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Investigation of the Relationship between Economic and Political Uncertainty and General Economic Outlook: An Econometric Analysis on Athens Stock Exchange

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Abstract

In this study, the relationship between economic and political uncertainties in Greece and price movements of the Athens Stock Exchange and its volatility are examined through 19 econometric models calculated by using the Chowdhury (1993) volatility calculation method. Panel data analysis is conducted. Kapetanios (2005) structural break unit root test is performed and it is observed that series are stationary at different levels. The bounds testing approach developed by Pesaran et al. (2001) is applied to detect cointegration between the series. To find out structural breaking dates that are critical and affect the performance of stock exchange, Bai-Perron (2003) multiple structural change method is performed by using dummy variables. In the long-term analysis, a negative relationship between the political and economic uncertainty indicators in Greece and the Athens Stock Exchange Index is determined. Uncertainties in tax policies (EPUT), economic uncertainties (EU) and uncertainties in banking policies (EPUB) are determined factors as having the most impact on the stock exchange. In the short term analysis, it is observed that the uncertainties in question are also effective on the Athens Stock Exchange Index, but they did not have a significant effect on the price volatility of the stock exchange.

Keywords

Greek economy, Athens Stock Exchange (ATHEX) index, volatility in Athens Stock Exchange index, uncertainties in economic policies, structural break analysis, boundary test, ardl.

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Ekonomik ve Politik Belirsizlikler ile Genel Ekonomik Görünüm Arasındaki İlişkinin İncelenmesi: Atina Menkul Kıymetler Borsası Üzerine Ekonometrik Bir Analiz

Öz

Bu çalışmada, Yunanistan'daki ekonomik ve politik belirsizlikler ile Atina Menkul Kıymetler Borsası'nın fiyat hareketleri ve oynaklığı arasındaki ilişki, Chowdhury (1993) oynaklık hesaplama yöntemi kullanılarak hesaplanan 19 ekonometrik model ile incelenmiştir. Çalışmada panel veri analizi yapılmıştır. Analizde ilk olarak Kapetanios (2005) yapısal kırılma ünitesi kök testi yapılmış ve serilerin farklı seviyelerde durağan olduğu görülmüştür. Seriler arasındaki eşbütünleşmeyi tespit etmek için Pesaran ve ark. (2001) tarafından geliştirilen Sınır Testi yöntemi uygulanmıştır. Atina Borsasının performansını etkileyen yapısal kırılma tarihlerini tespit etmek amacıyla kukla değişkenler kullanılarak Bai-Perron (2003) çoklu yapısal değişim yöntemi uygulanmıştır. Uzun vadeli analizde, Yunanistan'daki siyasi ve ekonomik belirsizlik göstergeleri ile Atina Menkul Kıymetler Borsası Endeksi arasında negatif bir ilişki belirlenmiştir. Vergi politikalarındaki belirsizlikler (EPUT), ekonomik belirsizlikler (EU) ve bankacılık politikalarındaki belirsizlikler (EPUB) borsa üzerinde en fazla etkiye sahip göstergeler olarak belirlenmiştir. Kısa vadeli analizde, söz konusu belirsizliklerin kısa vadede Atina Menkul Kıymetler Borsası Endeksi'nde de etkili olduğu, ancak borsaların fiyat oynaklığı üzerinde önemli bir etkiye sahip olmadıkları görülmektedir.

Anahtar Kelimeler

Yunanistan ekonomisi, Atina Menkul Kıymetler Borsası (ATHEX) endeksi, Atina Menkul Kıymetler Borsası endeksindeki oynaklık, ekonomi politikalarındaki belirsizlikler, yapısal kırılmalı analiz, sınır testi, ardl.

Introduction

Uncertainty is the situation where it is not clear that what will happen in the short and long future based on the available information and data. In other words, it is the possibility of occurring unexpected things. The main reason for the uncertainty is the difficulty degree for giving a decision and related increasing cost of the decision.

In real life, economic units avoid uncertainty as much as possible. Because of the uncertainty, all the variables that are determinant factors for decision-makers are constantly changing in extreme volatility, and it is impossible to make an accurate estimate of what will happen even in the short term (Erdogan Cosar & Sahinoz, 2018).

If the situation is considered within the macroeconomic framework, since the confidence of all the participants that include investors, consumers, firms and even governments, in the economy that is suffering uncertainty will decrease, the economic activities of these parties will also decrease significantly or even come to a halt. In such an environment, all actors in the market will look for economic stability, and in this case, the uncertainty caused by the slowing economic activity will lead the general economy to real or financial crises (UNCTAD, 2009).

Uncertainty in the economy will limit the activities of the countries which are the biggest actor in the market, and even bring it to bankruptcy (Guterres, 2020). The Iceland case, experienced with the 2008 global financial crisis, had shown that even states could financially go bankrupt The 2008 global financial crisis affected all the countries of the world directly or indirectly. All countries, especially the USA, where the crisis started, had to struggle with economic and political uncertainty after the crisis, which caused comments that the financial crisis has not yet ended and that the world economy will see a second bottom line.

As Knight (1921) mentioned in his book called Risk, Uncertainty, and Profit, risk and uncertainties have the potential to affect economic activities closely. Keynes (1936) stated that one of the most important reasons of the 1929 Great Depression lasted was the decrease of investment motivation of firms due to uncertainty in the economy.

Negative effects of global economic policy uncertainty are much more effective than positive effects. Therefore, the global economic policy uncertainty has greater impacts on stock returns in the high-volatile environment. The global economic policy uncertainty can be regarded as a systemic risk factor and a estimator of returns of the stocks (Hoque & Zaidi, 2019).

Dash et al. (2019) stated that uncertainties in economic policies significantly affect the liquidity and profitability of stock markets. Gilal (2019) also stated that uncertainties in economic policies are an important determinant on stock returns. Alqahtani and Martinez (2020) examined the effects of the uncertainty of economic policies in the USA on the stock exchanges in the Gulf Cooperation Countries and determined that these uncertainties had long-term negative effects on stock prices in Bahrain and Kuwait. According to these results, it can be said that policy uncertainties have the potential to affect stock markets closely and it is useful to analyze these effects frequently.

In this study, the relationship between economic and political uncertainty indicators and the general economic conjuncture will be examined in the case of Greece, which is one of the countries most affected by the 2008 global financial crisis. In the section 2, previous studies on this subject included in the literature are examined. In the section 3, detailed information about data and sample structure, econometric models and methodologies used in the analysis are provided. In the section 4, the tests included in the analysis are carried out and the results are shared. Section 5 provides comments and suggestions have been made for all countries in general based on the findings obtained.

In the preliminary studies conducted, it was observed that in the current studies the effects of changes in the EPU of the USA on the stock exchanges or other macroeconomic indicators of the other countries were investigated. Although the USA is a locomotive of the world economy and the developments in this country affect other countries, it is clear that the changes in the stock market indices of the USA will be more sensitive to the policy uncertainties in itself. In this study, a much more specific analysis was made by examining the effects of the Greek EPU on the Athens stock exchange. Moreover, this analysis was also carried out not only for the stock market index but also for the volatility in the stock market index. In addition, by using the 10 different indices associated with EPU apart from using EPU, a more detailed research than the current studies in the literature was conducted. This study is expected to make significant contributions to the literature, both in terms of the variables used and the way of handling the subject. On the other hand, it is hoped to grab attention of researchers in Turkey, and also encouraging them for the creation such index as EPI and its sub-indices. Finally, it is hoped that this study will contribute to the more efficient portfolio management by drawing attention of individual and corporate stock market investors to the effects of the economic policies on the stock market and price volatility.

Literature Review

Sum (2012) analyzed the effects of economic policy uncertainties in the USA on the performance of stock markets in the Asian countries (The ASEAN Stock Market Performance and Economic Policy Uncertainty in the United States), for the 1985:02-2012:M02 period by Granger causality. Results indicate that the changes in economic policy uncertainty in the U.S. adversely affect the returns on the five ASEAN stock markets. According to the vector autoregression analyses that they applied returns on the five ASEAN stock markets negatively react to the changes in economic policy uncertainty immediately. Based on the Granger causality tests, they concluded that the changes in economic policy uncertainty in the U.S. causes the returns on the Singapore and Malaysia stock markets while the same findings cannot be observed for the case of Indonesia, Philippines and Thailand.

Liu and Zhang (2015) analyzed effects of uncertainties in economy policies on the stock market volatility through Bollerslev and Ghysels (1996) method by using the five-minute data of S&P 500 for the 1996: M01-2013: M01 period, and EPU index data of Baker et al. (2013). As a result of in sample findings, they found out that higher EPU leads to significant increases in market volatility. Moreover, they also found out based on out-of-sample findings, including EPU as an additional predictive variable into the existing volatility prediction models significantly improves forecasting ability of these models.

Li et al. (2015) analyzed the effects of uncertainty in economic policies in China and India on stock returns, using the Bootstrap Rolling Window Causality test using data from China's 1995: M02 - 2013: M02 period, India's 2003: M02-2013: M02 period. Bidirectional causal relationships were found between EPU and stock returns in several sub-periods rather than in the entire sample period. They also stated that the generally relationship between EPU and stock returns is determined as not strong for these two emerging countries.

