LEPU	-3.451527**	-3.851818**	c	c	I(0)
LGPR	-4.406808**	-9.883463***	c	c	I(0)

Note: '*','**' and '***' indicate 10%, 5% and 1% probabilistic significance, respectively. C refers to empty cells where the respective variable is stationary in level. {-2.57}, {-2.87} and {-3.46} are the critical values of the table at 10 %, 5% and 1% respectively, relevant for the constant model only. Whereas for the model of constant and trend, {-3.14}, {-3.43} and {-4.00} table critical values equate to 10%, 5% and 1% significant level, respectively.

Similarly, the PP test is applied under the presumption of trendy and constant. Newey-West Bandwidth is automatically selected to correct autocorrelation problems for the series. Table 4.5 and table 4.6 report the PP test results for oil-exporter and importer countries, respectively. For all countries in the sample, LSP, LIPI and LOILPB are I(1) variables. For Russia, Turkey and Chile INTR series is level stationary, however, it becomes stationary after it has been first differenced for the remainder of the countries.

Finally, the stationarity null is rejected for LEPU and LGPR series for all emerging markets in the sample, hence I(0) variables.

Table 4.4 *ADF unit root test results for oil-importer countries*

Variable	Level (*Constant*)	Level (*Constant and Trend*)	1st Difference (*constant*)	1st Difference (*Constant and Trend)*	Decision
Chile					
LIGPA	-2.217448	-1.183284	-12.88062***	-13.05723***	I(1)
LIPI	-2.645789*	-0.433928	-19.28689***	-19.72368***	I(1)
INTR	-3.780761***	-3.819570**	c	c	I(0)
LOILPB	-2.738117	-2.475015	-10.89955***	-10.96643***	I(1)
LEPU	-2.919057**	-7.048735***	c	c	I(0)
LGPR	-4.915125***	-5.008812***	c	c	I(0)
Turkey					
LBIST	-1.502977	-2.206477	-16.04861***	-16.08252***	I(1)
LIPI	-1.429761	-2.293270	-17.79464***	-17.81524***	I(1)
INTR	-2.928590**	-2.620998	-5.054718***	-5.136688***	I(0)
LOILPB	-2.738117	-2.475015	-10.89955***	-10.96643***	I(1)
LGEPU	-2.861416*	-4.729144***	c	c	I(0)
LGPR	-5.230052***	-5.834155***	c	c	I(0)
Korea					
LKOSPI	-1.738949	-1.871773	-14.67360***	-14.67747***	I(1)
LIPI	-2.103026	-2.068699	-15.19540***	-15.19540***	I(1)
INTR	-1.583483	-3.038240	-6.863555***	-6.850650***	I(1)
LOILPB	-2.738117	-2.475015	-10.89955***	-10.96643***	I(1)
LEPU	-5.720963***	-6.204953***	c	c	I(0)
LGPR	-7.623421***	-7.906610***	c	c	I(0)
Greece					
LATHEX	-0.874097	-2.312461	-14.32843***	-14.29654***	I(1)
LIPI	-1.051449	-1.310054	-25.09646***	-25.05302***	I(1)
INTR	-1.610826	-2.615489	-5.376392***	-5.367993***	I(1)
LOILPB	-2.738117	-2.475015	-10.89955***	-10.96643***	I(1)
LEPU	-4.122433**	-4.041069**			I(0)
LGPR	-4.915125***	-5.008812***	c	c	I(0)

Note: '*','**' and '***' indicate 10%, 5% and 1% probabilistic significance, respectively. C refers to empty cells where the respective variable is stationary in level. {-2.57}, {-2.87} and {-3.46} are the critical values of the table at 10 %, 5% and 1% respectively, relevant for the constant model only. Whereas for the model of constant and trend, {-3.14}, {-3.43} and {-4.00} table critical values equate to 10%, 5% and 1% significant level, respectively.

Notwithstanding, the existence of structural break in series renders the standard unit room tests less efficient, biased and the unit root null can be spuriously rejected. To validate the outcomes of standard unit root checks, the ZAUR test is added for this purpose. Perron stated that certain economic variables can be modelled using Formula A or C, according to Waheed et al. (2006).

Table 4.5 *PP unit root test results for oil-exporter countries*

Variable	Level (*Constant*)	Level (*Constant and Trend*)	1st Difference (*constant*)	1st Difference (*Constant and Trend)*	Decision
Brazil					
LBVSP	-1.622963	-1.957436	-13.02007	-13.00068	I(1)
LIPI	-2.180493	-1.879945	-17.11726	-17.21592	I(1)
INTR	-1.534759	-2.489131	-8.641402	-8.627898	I(1)
LOILPB	-2.646529	-2.123391	-10.73490	-10.70859	I(1)
LEPU	-8.460748***	-9.569648***	c	c	I(0)
LGPR	-9.392083***	-9.456550***	c	c	I(0)
Russia					
LMOEX	-2.196590	-2.644818	-11.61615	-11.64591	I(1)
LIPI	-2.209572	-2.544416	-15.08009	-15.17890	I(1)
INTR	-3.384664***	-2.951718	-12.27806	-12.55022	I(0)
LOILPB	-2.646529	-2.123391	-10.73490	-10.70859	I(1)
LEPU	-8.887973***	-12.27840***	c	c	I(0)
LGPR	-7.891024***	-8.440843***	c	c	I(0)
Mexico					
LIPC	-2.205773	-1.062606	-13.33924	-13.50456	I(1)
LIPI	-1.991495	-2.245211	-17.32973	-17.43236	I(1)
INTR	-1.564681	-1.130540	-9.665757***	-9.791567***	I(1)
LOILPB	-2.646529	-2.123391	-10.73490	-10.70859	I(1)
LEPU	-6.493136***	-7.764353***	c	c	I(0)
LGPR	-8.843101***	-10.20511***	c	c	I(0)

Note: '*','**' and '***' indicate 10%, 5% and 1% probabilistic significance, respectively. C refers to empty cells where the respective variable is stationary in level. {-2.57}, {-2.87} and {-3.46} are the critical table values at 10 %, 5% and 1% respectively, relevant for the constant model only. Whereas for the model of constant and trend, {-3.14}, {-3.43} and {-4.00} table critical values equate to 10%, 5% and 1% significant level, respectively.

Sen (2003) argued that Formula C is superior to Formula A, thus if one uses Formula A when in reality a break happens according to Formula C, then there would be a substantial loss of regression efficiency. Nevertheless, if the break is defined by Formula A, however Formula C is applied, the havoc of power is minimal, indicating that Formula C is advantageous over Formula A. In view of this, both Formula A and C are used to apply the ZAUR test. Maximal of 11 lags is imposed and the optimum lag is initiated empirically.

Table 4.6 *PP unit root test results for oil-importer countries*					
Variable	Level (*Constant*)	Level (*Constant and Trend*)	1st Difference (*constant*)	1st Difference *(Constant and Trend)*	Decision
Chile					
LIGPA	-2.084702	-1.443015	-13.02118***	-13.13166***	I(1)
LIPI	-2.423853	-1.208842	-19.12940***	-19.94075***	I(1)
INTR	-2.823235*	-2.831235	-5.511994***	-5.494693***	I(0)
LOILPB	-2.646529	-2.123391	-10.73490***	-10.70859***	I(1)
LEPU	-6.133085***	-7.021923***	c	c	I(0)
LGPR	-4.569445***	-4.669393***	c	c	I(0)
Turkey					
LBIST	-1.490648	-2.185180	-16.04413***	16.08252***	I(1)
LIPI	-1.705254	-2.800214	-17.79464***	-17.82252***	I(1)
INTR	-4.515852***	-3.346309*	-11.54668***	-11.98974***	I(0)
LOILPB	-2.646529	-2.123391	-10.73490***	-10.70859***	I(1)
LGEPU	-2.381923	-4.564225***	-21.19389***	-21.94581***	I(0)
LGPR	-7.498659***	-8.307285***	c	c	I(0)
Korea					
LKOSPI	-1.764727	-2.102754	-14.70104***	-14.70240***	I(1)
LIPI	-2.235263	-1.964683	-15.25073***	-15.54854***	I(1)
INTR	-1.292996	-2.563346	-6.750310***	-6.737075***	I(1)
LOILPB	-2.646529	-2.123391	-10.73490***	-10.70859***	I(1)
LEPU	-5.555474***	-6.098116***	c	c	I(0)
LGPR	-7.941358***	-8.218309***	c	c	I(0)
Greece					
LATHEX	-1.149450	-2.673156	-24.09376***	-24.04418***	I(1)
LIPI	-0.986724	-1.768752	-26.88150***	-26.88645***	I(1)
INTR	-1.373689	-2.138607	-7.186661***	-7.175521***	I(1)
LOILPB	-2.646529	-2.123391	-10.73490***	-10.70859***	I(1)
LEPU	-6.187908***	-6.139677***	c	c	I(0)
LGPR	-4.569445***	-4.669393***	c	c	I(0)

Note: '*','**' and '***' indicate 10%, 5% and 1% probabilistic significance, respectively. C refers to empty cells where the respective variable is stationary in level. {-2.57}, {-2.87} and {-3.46} are the critical values of the table at 10 %, 5% and 1% respectively, relevant for the constant model only. Whereas for the model of constant and trend, {-3.14}, {-3.43} and {-4.00} table critical values equate to 10%, 5% and 1% significant level, respectively.

The ZAUR test results are presented in tables 4.7 and 4.8 for oil-exporter and -importer countries, respectively. The results are like the reported results from the traditional unit root testing approaches for all the series in five of the sampled countries. (Turkey, Mexico, Brazil, Korea, and Russia). Contrary to the traditional approach, INTR variable for Greece appears to be I(0).

Table 4.7 *ZAUR test results for oil-exporter countries*						
Variable	Level (*Constant*)	Level (*Constant and Trend*)	1st Difference (*constant*)	1st Difference *(Constant and Trend)*	Breakpoint	Decision
Brazil						
LBVSP	-2.930273	-3.506859	-13.34515***	-13.32639***	2008M06	I(1)
LIPI	-3.598259	-3.412947	-17.36887***	-17.36130***	2009M02	I(1)
INTR	-3.622745	-3.212890	-5.562525***	-5.608717***	2016M10	I(1)
LOILPB	-4.623135*	-4.333623	-7.212193***	-7.184047***	2014M07	I(1)
LEPU	-5.915407***	-6.530440***	c	c	2014M11	I(0)
LGPR	-6.379821***	-6.450763***	c	c	2005M09	I(0)
Russia						
LMOEX	-3.680383	-5.218843**	-11.89558***	-12.13773**	2008M06	I(1)
LIPI	-3.693225	-5.687410**	-9.480586***	-9.910388***	2008M10	I(1)
INTR	-5.303439**	-4.797730*	c	c	2014M03	I(0)
LOILPB	-4.623135*	-4.333623	-7.212193***	-7.184047***	2014M07	I(1)
LEPU	-12.40548***	-12.39328***	c	c	2011M07	I(0)
LGPR	-4.842957*	-5.252455**	c	c	2013M08	I(0)
Mexico						
LIPC	@	-3.565248	13.73726***	-13.91863***	2009M03	I(1)
LIPI	-3.089641	-3.538408	-6.963639***	-7.230770***	2008M07	I(1)
INTR	-3.042318	-3.575367	-4.406298***	-5.407523***	2008M12	I(1)
LOILPB	-4.623135*	-4.333623	-7.212193***	-7.184047***	2014M07	I(1)
LEPU	-5.319540**	-5.567699***	c	c	2016M09	I(0)
LGPR	-6.364543***	-6.510405***	c	c	2016M07	I(0)

Note: '*','**' and '***' indicate 10%, 5% and 1% probabilistic significance, respectively. c denotes empty cells where the corresponding variable is level stationary. And @ denotes empty cells where an error was given due to inappropriate model chosen with respect to the presence of 'trend' or 'intercept' in the series. {-4.58}, {-4.93} and {-5.34}, are the table critical values at 10%, 5% and 1% respectively level of significant for the model with structural break in the intercept only. While {-4.82}, {-5.08} and {-5.57} table critical values correspond with 10%, 5% and 1% significance level, respectively for the alternative model.

Finally, for Chile all the variables except LGPR seem to be I(1) series. In the nutshell, LEPU and INTR variables contradict the conventional unit root test results for Chile, thus the ZAUR test rejected the stationarity null hypothesis for these two variables which the traditional unit root tests are unable to reject.

The purpose of testing series stationarity prior to applying any econometric methodology to the series is to ensure that an appropriate econometric technique is applied. For instance, econometric techniques such as the vector autoregressive and the vector error correction models require that all the variables in the research model should be either purely I(0) or I(1). This indicates the superiority of the ARDL approach to conventional methods such as the vector autoregressive and the vector error correction models since it can be implemented independently of variables which are strictly I(1) or I(0).

Table 4.8 *ZAUR test results for oil-importer countries*						
Variable	Level (*Constant*)	Level (*Constant and Trend*)	1st Difference (*constant*)	1st Difference *(Constant and Trend)*	Breakpoint	Decision
Chile						
LIGPA	-2.333357	-2.805710	-13.25727***	-13.37980***	2013M03	I(1)
LIPI	-1.007285	-2.036514	-13.78389***	-13.75422***	2010M04	I(1)
INTR	-3.755767	-4.665834	-6.395092***	-6.418774***	2009M01	I(1)
LOILPB	-4.623135*	-4.333623	-7.212193***	-7.184047***	2014M07	I(1)
LEPU	-4.348956	@	-7.009409***	-7.037203***	2011M06	I(1)
LGPR	-4.373091	-5.243605**	-7.437197***	-7.379640***	2009M02	I(0)
Turkey						
LBIST	@	-4.607040	-16.33819***	-16.44773***	2007M11	I(1)
LIPI	-2.963556	-3.386117	-18.37253***	-18.52156***	2008M07	I(1)
INTR	-3.163364	-3.339657	-5.425807***	-5.369787***	2008M11	I(1)
LOILPB	-4.623135*	-4.333623	-7.212193***	-7.184047***	2014M07	I(1)
LGEPU	-5.234852**	-6.017922***	c	c	2007M08	I(0)
LGPR	-5.459265***	-5.409578**	c	c	2011M02	I(0)
Korea						
LKOSPI	-3.818196	-3.973627	-14.87685***	-15.09145***	2005M05	I(1)
LIPI	-3.537308	-4.705908	-15.86620***	-15.91422***	2009M02	I(1)
INTR	-4.137891	-5.104485**	-6.611720***	-6.604041***	2008M10	I(1)
LOILPB	-4.623135*	-4.333623	-7.212193***	-7.184047***	2014M07	I(1)
LEPU	-5.513045***	-5.773550***	c	c	2007M11	I(0)
LGPR	-5.491672***	-6.379184***	c	c	2012M12	I(0)
Greece						
LATHEX	-2.879283	-2.853068	-11.92036***	-11.77047***	2008M06	I(1)
LIPI	-3.888128	-3.636622	-4.725482*	-4.825245*	2008M8	I(1)
INTR	-5.330622**	-8.490071***	c	c	2008M10	I(0)
LOILPB	-4.623135*	-4.333623	-7.212193***	-7.184047***	2014M07	I(1)
LEPU	-4.920937**	-5.108529**	c	c	2008M10	I(0)
LGPR	-4.373091	-5.243605**	-7.437197***	-7.379640***	2009M02	I(1)

Note: '*','**' and '***' indicate 10%, 5% and 1% probabilistic significance, respectively. c denotes empty cells where the corresponding variable is level stationary. And @ denotes empty cells where an error was given due to inappropriate model chosen with respect to the presence of 'trend' or 'intercept' in the series. {-4.58}, {-4.93} and {-5.34}, are the table critical values at 10%, 5% and 1% respectively level of significant for the model with structural break in the intercept only. While {-4.82}, {-5.08} and {-5.57} table critical values correspond with 10%, 5% and 1% significance level, respectively for the alternative model.

However, the ARDL fails if there exist 1(2) series or greater, among the study variables in the research. The unit root test results provide compelling justification for using the ARDL in this study; LSP, LOILPB, LIPI are integrated of order 1 in all the sampled countries; INTR is I(1) for all countries except Russia, Chile and Turkey where it is I(0); and LEPU and LGPR variables are I(0) for all countries.

4.3. The ARDL Bounds Cointegration Test

As noticed above, the variables are a combination of $I(0)$ and $I(1)$ research variables and this allows for the usage of the bounds' cointegration testing in the ARDL framework. Eight Lags order is imposed manually, and the optimal lag orders are automatically determined by the three popular lag specification criteria in an ARDL setting. Namely, The Akaike Information Criterion (AIC), the Schwarz Information Criterion (SIC) and the Hannan-Quinn Information Criterion (HIC) respectively. Thus, the $ARDL\ (\ldots\ldots)$ model with unrestricted constant and no trend is specified for every sample country. As the findings are reported in $table$ 4.9. As it is pre-mentioned earlier, if the calculated F-statistic values is below the bottom critical bound value, i.e. $I(0)$ (Pesaran et al. 2001), at given level of significance, the decision is that, there is no long-run relationship between the variables. On the other hand, if the estimated F-statistic is greater than the upper critical bound value, i.e. bound to I(1), there is a cointegration association-ship amongst the variables. To sum up, the findings displayed in table 4.9 provide proof of a long-term association-ship amongst research variables for Chile, Russia, Turkey, and Greece variables. However, there is no proof for a cointegration amongst the research variables for Brazil, Korea, and Mexico.