Asteriou and Sarantidis (2016) analyzed the relationships between political instability and stock market returns using EFA, PCA and GARCH-M methods, based on data from the 18 OECD countries for the period 1993 - 2013. They found that political instability had direct and indirect effects on the returns of the banking sector stocks and on the stock market in general. However, they determined that the general trend was towards a decrease in stock market index and stock market return due to increasing political instability.

Moore (2017) examined the effects of economic uncertainty in Australia on real economic magnitudes by using the VAR method. He found that investments and employment in this country decreased when economic uncertainty increased. Similarly, it has been found that increases in economic uncertainty reduce household savings and spending on durable consumer goods and tend to be more cautious in environments of uncertainty. The author also stated that economic uncertainties are an important independent variable regarding the shape of the economy in the future.

Baker et al. (2016) analyzed the effects of uncertainties in economic policies on economic activities in the USA using the Panel VAR method for the period 1985: M01-2014: M12. As a result of the study, it is determined that the increase in uncertainties in the economic policies has an impact on the price volatility in the stock exchange and reduces the investments and employment. These effects are observed to be greater, especially in the defense, health, finance and infrastructure sectors.

Hatipoglu and Sekmen (2018), analyzed the effects of selected risk indicators on Islamic Stock Market Turkey by using data of 2002: M05-2018: M02 period with GARCH method and they suggest that USD significantly affect the risk level of the Islamic Stock Exchange Index. Also, the findings in their study show that the volatility of the Islamic Stock Exchange Index is more sensitive to changes in the dollar exchange rate than the economic and political uncertainties index and the VIX index. As a result, while the appreciation of the US dollar in the world decreased the volatility of the Islamic stock markets, they found that the depreciation in the dollar caused the volatility to increase in the Islamic stock markets.

Hardouvelis et al. (2018) examined the relationships between the indicators of the Greek economy and the uncertainty indicators for the period 1998-2017. They identified a close interaction between uncertainties in economic and political environment and the economic crises in Greece. They found a positive correlation between increases in uncertainty indices and crisis risk. The researchers determined that the increase in uncertainty in economic policies caused decreases in investments, industrial production, national income, employment, household deposits, economic sensitivity, and the stock market while it causes an increase in bond interest rates.

Dash et al. (2019), analyzed the effects of uncertainties in economic policies on stock market liquidity within the framework of –frequency approach by using the data of G7 countries (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States) 2000: M01-2017: M07 period. Based on findings of their study, only Canada shows a two-way causality between EPU and ILLIQ. Also, they observed the nonlinear causality from EPU to HLS for the United Kingdom, while, they also found out nonlinear causality from EPU to ILLIQ in Canada and France. They stated that both linear and nonlinear causality from (il)liquidity to EPU is quite obvious for Canada.

Gilal (2019) estimated the effects of US economic policy uncertainty on the return of the stock market in Indonesia using OLS based regression using the data of 2000: M01-2017: M12 and found that the uncertainties in question negatively affect the stock returns in this country.

Li et al. (2019), analyzed the effects of uncertainties in economic policies (economic policy uncertainty (EPU)) on the Chinese stock market (Shanghai Stock Exchange Composite Index (SSEC) and price volatility in the stock markets of G7 countries, using the principal component analysis (PCA) method, 1997: M01 - 2018 :M05 period. According to the results of the analysis, they determined that the increases in the EPU had a negative effect on forecasting in the future in China and some G7 countries.

Ulusoy and Pirgalip (2019) analyzed the causal relationship between economic policy uncertainty and stock returns using panel data analysis based on the data of the 21 countries for 2005: M03-2019: M03 period. The results obtained in the analysis revealed that exchanges determine the triggering role in the context of emerging markets, while in most developed markets there is no causality relationship between EPU and stock returns.

Li et al. (2020) analyzed the effects of economic policy uncertainty in the USA on the stock markets in China and India with the time-frequency domain method for the 1997 – 2018 period. The findings reveal that the interaction between EPU in the U.S. and stock returns in China and India is not found strong in the short term but in the long term it gradually becomes stronger, particularly when important financial events happen. In short term, they didn't find out Granger causality but in mid and long term they found unidirectional or bidirectional causality.

When the studies in the literature are analyzed, it is seen that there is no study examining the relationship between the policy uncertainty and the stock market for Greece. In this respect, this study will fill an important gap in the literature. In addition, the studies in the literature generally show that the effects of economy policy uncertainty in the USA on the stock markets of other countries. This is because the EPU index is not prepared for every country. In this study, the effects of EPU and other uncertainty indices calculated for Greece on the Athens stock exchange are examined and a more effective study is created. In this respect, the study differs from its counterparts in the literature.

Data and Methodology

In this study the relationship between economic and political uncertainties and the Athens Stock Exchange (ASE) index values and volatility (VOL) experienced in this stock exchange is investigated during 2005: M01-2019: M11 period.

Data Set and Sample Construction

In order to analyze the effects of economic and political uncertainties on the ASE and its volatility following data are used shown in Table 1.

Table 1. Data Used in the Analysis

Variable	Abbreviation	Purpose of usage	Source
Athens Stock Exchange Index	ASE	Dependent variable 1	ADVFN (2020)
Volatility in the Athens Stock Exchange Index	VOL	Dependent variable 2	Calculated by the author with the help of Equation (3) by using data obtained from ADVFN (2020).
Economic Policy Uncertainty	EPU	They are used as independent variables to reveal the effects of economic and political uncertainties on the Athens Stock Exchange Index.	Hardouvelis et. al. (2019).
Economic Uncertainty	EU		
Political Uncertainty	POLU		
Monetary Policy Uncertainty	EPUM		
Fiscal Policy Uncertainty	EPUF		
Public Debt Uncertainty	EPUD		
Tax Uncertainty	EPUT		
Currency Uncertainty	EPUC		
Banking Uncertainty	EPUB		
Pension Uncertainty	EPUP		

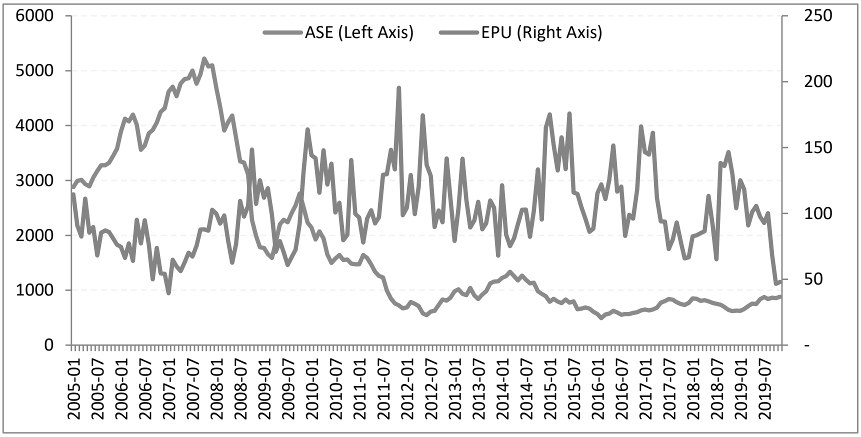
The uncertainty indices in Table 1 have been obtained by scanning keywords[1] that associate uncertainty terms and are included in the more than 500 thousand issues of 4 major newspapers[2] published in Greece by Hardouvelis et al. (2019). They arranged and normalized the numbers obtained from scanning and converted them into different indices. To prepare these indices Hardouvelis et al. (2019) used an approach developed by Baker et al. (2016) in the calculation Economic Policy Uncertainty index in the USA as the base method. Natural logarithms[3] of all the series obtained are used in the analyses. Descriptive statistics of the data set are provided in Appendix 1 and correlation matrices in Appendix 2. Also, in order to shed more light on the subject, the relations between the Athens Stock Exchange Index (ASE) values and the arithmetic mean of the 10 uncertainty indices (EPU) used in the analysis are presented in Graph 1.

1 For example, in order to detect uncertainty; The words uncertainty ("αβεβαιότητα"), vagueness ("ασάφεια"), doubt ("αμφιβολία"), concern ("ανησυχία") were scanned. For details of these words and index calculation method, see: Hardouvelis et al. (2019).

2 These newspapers are: To Vima, Ta Nea, Naftemporiki and Kathimerini.

3 Taking the logarithms of the series is to avoid the heteroscedasticity problem as a result of the analysis to be made.

Graph 1. Interaction between Athens Stock Exchange Index and Uncertainty in Economic Policies



Source: *It is created by the author using data from ADVFN (2020) and Hardouvelis et al. (2019).*

The first thing that attracts attention in Graph 1 is that the Athens Stock Exchange started to decrease rapidly with the leading effects of the 2008 crisis after reaching the peak value with 5221 points in 2007: M10, and during external debt crisis period fell to its lowest level with 546 points in 2012: M06 and continues at these levels. 90% of the depreciation is enough to reveal the depth of the crisis in this country.

Model

In this study, two basic models are created to analyze the effects of uncertainty indices on the stock market.

$$LnASE_t = \beta_0 + \beta_1 LnUI_{it} + e_t \quad (1)$$

$$LnVOL_t = \alpha_0 + \alpha_1 LnUI_{it} + u_t \quad (2)$$

Here the UI is the Uncertainty Index, which will be replaced by (1) EPU, ..., (10) EPUD values in Table 1, respectively. Thus, 20 different models will be estimated in the study. e_t and u_t; refer to the series of error terms which its mean is zero, the variance is fixed and is free from econometric problems.

Methodology

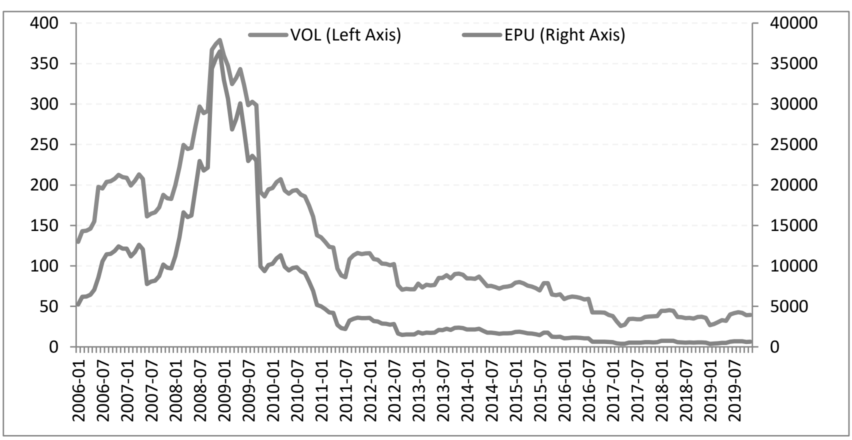
In this study, the effects of economic and political uncertainties in Greece on the Athens Stock Exchange Index (ASE) and the volatility of this index (VOL) are analyzed separately. The volatility of the Athens Stock Exchange Index is calculated by authors through using Equation (3) based on Chowdhury (1993) volatility calculation method.

$$VOL_t = \left[\frac{1}{m}\sum_{i=1}^{m}(ASE_{t+i-1} - ASE_{t+i-2})^2\right]^{1/2} \quad (3)$$

Equation (3) calculates the moving average of ASE for the previous *m* period. The functioning of the method can be summarized as follows: Firstly, ASE volatility is calculated for the period from *m* to *m + 1*, then the exchange rate volatility is calculated for the period from *m + 1* to *m + 2* and this will be continued until the final period (Sevim and Dogan, 2016: 308). Here, how many days are covered as *m* is depending on the preference of the authors, according to the structural conditions of the country and the policies being implemented. Generally, in the literature, it is considered as 8 or 12 (Tarı and Yildirim, 2009: 98). In the data set, observation disappears (missing value) as much as the *m* value selected from the beginning. In this study, *m* is taken as 12. As a result of this transformation, the analysis period of the study has become 2006: M01-2019: 11.

Relationships between the calculated volatility series and the arithmetic mean of the 10 uncertainty indices (EPU) used in the analysis are presented in Graph 2.

Graph 2. Interaction between Volatility in Athens Stock Exchange and Uncertainty in Economic Policies



Source: *It is created by the author using data from ADVFN (2020) and Hardouvelis et al. (2019).*

In Graph 2, the relations between the uncertainties in the economic policies in Greece and the volatility in the Athens Stock Exchange Index can be observed clearly. In other words, as uncertainties in economic policies increase in this country, volatility in the stock market will respond positively. This volatility will harm the economy of the country, which will decrease the return on the stock market.

In this study, the stationarity of the series is investigated with Kapetanios (2005) *m* breaking unit root test, and the existence of cointegration between the series included in the models are analyzed with the Border Test developed by Pesaran, Shin, and Smith (2001). Long and short term analyzes are carried out by the ARDL method.

Test Results

Unit Root Test

During the analysis period, many events occurred that closely affected the Greek economy. These events are respectively the 2008 global economic crisis, the 2010 debt crisis, austerity policies, the structural reforms (MFO, 2019) in return for 331 billion Euros of aid received from the EU Central Bank, the European Union and the IMF, discounting in pensions up to %30 and protest demonstrations that started later. Since such events occur during the analysis period, it is highly likely that structural breaks may exist in the series.

In such cases, unit root tests to be performed without considering the structural breaks in the series may give misleading results. For this reason, the stationarity of the series has been investigated by multiple structural break unit root test developed by Kapetanios (2005). In this test, *m* structural breaks are allowed, and the number of structural breaks and dates of the structural breaks is determined internally (Arı & Ozcan, 2015: 34). In order to test the stability of a *Y* series, Kapetanios (2005) test is performed with the help of Equation (4):

$$Y_t = \beta_0 + \beta_1 t + \beta_2 Y_{t-1} + \sum_{i=1}^{m_1} \beta_{3i} \Delta Y_{t-i} + \sum_{i=1}^{m_2} \beta_{4i} DU_{it} + \sum_{i=1}^{m_2} \beta_{4i} DT_{it} + \epsilon_t \tag{4}$$

Here m_1 and m_3 are the optimum lag lengths that can be determined using the Akaike or Schwarz information criteria.

DU_{it}; it is a dummy variable that determines the structural breaks in the constant term and is organized as in Equation (5):

$$DU_{it} = \begin{cases} 1, & t > T_{b,i} \\ 0, & Other\ Cases \end{cases} \tag{5}$$

DT_{it}; it is the dummy variable that represents the structural breaks in the trend and is defined as in Equation (6):

$$DT_{it} = \begin{cases} t - T_{b,i} & t > T_{b,i} \\ 0, & Other\ Cases \end{cases} \quad (6)$$

Kapenanios (2005) hypotheses tested in structural break unit root test:

H_0 : Series is not stationary under structural breaks

H_1 : Series is stationary under structural breaks

Kapetanios (2005) multiple structural break unit root test was applied to the variables to be used in the study and the findings obtained are presented in Table 2. In addition, the graphics obtained from this process are included in Appendix 3.

Table 2. Kapetanios (2005) Multiple Structural Break Unit Root Test Results

Series	***Test Statistics***	***Structural Breaking Date***	***Critical Values***		
			%1	***%5***	***%10***
LnASE	-3.794	2007:M12; 2011:M02	-5.653	-5.036	-4.737
LnVOL	-4.557	2007:M12; 2009:M05	-5.653	-5.036	-4.737
LnEPU	-6.558***	2007:M07;2014:M11;2017:M03; 2019:M06	-5.954	-5.367	-5.089
LnEU	-6.833***	2007:M05; 2017:M04; 2019:M06	-5.847	-5.234	-4.941
LnPOLU	-7.673	2011:M11; 2012:M06; 2014:M06; 2016:M08; 2018:M07	-9.039	-8.343	-8.016
LnEPUM	-8.164**	2007:M05; 2009:M02; 2012:M08; 2013:M12	-8.243	-7.736	-7.426
LnEPUF	-7.575***	2008:M05;2019:M06	-5.653	-5.036	-4.737
LnEPUD	-8.649***	2007:M04; 2009:M09; 2017:M07	-7.401	-7.006	-6.686
LnEPUT	-5.470***	2008:M06	-4.899	-4.354	-4.078
LnEPUC	-3.751	2009:M09	-4.899	-4.354	-4.078
LnEPUB	-7.042***	2007:M05; 2017:M03; 2019:M06	-5.847	-5.234	-4.941
LnEPUP	-9.083***	2009:M10; 2011:M08; 2015:M01; 2017:M03; 2018:M07	-9.039	-8.343	-8.016
ΔLnASE	-9.972***	2007:M07; 2008:M11	-6.587	-6.113	-5.847
ΔLnVOL	-11.363***	2007:M05; 2008M09	-6.587	-6.113	-5.847
ΔLnPOLU	-12.791***	2012:M04; 2018:M06	-6.587	-6.113	-5.847
ΔLnEPUC	-13.035***	2007:M04; 2009:M06; 2017:M11	-7.401	-7.006	-6.686

Note: ** and *** indicate that the series are stationary at 5% and 1% levels, respectively. Optimum lag lengths are determined according to Hannan Quin Information Criterion (HQIC). Δ shows that the first-order difference of the series has been taken.

According to the findings in Table 2; some of the series are stationary in their level values, while others become stationary only when their first difference is taken. In other words, the series have a mixed combination between I (0) and I (1). Considering the structural break dates determined by Kapetanios (2005) test; the effects of following events on Greece Economy can be seen clearly respectively;

- *The preliminary & backward effects of the 2008 global economic crisis,*
- *The debt crisis and anti-government demonstrations in streets during 2010-2012,*
- *Termination of the Financial Aid Agreement signed between the EU Institutions and the IMF and Greece in 2018 and*
- *Finally, the statement made by Tsipras: Greece regaining independence to determine its own future (MFO, 2019).*

Cointegration Test

In analyses with series, which are not stationary at the level values, spurious regression problems may be encountered (Granger and Newbold, 1974). Engle and Granger (1987) stated that in order to overcome this problem, the existence of a cointegration relationship between the series should be tested before proceeding to regression analysis and stated that if the series cointegrated, there will be no problem in the analyzes to be performed. When the series is stationary from different levels, the existence of a cointegration relationship between such series is examined by the Boundary Test method developed by Pesaran, Shin, and Smith (2001). Models used in this study to perform Boundary Test:

$$\Delta LnASE_t = \theta_0 + \sum_{j=1}^{p_1} \theta_{1j}\Delta LnASE_{t-j} + \sum_{j=0}^{p_2} \theta_{2j}\Delta LnUI_{t-j} + \theta_3 LnASE_{t-1} + \theta_4 LnUI_{t-1} + e_t \quad (7)$$

$$\Delta LnVOL_t = \gamma_0 + \sum_{j=1}^{p_1} \gamma_{1j}\Delta LnVOL_{t-j} + \sum_{j=0}^{p_2} \gamma_{2j}\Delta LnUI_{t-j} + \gamma_3 LnVOL_{t-1} + \gamma_4 LnUI_{t-1} + u_t \quad (8)$$

Here p_1 and p_2 ; are the optimum lag lengths that can be determined with the help of Akaike or Schwarz Information Criteria. In the Boundary Test, a Wald test is performed and a *F* statistic is obtained by restricting the level values of the series with period lag coefficients (θ_3 *ve* θ_3).