Table 4.9 *Bounds Cointegration test results*					
Model	Lag length	F statistic	I(0) bound	I(1) bound	Outcome
Brazil					
LBVSP	(1, 0, 2, 1, 1, 0, 5)	0.794975	2.45	3.61	No cointegration
$LBVSP = f$(LIPI INTR LOILPB LEPU LGPR DUM); k=6					
Russia					
LMOEX	(1, 8, 2, 1, 4, 0, 6)	[7.055867]	2.45	3.61	Cointegration
$LMOEX = f$(LIPI INTR LOILPB LEPU LGPR DUM); $k = 6$					
Mexico					
LIPC	(8, 0, 1, 1, 0, 1)	2.917860	2.62	3.79	No cointegration
$LIPC = f(LIPI\ \ INTR\ LOILPB\ LEPU\ LGPR);\ k = 5$					
Chile					
LIGPA	(1, 0, 0, 0, 0, 0)	[4.564463]	2.62	3.79	Cointegration
$LIGPA = f$(LIPI INTR LOILPB LEPU LGGPR); $k = 5$					
Turkey					
LBIST	(2, 0, 0, 1, 1, 0, 0)	[3.647594]	2.45	3.61	Cointegration
$LBIST = f$(LIPI INTR LOILPB LGEPU LGPR DUM); $k = 6$					
Korea					
LKOSPI	(2, 3, 0, 3, 2, 1, 6)	1.112442	2.45	3.61	No cointegration
$LKOSPI = f(LIPI\ INTR\ LOILPB\ LEPU\ LGPR\ DUM);\ k = 6$					
Greece					
LATHEX	(1, 0, 0, 1, 0, 0, 3)	[5.504918]	2.45	3.61	Cointegration
$LATHEX = f(LIPI\ INTR\ LOILPB\ LEPU\ LGGPR\ DUM);\ k = 6$					
*Note: The AIC, SIC and HIC are utilized to choose the optimal lag order. ARDL models with unrestricted constant and no trend is developed in each case. k denotes the number of dynamic regressors in each model. I(0) and I(1) are F bounds critical values at 5% significance level computed by Pesaran et al (2001) for CASE III. [.] denotes the existence of cointegration relationship at 5% significance level. k denotes number regressors in the function.					

4.4. The ARDL Long-run, Short-run, and Error Correction Estimation Results

In this subsection, based on the goals of the study the long-run, short-run and the error correction models are estimated using Pesaran et al. (2001) ARDL bounds testing framework, for Chile, Brazil, Turkey, Mexico, Greece, Russia and Korea. To determine suitable lag order for all the variables in the model, Akaike Information Criterion (AIC) is used after the imposition of maximum lags of eight. Long-run, short-run, the ECT estimate and the diagnostic tests results are tabulated in panel A, B and C respectively, for each country in the analysis. Eq. (3.18) is utilized to obtain the long-run coefficients using the ARDL approach. The results are organized in panel A of each table for every country in the sample.

Table 4.10 *Short-run, long-run, and error correction estimation results for Brazil*				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Panel A: Long-run results	ARDL (1, 0, 2, 1, 1, 0, 5)			
$\boldsymbol{LBVSP_{t-1}}$	1.004750	0.019395	51.80430	0.0000
$\boldsymbol{LIPI_{t}}$	0.005118	0.118449	0.043207	0.9656
$\boldsymbol{INTR_{t}}$	-0.004056	0.009266	-0.437732	0.6621
$\boldsymbol{INTR_{t-1}}$	-0.012970	0.014713	-0.881585	0.3791
$\boldsymbol{INTR_{t-2}}$	0.018257	0.007515	2.429442	0.0160
$\boldsymbol{LOILPB_{t}}$	0.130921	0.056962	2.298379	0.0226
$\boldsymbol{LOILPB_{t-1}}$	-0.130126	0.056389	-2.307646	0.0220
$\boldsymbol{LEPU_{t}}$	-0.012569	0.008505	-1.477895	0.1410
$\boldsymbol{LEPU_{t-1}}$	0.018246	0.008151	2.238517	0.0263
$\boldsymbol{LGPR_{t}}$	0.023285	0.016140	1.442677	0.1507
$\boldsymbol{DUM_{t}}$	-0.129227	0.015297	-8.447718	0.0000
$\boldsymbol{DUM_{t-1}}$	0.036413	0.006369	5.717209	0.0000
C	-0.212093	0.556742	-0.380953	0.7036
Panel B: Short-run results				
C	-0.212093	0.093210	-2.275441	0.0239
$\boldsymbol{\Delta INTR_{t}}$	-0.004056	0.008072	-0.502466	0.6159
$\boldsymbol{\Delta INTR_{t-1}}$	-0.018257	0.008143	-2.242010	0.0261
$\boldsymbol{\Delta LOILPB_{t}}$	0.130921	0.048017	2.726574	0.0070
$\boldsymbol{\Delta LEPU_{t}}$	-0.012569	0.008280	-1.517898	0.1306
$\boldsymbol{\Delta DUM_{t}}$	-0.129227	0.054581	-2.367623	0.0189
Panel C: Diagnostic tests				
Test	F statistics	Prob.		
Serial correlation LM test	5.291642	0.7260		
Heteroscedasticity test	20.51336	0.1980		
Normality test	0.991998	0.6289		
CUSUM	Stable			
CUSUMsq	Stable			

Eq. (3.20) which is ARDL short-run and error correction term (ect_{t-1}) specification is used to obtain the short-run and ect_{t-1} coefficients for each country, and the results are as given in panel B in each table. For model stability and diagnostic tests, Lagrange Multiplier (LM) test for serially correlated residuals, Breusch-Pagan-Godfrey test for homoscedastic residuals, Jarque-Bera test for normally distributed residuals and CUSUM and CUSUMsq tests (in Appendix A) are conducted, as the results are shown in panel C of each table.

Table 4.10 presents the estimation outcome of short and long-run for Brazil since there is no evidence of cointegration relationship between BVSP and its determinants in the model. As it can be seen from the table, the IPI impacts on BVSP index positively but insignificant statistically in the long run only. This is theoretically expected since increase in aggregate economic activity (output growth) results in an increase in stock indices performance. The positive sign is consistent with extant literature and theoretically expected. Both in the short-run and long-run, the INTR has negative consequence on the Brazilian stock market but only the short-run coefficient is significant. Oil price (OILPB) as theoretically expected, has positive significant impact on BVSP index, consistent with Wen et al. (2019) finding for Brazil. The policy uncertainty (EPU) impacts negatively on the Brazilian stock index performance both in the short and long-run, however the coefficients are not significant statistically. The geopolitical risk (GPR) has insignificant favorable consequence on the Brazilian stock index efficiency, in the long run. Hoque et al. (2019) find similar results for Malaysia in the short run. They explain that, theoretically, if the domestic economy and the stock market continue to be resilient during geopolitical risk spikes, shocks may not have direct and significant detrimental consequence on the stock indices performance in the short and medium term. In panel C, the autocorrelation test of the Lagrange Multiplier (LM) indicates the residuals are free from autocorrelation. The residuals are normally distributed according to the Jarque-Bera (J-B) normality technic. The Breusch-Pagan-Godfrey heteroskedasticity check indicates that the residual terms are homoscedastic in the estimation. And finally, the parameter robustness test of CUSUM and CUSUMsq (Appendix A; Fig. 1 and 2) show the estimated parameters are stable since both statistics lies in the boundary at 5% significance level.

Table 4.11 shows the ARDL estimation outcomes for short-run, long-run, and the error correction term together with model diagnostic tests for Russia. IPI impacts Russia stock index performance positively both in the short-run and long-run but statistically insignificant. The positive sign of the IPI is as theoretically expected; thus, an increase in aggregate economic output has a favorable effect on the MOEX index efficiency. The obtained positive coefficient of IPI is consistent with results in the previous literature (Tiryaki et at., 2017; Camilleri et al., 2019; Abbas et al., 2019; Musah et al., 2019; Demir, 2019 and many others). The lags variables are however statistically significant. The interest rate impacts negatively on the Russian stock index efficiency both in short-run and long-run with the coefficients being significant at 5% level significance. Theoretically speaking, the INTR coefficient could be negative or positive. In the previous studies authors such as Ndlovu et al. (2018), Suhaibu et al. (2017), Adam and Tweneboah (2008) documented similar report in their respective studies, while it counters crosses with findings.

Table 4.11 *Short-run, long-run, and error correction estimation results for Russia*				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Panel A: Long-run results	ARDL (1, 8, 2, 1, 4, 0, 6)			
$LMOEX_{t-1}$	0.877060	0.036713	23.88963	0.0000
$LIPI_t$	0.470994	0.371159	1.268980	0.2060
$LIPI_{t-5}$	-0.804673	0.461770	-1.742582	0.0831
$LIPI_{t-7}$	1.478000	0.440653	3.354113	0.0010
$LIPI_{t-8}$	-0.898707	0.319668	-2.811373	0.0055
$INTR_t$	-0.014592	0.005944	-2.454888	0.0150
$INTR_{t-1}$	0.029351	0.008596	3.414362	0.0008
$INTR_{t-2}$	-0.021815	0.006129	-3.559241	0.0005
$LOILPB_t$	0.244150	0.055991	4.360555	0.0000
$LOILPB_{t-1}$	-0.345665	0.055832	-6.191193	0.0000
$LEPU_t$	-0.008822	0.009427	-0.935805	0.3506
$LEPU_{t-4}$	0.023555	0.009559	2.464157	0.0146
$LGPR_t$	-0.009456	0.020645	-0.458030	0.6475
DUM_t	0.050104	0.061926	0.809095	0.4195
DUM_{t-6}	0.141345	0.066701	2.119064	0.0354
C	0.956662	0.504505	1.896240	0.0595
Panel B: Short-run and ect_{t-1}				
C	0.956662	0.132596	7.214879	0.0000
$\Delta LIPI_t$	0.470994	0.331060	1.422685	0.1565
$\Delta LIPI_{t-1}$	0.885500	0.324197	2.731364	0.0069
$\Delta LIPI_{t-2}$	1.046318	0.331110	3.160030	0.0018
$\Delta LIPI_{t-4}$	0.622553	0.331933	1.875537	0.0623
$\Delta LIPI_{t-6}$	-0.579293	0.311926	-1.857151	0.0649
$\Delta LIPI_{t-7}$	0.898707	0.310973	2.889988	0.0043
$\Delta INTR_t$	-0.014592	0.005668	-2.574705	0.0108
$\Delta INTR_{t-1}$	0.021815	0.005667	3.849669	0.0002
$\Delta LOILPB_t$	0.244150	0.052587	4.642755	0.0000
$\Delta LEPU_t$	-0.008822	0.008604	-1.025410	0.3065
$\Delta LEPU_{t-1}$	-0.041379	0.010780	-3.838314	0.0002
$\Delta LEPU_{t-2}$	-0.036882	0.010680	-3.453488	0.0007
$\Delta LEPU_{t-3}$	-0.023555	0.008567	-2.749520	0.0066
ΔDUM_t	0.050104	0.059313	0.844738	0.3993
ect_{t-1}	-0.122940	0.017219	-7.139735	0.0000
Panel C: Diagnostic tests				
Test	F statistics	Prob.		
Serial correlation LM test	6.703335	0.5690		
Heteroscedasticity test	33.20711	0.2282		
Normality test	51.63591	0.0000		
CUSUM	Stable			
CUSUMsq	Stable			

reported by Demir (2019), Asamoah et al. (2016), Alam and Uddin (2009), Hamrita and Trifi (2011), Kurwornu and Victor (2011). Both in the short-run and long-run oil price exhibits statistically significant positive links with the Russian stock market. Tchatoka et al. (2019) and Wen et al. (2019) also document similar outcomes when they investigated oil price – stock market link for Russia. Theoretically, oil price-oil exporter stock market link is generally accepted to be positive because of the movement of incomes from oil-importer nations to oil-exporter nations. The positive and highly statistically significant of the parameter of OILPB justifies the theoretical expectation. Economic policy uncertainty (EPU) carries insignificant negative coefficient for the Russian stock market, which is theoretically expected sign. Similarly, Kang and Ratti (2013), Arouri et al. (2016), Hillier and Loncan (2019), Hoque et al. (2019) also report negative effects of policy uncertainty on returns in their various studies. This argument makes financial sense, as policy uncertainty risks as a function of discount rates and rising investment risk give rise to detrimental changes in the expected potential cash flows. That, in effect, contributes to decreased stock returns in tandem with increasing uncertainty, culminating in a negative relationship between risk and return. (Bloom, 2009; Brogaard & Detzel, 2015). Geopolitical risk index has negative insignificant influence on stock index efficiency in Russia, only in the long run just as Hoque et al. (2019) find negative relations of GPR with stock returns for Malaysia. The coefficient of the speed of adjustment term is negative (-0.122940) and significant at 1% level economically. It indicates long-run adjustment of deviation from short-run equilibrium. This means that errors in the short-run are adjusted by 12% in the long-run which brings the whole system back to equilibrium. Panel C presents the diagnostic tests; serial correlation, heteroscedasticity and normality which follow the Chi-square distribution; and the CUSUM test and CUSUMsq test for stable parameters invented by Brown, Durbin, and Evans (1975). The autocorrelation test of the Lagrange Multiplier (LM) indicates the residuals are free from autocorrelation. The normally distributed null hypothesis is rejected according to the Jarque-Bera (J-B) technique. The Breusch-Pagan-Godfrey heteroskedasticity check indicates that the residual terms are homoscedastic in the estimation. The CUSUM and CUSUMsq tests (Appendix A; Fig. 3 and 4) show the estimated parameters are stable since both statistics stay in the boundary at 5%.

For Mexico, as it can be seen from the table 4.12, the industrial production growth favorably influences the Mexican stock index performance as theoretically expected, however insignificant. Changes of OILPB and GPR variables have positive short-run and long-run link with stock index efficiency, however, only OILPB carries significant coefficient, indicating that global oil price increments would influence favorably on the Mexican index efficiency.

Table 4.12 *Short-run, long-run, and error correction estimation results for Mexico*				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Panel A: Long-run results	ARDL (8, 0, 1, 1, 0, 1)			
$LIPC_{t-1}$	0.929790	0.082494	11.27101	0.0000
$LIPC_{t-7}$	0.309263	0.097681	3.166054	0.0018
$LIPC_{t-8}$	-0.190047	0.069022	-2.753442	0.0064
$LIPI_t$	0.044430	0.138247	0.321384	0.7483
$INTR_t$	-0.048242	0.017522	-2.753241	0.0064
$LIPI_{t-1}$	0.048349	0.017066	2.833059	0.0051
$LOILPB_t$	0.089354	0.045756	1.952854	0.0522
$LOILPB_{t-1}$	-0.087822	0.046424	-1.891728	0.0600
$LEPU_t$	-0.022100	0.006272	-3.523455	0.0005
$LGPR_t$	0.009449	0.014551	0.649366	0.5169
$LGPR_{t-1}$	0.039310	0.016239	2.420657	0.0164
C	-0.038509	0.571693	-0.067359	0.9464
Panel B: Short-run and ect_{t-1}				
C	-0.038509	0.010858	-3.546511	0.0005
$\Delta LIPC_{t-1}$	-0.040522	0.069989	-0.578974	0.5633
$\Delta LIPC_{t-6}$	-0.119216	0.063655	-1.872836	0.0626
$\Delta LIPC_{t-7}$	0.190047	0.062986	3.017287	0.0029
$\Delta INTR_t$	-0.048242	0.012898	-3.740281	0.0002
$\Delta LOILPB_t$	0.089354	0.034981	2.554375	0.0114
$\Delta LGPR_t$	0.009449	0.013787	0.685355	0.4939
ect_{t-1}	-0.029688	0.007008	-4.236394	0.0000
Panel C: Diagnostic tests				
Test	F statistics	Prob.		
Serial correlation LM test	4.764199	0.7825		
Heteroscedasticity test	28.16978	0.3001		
Normality test	11.72244	0.0028		
CUSUM	Stable			
CUSUMsq	Stable			

It is also shown from the table that INTR and EPU have significant negative consequences on the Mexican stock index performance in the long run. The empirical result justifies the theoretical expectation; Gulen and Ion (2016) notice that economic policy instability depresses firms' investment, decrease in corporate investment in turn depresses output, hence a decrease in aggregate economic activity. This, in turn results in lower output, and hence, decreases stock market performance. The ect_{t-1} coefficient (-0.03) shows a weak cointegration relationship between IPC and its determinants in the analysis, somehow confirming bounds test results of no cointegration relationship. Since only 3% of short-run deviations speedily return to long-run equilibrium. In panel C, the autocorrelation test of the Lagrange Multiplier (LM) indicates the residuals are free from autocorrelation. The normal distribution of the residuals is proven by the graphical representation of the normality test. However, Jarque-Bera (J-B) statistics shows a violation of normal distribution of residuals, this. The Breusch-Pagan-Godfrey heteroskedasticity test indicates the residual terms are homoscedastic in the estimation. Finally, CUSUM and CUSUMsq tests (Appendix A; Fig. 5A and 6A) show the estimated parameters are marginally stable since both statistics stay in the 5% boundary.