It is decided that there is cointegration between the series when *F* statistics is greater than the critical value of the upper limit is used in Pesaran et al. (2001) study, and when *F* statistics is less than the lower limit value then it is decided that there is no cointegration relationship between the series and when the results remain between the lower and upper limit values, neither cointegration nor non-cointegration can be mentioned therefore researchers become on indifference line (Belloumi, 2014).

Boundary Test hypotheses;

$H_o : \theta_3 = \theta_4 = 0$ There is no cointegration.

$H_1 : \theta_3 \neq \theta_4 \neq 0$ There is cointegration.

In this study, the Border Test was performed separately for the series in each model and the results obtained are presented in Table 3. Structural breaking dates in cointegration equations were determined by Bai-Perron (2003) multiple structural change method and those findings are given in the last column of Table 3.

Table 3. Cointegration Test Results and Structural Break Dates in Models

		***F*-statistic**	**Boundary Test Critical Values**						**Structural Break Dates in Cointegration Equations**
			Lower Bounds			**Upper Bounds**			
			10%	**5%**	**1%**	**10%**	**5%**	**1%**	
The dependent variable ASE	***Model 1***	3.87*	3.11	3.62	4.94	3.51	4.16	5.58	2008:M08; 2011:M05; 2015:M07
	Model 2	16.11***	3.11	3.74	5.15	3.61	4.30	5.91	2008:M08; 2011:M05; 2015:M07
	Model 3	5.36**	3.11	3.74	5.15	3.61	4.30	5.91	2008:M10; 2011:M05; 2013:M06; 2015:M07; 2017:M08
	Model 4	4.35**	3.11	3.74	5.15	3.61	4.30	5.91	2008:M04; 2011:M06; 2015:M01
	Model 5	5.87**	3.11	3.74	5.15	3.61	4.30	5.91	2008:M10; 2011:M05; 2013:M06; 2015:M07
	Model 6	4.58**	3.11	3.74	5.15	3.61	4.30	5.91	2008:M10; 2011:M06; 2015:M04; 2017:M05
	Model 7	3.60*	3.02	3.62	3.94	3.51	4.16	5.58	2008:M09; 2011:M06; 2015:M07
	Model 8	6.95***	3.11	3.74	5.15	3.61	4.30	5.91	2008:M10; 2011:M08; 2015:M08
	Model 9	13.73***	3.11	3.74	5.15	3.61	4.30	5.91	2008:M10; 2011:M05; 2013:M06; 2015:M08
	Model 10	2.21	5.72	6.82	9.17	6.45	7.67	10.24	2008:M08; 2011:M05; 2015:M01
The dependent variable VOL	***Model 1***	5.10**	3.11	3.74	5.15	3.61	4.30	5.91	2009:M04; 2011:M05; 2014:M06; 2016:M08
	Model 2	5.09**	3.11	3.74	5.15	3.61	4.30	5.91	2009:M04; 2011:M05; 2014:M06; 2016:M08
	Model 3	4.64**	3.11	3.74	5.15	3.61	4.30	5.91	2008:M08; 2010:M07; 2012:M08; 2016:M08
	Model 4	4.74**	3.11	3.74	5.15	3.61	4.30	5.91	2008:M02; 2010:M07; 2012:M08; 2016:M08
	Model 5	4.64**	3.11	3.74	5.15	3.61	4.30	5.91	2009:M04; 2011:M05; 2014:M06; 2016:M08
	Model 6	4.66**	3.02	3.62	3.94	3.51	4.16	5.58	2008:M02; 2010:M12; 2014:M06; 2016:M08
	Model 7	5.05**	3.02	3.62	3.94	3.51	4.16	5.58	2009:M04; 2011:M05; 2014:M06; 2016:M08
	Model 8	4.74**	3.02	3.62	3.94	3.51	4.16	5.58	2008:M02; 2010:M12; 2014:M07; 2016:M08
	Model 9	5.34**	3.02	3.62	3.94	3.51	4.16	5.58	2009:M04; 2011:M05; 2014:M06; 2016:M08
	Model 10	4.67**	3.02	3.62	3.94	3.51	4.16	5.58	2008:M02; 2010:M12; 2016:M08

Note: *, ** and *** indicate that there is a cointegration relationship between the variables in the model at the level of 10%, 5%, and 1%, respectively. The critical values in the table are the critical values that are produced based on the actual sample size by using the Eviews 10 program. Since series are created by months, max. the lag length was taken as 12, the optimum lag lengths are determined automatically by using the Akaike information criterion. Structural breaking dates are detected automatically under the Bai-Perron tests of L+1 vs. L sequentially determined breaks option. In this process, trimming value is taken as 0.15.

According to the results in Table 3, there is a cointegration relationship of at least 10% significance level between the series in all models except Model 10, where the dependent variable is ASE. In this case, there will be no spurious regression problem in the estimation of these models. However, for Model 10, where cointegration cannot be detected, the same situation is not valid and therefore estimates for this model will not be made. When the findings obtained up to now are generally evaluated; there is a long-term movement (cointegration) between the stock market index (ASE) and the volatility (VOL) of this stock market and the uncertainty indicators in the Greek economy.

Considering the structural breaking dates determined by Bai-Perron (2003) method; the effects of the following cases on the uncertainty in the stock market and the country are clearly observed:

- The 2008 global economic crisis,

- The foreign debt crisis in 2010-2012 and the structural reforms tried to be implemented,

- The latest aid agreement signed with the European Stability Mechanism (ESM) in 2015 (through this agreement 61.9 Billion Euros is granted to the Greek economy). These dates are included in long and short term analyzes with dummy (artificial) variables. While creating dummy variables, 1 is given to the structural break dates and 0 to other years.

Long Term Analysis

Long-term analyzes for cointegration models are carried out by using the following models based on the ARDL method:

$$LnASE_t = \theta_0 + \sum_{j=1}^{p_1} \theta_{1j} LnASE_{t-j} + \sum_{j=0}^{p_2} \theta_{2j} LnUI_{t-j} + \sum_{i=1}^{k}\sum_{j=0}^{p_3} \delta_{ij} K_{t-j} + e_t \qquad (9)$$

$$LnVOL_t = \gamma_0 + \sum_{j=1}^{p_1} \gamma_{1j} LnVOL_{t-j} + \sum_{j=0}^{p_2} \gamma_{2j} LnUI_{t-j} + \sum_{i=1}^{k}\sum_{j=0}^{p_3} \gamma_{ij} K_{t-j} + u_t \qquad (10)$$

Where P_1, P_2 and P_3 *:* are optimum lag lengths and determined using Akaike information criteria. K_i *:*Refers to artificial variables created for each model, and k represents the number of dummy variables in each model. In these estimations made with the ARDL model, the long-term coefficients are determined with the help of the following equations (Johnston and Dinardo, 1997):

$$\theta_2 = \frac{\sum_{j=0}^{p_2} \theta_{2j}}{1 - \sum_{j=1}^{p_1} \theta_{1j}} \tag{11}$$

$$\delta_i = \frac{\sum_{j=0}^{p_3} \delta_{ij}}{1 - \sum_{j=1}^{p_1} \theta_{1j}} \tag{12}$$

In this study, long-term analyzes are made with the ARDL method and the findings obtained are presented in Tables 4 and 5.

Table 4. Long Term Analysis Results (Dependent Variable: ASE)

Variables	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***	***(8)***	***(9)***
LnEPU	-2.80** (0.03)	-	-	-	-	-	-	-	-
LnEU	-	-1.26* (0.09)	-	-	-	-	-	-	-
LnPOLU	-	-	-1.79*** (0.00)	-	-	-	-	-	-
LnEPUM	-	-	-	-2.30* (0.06)	-	-	-	-	-
LnEPUF	-	-	-	-	-2.36*** (0.00)	-	-	-	-
LnEPUD	-	-	-	-	-	-1.65* (0.05)	-	-	-
LnEPUT	-	-	-	-	-	-	-1.93*** (0.00)	-	-
LnEPUC	-	-	-	-	-	-	-	-1.53** (0.04)	-
LnEPUB	-	-	-	-	-	-	-	-	-2.92*** (0.00)
$K_{2008:M04}$	-	-	-	-31.82*** (0.00)	-	-	-	-	-
$K_{2008:M08}$	-34.80*** (0.00)	-74.63*** (0.00)	-	-	-	-	-	-	-
$K_{2008:M09}$	-	-	-	-	-	-	-2.17 (0.79)	-	-
$K_{2008:M10}$	-	-	-5.94 (0.41)	-	-7.08** (0.01)	-3.76 (0.74)	-	-14.69* (0.06)	-7.66** (0.02)
$K_{2011:M05}$	-53.69*** (0.00)	-100.75***(0.00)	-21.19** (0.02)	-	-9.26** (0.04)	-	-	-	-21.68** (0.01)
$K_{2011:M06}$	-	-	-	-36.59*** (0.00)	-	-16.46 (0.14)	-12.90 (0.13)	-	-
$K_{2011:M08}$	-	-	-	-	-	-	-	-14.91 (0.24)	-
$K_{2013:M06}$	-	-	-6.29** (0.04)	-	-5.84** (0.01)	-	-	-	-6.13** (0.03)
$K_{2015:M01}$	-	-	-	-32.10*** (0.00)	-	-	-	-	-
$K_{2015:M04}$	-	-	-	-	-	-10.41 (0.26)	-	-	-
$K_{2015:M07}$	-35.31*** (0.00)	-64.05*** (0.00)	-17.93** (0.03)	-	-11.99** (0.04)	-	-9.90 (0.18)	-	-
$K_{2015:M08}$	-	-	-	-	-	-	-	-22.22* (0.07)	-14.82** (0.03)
$K_{2017:M05}$	-	-	-	-	-	5.03 (0.27)	-	-	-
$K_{2017:M08}$	-	-	-7.33* (0.08)	-	-	-	-	-	-
Model Diagnostic Tests									
R^2	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
$\bar{R}^2$	0.99	0.99	0.99	0.98	0.99	0.99	0.99	0.99	0.99
F	406.54 (0.00)	414.19 (0.00)	541.51 (0.00)	697.62 (0.00)	802.14 (0.00)	715.86(0.00)	515.19 (0.00)	700.08 (0.00)	780.30 (0.00)
DW	2.01	1.97	1.97	1.99	2.04	1.96	1.95	2.08	1.94
χ^2_{BG}	0.27 (0.87)	1.37 (0.50)	0.13 (0.93)	1.97 (0.37)	1.33 (0.51)	1.85 (0.39)	1.58 (0.45)	1.86 (0.17)	0.52 (0.77)
χ^2_{BPG}	41.81 (0.86)	34.73 (0.95)	27.59 (0.93)	15.81 (0.82)	17.55 (0.78)	15.02 (0.89)	17.11 (0.99)	18.81 (0.87)	19.71 (0.80)
χ^2_{JB}	0.75 (0.68)	1.94 (0.37)	0.23 (0.88)	3.48 (0.17)	2.08 (0.35)	4.90 (0.86)	3.79 (0.14)	0.61 (0.73)	0.81 (0.16)
χ^2_{RR}	3.79 (0.54)	5.96 (0.16)	4.24 (0.41)	3.84 (0.51)	0.13 (0.71)	0.82 (0.36)	3.05 (0.083)	2.27 (0.13)	1.27 (0.25)

Note: *, ** and *** indicate that the relevant coefficient is significant at the level of 10%, 5% and 1%, respectively. DW; Durbin-Watson autocorrelation test, χ^2_{BG}; Breusch - Godfrey autocorelation test, χ^2_{BPG}; Breusch - Pagan- Godfrey heteroscedasticity test, χ^2_{JB}; Jarque - Bera normality test, χ^2_{RR}; $Ramsey - Reset$ a test for functional form misspecification.

Table 5. Long Term Analysis Results (Dependent Variable: VOL

Variables	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***	***(8)***	***(9)***	***(10)***
LnEPU	0.44* (0.08)	-	-	-	-	-	-	-	-	-
LnEU	-	3.89** (0.03)	-	-	-	-	-	-	-	-
LnPOLU	-	-	-1.96 (0.19)	-	-	-	-	-	-	-
LnEPUM	-	-	-	-0.20 (0.74)	-	-	-	-	-	-
LnEPUF	-	-	-	-	0.90**(0.04)	-	-	-	-	-
LnEPUD	-	-	-	-	-	0.009***(0.00)	-	-	-	-
LnEPUT	-	-	-	-	-	-	5.63** (0.02)	-	-	-
LnEPUC	-	-	-	-	-	-	-	0.02*** (0.00)	-	-
LnEPUB	-	-	-	-	-	-	-	-	1.04*** (0.00)	-
LnEPUP	-	-	-	-	-	-	-	-	-	0.90** (0.04)
$K_{2008:M02}$	-	-	-	37.73** (0.01)	-	36.96***(0.00)	-	40.37*** (0.00)	-	44.79*** (0.00)
$K_{2008:M08}$	-	-	16.00***(0.00)	-	-	-	-	-	-	-
$K_{2009:M04}$	-73.72***(0.00)	2285.67 (0.19)	-	-	-79.57 (0.12)	-	-16.94**(0.02)	-	-70.89*** (0.00)	-
$K_{2010:M07}$	-	-	0.69*(0.06)	0.84 (0.79)	-	-	-	-	-	-
$K_{2010:M12}$	-	-	-	-	-	-13.76***(0.00)	-	-14.12*** (0.00)	-	-12.82** (0.01)
$K_{2011:M05}$	-17.81***(0.00)	288.39 (0.19)	-	-	-19.20*(0.07)	-	-28.73**(0.01)	-	-18.13*** (0.00)	-
$K_{2012:M08}$	-	-	-18.17***(0.00)	-11.52**(0.03)	-	-	-	-	-	-
$K_{2014:M07}$	1.42***(0.00)	-102.57 (0.19)	-	-	1.44 (0.16)	0.27***(0.00)	1.38**(0.03)	-0.09*** (0.00)	1.32*** (0.00)	-
$K_{2016:M08}$	-13.63***(0.00)	-	-20.82***(0.00)	-36.20**(0.01)	-14.97*(0.06)	-40.45***(0.00)	-27.92**(0.01)	-41.87*** (0.00)	-13.88*** (0.00)	-45.38*** (0.00)
$K_{2017:M08}$	-	-35.14* (0.06)	-	-	-	-	-	-	-	-
Model Diagnostic Tests										
R^2	0.99	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99
$\bar{R}^2$	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
F	204.44 (0.00)	827.76 (0.00)	1435.96 (0.00)	601.57 (0.00)	204.47 (0.00)	198.53 (0.00)	654.07 (0.00)	437.30 (0.00)	650.29 (0.00)	484.56 (0.00)
DW	1.93	1.94	1.96	2.05	1.92	2.04	1.92	2.04	1.93	1.92
χ^2_{BG}	1.67 (0.43)	1.04 (0.59)	1.39 (0.49)	0.94 (0.62)	1.69 (0.42)	0.48 (0.78)	1.63 (0.44)	0.39 (0.82)	1.72 (0.42)	1.99 (0.36)
χ^2_{BPG}	3.66 (0.99)	4.64 (0.99)	0.91 (0.99)	3.38 (0.94)	4.69 (0.96)	3.08 (0.99)	7.46 (0.99)	11.43 (0.99)	4.32 (0.97)	3.00 (0.99)
χ^2_{JB}	2.94 (0.31)	3.29 (0.15)	4.19 (0.12)	4.02 (0.29)	3.73 (0.15)	4.95 (0.30)	1.40 (0.49)	3.57 (0.22)	2.52 (0.23)	2.13 (0.28)
χ^2_{RR}	0.04 (0.83)	0.47 (0.49)	3.89 (0.15)	0.36 (0.54)	2.47 (0.11)	1.44 (0.36)	0.06 (0.79)	3.38 (0.21)	1.40 (0.23	3.15 (0.07)

Note: *, ** and *** indicate that the relevant coefficient is significant at the level of 10%, 5% and 1%, respectively. DW; Durbin-Watson autocorrelation test, χ^2_{BG}; Breusch - Godfrey autocorelation test, χ^2_{BPG}; Breusch - Pagan- Godfrey heteroscedasticity test, χ^2_{JB}; Jarque - Bera normality test, χ^2_{RR}; $Ramsey - Reset$ a test for functional form misspecification.

According to the findings in Table 4, when the political and economic uncertainties in Greece increase, Athens Stock Exchange Index (ASE) decreases. The types of uncertainty that have the greatest impact are uncertainty in economic policies (EPU), uncertainty in monetary policies (EPUM), uncertainty in fiscal policies (EPUF) and uncertainties in the banking system (EPUB). The results obtained at this stage of the study show consistency with the findings of the studies included in the literature such as Asteriou and Sarantidis (2016) and Hardouvelis et al. (2018). It is observed that the 2008 global economic crisis, the foreign debt crisis occurred in this country in 2011 and the last aid agreement signed with the European Stability Mechanism (ESM) in 2015 also has a decreasing effect on the stock market index in this country. During the 2015-2017 period, cuts in up to 40% increases observed in tax rates seem to have affected the Athens Stock Exchange in some models positively and in other models in a negative way. Model reliability tests reveal that the analyzes are reliable.