Table 4.13 *Short-run, long-run, and error correction estimation results for Chile*

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Panel A: Long-run results	ARDL (1, 0, 0, 0, 0, 0)			
$\boldsymbol{LIGPA_{t-1}}$	0.938498	0.024613	38.12995	0.0000
$\boldsymbol{LIPI_t}$	0.137742	0.059176	2.327673	0.0209
$\boldsymbol{INTR_t}$	-0.005492	0.001762	-3.116488	0.0021
$\boldsymbol{LOILPB_t}$	0.002496	0.009738	0.256280	0.7980
$\boldsymbol{LEPU_t}$	-0.024843	0.008427	-2.947869	0.0036
$\boldsymbol{LGGPR_t}$	-0.003312	0.006428	-0.515251	0.6069
C	0.120664	0.060149	2.006073	0.0461
Panel B: Short-run and $\boldsymbol{ect_{t-1}}$				
C	0.120664	0.021617	5.581832	0.0000
$\boldsymbol{ect_{t-1}}$	-0.061502	0.011614	-5.295467	0.0000
Panel C: Diagnostic tests				
Test	F statistics	Prob.		
Serial correlation LM test	4.209066	0.8378		
Heteroscedasticity test	4.108271	0.6620		
Normality test	15.79582	0.0003		
CUSUM	Stable			
CUSUMsq	Stable			

In the table 4.13 the results for Chile are documented. The long-run results of the table are presented in panel A. The LIPI has a positive impact on the stock indices efficiency in Chile which is statistically significant at 5%. The positive coefficient of Chile industrial production index presents a proof for economic theory. Economic theory postulates that an increase in production affects stock indices performance positively. This confirms evidence in the recent previous literature such Tiryaki et at. (2017), Camilleri et al. (2019), Abbas et al. (2019), Musah et al. (2019) and Demir (2019). The interest rate

(INTR) of Chile has detrimental consequences on stock indices efficiency and is statistically significant at 5%. However, the interest rate explains almost insignificant portion of the variations of stock indices in the Chilean market. In the economic theory's view, the effect of interest rate on stock market performance could either be negative or positive depending on how the former affects the future cash flow of companies. Nevertheless, the negative coefficient confirms the findings by authors such as Demir (2019), Asamoah et al. (2016), Alam and Uddin (2009), Hamrita and Trifi (2011), Kurwornu and Victor (2011), while it is contradicts with results reported by Ndlovu et al. (2018), Suhaibu et al. (2017), Adam and Tweneboah (2008). Oil price changes have favorable consequences on the stock indices efficiency in Chile, but statistically insignificant, consistent with Wen et al. (2019) who report positive links between emerging stock indices and global crude oil prices. Theoretically, oil price increases could have positive or negative consequences on equity prices of companies depending on the net position of the company, that is, an oil user or oil manufacturer—thus negative for the former and positive for the latter. Oil price changes might not have a significant detrimental consequence on a firm's stocks if it is a moderate oil user—that is, if oil is not the main input of production for the firm. This is a justification for the insignificant positive coefficient of oil price (OILPB) for Chile. Policy uncertainty (LEPU) negatively affects the Chilean stock index (LIGPA) as theoretically expected, and statistically significant at 5%. In theory, policy uncertainty counter-cyclically affects stock market performance. That is, a rise in uncertainty regarding economic policy decisions inhibits stock indices efficiency while a decrease fuels stock indices' performance. This finding supports Kang and Ratti (2013), Arouri et al. (2016), Hillier and Loncan (2019), Hoque et al. (2019) and many more. The GGPR exhibits negative but statistically insignificant consequence on stock indices performance for Chile in the long run, confirming the finding by Hoque et al. (2019) in the case of Malaysia. The negative coefficient of the GGPR is consistent with theoretical expectation. The theory asserts that political risk could invoke uncertainties and impacts negatively on investors' decisions and risk behavior amid uncertainty in economic policy and oil price increases–thus creating volatility in the stock indices market (Balcilar et al., 2018; Bouri et al., 2018). In panel B, the speed of adjustment term has a negative coefficient (-0.06) and significant economically. Hence, there are long run equilibrium associations among IGPA and its determinants in the model. This indicates that a deviation from short-run equilibrium would have been corrected swiftly in the long-run by 6%. However, the research variables have no short-run consequences on the IGPA index efficiency. In panel C found the Chi-square tests for serial correlation, heteroscedasticity, and normality; and CUSUM and CUSUMsq stability tests (see in Fig. 7A and 8A in appendix A). The autocorrelation test of the Lagrange Multiplier (LM) indicates the residuals are serially uncorrelated. Due to few outliers in the observations, the normally distributed residuals null hypothesis has been rejected according to the Jarque-Bera (J-B) method, but the graphical representation of the test shows normally distributed residuals as in Fig. 4B of Appendix B. The Breusch-Pagan-Godfrey heteroskedasticity test indicates that the residual terms are homoscedastic in the calculation. The stability tests show the estimated parameters are stable since both the CUSUM and the CUSUMsq statistics for parameter stability stays in the 5% significance boundary.

Table 4.14 *Short-run, long-run, and error correction estimation results for Turkey*

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Panel A: Long-run results	ARDL (2, 0, 0, 1, 1, 0, 0)			
$\boldsymbol{LBIST_{t-1}}$	0.708746	0.091594	7.737893	0.0000
$\boldsymbol{LBIST_{t-2}}$	0.183724	0.091544	2.006936	0.0461
$\boldsymbol{LIPI_{t}}$	0.162920	0.070242	2.319414	0.0214
$\boldsymbol{INTR_{t}}$	-0.002879	0.001051	-2.738388	0.0067
$\boldsymbol{LOILPB_{t}}$	0.001956	0.001221	1.601673	0.1108
$\boldsymbol{LOILPB_{t-1}}$	-0.002372	0.001216	-1.950376	0.0525
$\boldsymbol{LGEPU_{t}}$	-0.107393	0.036713	-2.925231	0.0038
$\boldsymbol{LGEPU_{t-1}}$	0.092134	0.029598	3.112845	0.0021
$\boldsymbol{LGPR_{t}}$	-0.016514	0.018025	-0.916180	0.3606
$\boldsymbol{DUM_{t}}$	0.013925	0.025967	0.536260	0.5924
C	0.676221	0.183813	3.678861	0.0003
Panel B: Short-run and $\boldsymbol{ect_{t-1}}$				
C	0.676221	0.144472	4.680656	0.0000
$\boldsymbol{\Delta LBIST_{t-1}}$	-0.183724	0.063381	-2.898709	0.0042
$\boldsymbol{\Delta LOILPB_{t}}$	0.001956	0.000951	2.057496	0.0409
$\boldsymbol{\Delta LGEPU_{t}}$	-0.107393	0.031151	-3.447486	0.0007
$\boldsymbol{ect_{t-1}}$	-0.107530	0.023377	-4.599768	0.0000
Panel C: Diagnostic tests				
Test	F statistics	Prob.		
Serial correlation LM test	10.64968	0.2223		
Heteroscedasticity test	39.95488	0.3402		
Normality test	9.087641	0.0106		
CUSUM	Stable			
CUSUMsq	Stable			

Table 4.14 reports short-run, long-run and the error correction estimate for Turkey. It is shown in the table that IPI has a statistically significant positive correlation with BIST which represents Turkish stock index. Theoretically, the positive and significant coefficient of IPI does make economic sense because economic theory postulates that an increase in output growth should have positive consequences on stock indices performance. This finding confirms the evidence in the extant literature (Tiryaki et al., 2017; Demir, 2019). In theory, interest could either have favorable or detrimental consequences on stock indices

Table 4.15 *Short-run, long-run, and error correction estimation results for Korea*

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Panel A: Long-run	ARDL (2, 3, 0, 3, 2, 1, 6)			
$\boldsymbol{LKOSPI_{t-1}}$	0.766249	0.073672	10.40075	0.0000
$\boldsymbol{LKOSPI_{t-2}}$	0.179138	0.073497	2.437338	0.0157
$\boldsymbol{LIPI_{t}}$	0.327295	0.159673	2.049779	0.0418
$\boldsymbol{LIPI_{t-3}}$	-0.290970	0.148050	-1.965353	0.0509
$\boldsymbol{INTR_{t}}$	-0.014887	0.008492	-1.752976	0.0813
$\boldsymbol{LOILPB_{t}}$	0.067302	0.044657	1.507077	0.1335
$\boldsymbol{LOILPB_{t-3}}$	0.118306	0.043760	2.703536	0.0075
$\boldsymbol{LEPU_{t}}$	-0.041084	0.012529	-3.279117	0.0012
$\boldsymbol{LEPU_{t-2}}$	0.033691	0.012472	2.701265	0.0075
$\boldsymbol{LGPR_{t}}$	-0.024845	0.012124	-2.049340	0.0418
$\boldsymbol{LGPR_{t-1}}$	0.021550	0.011923	1.807455	0.0723
$\boldsymbol{DUM_{t}}$	0.022264	0.045134	0.493284	0.6224
$\boldsymbol{DUM_{t-5}}$	-0.207861	0.064712	-3.212100	0.0016
$\boldsymbol{DUM_{t-6}}$	0.191950	0.049088	3.910352	0.0001
C	0.158286	0.158929	0.995958	0.3206
Panel B: Short-run results				
C	0.158286	0.054053	2.928348	0.0038
$\boldsymbol{\Delta LKOSPI_{t-1}}$	-0.179138	0.068099	-2.630550	0.0092
$\boldsymbol{\Delta LIPI_{t}}$	0.327295	0.145324	2.252165	0.0255
$\boldsymbol{\Delta LIPI_{t-1}}$	0.309562	0.148147	2.089565	0.0380
$\boldsymbol{\Delta LIPI_{t-2}}$	0.290970	0.144247	2.017156	0.0451
$\boldsymbol{\Delta LOILPB_{t}}$	0.067302	0.043233	1.556714	0.1212
$\boldsymbol{\Delta LOILPB_{t-2}}$	-0.118306	0.041723	-2.835500	0.0051
$\boldsymbol{\Delta LEPU_{t}}$	-0.041084	0.011482	-3.577995	0.0004
$\boldsymbol{\Delta LEPU_{t-1}}$	-0.033691	0.011451	-2.942242	0.0037
$\boldsymbol{\Delta LGPR_{t}}$	-0.024845	0.010167	-2.443612	0.0155
$\boldsymbol{\Delta DUM_{t}}$	0.022264	0.043416	0.512807	0.6087
$\boldsymbol{\Delta DUM_{t-5}}$	-0.191950	0.046777	-4.103508	0.0001
Panel C: Diagnostic tests				
Test	F statistics	Prob.		
Serial correlation LM test	7.506378	0.4831		
Heteroscedasticity test	27.12093	0.2509		
Normality test	28.39049	0.0000		
CUSUM	Stable			
CUSUMsq	Stable			

performance relying on the transmission mechanism of monetary policy rate changes. This study finds significant negative correlation of Turkish monetary policy rate and the BIST index efficiency in the long run. The negative link between INTR and BIST gives support to evidence documented in the previous literature (Demir, 2019; Asamoah et al., 2016; Alam and Uddin, 2009; Hamrita and Trifi, 2011, Kurwornu and Victor, 2011). The global oil price (OILPB) seems to have insignificant favorable relations with the Turkish stock market (consistent with Tiryaki et al., 2017). The global policy uncertainty (GEPU) and the GPR also have long run adverse detrimental influence on the Turkish stock market, but only the influence of GEPU is economically significant at 1% level (consistent with Sum, 2012; Tiryaki and Tiryaki, 2019 findings). In addition, only GEPU has a short-run negative influence on Turkish stock index efficiency. The bounds cointegration test detects cointegration associations among BIST and the explanatory variables, hence, the ect_{t-1} coefficient has been estimated. The ect_{t-1} coefficient is negative (-0.11) and statistically significant at 1% level. This indicates that short-run deviations from equilibrium position are attained by 11% in the long term. The diagnostic tests in Panel C show that the residuals are free from serial correlation and are also homoscedastic. The fact that J-B normality null is rejected which could be as result of few outliers in the observations, however, proof of normally distributed residuals is evidenced by the graphical representation of the test (see Fig. 5B in Appendix B.). Finally, the stability check (see Appendix A; Fig. 9A and 10A) shows the estimated parameters are stable.

In table 4.15 the estimation results for Korea are shown. In panel A and B, it is demonstrated that IPI and OILPB have positive consequences on stock indices performance in Korea both for the short-run and long-run, however only the IPI variable has a significant impact at 5% level. EPU and GPR have both significant short-run and long-run negative consequences on the Korean stock index efficiency. Finally, interest rate (INTR) is shown to have only long-run significant effects on the KOSPI index, consistent with economic theory. Panel C contains the diagnostic tests for the model. As it can be seen from the table, the residuals are serially uncorrelated and homoscedastic; however, they are not normally distributed. The parameter stability tests (Appendix A; Fig. 11A and 12A) indicate stability of the estimated coefficients in the 5% significance boundary.

Table 4.16 displays the ARDL short-run, long-run and ect_{t-1} estimations, and model diagnostic tests for Greece. It is indicated from the table that industrial production (LIPI) have favorable long-run significant influence on the Greek stock index efficiency. As theoretically expected, an increase in aggregate economic activity increases stock market performance in Greece. The global oil price (OILPB) has a significant favorable link with stock index efficiency in Greece both in the short-run and long-run, which contradicts the finding by Filis (2010) who found a negative association of global oil price movements with Greek stock index performance.

Table 4.16 *Short-run, long-run, and error correction estimation results for Greece*

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Panel A: Long-run results	ARDL (1, 0, 0, 1, 0, 0, 3)			
$LATHEX_{t-1}$	0.917105	0.030736	29.83864	0.0000
$LIPI_t$	0.343685	0.174785	1.966334	0.0506
$INTR_t$	-0.008107	0.009580	-0.846257	0.3984
$LOILPB_t$	0.192996	0.079736	2.420426	0.0164
$LOILPB_{t-1}$	-0.220072	0.082988	-2.651849	0.0086
$LEPU_t$	-0.070678	0.017785	-3.974144	0.0001
$LGGPR_t$	-0.014861	0.016220	-0.916222	0.3606
DUM_t	0.106630	0.018116	5.885992	0.0000
DUM_{t-1}	-2.357703	0.007078	-333.0931	0.0000
DUM_{t-2}	4.112958	0.076014	54.10785	0.0000
DUM_{t-3}	-1.920920	0.063457	-30.27132	0.0000
C	-0.395526	0.754797	-0.524016	0.6008
Panel C: Short-run and ect_{t-1}				
C	-0.395526	0.061703	-6.410152	0.0000
$\Delta LOILPB_t$	0.192996	0.068209	2.829485	0.0051
DUM_t	0.106630	0.078115	1.365044	0.1738
DUM_{t-1}	-2.192038	0.079429	-27.59754	0.0000
DUM_{t-2}	1.920920	0.081401	23.59835	0.0000
ect_{t-1}	-0.082895	0.013159	-6.299580	0.0000
Panel C: Diagnostic tests				
Test	F statistics	Prob.		
Serial correlation LM test	3.807572	0.8741		
Heteroscedasticity test	49.30755	0.0849		
Normality test	4.018627	0.1341		
CUSUM	Stable			
CUSUMsq	Stable			

The significant positive impact of OILPB on the ATHEX could be explained by two reasons. First, the ATHEX index comprises of twenty (20) firms, which is relatively low considering the Greek economy. Second, if stock markets are already doing well in an oil-importer country, an increase in oil prices could have significant positive effect on stock market efficiency, as the case of Greece. The INTR, EPU and GGPR as theoretically expected, impose negative impacts on the ATHEX index in the long run, but only EPU's coefficient is 1% level economically significant. The negative estimate (-0.083) of ect_{t-1} confirms the bounds test of cointegration results indicating that long-run adjustments occur at 8%. The diagnostic tests shown in panel C indicate well specification of the model since the residuals are homoscedastic and serially not correlated. The normality test both graphical representation and J-B statistics show the residuals are distributed normally. The estimated coefficients are demonstrated to be stable by conducting CUSUM and CUSUMsq tests as shown in Fig. 13A and 14A in the Appendix A.

4.5. Robustness Check

The 2007—2008 global financial crisis started in the US caused an economic downturn globally. The economic downturn resulted in abrupt systematic breakages in various variables used in the study, owing to the strong contagion and spillover effects of the crisis to emerging markets. The evidence of structural breaks during the episode of the pre-mentioned financial crisis is provided in reference with the ZAUR test results in the previous chapter. Nevertheless, the CUSUM and CUSUMsq tests results on the model pre-analysis indicate structural breaks occurring mostly during the 2007—2008 global financial crisis period. Though dummy variables are incorporated into the models to nullify the effects of structural breaks in the full sample analysis, however, for the purpose of reinforcement and to check the robustness of the research findings, sub-sample analyses are conducted. Again, the ARDL method is employed to conduct the sub-samples of pre-crisis (2002-2008) and post-crisis (2008-2019) periods for all countries in the sample. For brevity and clarity, the results for the sub-sample analysis are reported as shown in the tables 4.17, 4.18, 4.19, 4.20, 4.21 and 4.22.

For oil-exporter countries the pre-crisis and post-crisis model estimation outcomes are reported in tables 4.17 and 4.18, respectively. It is shown that, like the full sample analysis, the positive effect of industrial production (IPI) is consistent across sub-samples, except for Brazil where negative effects of IPI is recorded for post-crisis analysis. The long-run negative effects of INTR variable on stock returns is homogeneous across both

Table 4.17 *Pre-crisis sub-sample results for oil-exporter countries.*

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long-run results	ARDL (1, 1, 3, 0, 2, 0)			
Brazil				
$LIPI_t$	0.753828	0.638175	1.181225	0.2419
$INTR_t$	0.011847	0.014735	0.803995	0.4244
$LOILPB_t$	-0.087976	0.073910	-1.190323	0.2383
$LEPU_t$	-0.037796	0.020431	-1.849948	0.0689
$LGPR_t$	0.029228	0.033062	0.884039	0.3800
C	-7.865164	2.111568	-3.724799	0.0004
Short-run and ect_{t-1} results				
C	-7.865164	1.585488	-4.960722	0.0000
$\Delta LIPI_t$	0.753828	0.586896	1.284431	0.2036
$\Delta INTR_t$	0.011847	0.011184	1.059321	0.2934
$\Delta INTR_{t-1}$	-0.028398	0.011265	-2.520937	0.0142
$\Delta LEPU_t$	-0.037796	0.014583	-2.591696	0.0118
ect_{t-1}	-0.138253	0.027790	-4.974852	0.0000
Russia				
Long-run results	ARDL (1, 0, 3, 1, 0, 1)			
$LIPI_t$	0.633903	0.567096	1.117806	0.2696
$INTR_t$	-0.018384	0.015720	-1.169475	0.2484
$LOILPB_t$	0.347040	0.127766	2.716216	0.0093
$LEPU_t$	-0.014159	0.019647	-0.720680	0.4748
$LGPR_t$	-0.022956	0.049654	-0.462316	0.6461
C	-2.709588	2.220073	-1.220495	0.2286
Short-run and ect_{t-1} results				
C	-2.709588	0.925644	-2.927245	0.0053
$\Delta INTR_t$	-0.018384	0.012521	-1.468207	0.1490
$\Delta LOILPB_t$	0.347040	0.119177	2.911968	0.0056
$\Delta LGPR_t$	-0.022956	0.042089	-0.545413	0.5882
ect_{t-1}	-0.056166	0.019079	-2.943835	0.0051
Mexico				
Long-run results	ARDL (1, 1, 1, 1, 0, 1)			
$LIPI_t$	0.421212	0.622579	0.676561	0.5008
$INTR_t$	-0.028749	0.016125	-1.782912	0.0788
$LOILPB_t$	0.053274	0.082707	0.644125	0.5215
$LEPU_t$	-0.025253	0.011261	-2.242472	0.0280
$LGPR_t$	0.019119	0.025303	0.755633	0.4523
C	-6.117096	1.750391	-3.494702	0.0008
Short-run and ect_{t-1} results				
C	-6.117096	1.249663	-4.894995	0.0000
$\Delta LIPI_t$	0.421212	0.562331	0.749047	0.4562
$\Delta INTR_t$	-0.028749	0.016561	-1.735964	0.0868
$\Delta LOILPB_t$	0.053274	0.054511	0.977291	0.3317
$\Delta LGPR_t$	0.019119	0.025748	0.742562	0.4601
ect_{t-1}	-0.091280	0.018603	-4.906695	0.0000