According to the findings in Table 5, when the political and economic uncertainties in Greece increase, the volatility (VOL) in the Athens Stock Exchange Index increases. The types of uncertainty where this effect is greatest are economic uncertainty (EU), uncertainties in tax policies (EPUT) and uncertainties in banking policies (EPUB). The result obtained at this stage of the study is consistent with the results of Baker et al. (2016) study. It is seen that the 2008 global economic crisis, the foreign debt crisis observed during the 2010-2012 period and the negative developments in the Greek economy in 2014 increased the volatility in the stock market of this country. It is seen that the end of the structural reform agreement signed with the EU in 2016 has a decreasing effect on the stock market volatility. Model reliability tests reveal that the analyzes are reliable.

Short Term Analysis

There may be some small deviations in the short term between the series, in which cointegration is detected and acting together in the long term. The disappearance of these deviations in the short run between the series will show that the error correction mechanism of the model is working truly and the analyzes performed are reliable. In this study, ARDL model is used to reveal the short-term relationships between the series. Models used for this purpose:

$$\Delta LnASE_t = \theta_0 + \sum_{j=1}^{p_1} \theta_{1j} \Delta LnASE_{t-j} + \sum_{j=0}^{p_2} \theta_{2j} \Delta LnUI_{t-j} + \sum_{i=1}^{k} \sum_{j=0}^{p_3} \delta_{ij} \Delta K_{t-j} + \psi_i ECT_{it-1} + e_t \quad (11)$$

$$\Delta LnVOL_t = \gamma_0 + \sum_{j=1}^{p_1} \gamma_{1j} \Delta LnVOL_{t-j} + \sum_{j=0}^{p_2} \gamma_{2j} \Delta LnUI_{t-j} + \sum_{i=1}^{k} \sum_{j=0}^{p_3} \gamma_{ij} \Delta K_{t-j} + \varphi_i ECT_{it-1} + u_t \quad (12)$$

P_1 , P_2 *ve* P_3 *;* refer to optimum lag lengths and can be determined using Akaike or Schwarz information criteria. ECT_{t-1} , is error correction terms derived from long-term analysis. As a result of the short-term analysis to be made, statistically significant the coefficients of these terms indicate that the error correction mechanism of the relevant model is working correctly (Clements, 2019). In the study, short term analyzes are also made with the ARDL method and the findings obtained are presented in Table 6 and Table 7.

Table 6. Short Term Analysis Results (Dependent Variable: ΔASE)

Variable	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***	***(8)***	***(9)***
$\Delta LnEPU$	-0.12*** (0.00)	-	-	-	-	-	-	-	-
$\Delta LnEU$	-	-0.14*** (0.00)	-	-	-	-	-	-	-
$\Delta LnPOLU$	-	-	-0.11*** (0.00)	-	-	-	-	-	-
$\Delta LnEPUD$	-	-	-	-	-	-0.03** (0.01)	-	-	-
$\Delta LnEPUC$	-	-	-	-	-	-	-	-0.07*** (0.00)	-
$\Delta K_{2008:M04}$	-	-	-	0.08 (0.18)	-	-	-	-	-
$\Delta K_{2008:M08}$	0.02 (0.64)	0.04 (0.38)	-	-	-	-	-	-	-
$\Delta K_{2008:M09}$	-	-	-	-	-	-	-0.09 (0.55)	-	-
$\Delta K_{2008:M10}$	-	-	-0.22*** (0.00)	-	-0.08 (0.10)	-0.25*** (0.00)		-	-
$\Delta K_{2011:M05}$	0.66*** (0.00)	-0.08 (0.15)	-0.10* (0.05)	-	-0.08 (0.10)			-	-0.10* (0.07)
$\Delta K_{2011:M06}$	-	-	-	-0.03 (0.60)	-	-0.02 (0.69)	-0.03 (0.62)	-	-
$\Delta K_{2011:M08}$	-	-	-	-	-	-	-	-0.14** (0.01)	-
$\Delta K_{2015:M01}$	-	-	-	-0.09 (0.14)	-	-	-	-	-
$\Delta K_{2015:M04}$	-	-	-	-	-	-0.02 (0.61)	-	-	-
$\Delta K_{2015:M07}$	0.01 (0.75)	0.04 (0.45)	-0.01 (0.78)	-	0.01 (0.75)	-	0.03 (0.62)	-	-
$\Delta K_{2015:M08}$	-	-	-	-	-	-	-	-0.22*** (0.00)	-0.20*** (0.00)
$\Delta K_{2017:M08}$	-	-	-0.05 (0.22)	-	-	-	-	-	-
ECT_{t-1}	-0.01*** (0.00)	-0.06*** (0.00)	-0.02*** (0.00)	-0.009** (0.00)	-0.03*** (0.00)	-0.01*** (0.00)	-0.02*** (0.00)	-0.01*** (0.00)	-0.02*** (0.00)
Model Diagnostic Tests									
R^2	0.69	0.67	0.61	0.35	0.48	0.40	0.49	0.49	0.52
$\bar{R}^2$	0.55	0.53	0.50	0.28	0.41	0.33	0.38	0.41	0.45
LL	262.37	257.05	252.29	213.71	228.98	219.86	231.59	233.19	238.21
DW	2.01	1.97	1.97	1.99	2.04	1.96	1.95	2.08	1.94
χ^2_{BG}	0.27 (0.87)	1.37 (0.50)	0.13 (0.93)	1.97 (0.37)	1.33 (0.51)	1.85 (0.39)	1.58 (0.45)	1.86 (0.17)	0.52 (0.77)
χ^2_{BPG}	41.81 (0.86)	34.73 (0.95)	27.59 (0.93)	15.81 (0.82)	17.55 (0.78)	15.02 (0.89)	17.11 (0.99)	18.81 (0.87)	19.71 (0.80)
χ^2_{JB}	0.75 (0.68)	1.94 (0.37)	0.23 (0.88)	3.48 (0.17)	2.08 (0.35)	4.90 (0.86)	3.79 (0.14)	0.61 (0.73)	0.81 (0.16)
χ^2_{RR}	3.79 (0.54)	5.96 (0.16)	4.24 (0.41)	3.84 (0.51)	0.13 (0.71)	0.82 (0.36)	3.05 (0.083)	2.27 (0.13)	1.27 (0.25)

Note: *, ** and *** indicate that the relevant coefficient is significant at the level of 10%, 5% and 1%, respectively. DW; Durbin-Watson autocorrelation test, χ^2_{BG}; Breusch - Godfrey autocorelation test, χ^2_{BPG}; Breusch - Pagan- Godfrey heteroscedasticity test, χ^2_{JB}; Jarque - Bera normality test, χ^2_{RR}; $Ramsey - Reset$ a test for functional form misspecification.

Table 7. Short Term Analysis Results (Dependent Variable: ΔVOL

Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
$\Delta LnEPUC$	-	-	-	-	-	-	-	-0.02(0.10)	-	-
$\Delta LnEPUP$	-	-	-	-	-	-	-	-	-	-0.01 (0.35)
$\Delta K_{2008:M02}$	-	-	-	0.12*(0.08)	-	0.12* (0.09)	-	0.12(0.10)	-	0.14**(0.04)
$\Delta K_{2008:M08}$	-	-	-0.02 (0.66)	-	-	-	-	-	-	-
$\Delta K_{2009:M04}$	0.03 (0.58)	0.03 (0.63)	-	-	-0.08(0.22)	-	0.04 (0.53)	-	0.03 (0.56)	-
$\Delta K_{2010:M12}$	-	-	-	-	-	-0.13* (0.06)	-	-0.14**(0.04)	-	-0.14**(0.04)
$\Delta K_{2011:M05}$	-0.24***(0.00)	-0.23***(0.00)	-	-	-0.24***(0.00)	-	-0.23***(0.00)	-	-0.23***(0.00)	-
$\Delta K_{2016:M08}$	-0.33***(0.00)	-	-	-0.33***(0.00)	-0.33*** (0.00)	-0.330.00)	-0.33***(0.00)	-0.35***(0.00)	-0.33***(0.00)	-0.33***(0.00)
ECT_{t-1}	-0.06*** (0.00)	0.002***(0.00)	- 0.01***0.00)	-0.02***0.00)	-0.05***(0.00)	- 0.02***(0.00)	-0.03***(0.00)	-0.02***0.00)	-0.06***(0.00)	-0.02***(0.00)
Model Diagnostic Tests										
R^2	0.41	0.26	0.22	0.34	0.41	0.38	0.42	0.39	0.42	0.38
$\bar{R}^2$	0.34	0.21	0.21	0.27	0.34	0.27	0.34	0.28	0.34	0.27
LL	204.44	187.57	185.19	193.82	204.47	198.53	204.99	200.15	1.93	198.62
DW	1.93	1.94	1.96	2.05	1.92	2.04	1.92	2.04	204.53	1.92
χ^2_{BG}	1.67 (0.43)	1.04 (0.59)	1.39 (0.49)	0.94 (0.62)	1.69 (0.42)	0.48 (0.78)	1.63 (0.44)	0.39 (0.82)	1.72 (0.42)	1.99 (0.36)
χ^2_{BPG}	3.66 (0.99)	4.64 (0.99)	0.91 (0.99)	3.38 (0.94)	4.69 (0.96)	3.08 (0.99)	7.46 (0.99)	11.43 (0.99)	4.32 (0.97)	3.00 (0.99)
χ^2_{JB}	2.94 (0.31)	3.29 (0.15)	4.19 (0.12)	4.02 (0.29)	3.73 (0.15)	4.95 (0.30)	1.40 (0.49)	3.57 (0.22)	2.52 (0.23)	2.13 (0.28)
χ^2_{RR}	0.04 (0.83)	0.47 (0.49)	3.89 (0.15)	0.36 (0.54)	2.47 (0.11)	1.44 (0.36)	0.06 (0.79)	3.38 (0.21)	1.40 (0.23	3.15 (0.07)

Note: *, ** and *** indicate that the relevant coefficient is significant at the level of 10%, 5% and 1%, respectively. DW; Durbin-Watson autocorrelation test, χ^2_{BG}; Breusch - Godfrey autocorelation test, χ^2_{BPG}; Breusch - Pagan- Godfrey heteroscedasticity test, χ^2_{JB}; Jarque - Bera normality test, χ^2_{RR}; $Ramsey - Reset$ a test for functional form misspecification.

According to the findings in Table 6, uncertainties in economic policies (EPU), general economy (EU), policy implementations (POLU), public debt (EPUD) and exchange rates (EPUC) also reduce the Athens Stock Exchange Index (ASE) in the short term. Among these uncertainties, uncertainties seen in general the economy (EU) are the most influential in the short term. The 2008 global economic crisis, the foreign debt crisis that emerged in 2011, the last aid agreement signed with the European Stability Mechanism (ESM) in 2015, the cuts in pensions and increases in tax rates during the 2015-2017 period have reducing effects on the stock index. The important thing in this analysis is that the coefficients of error correction terms are found statistically significant. According to this result, error correction mechanisms of all models are working truly. In other words, the short-term deviations from the cointegration relationship disappear and the analyses made in this respect are reliable. Model reliability tests also support that the analyzes are reliable.

According to the findings in Table 7, uncertainties in the Greek economy do not affect the volatility in the Athens Stock Exchange Index (VOL) statistically in the short term. The 2008 global economic crisis has also increased the volatility in the Athens Stock Exchange Index (VOL) in the short term. The important thing in this analysis is that the coefficients of error correction terms are found statistically significant. According to this result, error correction mechanisms of all models are working truly. In other words, the short-term deviations from the cointegration relationship disappear and the analyses made in this respect are reliable. Model reliability tests also support that the analyzes are reliable.

Conclusion and Recommendations

Stock exchanges are one of the most important pioneering institutions in the financial development of countries and it is known that the development of these institutions has positive contributions to real economic activities and economic growth. Today, with the increasing global financial integration, investors from all over the world can enter the stock markets of any country. This provides a considerable portfolio investment to the countries, and the financial problems of the countries can be solved even in the short term, and their economic activities accelerate. However, when investors perceive an economic or political risk in the country, they can shift their investments to other countries in a very short time. This situation can bring countries to significant foreign exchange rates and financing problems. For this reason, it is very important for the governments to give confidence to the stock market investors and to reduce the economic and political uncertainties in their countries.

The existence of cointegration relationship between the series in the models is analyzed by the Boundary Test method developed by Pesaran et al. (2001)

and it is determined that the series in other models except one model are cointegrated. The structural breaking dates in the cointegration vector are determined by the Bai-Perron (2003) method and included in long and short term analyzes with dummy variables.

Long and short term analyzes are done by the ARDL method. In the long-term analysis, it is determined that when the political and economic uncertainties in Greece increased, the uncertainty types with the highest impact on decreasing of the Athens Stock Exchange Index are tax uncertainties (EPUT), economic uncertainties (EU) and uncertainties in banking policies (EPUB), respectively. When uncertainties in economic policies increase, stock index index decreases and volatility in stock market increases. These results obtained in the literature, are consistent with the findings of Sum (2012), Baker et al. (2016) and Hardouvelis et al. (2018). In this study, in addition to the studies in the literature, a significant contribution is made to the literature by using economic policy uncertainty index directly in Greece, and by including a total of 10 uncertainty indices associated with EPU. It is found that the 2008 global economic crisis, the external debt crisis of Greece and subsequent the austerity policies (tax increases, pensions cuts, etc.) they had to implement because of Troika pressures, decreased the Athens Stock Exchange while increased its price volatility.

In the short-term analysis, it is observed that the uncertainties are also affect on the Athens Stock Exchange Index in the short term, but they have got effect less than the long run on the price volatility of the stock exchange. In this analysis, it is also determined that error correction mechanisms of all models are working.

Based on the findings obtained from this study, it can be stated that countries need to reduce uncertainty in economic policies in order to increase the return performance of stock exchanges and to decrease volatility in these exchanges.

In order not to face economic and social turbulences that emerged in Greece which is the immediate neighbor of Turkey, it is better to reduce the economic and political uncertainties and provide all kinds of legal safeguards to both domestic and foreign investors, institutional investors, companies, policy makers.

In this study, the effects of the Greek EPU and its sub-items on the Athens stock exchange are examined, and it is tried to prepare a guide for the researchers working on this subject. In the study, the importance of examining not only the stock market index but also the price volatility in the stock market has been revealed. This study is expected to make significant contributions to the literature both in terms of the variables used and the results achieved. Moreover, in this study, it is hoped to attract attention of researchers in Turkey to the EPU and its sub-index and create a similar index for Turkey and thus much better-quality studies will be created at a later stage. Finally, it is hoped that the findings obtained from this study will attract investors, institutional investors, companies, attention to the effects of uncertainties in economic policies on stock market and stock price volatility and contribute to more efficient portfolio management. As seen from the example of Greece in this study, policymakers should not forget that they can positively affect the functioning of financial markets by reducing their uncertainties in their countries.

References

ADVFN. (2020). ATHEX Composite Share. *GD Historical Prices:* https://www.advfn.com/stock-market/ASI/GD/historical/more-historical-data?current=16&Date1=01/01/09&Date2=01/20/20, [22.01.2020].

Arı, A. & Ozcan, B. (2015). The Stationarity of Consumption-Income Ratio: Evidence from Turkey. *Hacettepe University Journal of Economics and Administrative Sciences, 33*(3), 23-46.

Asteriou, D. & Sarantidis, A. (2016). Political Instability and Stock Market Return: Evidence from OECD Countries. *Economics and Business Letters, 5*(4), 113 - 124.

Bai, J. & Perron, P. (2003). Computation and Analysis of Multiple Structural Change Models. *Journal of Applied Econometrics*, 18, 1-22.

Baker, S R., Bloom, N. & Davis, S. J. (2016). Measuring Economic Policy Uncertainty. *The Quarterly Journal of Economics, 131*(4), 1593–1636.

Belloumi, M. (2014). The Relationship between Trade, FDI and Economic Growth in Tunisia: An Application of Autoregressive Distributed Lag Model. *Economic Systems, 38*(2), 269-287.

Chowdhury, A. R. (1993). Does Exchange Rate Volatility Depress Trade Flows? Evidence from Error Correction Models. *The Review of Economics and Statistics, 75*(4), 700–706.

Clements, J. (2019). *The Error-Correction Model for Co-integrated Time Series (and checking parameter stability):* https://towardsdatascience.com/the-error-correction-model-for-co-integrated-time-series-and-checking-parameter-stability-a60bbdafb9e4 [30.01.2020].

Dash, S. R., Maitra, D., Debeta, B. & Mahakud, J. (2019). Economic policy uncertainty and stock market liquidity: Evidence from G7 countries. *International Review of Finance*, 1-16. DOI: 10.1111/irfi.12277

Engle, R. F., & Granger, C. W. J. (1987). Co-integration and Error Correction: Representation, Estimation, and Testing. *Econometrica: Journal of the Econometric Society, 55*(2), 251-276.

Sahinoz, S., & Cosar, E. E. (2018). Quantifying uncertainty and identifying its impacts on the Turkish economy. *Empirica*, 47, 365-387.

Gilal, M. (2019). *Economic Policy Uncertainty and Stock Market Returns in Indonesia*. DOI: 10.13140/RG.2.2.10905.88168

Granger, C. W., J. & Newbold, P. (1974). Spurious Regressions in Econometrics. *Journal of Econometrics, 2*(2), 111 – 120.

Guterres, A. (2020). *World Economic Situation Prospects 2020. United Nations Conference on Trade and Development:* https://unctad.org/en/PublicationsLibrary/wesp2020_en.pdf [16.05.2020].

Hardouvelis, G., Karalas, G., Karanastasis, D., & Samartzis, P. (2018). Economic Policy Uncertainty, *Political Uncertainty, and the Greek Economic Crisis*: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3155172 [22.01.2020].

Hardouvelis, G., Karalas, G., Karanastasis, D. and Samartzis, P. (2019). *Uncertainty Indices for Greece*: http://hardouvelis.gr/hkks-uncertainty-indices-for-greece [22.01.2020].

Hatipoglu, M., & Sekmen, T. (2018). The Impacts of Some Selected Risk Factors on Islamic Stock Markets. *MANAS Journal of Social Studies, 7*(4), 231-240.

Hoque, M. E., & Zaidi, M. A. S. (2019). The Impacts of Global Economic Policy Uncertainty on Stock Market Returns in Regime Switching Environment: Evidence from Sectoral Perspectives. *International Journal of Finance & Economics*, *24*(2), 991-1016.