Table 4.18 *Post-crisis sub-sample results for oil-exporter countries*.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Brazil				
Long-run results	ARDL (1, 0, 0, 1, 0, 0)			
$LIPI_t$	-0.146295	0.140196	-1.043498	0.2987
$INTR_t$	-0.005667	0.002330	-2.431956	0.0164
$LOILPB_t$	0.228638	0.070449	3.245454	0.0015
$LEPU_t$	-0.006903	0.009227	-0.748093	0.4558
$LGPR_t$	0.005536	0.016299	0.339642	0.7347
C	1.662329	0.701678	2.369076	0.0194
Short-run and ect_{t-1} results				
C	1.662329	0.422608	3.933497	0.0001
$\Delta LOILPB_t$	0.228638	0.056868	4.020473	0.0001
ect_{t-1}	-0.075116	0.019185	-3.915365	0.0001
Russia				
Long-run results	ARDL (3, 6, 2, 1, 0, 0)			
$LIPI_t$	0.546994	0.418117	1.308231	0.1934
$INTR_t$	-0.014707	0.003239	-4.540756	0.0000
$LOILPB_t$	0.126300	0.062750	2.012746	0.0465
$LEPU_t$	-0.015230	0.010784	-1.412253	0.1606
$LGPR_t$	0.006650	0.020265	0.328146	0.7434
C	-0.053658	0.392241	-0.136799	0.8914
Short-run and ect_{t-1} results				
C	-0.053658	0.017654	-3.039433	0.0029
$\Delta LIPI_t$	0.546994	0.469924	1.164006	0.2468
$\Delta INTR_t$	-0.014707	0.005276	-2.787687	0.0062
$\Delta LOILPB_t$	0.126300	0.063080	2.002209	0.0476
ect_{t-1}	-0.059805	0.015172	-3.941746	0.0001
Mexico				
Long-run results	ARDL (1, 1, 2, 4, 1, 0)			
$LIPI_t$	1.139951	0.435104	2.619949	0.0100
$INTR_t$	-0.071362	0.027408	-2.603703	0.0104
$LOILPB_t$	0.092462	0.043110	2.144792	0.0340
$LEPU_t$	-0.027705	0.008255	-3.356231	0.0011
$LGPR_t$	-0.001397	0.019748	-0.070739	0.9437
C	-0.526864	0.495827	-1.062596	0.2902
Short-run and ect_{t-1} results				
C	-0.526864	0.131031	-4.020923	0.0001
$\Delta LIPI_t$	1.139951	0.316838	3.597903	0.0005
$\Delta INTR_t$	-0.071362	0.028026	-2.546235	0.0122
$\Delta LOILPB_t$	0.092462	0.036204	2.553916	0.0119
$\Delta LEPU_t$	-0.027705	0.006827	-4.057948	0.0001
ect_{t-1}	-0.154528	0.038080	-4.057987	0.0001

sub-sample regressions for all oil-exporter countries. Just as it was in the case of the full sample regressions, oil prices (OILPB) affect oil-exporter emerging stocks positively and significantly in the long-run, except for Brazil in the pre-crisis analysis where insignificant negative effects of oil prices are obtained. Consistent with the full sample analysis, the long-run significant inverse impact of EPU on emerging stocks is proven to be consistent for all sub-analysis. The geopolitical uncertainty is over again has varying (heterogeneous) insignificant long-run influence on stock indices efficiency across pre-crisis and post-crisis analysis. For short-run effects, the INTR negatively affects only Russian and the Mexican stock markets, however, positive short-run effect of INTR is obtained for Brazil for only pre-crisis analysis. Positive short-run significant effects of OILPB is evidenced for all oil-exporter countries except only for Brazil for the pre-crisis analysis where oil price has no short-run effects on stock returns at all. EPU only has significant detrimental short-run influence on the Brazilian (Mexican) stocks in the pre-crisis (post-crisis) period.

Table 4.19 *Sub-analysis diagnostic tests for oil-exporter countries*

Pre-crisis Diagnostic tests				
Country	LM test	Heteroscedasticity test	Normality test	CUSUM & CUSUMsq test
Brazil	7.505 [0.2767]	14.446 [0.2731]	1.665 [0.435]	stable
Russia	3.979 [0.552]	11.711 [0.386]	0.484 [0.785]	stable
Mexico	9.450 [0.150]	5.805 [0.831]	13.148 [0.001]	stable
Post-crisis Diagnostic tests				
Country	LM test	Heteroscedasticity test	J-B Normality test	CUSUM & CUSUMsq tests
Brazil	8.389 [0.396]	6.838 [0.446]	0.087 [0.958]	Highly stable
Russia	7.149 [0.307]	25.607 [0.082]	112.604 [0.000]	Fairly stable
Mexico	5.843 [0.441]	23.160 [0.058]	11.380 [0.003]	Highly stable

Note: Numbers in parenthesis are probability values associated with Chi-Square distributed obs*R-squared statistics. LM test is Breusch-Godfrey serial correlation test and Breusch-Pagan-Godfrey test for heteroscedasticity. J-B test statistics for normality are also reported with the corresponding probability values in parenthesis.

Table 4.20 *Pre-crisis sub-sample results for oil-importer countries*				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Chile				
Long-run results	ARDL (1, 1, 0, 0, 0, 0)			
$LIPI_t$	0.146051	0.357097	0.408994	0.6838
$INTR_t$	-0.007249	0.002693	-2.691755	0.0089
$LOILPB_t$	-0.122729	0.030340	-4.045148	0.0001
$LEPU_t$	-0.026302	0.017089	-1.539103	0.1282
$LGGPR_t$	-0.014742	0.011433	-1.289455	0.2014
C	-2.534634	0.639580	-3.962967	0.0002
Short-run and ect_{t-1} results				
C	-2.534634	0.419399	-6.043489	0.0000
$\Delta LIPI_t$	0.146051	0.402669	0.362707	0.7179
ect_{t-1}	-0.225915	0.037197	-6.073484	0.0000
Turkey				
Long-run results	ARDL (2, 0, 0, 0, 0, 0)			
$LIPI_t$	0.295300	0.186791	1.580910	0.1181
$INTR_t$	-0.003236	0.001491	-2.170529	0.0331
$LOILPB_t$	0.000435	0.000710	0.612375	0.5421
$LGEPU_t$	-0.199149	0.051100	-3.897267	0.0002
$LGPR_t$	0.051654	0.031181	1.656593	0.1017
C	1.764732	0.651772	2.707593	0.0084
Short-run and ect_{t-1} results				
C	1.764732	0.274960	6.418140	0.0000
ect_{t-1}	-0.222936	0.034930	-6.382280	0.0000
Korea				
Long-run results	ARDL (1, 0, 0, 0, 0, 0)			
$LIPI_t$	0.586653	0.259369	2.261845	0.0266
$INTR_t$	-0.001194	0.017535	-0.068113	0.9459
$LOILPB_t$	-0.062672	0.053156	-1.179035	0.2421
$LEPU_t$	-0.085603	0.025255	-3.389519	0.0011
$LGPR_t$	0.001878	0.027677	0.067859	0.9461
C	-0.416055	0.564654	-0.736831	0.4635
Short-run and ect_{t-1} results				
C	-0.416055	0.084931	-4.898763	0.0000
ect_{t-1}	-0.201050	0.040435	-4.972162	0.0000
Greece				
Long-run results	ARDL (1, 0, 0, 0, 0, 0)			
$LIPI_t$	0.107257	0.349251	0.307107	0.7597
$INTR_t$	-0.011469	0.010128	-1.132362	0.2614
$LOILPB_t$	0.062897	0.027511	2.286232	0.0253
$LEPU_t$	-0.084488	0.021189	-3.987406	0.0002
$LGGPR_t$	-0.014766	0.017995	-0.820595	0.4147
C	1.147712	1.691785	0.678403	0.4998
Short-run and ect_{t-1} results				
C	1.147712	0.205713	5.579202	0.0000
ect_{t-1}	-0.148549	0.026763	-5.550576	0.0000

The model diagnostics tests results reported in table 4.19 indicate the models do not have any diagnostic problems.

Accordingly, pre-crisis and post-crisis regression outcomes are reported in tables 4.20 and 4.21 for oil-importer countries. Consistent with the whole sample results, IPI (INTR) affects oil-importer emerging stocks positively (negatively) across sub-samples in the long-run. Oil price movements affected the Chilean and Korean market negatively in the pre-crisis period. For the remaining oil-importer countries the long-run influences of oil price movements on stock indices efficiency are positive across both sub-sample periods just as was in the case of full sample analysis. Policy uncertainty has significant inverse effects on all oil-importer emerging stocks except for Chile, in the long-run. Geopolitical risks have favorable influence on the Turkish and Korean stock indices efficiency during the pre-crisis period while the effects are negative on stock markets for Chile and Greece. For the post-crisis period geopolitical threats affect all oil-importing emerging stocks negatively in the long-run. For the short-run effects, in the pre-crisis period, among the study variables only industrial production has insignificant positive effects on stock indices efficiency only for Chile. The positive effect of oil prices is obvious for only Turkey and Korea during the after-crisis period in the short-run. Finally, the negative policy uncertainty and stock indices efficiency nexus is reinforced with short-run evidence for Chile, Turkey, and Korea in the after-crisis period. The model diagnostics test results for oil-importer countries reported in table 4.22 are proofs of diagnostic problem-free regressions.

The robustness checks on the models are conducted to reinforce and control the consistency of findings of the study. The researcher did that by disentangling the overall sample range to pre-crisis and post-crisis, that is, before and after the episode of 2007—2008 world financial crisis. Though the obtained results from the sub-sample analysis are not exactly the same in terms of significance and the direction of coefficients (positive/negative) for all the variables, however in general, the results for most variables are in resemblance with the full sample analysis results, hence proven and reinforced the robustness of the overall sample estimation results.

Table 4.21 *Post-crisis sub-sample results for oil-importer countries.*

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Chile				
Long-run results	ARDL (1, 0, 0, 0, 2, 0)			
$LIPI_t$	0.041331	0.082976	0.498103	0.6192
$INTR_t$	-0.007154	0.002059	-3.474420	0.0007
$LOILPB_t$	0.005141	0.010302	0.499096	0.6185
$LEPU_t$	-0.011691	0.011450	-1.021066	0.3090
$LEPU_{t-1}$	-0.031871	0.014957	-2.130787	0.0349
$LGGPR_t$	0.007077	0.009010	0.785384	0.4336
C	0.429600	0.163991	2.619650	0.0098
Short-run and ect_{t-1} results				
C	0.429600	0.094640	4.539293	0.0000
$\Delta LEPU_t$	-0.011691	0.011094	-1.053830	0.2938
$\Delta LEPU_{t-1}$	-0.035762	0.010916	-3.276030	0.0013
ect_{t-1}	-0.061327	0.013633	-4.498487	0.0000
Turkey				
Long-run results	ARDL (7, 0, 0, 1, 1, 0)			
$LIPI_t$	0.174265	0.098661	1.766299	0.0797
$INTR_t$	-0.001980	0.001449	-1.366254	0.1742
$LOILPB_t$	0.001486	0.001068	1.391552	0.1665
$LGEPU_t$	-0.109686	0.038405	-2.856079	0.0050
$LGPR_t$	-0.008592	0.018199	-0.472109	0.6376
C	0.554507	0.260661	2.127314	0.0353
Short-run and ect_{t-1} results				
C	0.554507	0.172064	3.222684	0.0016
$\Delta LOILPB_t$	0.001486	0.000883	1.684225	0.0946
$\Delta LGEPU_t$	-0.109686	0.030357	-3.613242	0.0004
ect_{t-1}	-0.125837	0.039446	-3.190107	0.0018
Korea				
Long-run results	ARDL (1, 0, 0, 0, 1, 0)			
$LIPI_t$	0.251274	0.102267	2.457031	0.0154
$INTR_t$	-0.013445	0.011497	-1.169359	0.2445
$LOILPB_t$	0.010587	0.018949	0.558747	0.5773
$LEPU_t$	-0.037305	0.012927	-2.885811	0.0046
$LEPU_{t-1}$	0.027419	0.010895	2.516551	0.0131
$LGPR_t$	-0.000438	0.010444	-0.041933	0.9666
C	0.636311	0.204341	3.113969	0.0023
Short-run and ect_{t-1} results				
C	0.636311	0.117371	5.421359	0.0000
$\Delta LEPU_t$	-0.037305	0.010653	-3.501911	0.0006
ect_{t-1}	-0.231027	0.042960	-5.377777	0.0000
Greece				
Long-run results	ARDL (3, 0, 0, 0, 0, 0)			
$LIPI_t$	0.785164	0.691404	1.135608	0.2583
$INTR_t$	-0.022431	0.065295	-0.343533	0.7318
$LOILPB_t$	0.020320	0.109812	0.185047	0.8535
$LEPU_t$	-0.136712	0.059355	-2.303304	0.0229
$LGGPR_t$	-0.113327	0.045378	-2.497403	0.0138
C	-1.127240	3.253102	-0.346512	0.7295
Short-run and ect_{t-1} results				
C	-1.127240	0.265545	-4.245013	0.0000
ect_{t-1}	-0.182490	0.043596	-4.185970	0.0001

Table 4.22 *Sub-analysis diagnostic tests for oil-importer countries*				
Pre-crisis Diagnostic tests				
Country	LM test	Heteroscedasticity test	Normality test	CUSUM & CUSUMsq test
Chile	14.937 [0.093]	8.922 [0.258]	11.395 [0.003]	stable
Turkey	3.800 [0.704]	8.860 [0.263]	4.635 [0.099]	stable
Korea	6.040 [0.419]	4.360 [0.628]	11.970 [0.003]	Fairly stable
Greece	7.668 [0.264]	6.262 [0.395]	0.709 [0.701]	stable
Post-crisis Diagnostic tests				
Country	LM test	Heteroscedasticity test	J-B Normality test	CUSUM & CUSUMsq tests
Chile	1.875 [0.931]	5.457 [0.708]	2.201[0.333]	stable
Turkey	11.499 [0.175]	21.841 [0.082]	7.433 [0.024]	stable
Korea	3.951 [0.683]	6.203 [0.516]	32.309 [0.00]	stable
Greece	8.007 [0.238]	6.895 [0.548]	3.943 [0.139]	Fairly stable
Note: Numbers in parenthesis are probability values associated with Chi-Square distributed obs*R-squared statistics. LM test is Breusch-Godfrey serial correlation test and Breusch-Pagan-Godfrey test for heteroscedasticity. J-B test statistics for normality are also reported with the corresponding probability values in parenthesis.				

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the research empirical findings, draws conclusions from the findings, gives recommendations for future research and finally drives policy implications from the empirical findings.

5.1. Research Results

To attain the goals of the research the best ARDL models are specified for each country using monthly data ranging from 2002:01-2019:12. With the specified models for each country, the dynamic associations among emerging stock returns and the chosen macroeconomic variables namely, industrial production, monetary policy rate, global oil price movements, the news-based EPU index and the GPR index are explored and the findings are as discussed below.

The impact of growth in aggregate production, represented by the industrial production index of each emerging country on stock returns is homogenous across all the seven emerging markets in the analysis. This research provides evidence of overall positive emerging stock market—aggregate production growth linkage. However, the positive effects of output growth on stock returns is statistically significant for only oil-importer emerging markets in the long run. Thus, an increase in aggregate output growth has positive influence on emerging stock market performance, whilst a decrease in output level has adverse negative influence on stock returns in emerging markets. This evidence supports the theoretical expectation, where production growth or retardation in production during a business cycle has a procyclical link with stock returns. The evidence also confirms findings in the extant literature (Tiryaki et al., 2017; Camilleri et al., 2019; Demir, 2019; Musah et al., 2019)

Next, the research also provides evidence establishing the negative correlation of monetary policy rate with stock indices efficiency for the analyzed emerging market. The influence of monetary policy rate changes on emerging stock indices is homogeneous. The findings of the research generally provide evidence supporting significant long-run detrimental influence of monetary policy on emerging stock indices efficiency except for

Brazil and Greece, confirms Hu et al. (2018) findings of adverse consequence of monetary policy rate changes on stock indices performance for China. As far as economic theory is concerned monetary policy changes could either have favorable or detrimental consequences on stock indices efficiency depending on the transmission channel of monetary policy. Generally, the finding supports economic theory, increase in the interest rate affects investors' decision by influencing fixed investment through the user cost of capital, thereby raising the expected return of investment projects and therefore a reduction in business investment (Bean et al., 2002). As a result, reduced business investment tends to lower the returns of equity and shares and thus, lowers stock returns. Nevertheless, the negative relation among monetary policy rate and emerging stock indices efficiency confirms the findings by authors such as Demir (2019), Asamoah et al. (2016), Alam and Uddin (2009), Hamrita and Trifi (2011), Kurwornu and Victor (2011) in the previous literature. While it contradicts with findings reported by Ndlovu et al. (2018), Suhaibu et al. (2017), Adam and Tweneboah (2008).

Likewise, the research provides evidence to support the positive correlation of oil price movements with emerging stock indices efficiency. One of the main objectives of this study was to observe if there are differences on how oil-exporter emerging market stocks and oil-importer emerging market stocks respond to oil price movements. Though the overall findings show positive correlation of oil price movements and emerging stock indices efficiency, the positive influence of oil price movements on emerging stocks efficiency is intense and stronger for net oil-exporter emerging countries (Brazil, Russia, and Mexico) in the long-run, where the estimated coefficients are highly significant. That is, innovations to oil prices play a significant role in explaining variations in oil-exporter emerging stocks efficiency. This finding is consistent with Wang, Wu and Yang (2013), Tchatoka et al. (2019), Wen et al. (2019), who also find favorable consequences of crude oil prices on emerging stocks efficiency, for both oil-exporter and oil-importer markets. Surprisingly, oil price movements have economically significant positive influence on the Greek stock index though Greece is oil-importer. For Greece case, if stock markets are already doing well and there are positive oil price changes, the positive oil price changes might have significant favorable influence on the already-doing well stock markets. The findings for oil-exporter emerging countries support the theoretical expectation.

Theoretically, a highly significant estimate of the oil price changes for net-exporter countries is explained by Bjørnland (2009), Jiménez-Rodríguez, and Sánchez (2005) and Degiannakis et al., (2018). Thus, a rise in oil price would increase income in oil-exporter countries resulting from a transfer of incomes from oil importer countries and a fall in oil prices decreases income in oil producer countries. Degiannakis et al. (2018) explain that oil price movements in oil exporter countries positively impact stock returns if government expenditure complements private investment. The consequent effect results in increased aggregate economic activity, therefore, boost stock returns performance.

Furthermore, the findings of the research provide evidence to support the negative link between emerging stock indices efficiency and the news based EPU index. Generally, evidence provided shows the negative impact of country specific economic policy uncertainty index on emerging stock indices performance. The long-run negative impact of the EPU on emerging stock performance is statistically significant for all countries in the analysis except for Brazil and Russia. This finding is consistent with evidence in the previous studies (Kang and Ratti, 2013; Arouri et al., 2016; Bahmaani-Oskooee and Saha, 2019a; Sum, 2012; Sum, 2013; Hoque et al., 2019). The evidence also shows statistically significant detrimental influence of global policy uncertainty on Turkish stock indices efficiency. In the nutshell, the study findings support the theoretical expectation of counter-cyclical effects of policy uncertainty on stock indices—thus policy uncertainty causes slumps in aggregate economic activity depressing corporate investment, which in turn has adverse effects on stock market performance.

Lastly, the research provides evidence of the correlation of the GPR index with emerging stock indices performance. The link between the GPR index and emerging stock returns is non uniform across the countries. Accordingly, the findings show statistically insignificant negative linkage between emerging stock returns and geopolitical uncertainties for four countries (Russia, Chile, Turkey and Greece) countries in the analysis—consistent with (Balcilar et al., 2018; Das et al., 2019; Hoque et al., 2019) who found geopolitical uncertainty to have detrimental influence on stock market efficiency and volatility. However, the GPR index has been observed to have detrimental significant influence on the Korean stock market only. The evidence of negative geopolitical uncertainty—emerging stocks efficiency link supports the economic theory. Because the theory postulates the GPR carries threats to the business cycle causing slumps in aggregate economic activity, thereupon depresses stock indices performance by affecting decisions of entrepreneurs, market participants, central bank official and the business press (Caldara and Iacoviello, 2018; Dissanayake et. al., 2018). Contrary, positive insignificant impact of geopolitical tensions is recorded for Mexico and Brazil. Theoretically, if the home economy and the stock market continue to stand firm against geopolitical unrest, shocks might not have direct and significant detrimental consequences on stock market efficiency in the short and medium term (Hoque et al., 2019).

5.2. Conclusion

The research scrutinizes the impact of changes in the chosen macroeconomic variables namely, aggregate demand (industrial production growth), monetary policy rate, oil price, economic policy uncertainty and geopolitical risk on stock indices efficiency for Brazil, Russia, Mexico, Chile, Turkey, Korea, and Greece. The study uses Pesaran et al. (2001) the ARDL approach and secondary monthly data over the period of 2002:01—2019:12 in investigating the emerging stock indices efficiency and macroeconomic variables nexus. In doing so, the study makes a significant contribution to the literature in the following ways. First, the evidence of cointegration relationship between the study variables is provided for Russia, Chile, Turkey, and Greece, and no cointegration relationship for the remaining three countries. Secondly, industrial production index and oil price movements are positively correlated with emerging stock returns in the long run. The positive effects of industrial production on stock returns is significant for only oil-importer countries in the long run (with short-run significant effects for only Korea). Comparatively, the long-run positive influence of oil price movements on emerging stocks is more obvious and stronger for oil-exporter countries than oil-importer countries, indicating transfer of wealth to oil producers from oil users. In the short run however, oil price changes have statistically significant effects on stock returns for all sample countries except two (Chile and Korea). Furthermore, monetary policy rate and economic policy uncertainty changes have overall negative linkages with emerging stocks efficiency in the long run. The adverse effect of monetary policy rate on stock returns is statistically significant for four countries (Russia, Mexico, Chile and Turkey). However, there is short-run significant effect of monetary policy rate on stock returns for only Russia and Mexico. The long-run impact of economic policy uncertainty on stock returns is significant for all, excluding Brazil and Russia. But, the short-run effects are economically significant for only Turkey and Korean. Finally, the influence of geopolitical uncertainty on stock returns efficiency are heterogeneous across emerging markets and plays significant role in explaining variations of stock returns only for the Korean market, both in short and long run.

5.3. Recommendations

The findings of the research have several policy recommendations for governments, investors, and portfolio managers of emerging economies. Firstly, to reduce adverse negative influence of monetary policy rate movement on emerging stock indices efficiency governments should optimize policy consistency thereupon achieving stable interest rates. Secondly, the positive link between emerging stocks and oil price movements is an indication that market diversification of portfolio benefits between oil futures and stock indices of emerging markets diminishes over time, especially during severe downturn market events. Finally, policy makers should lay grounds to provide incentives for both local and foreign investors to prevent them from flying capitals to safety due to rising geopolitical unrest and ambiguous economic policy decisions, coupled with high investment risk and negative stock returns in emerging markets. Future researchers can adopt different economic techniques such as panel data analysis to enable them to see very well and compare common features and characteristics of data collected for countries during analysis, which is a limitation of this study.

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APPENDICES

Appendices A: Stability Tests

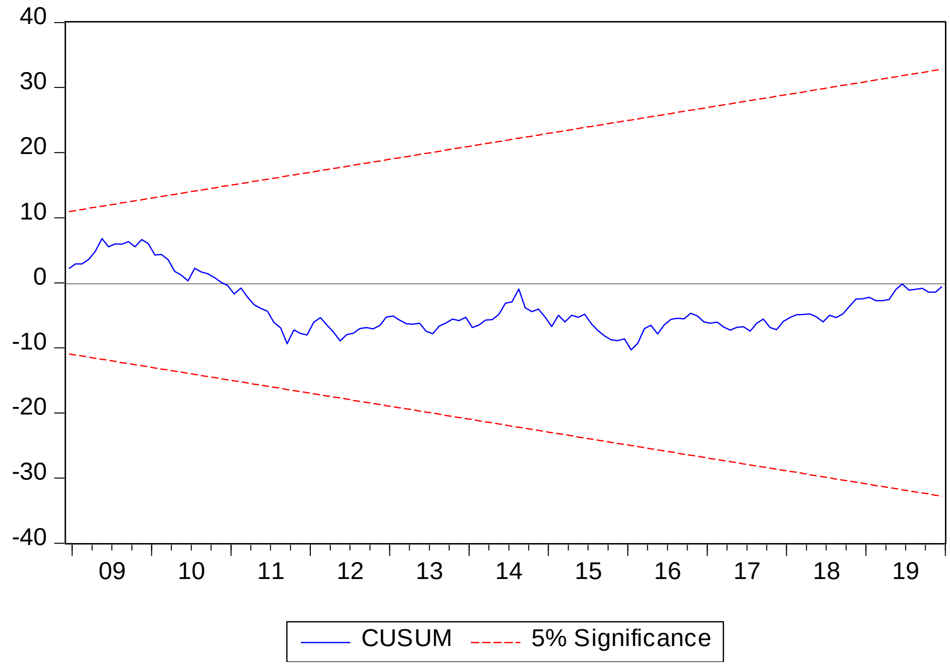

Figure 1A Brazil

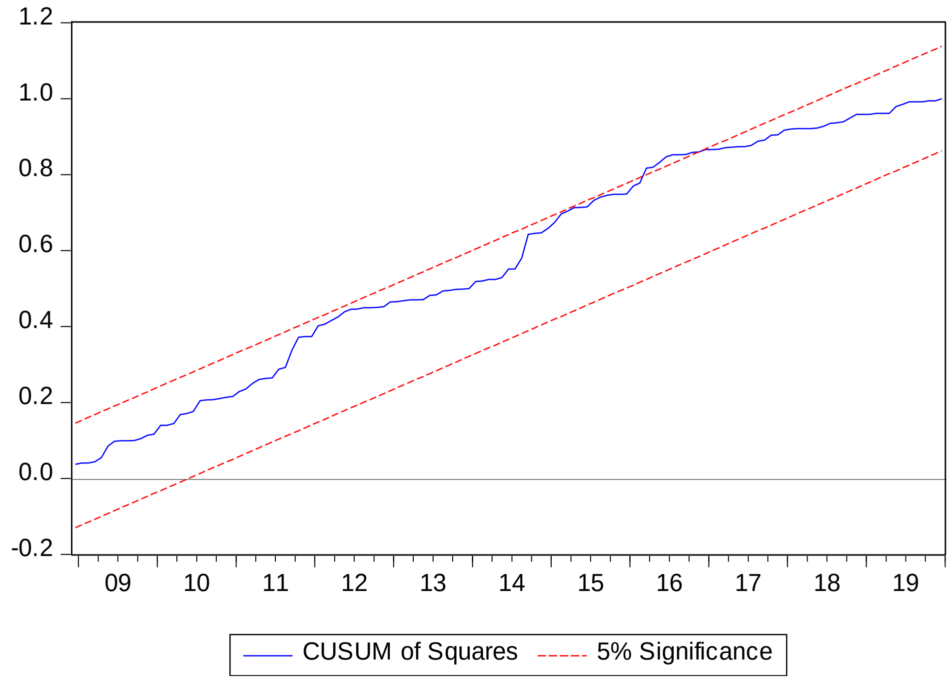

Figure 2A Brazil

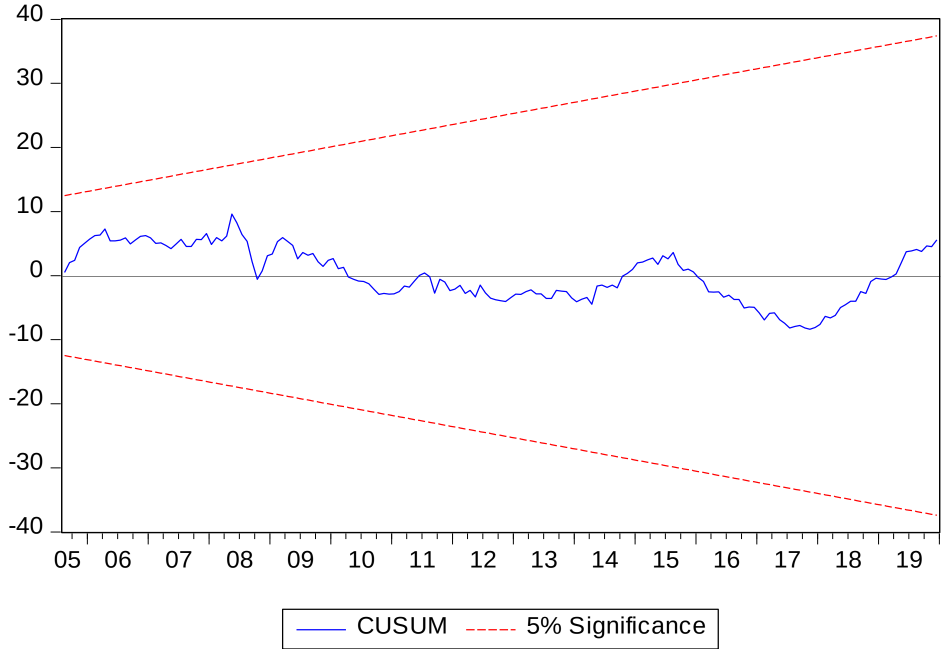

Figure 3A Russia

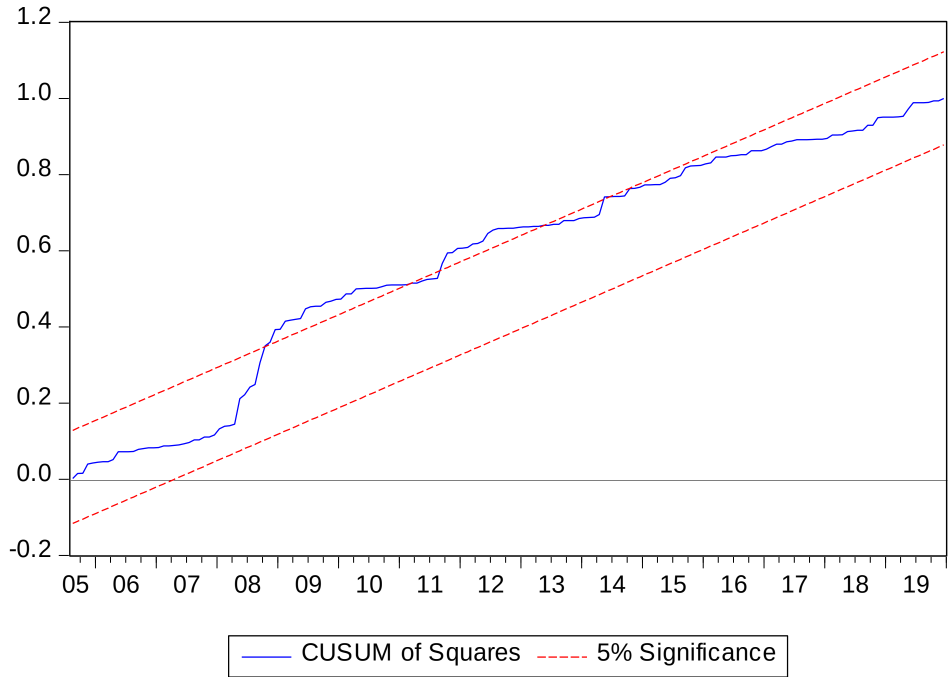

Figure 4A Russia

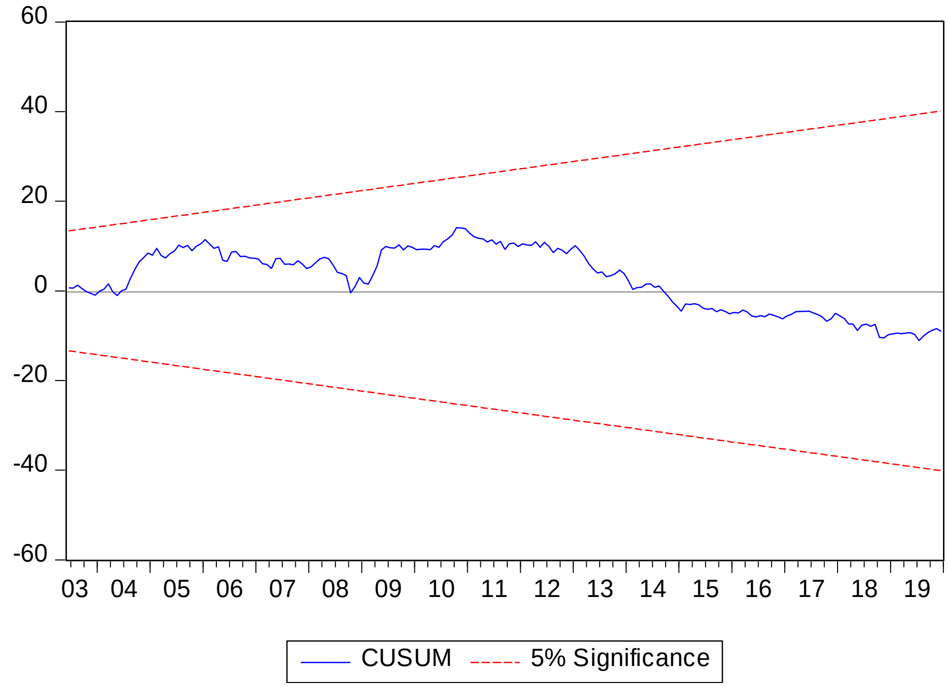

Figure 5A Mexico

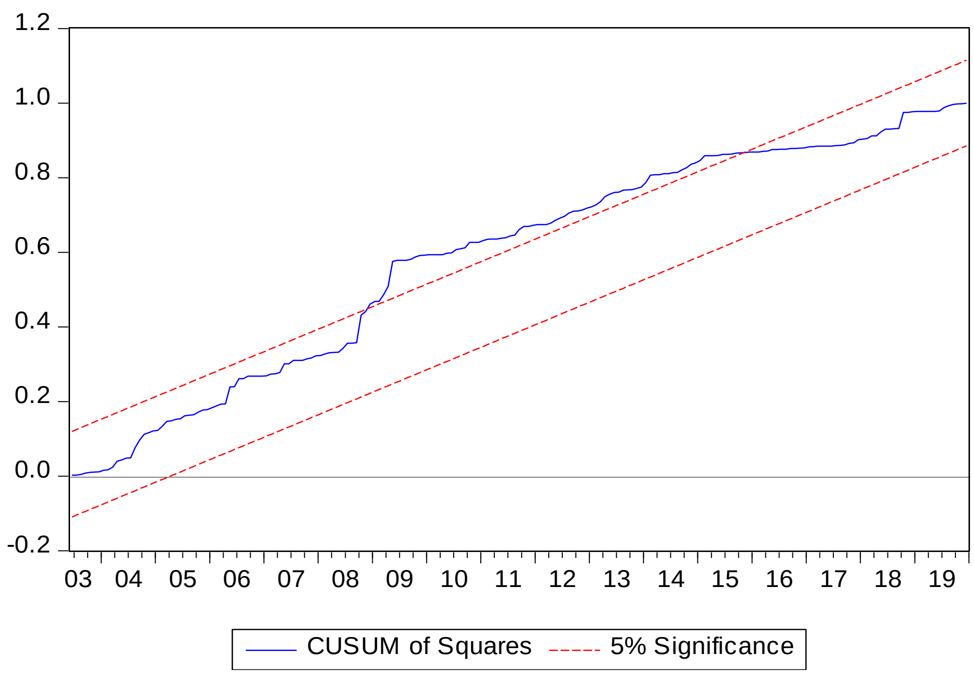

Figure 6A Mexico

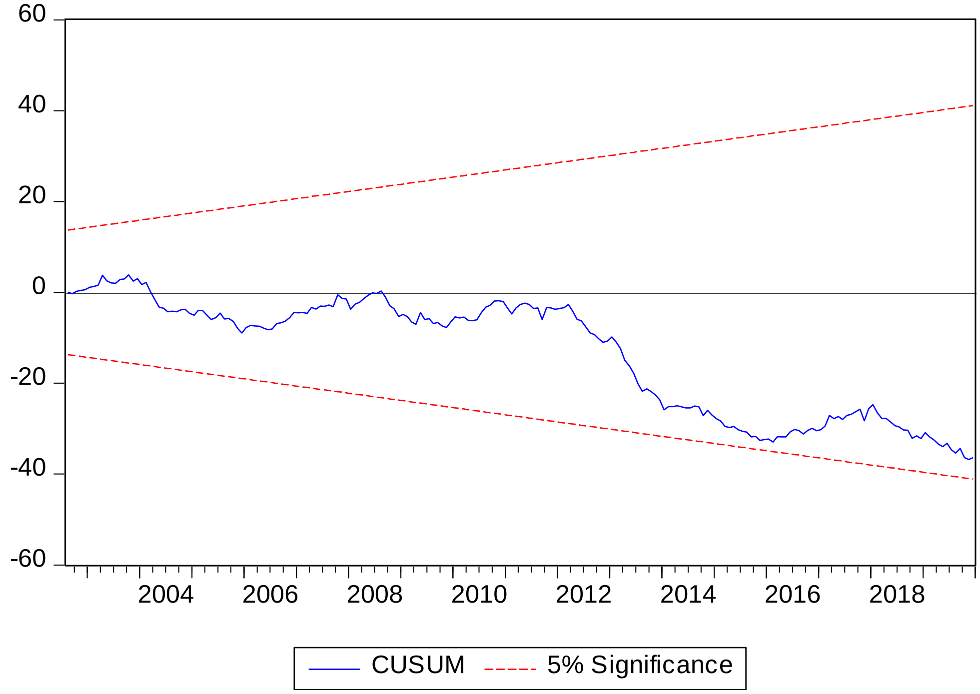

Figure 7A Chile

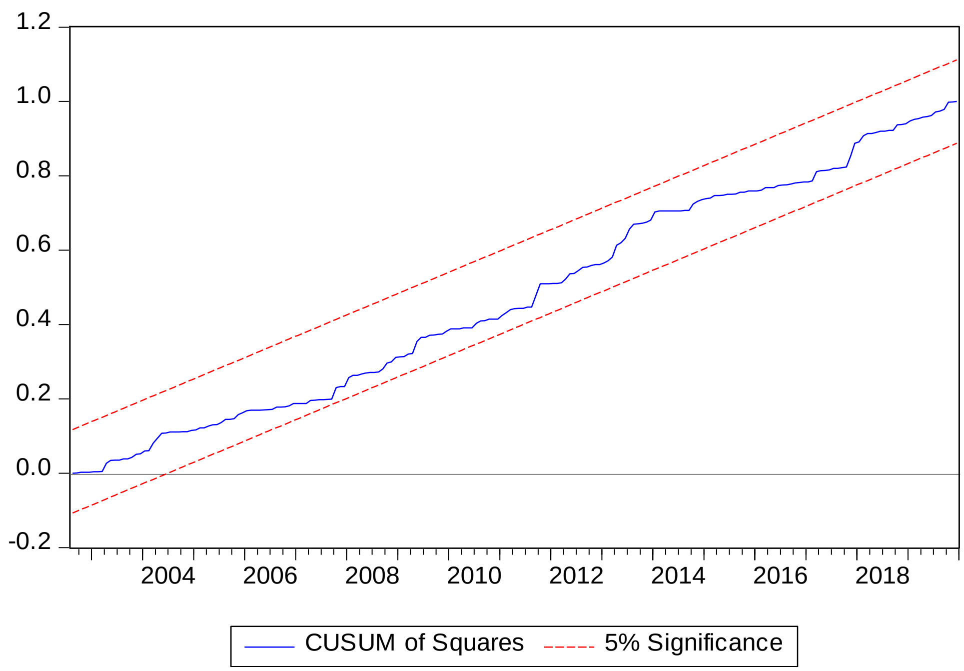

Figure 8A Chile

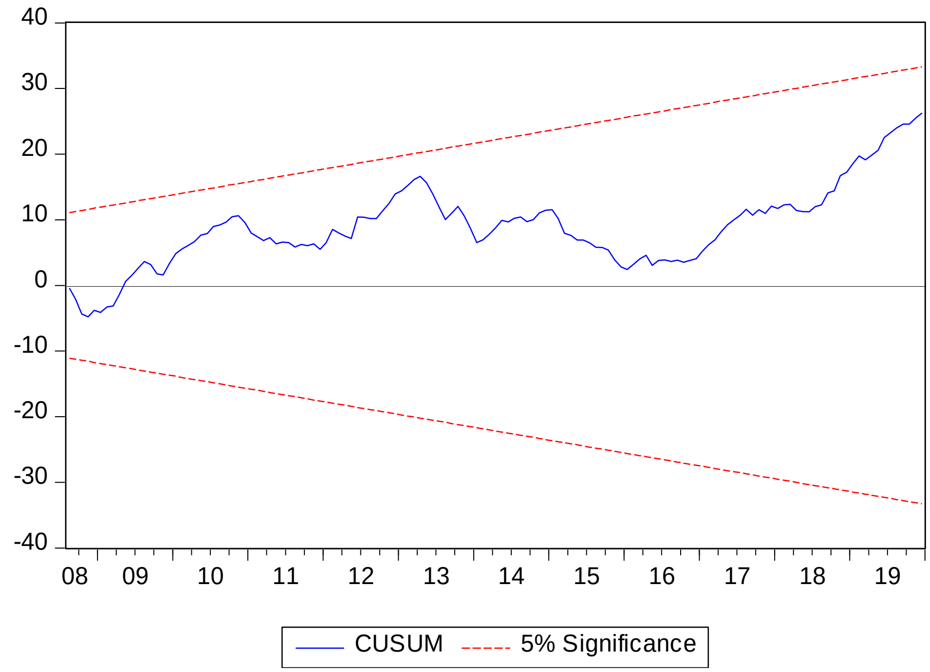

Figure 9A Turkey

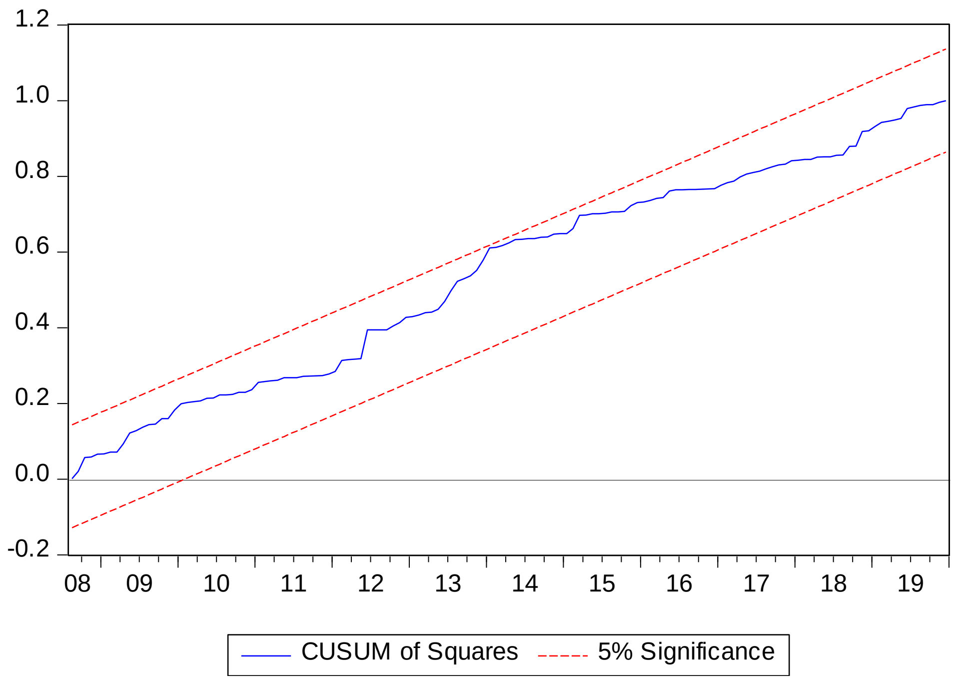

Figure 10A Turkey

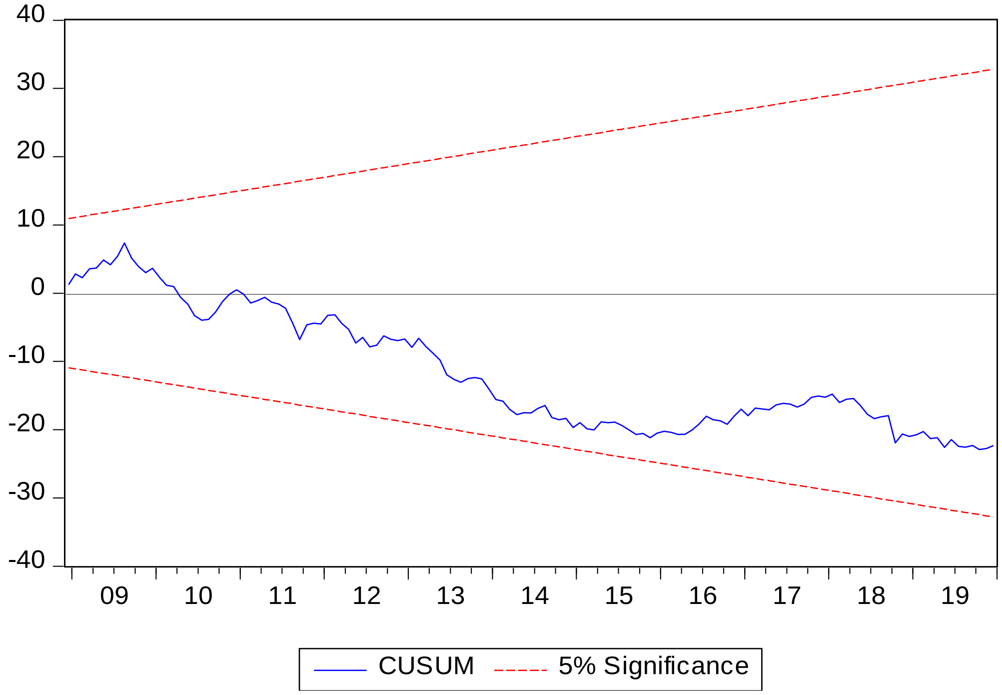

Figure 11A Korea

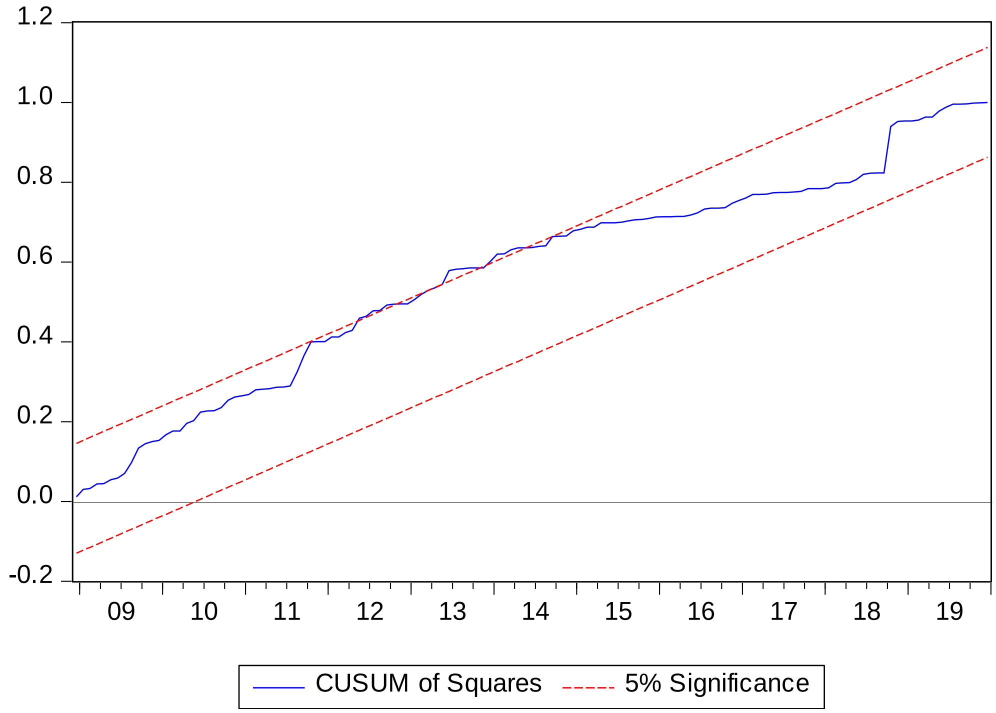

Figure 12A Korea

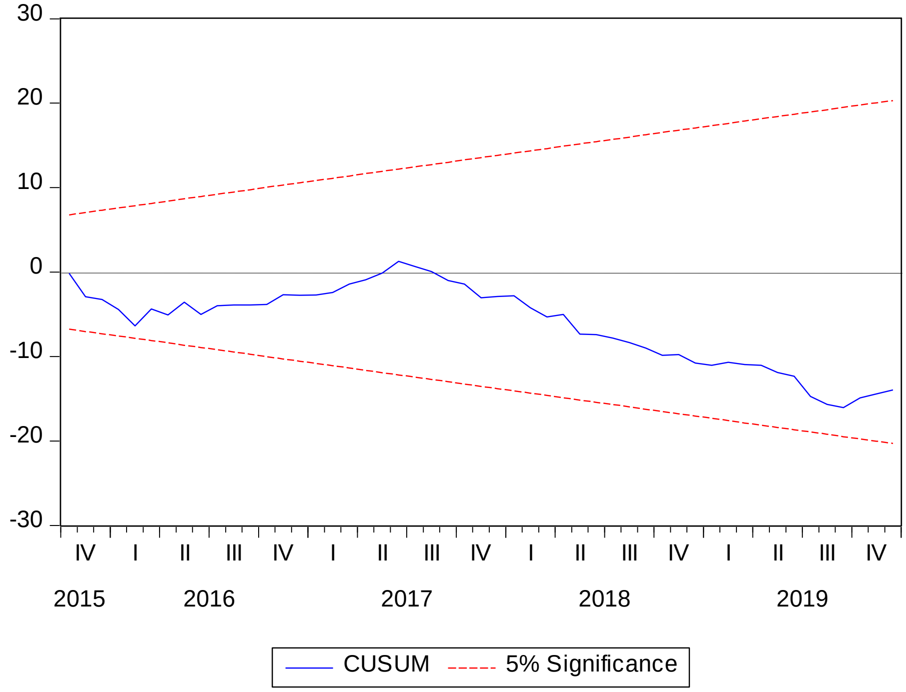

Figure 13A Greece

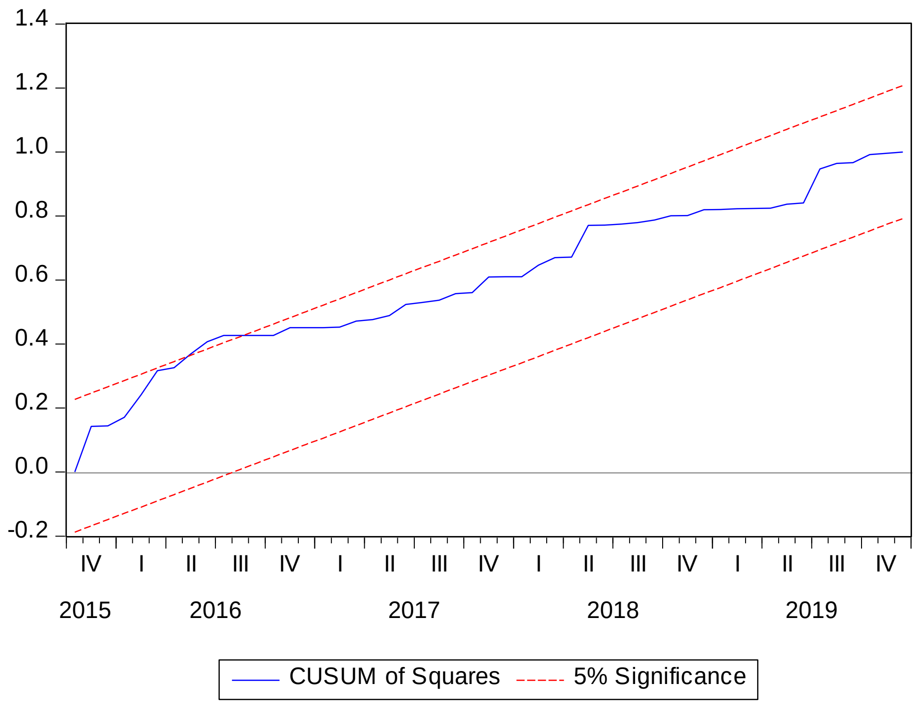

Figure 14A Greece

Appendix B: Normality Test

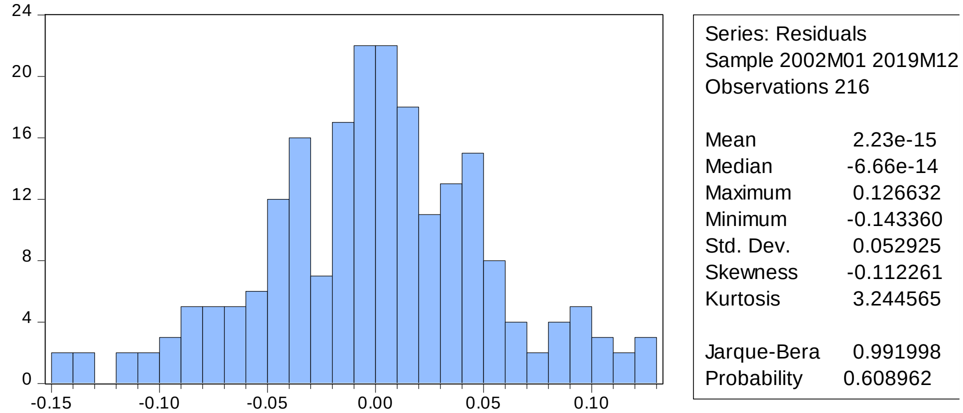

Figure 1B Brazil

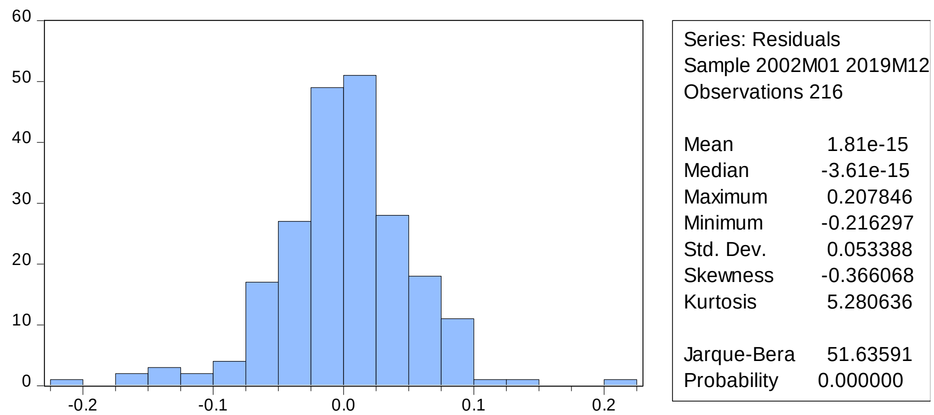

Figure 2B Russia

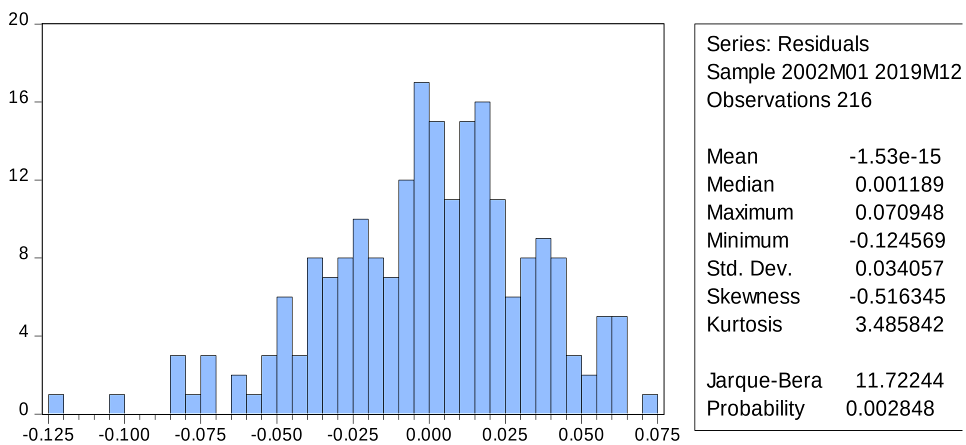

Figure 3B Mexico

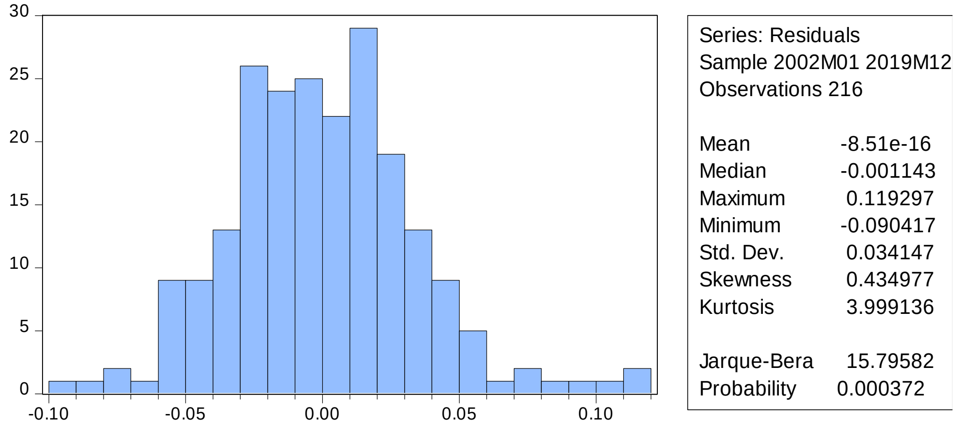

Figure 4B Chile

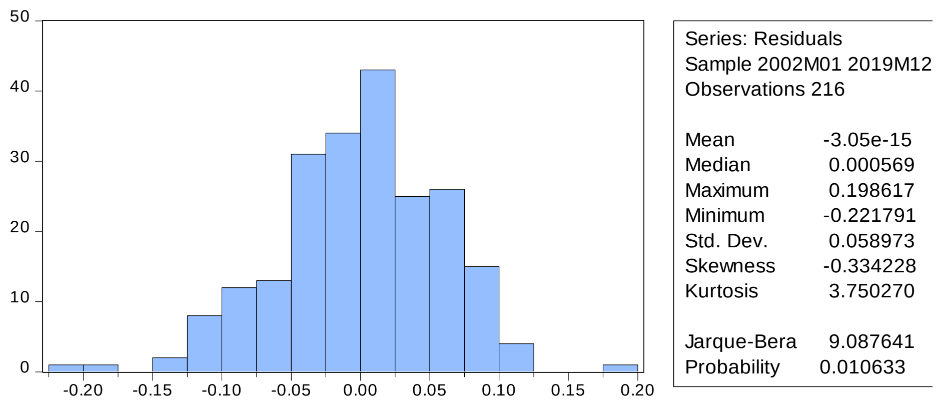

Figure 5B Turkey

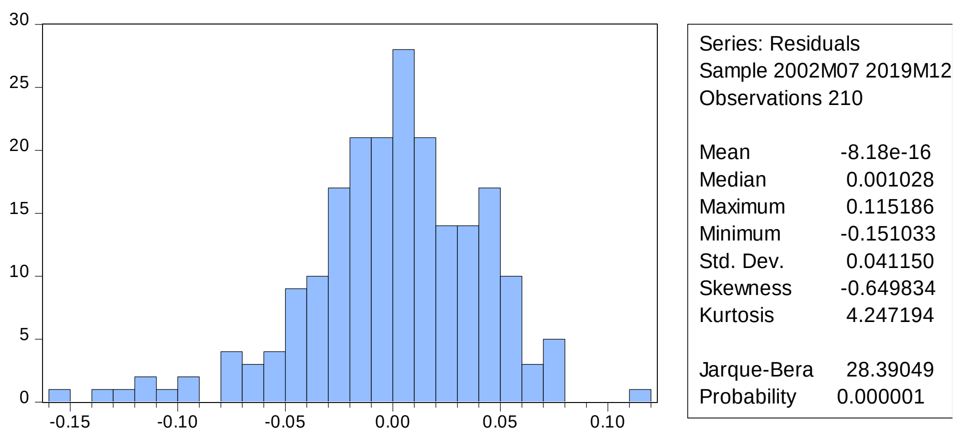

Figure 6B Korea

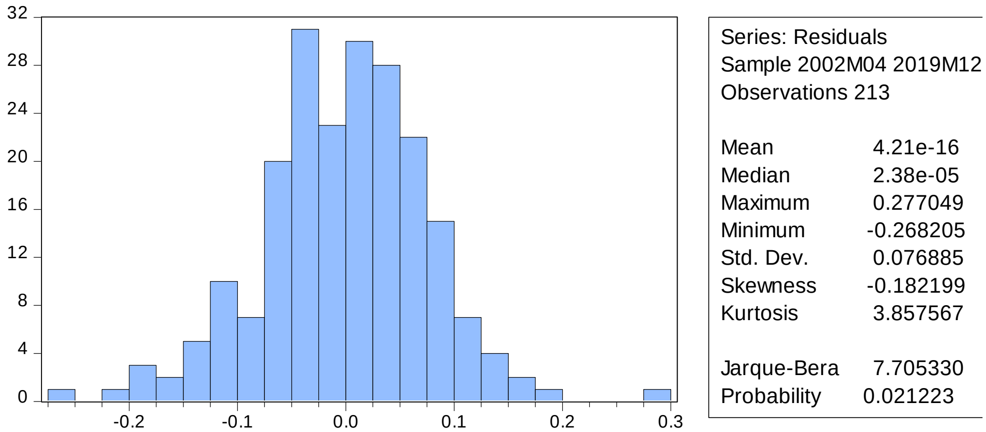

Figure 7B Greece

Appendix C: Long-run Model EViews Estimation Results

Table 1C Brazil

Dependent Variable: LBOVESPA
Method: ARDL
Date: 03/13/20 Time: 00:21
Sample: 2002M01 2019M12
Included observations: 216
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Hannan-Quinn criterion (HQ)
Dynamic regressors (8 lags, automatic): LIPI INTR LOILPB LEPU LGPR DUM
Fixed regressors: C
Number of models evalulated: 4251528
Selected Model: ARDL(1, 0, 2, 1, 1, 0, 5)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LBOVESPA(-1)	1.004750	0.017442	57.60394	0.0000
LIPI	0.005118	0.121587	0.042092	0.9665
INTR	-0.004056	0.008598	-0.471715	0.6376
INTR(-1)	-0.012970	0.014496	-0.894781	0.3720
INTR(-2)	0.018257	0.008521	2.142551	0.0334
LOILPB	0.130921	0.052478	2.494772	0.0134
LOILPB(-1)	-0.130126	0.050692	-2.566996	0.0110
LEPU	-0.012569	0.009980	-1.259348	0.2094
LEPU(-1)	0.018246	0.009794	1.862972	0.0639
LGPR	0.023285	0.016987	1.370800	0.1720
DUM	-0.129227	0.056789	-2.275579	0.0239
DUM(-1)	0.036413	0.078103	0.466216	0.6416
DUM(-2)	0.085837	0.079032	1.086101	0.2787
DUM(-3)	-0.140027	0.079949	-1.751446	0.0814
DUM(-4)	-0.104389	0.079786	-1.308353	0.1923

DUM(-5)	0.241976	0.057912	4.178352	0.0000
C	-0.212093	0.574457	-0.369205	0.7124

R-squared	0.991533	Mean dependent var	10.71722
Adjusted R-squared	0.990853	S.D. dependent var	0.575190
S.E. of regression	0.055012	Akaike info criterion	-2.887102
Sum squared resid	0.602235	Schwarz criterion	-2.621455
Log likelihood	328.8070	Hannan-Quinn criter.	-2.779780
F-statistic	1456.584	Durbin-Watson stat	2.204421
Prob(F-statistic)	0.000000		

Table 2C Russia

Dependent Variable: LMOEX
Method: ARDL
Date: 03/13/20 Time: 18:50
Sample: 2002M01 2019M12
Included observations: 216
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (8 lags, automatic): LIPI INTR LOILPB LEPU LGPR DUM1
Fixed regressors: C
Number of models evalulated: 4251528
Selected Model: ARDL(1, 8, 2, 1, 4, 0, 6)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LMOEX(-1)	0.877060	0.036713	23.88963	0.0000
LIPI	0.470994	0.371159	1.268980	0.2060
LIPI(-1)	0.449209	0.472384	0.950941	0.3429
LIPI(-2)	0.160818	0.466897	0.344440	0.7309
LIPI(-3)	-0.705615	0.469548	-1.502753	0.1346
LIPI(-4)	0.281850	0.467878	0.602400	0.5476
LIPI(-5)	-0.804673	0.461770	-1.742582	0.0831
LIPI(-6)	-0.397173	0.444102	-0.894329	0.3723
LIPI(-7)	1.478000	0.440653	3.354113	0.0010
LIPI(-8)	-0.898707	0.319668	-2.811373	0.0055
INTR	-0.014592	0.005944	-2.454888	0.0150
INTR(-1)	0.029351	0.008596	3.414362	0.0008
INTR(-2)	-0.021815	0.006129	-3.559241	0.0005
LOILPB	0.244150	0.055991	4.360555	0.0000
LOILPB(-1)	-0.345665	0.055832	-6.191193	0.0000
LEPU	-0.008822	0.009427	-0.935805	0.3506
LEPU(-1)	0.002685	0.009483	0.283102	0.7774
LEPU(-2)	0.004497	0.009408	0.478009	0.6332
LEPU(-3)	0.013327	0.009628	1.384167	0.1680
LEPU(-4)	0.023555	0.009559	2.464157	0.0146
LGPR	-0.009456	0.020645	-0.458030	0.6475
DUM1	0.050104	0.061926	0.809095	0.4195

DUM1(-1)	0.031374	0.086718	0.361800	0.7179
DUM1(-2)	-0.142417	0.091594	-1.554871	0.1217
DUM1(-3)	0.107665	0.093085	1.156631	0.2489
DUM1(-4)	0.096550	0.090510	1.066728	0.2875
DUM1(-5)	-0.121855	0.090730	-1.343047	0.1809
DUM1(-6)	0.141345	0.066701	2.119064	0.0354
C	0.956662	0.504505	1.896240	0.0595

R-squared	0.991933	Mean dependent var	7.118382
Adjusted R-squared	0.990725	S.D. dependent var	0.594418
S.E. of regression	0.057246	Akaike info criterion	-2.758572
Sum squared resid	0.612817	Schwarz criterion	-2.305410
Log likelihood	326.9258	Hannan-Quinn criter.	-2.575493
F-statistic	821.2173	Durbin-Watson stat	1.929348
Prob(F-statistic)	0.000000		

Table 3C Mexico

Dependent Variable: LIPC
Method: ARDL
Date: 04/11/20 Time: 15:31
Sample: 2002M01 2019M12
Included observations: 216
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (8 lags, automatic): LIPI INTR LOILPB LEPU LGPR
Fixed regressors: C
Number of models evalulated: 472392
Selected Model: ARDL(8, 0, 1, 1, 0, 1)
White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LIPC(-1)	0.929790	0.082494	11.27101	0.0000
LIPC(-2)	0.099319	0.108203	0.917896	0.3598
LIPC(-3)	0.014468	0.110564	0.130852	0.8960
LIPC(-4)	0.020626	0.103780	0.198749	0.8427
LIPC(-5)	-0.081179	0.105047	-0.772791	0.4406
LIPC(-6)	-0.131927	0.088665	-1.487932	0.1384
LIPC(-7)	0.309263	0.097681	3.166054	0.0018
LIPC(-8)	-0.190047	0.069022	-2.753442	0.0064
LIPI	0.044430	0.138247	0.321384	0.7483
INTR	-0.048242	0.017522	-2.753241	0.0064
INTR(-1)	0.048349	0.017066	2.833059	0.0051
LOILPB	0.089354	0.045756	1.952854	0.0522
LOILPB(-1)	-0.087822	0.046424	-1.891728	0.0600
LEPU	-0.022100	0.006272	-3.523455	0.0005
LGPR	0.009449	0.014551	0.649366	0.5169
LGPR(-1)	0.039310	0.016239	2.420657	0.0164

C	-0.038509	0.571693	-0.067359	0.9464

R-squared	0.996692	Mean dependent var	10.19447
Adjusted R-squared	0.996427	S.D. dependent var	0.641566
S.E. of regression	0.038352	Akaike info criterion	-3.608589
Sum squared resid	0.292703	Schwarz criterion	-3.342942
Log likelihood	406.7276	Hannan-Quinn criter.	-3.501267
F-statistic	3747.899	Durbin-Watson stat	1.990826
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Table 4C Chile

Dependent Variable: LIGPA
Method: ARDL
Date: 03/13/20 Time: 11:45
Sample: 2002M01 2019M12
Included observations: 216
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (8 lags, automatic): LIPI INTR LOILPB LEPU LGGPR

Fixed regressors: C
Number of models evalulated: 472392
Selected Model: ARDL(1, 0, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LIGPA(-1)	0.938498	0.024613	38.12995	0.0000
LIPI	0.137742	0.059176	2.327673	0.0209
INTR	-0.005492	0.001762	-3.116488	0.0021
LOILPB	0.002496	0.009738	0.256280	0.7980
LEPU	-0.024843	0.008427	-2.947869	0.0036
LGGPR	-0.003312	0.006428	-0.515251	0.6069
C	0.120664	0.060149	2.006073	0.0461

R-squared	0.995142	Mean dependent var	9.611283
Adjusted R-squared	0.995003	S.D. dependent var	0.489935
S.E. of regression	0.034634	Akaike info criterion	-3.856081
Sum squared resid	0.250701	Schwarz criterion	-3.746697
Log likelihood	423.4568	Hannan-Quinn criter.	-3.811890
F-statistic	7135.757	Durbin-Watson stat	2.011248
Prob(F-statistic)	0.000000		

Table 5C Turkey

Dependent Variable: LBIST
Method: ARDL
Date: 04/10/20 Time: 00:22
Sample: 2002M01 2019M12
Included observations: 216
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (8 lags, automatic): LIPI INTR LOILPB LGEPU LGPR DUM
Fixed regressors: C
Number of models evalulated: 4251528
Selected Model: ARDL(2, 0, 0, 1, 1, 0, 0)
White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LBIST(-1)	0.708746	0.091594	7.737893	0.0000
LBIST(-2)	0.183724	0.091544	2.006936	0.0461
LIPI	0.162920	0.070242	2.319414	0.0214
INTR	-0.002879	0.001051	-2.738388	0.0067
LOILPB	0.001956	0.001221	1.601673	0.1108
LOILPB(-1)	-0.002372	0.001216	-1.950376	0.0525
LGEPU	-0.107393	0.036713	-2.925231	0.0038
LGEPU(-1)	0.092134	0.029598	3.112845	0.0021
LGPR	-0.016514	0.018025	-0.916180	0.3606
DUM	0.013925	0.025967	0.536260	0.5924
C	0.676221	0.183813	3.678861	0.0003

R-squared	0.989082	Mean dependent var	10.77668
Adjusted R-squared	0.988549	S.D. dependent var	0.681015
S.E. of regression	0.072874	Akaike info criterion	-2.350578
Sum squared resid	1.088686	Schwarz criterion	-2.178689
Log likelihood	264.8624	Hannan-Quinn criter.	-2.281134
F-statistic	1857.100	Durbin-Watson stat	2.018628
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Table 6C Korea

Dependent Variable: LKOSPI
Method: ARDL
Date: 03/14/20 Time: 16:30
Sample (adjusted): 2002M07 2019M12
Included observations: 210 after adjustments
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (8 lags, automatic): LIPI INTR LOILPB LEPU LGPR DUM

Fixed regressors: C
Number of models evalulated: 4251528
Selected Model: ARDL(2, 3, 0, 3, 2, 1, 6)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LKOSPI(-1)	0.766249	0.073672	10.40075	0.0000
LKOSPI(-2)	0.179138	0.073497	2.437338	0.0157
LIPI	0.327295	0.159673	2.049779	0.0418
LIPI(-3)	-0.290970	0.148050	-1.965353	0.0509
INTR	-0.014887	0.008492	-1.752976	0.0813
LOILPB	0.067302	0.044657	1.507077	0.1335
LOILPB(-3)	0.118306	0.043760	2.703536	0.0075
LEPU	-0.041084	0.012529	-3.279117	0.0012
LEPU(-2)	0.033691	0.012472	2.701265	0.0075
LGPR	-0.024845	0.012124	-2.049340	0.0418
LGPR(-1)	0.021550	0.011923	1.807455	0.0723
DUM	0.022264	0.045134	0.493284	0.6224
DUM(-5)	-0.207861	0.064712	-3.212100	0.0016
DUM(-6)	0.191950	0.049088	3.910352	0.0001
C	0.158286	0.158929	0.995958	0.3206

R-squared	0.988232	Mean dependent var	7.366380
Adjusted R-squared	0.986777	S.D. dependent var	0.379334
S.E. of regression	0.043620	Akaike info criterion	-3.319372
Sum squared resid	0.353910	Schwarz criterion	-2.936845
Log likelihood	372.5340	Hannan-Quinn criter.	-3.164730
F-statistic	679.1131	Durbin-Watson stat	2.050866
Prob(F-statistic)	0.000000		

Table 7C Greece

Dependent Variable: LATHEX
Method: ARDL
Date: 04/09/20 Time: 17:44
Sample (adjusted): 2002M04 2019M12
Included observations: 213 after adjustments
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Hannan-Quinn criterion (HQ)
Dynamic regressors (8 lags, automatic): LIPI INTR LOILPB LEPU LGGPR DUM
Fixed regressors: C
Number of models evalulated: 4251528
Selected Model: ARDL(1, 0, 0, 1, 0, 0, 3)
Note: final equation sample is larger than selection sample
White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LATHEX(-1)	0.917105	0.030736	29.83864	0.0000

LIPI	0.343685	0.174785	1.966334	0.0506
INTR	-0.008107	0.009580	-0.846257	0.3984
LOILPB	0.192996	0.079736	2.420426	0.0164
LOILPB(-1)	-0.220072	0.082988	-2.651849	0.0086
LEPU	-0.070678	0.017785	-3.974144	0.0001
LGGPR	-0.014861	0.016220	-0.916222	0.3606
DUM	0.106630	0.018116	5.885992	0.0000
DUM(-1)	-2.357703	0.007078	-333.0931	0.0000
DUM(-2)	4.112958	0.076014	54.10785	0.0000
DUM(-3)	-1.920920	0.063457	-30.27132	0.0000
C	-0.395526	0.754797	-0.524016	0.6008

R-squared	0.993695	Mean dependent var	8.667163
Adjusted R-squared	0.993350	S.D. dependent var	0.968290
S.E. of regression	0.078961	Akaike info criterion	-2.185029
Sum squared resid	1.253212	Schwarz criterion	-1.995661
Log likelihood	244.7056	Hannan-Quinn criter.	-2.108499
F-statistic	2879.907	Durbin-Watson stat	2.083911
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model

Appendix D: Regression Statistics for Short-run and Error Correction Model

Table 8D Brazil

R-squared	0.265343	Mean dependent var	0.010238
Adjusted R-squared	0.229506	S.D. dependent var	0.061748
S.E. of regression	0.054201	Akaike info criterion	-2.942658
Sum squared resid	0.602235	Schwarz criterion	-2.770768
Log likelihood	328.8070	Hannan-Quinn criter.	-2.873214
F-statistic	7.404170	Durbin-Watson stat	2.204421
Prob(F-statistic)	0.000000		

Table 9D Russia

R-squared	0.407506	Mean dependent var	0.011518
Adjusted R-squared	0.339968	S.D. dependent var	0.069359
S.E. of regression	0.056349	Akaike info criterion	-2.814128
Sum squared resid	0.612817	Schwarz criterion	-2.454723
Log likelihood	326.9258	Hannan-Quinn criter.	-2.668927
F-statistic	6.033714	Durbin-Watson stat	1.929348
Prob(F-statistic)	0.000000		0.011518

Table 10D Mexico			
R-squared	0.249452	Mean dependent var	0.009116
Adjusted R-squared	0.208982	S.D. dependent var	0.042590
S.E. of regression	0.037879	Akaike info criterion	-3.654886
Sum squared resid	0.292703	Schwarz criterion	-3.467370
Log likelihood	406.7276	Hannan-Quinn criter.	-3.579129
F-statistic	6.163772	Durbin-Watson stat	1.990826
Prob(F-statistic)	0.000000		

Table 11D Chile			
R-squared	0.115856	Mean dependent var	0.006857
Adjusted R-squared	0.111724	S.D. dependent var	0.036316
S.E. of regression	0.034227	Akaike info criterion	-3.902377
Sum squared resid	0.250701	Schwarz criterion	-3.871125
Log likelihood	423.4568	Hannan-Quinn criter.	-3.889751
F-statistic	28.04197	Durbin-Watson stat	2.011248
Prob(F-statistic)	0.000000		

Table 12D Turkey			
R-squared	0.185832	Mean dependent var	0.010130
Adjusted R-squared	0.170398	S.D. dependent var	0.078863
S.E. of regression	0.071831	Akaike info criterion	-2.406133
Sum squared resid	1.088686	Schwarz criterion	-2.328002
Log likelihood	264.8624	Hannan-Quinn criter.	-2.374568
F-statistic	12.04008	Durbin-Watson stat	2.018628
Prob(F-statistic)	0.000000		

Table 13D Korea			
R-squared	0.320465	Mean dependent var	0.005089
Adjusted R-squared	0.260297	S.D. dependent var	0.049919
S.E. of regression	0.042933	Akaike info criterion	-3.376515
Sum squared resid	0.353910	Schwarz criterion	-3.089620
Log likelihood	372.5340	Hannan-Quinn criter.	-3.260534
F-statistic	5.326236	Durbin-Watson stat	2.050866
Prob(F-statistic)	0.000000		

Table 14D Greece			
R-squared	0.885105	Mean dependent var	-0.007777
Adjusted R-squared	0.882329	S.D. dependent var	0.226826
S.E. of regression	0.077809	Akaike info criterion	-2.241367
Sum squared resid	1.253212	Schwarz criterion	-2.146683
Log likelihood	244.7056	Hannan-Quinn criter.	-2.203102
F-statistic	318.9277	Durbin-Watson stat	2.083911
Prob(F-statistic)	0.000000		

Appendix E: Model Selection Summary Graphs

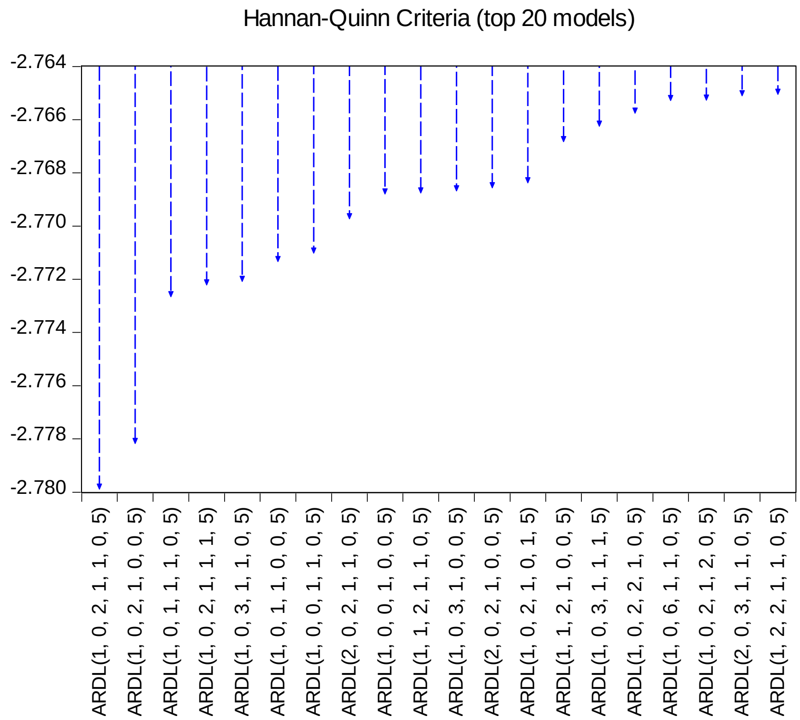

Figure 1E Brazil

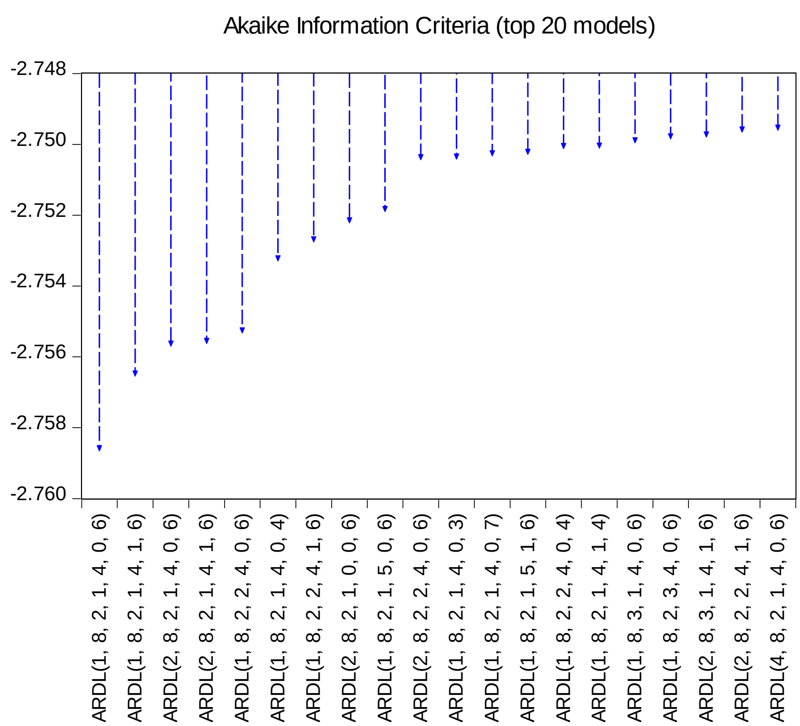

Figure 2E Russia

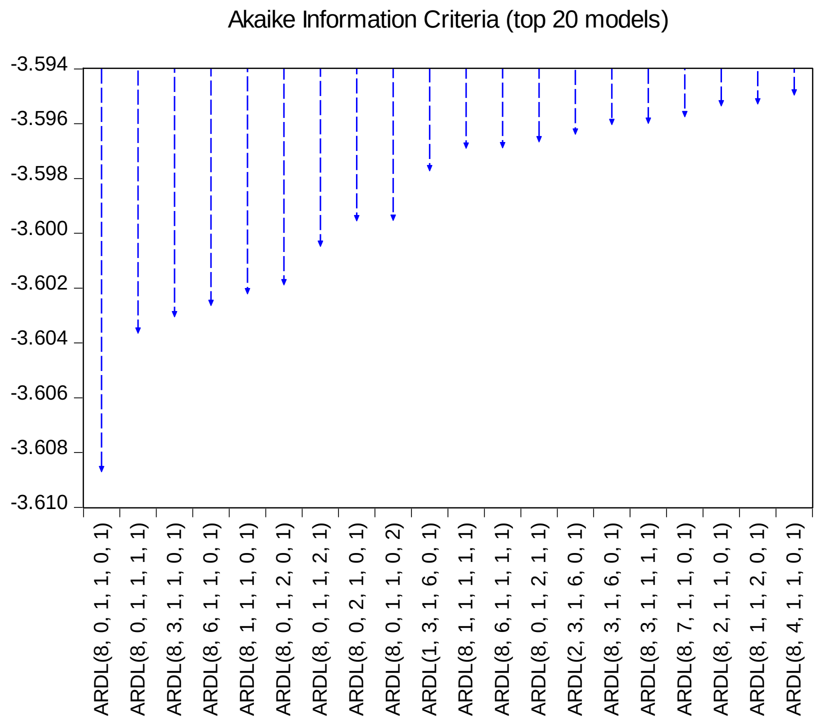

Figure 3E Mexico

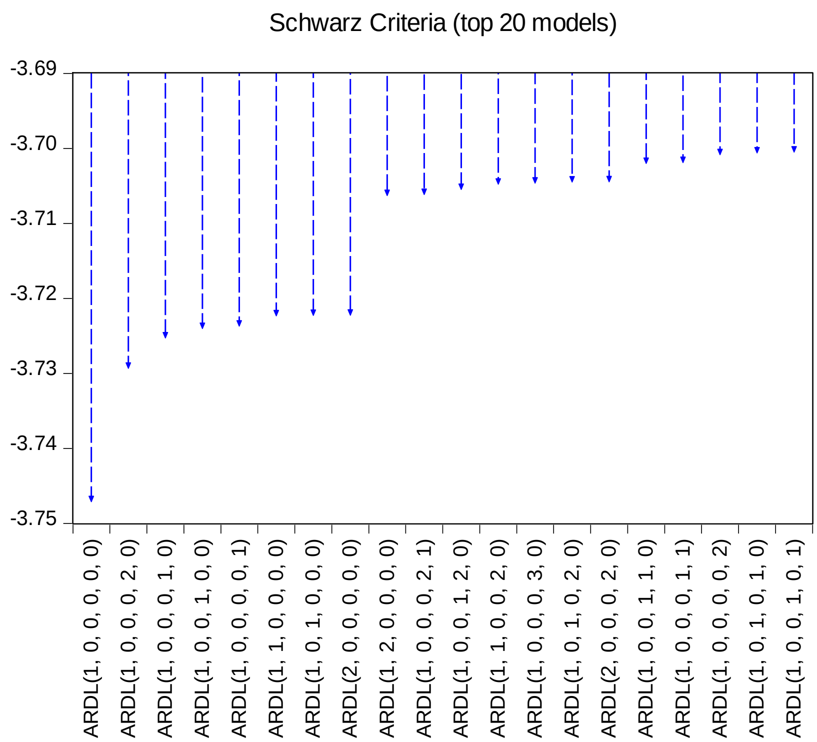

Figure 4E Chile

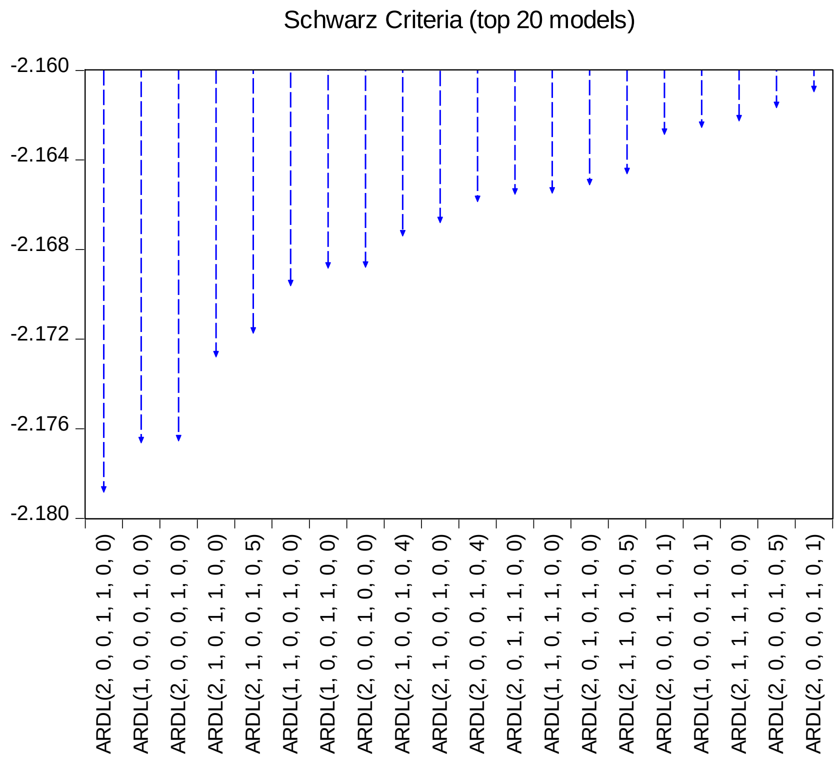

Figure 5E Turkey

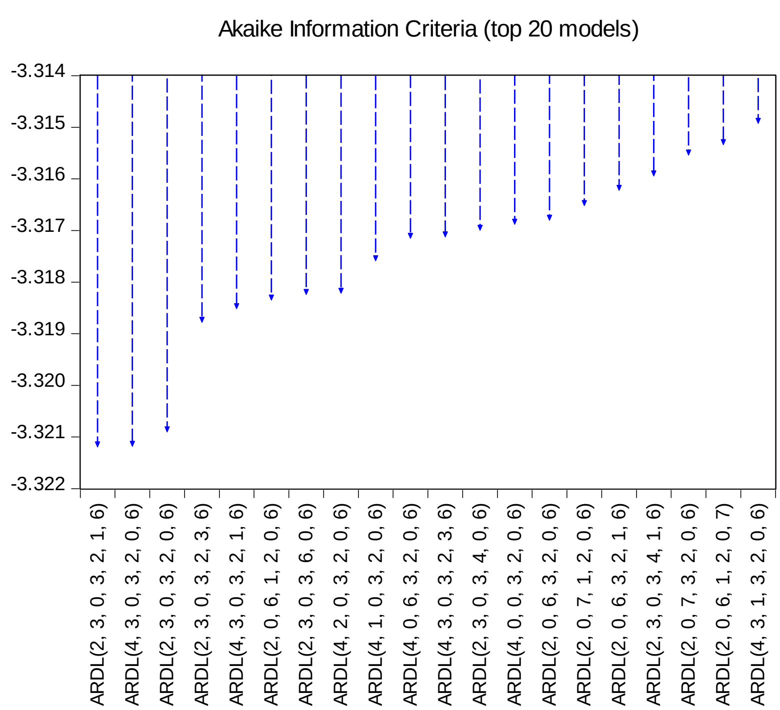

Figure 6E Korea

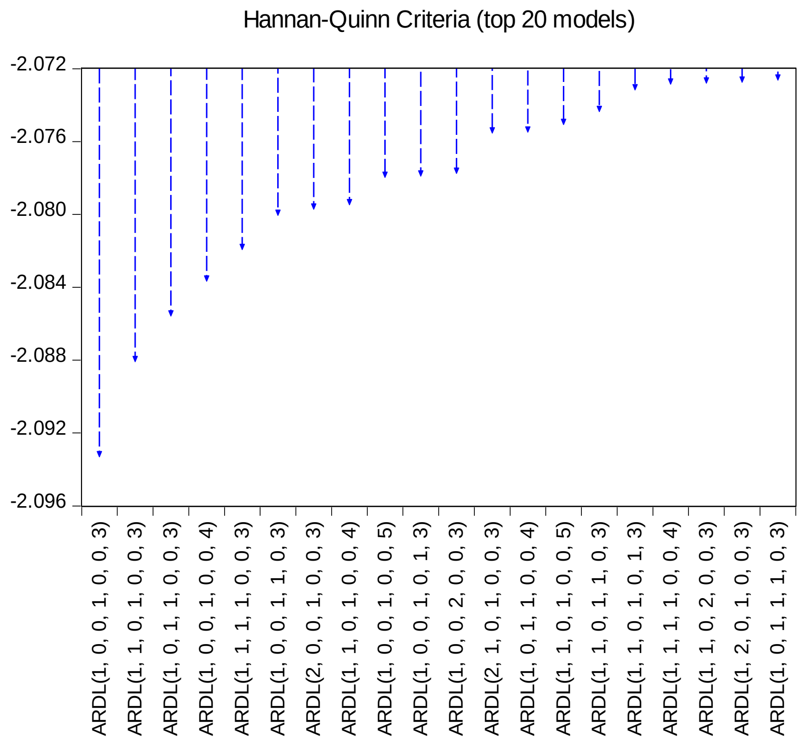

Figure 7E Greece