Johnston, J., & Dinardo, J. (1997). *Econometric Methods*. (Fourth Edition), McGraw-Hill Companies, United States.

Kapetanios, G. (2005). Unit-Root Testing Against the Alternative Hypothesis of Up to *m* Structural Breaks. *Journal of Time Series Analysis, 26*(1), 123-133.

Karacaer Ulusoy, M., & Pirgaip, B. (2019). The Casual Relationship between Economic Policy Uncertainty and Stock Market Returns. *Journal of Atatürk University Social Science Institute*, *23*(December Special Issue), 2239-2251.

Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money*. Macmillan Cambridge University Press, for Royal Economic Society in 1936.

Knight, F. (1921). *Risk, Uncertainty, and Profit*. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship: https://ssrn.com/abstract=1496192 [22.01.2020].

Li, Y., Ma, F., Zhang, Y., & Xiao, Z. (2019). Economic policy uncertainty and the Chinese stock market volatility: new evidence. *Applied Economics, 51*(49), 5398-5410. DOI: 10.1080/00036846.2019.1613507

Li, X. L., Balcilar, M., Gupta, R., & Chang, T. (2016) The Causal Relationship Between Economic Policy Uncertainty and Stock Returns in China and India: Evidence from a Bootstrap Rolling Window Approach. *Emerging Markets Finance and Trade, 52*(3), 674-689. DOI: 10.1080/1540496X.2014.998564

Li, R., Li, S., Yuan, D., & Yu, K. (2020) Does Economic Policy Uncertainty in the U.S. Influence Stock Markets in China and India? Time-Frequency Evidence. *Applied Economics,* 1-17. DOI: 10.1080/00036846.2020.1734182

Liu, L., & Zhang, T. (2015). Economic policy uncertainty and stock market volatility. *Finance Research Letters, 15*, 99-105.

MFA. (2019). *Greece Economy:* http://www.mfa.gov.tr/yunanistan-ekonomisi.tr.mfa [25.01.2020]

Moore, A. (2017). Measuring economic uncertainty and its effects. *Economic record, 93*(303), 550-575.

Pesaran, H. M., Shin, Y., & Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics, 16*(3), 289 - 326.

Sevim, C., & Dogan, T. T. (2016). Export and Exchange Rate Volatility Relationship in Turkish Economy. *Ege Academic Review, 16*(2), 303- 318.

Sum, V. (2012). The ASEAN Stock Market Performance and Economic Policy Uncertainty in the United States. *Economic Papers: A Journal of Applied Economics and Policy*, *32*(4), 512-521.

Tarı, R., & Yildirim, D. Ç. (2009). The Effects of Exchange Rate on Export: An Analysis for Turkey. *Journal of Management and Economics, 16*(2), 95-105.

UNCTAD. (2009). *The Global Economic Crisis: Systemic Failures and Multilateral Remedies.* United Nations Publications.

APPENDIX

Appendix 1. Descriptive Statistics of the Data Set

	LnASE	LnVOL	LnEPU	LnEPUB	LnEPUC	LnEPUD	LnEPUF	LnEPUM	LnEPUP	LnEPUT	LnEU	LnPOLU
Mean	7.17	4.57	4.59	4.57	4.48	4.56	4.60	4.41	4.57	4.59	4.58	4.64
Median	6.89	4.45	4.60	4.58	4.44	4.60	4.62	4.46	4.57	4.62	4.57	4.63
Maximum	8.56	5.94	5.24	5.37	5.73	5.54	5.24	5.56	5.94	5.35	5.19	5.73
Minimum	6.20	3.25	3.63	3.20	3.20	1.98	3.64	2.99	2.98	3.71	3.56	3.98
Std. Dev.	0.70	0.72	0.28	0.37	0.51	0.47	0.33	0.44	0.47	0.33	0.27	0.32
Skewness	0.69	0.07	-0.31	-0.74	0.14	-1.14	-0.50	-0.53	-0.02	-0.25	-0.51	0.57
Kurtosis	2.10	1.94	3.41	4.28	2.61	7.70	3.06	3.36	3.58	2.94	3.94	3.28
Jarque-Bera	18.90	8.00	3.85	26.60	1.60	189.68	7.07	8.73	2.34	1.73	13.24	9.56
Probability	0.00	0.02	0.15	0.00	0.45	0.00	0.03	0.01	0.31	0.42	0.00	0.01
Sum	1197.1	763.1	766.5	763.2	747.6	761.9	767.8	736.1	763.0	766.5	764.8	774.6
Sum Sq. Dev.	82.2	86.6	13.4	22.8	43.6	36.6	18.6	32.8	36.5	18.4	12.4	17.5
Observations	167	167	167	167	167	167	167	167	167	167	167	167

According to the information in this table, the series used in the analysis are types of series that fluctuate around their arithmetic averages, have minor the range between max. and min levels and based on these low differences have minor standard deviations and don't have skewness and kurtosis problems. The time dimension of the study is 167 and its degree of freedom is high and sufficient for reliable time series analysis.

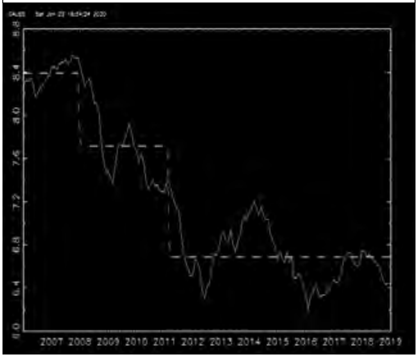
Appendix 2. Correlation Matrix

	LnASE	LnVOL	LnEPU	LnEPUB	LnEPUC	LnEPUD	LnEPUF	LnEPUM	LnEPUP	LnEPUT	LnEU	LnPOLU
LnASE	1	0.78	-0.43	-0.36	-0.44	-0.40	-0.56	0.17	-0.26	-0.59	-0.27	-0.60
LnVOL	0.78	1	-0.10	-0.04	-0.13	-0.11	-0.28	0.14	-0.24	-0.40	0.08	-0.38
LnEPU	-0.43	-0.10	1	0.92	0.83	0.68	0.80	0.34	0.53	0.68	0.95	0.85
LnEPUB	-0.36	-0.04	0.92	1	0.76	0.64	0.71	0.39	0.50	0.58	0.88	0.75
LnEPUC	-0.44	-0.13	0.83	0.76	1	0.64	0.69	0.16	0.33	0.52	0.76	0.73
LnEPUD	-0.40	-0.11	0.68	0.64	0.64	1	0.84	0.19	0.43	0.60	0.58	0.58
LnEPUF	-0.56	-0.28	0.80	0.71	0.69	0.84	1	0.16	0.53	0.89	0.69	0.77
LnEPUM	0.17	0.14	0.34	0.39	0.16	0.19	0.16	1	0.24	0.12	0.36	0.21
LnEPUP	-0.26	-0.24	0.53	0.50	0.33	0.43	0.53	0.24	1	0.53	0.47	0.51
LnEPUT	-0.59	-0.40	0.68	0.58	0.52	0.60	0.89	0.12	0.53	1	0.58	0.72
LnEU	-0.27	0.08	0.95	0.88	0.76	0.58	0.69	0.36	0.47	0.58	1	0.74
LnPOLU	-0.60	-0.38	0.85	0.75	0.73	0.58	0.77	0.21	0.51	0.72	0.74	1

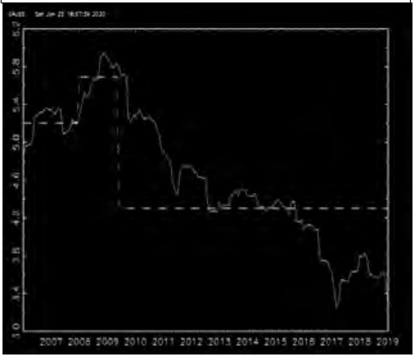
According to the results in this table, the variables that have the highest relationship with the Athens Stock Exchange Index (ASE) are Political Uncertainty Index (POLU), Tax Uncertainty Index (EPUT) and Uncertainty Index (EPUF) in Fiscal Policies, respectively. It is noteworthy that all kinds of uncertainty have a reducing effect on the Athens Stock Exchange Index. The variables that have the highest relationship with volatility (VOL) in the Athens Stock Exchange are Tax Uncertainty Index (EPUT), Political Uncertainty Index (POLU) and Uncertainty Index (EPUF) in Fiscal Policies, respectively. The effects of uncertainty indices on volatility in the Athens Stock Exchange appear to be in different directions. For this reason, it will be useful to use all uncertainty indices separately in the analysis.

Appendix 3. Kapetanios Structural Break Unit Root Test Charts

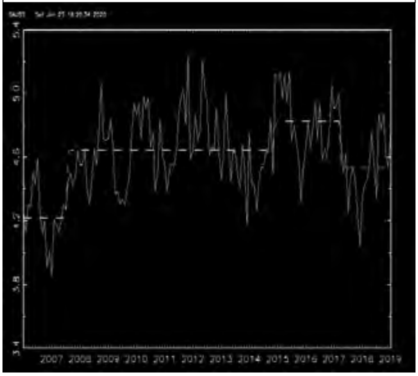
LnASE Series Level Value Chart



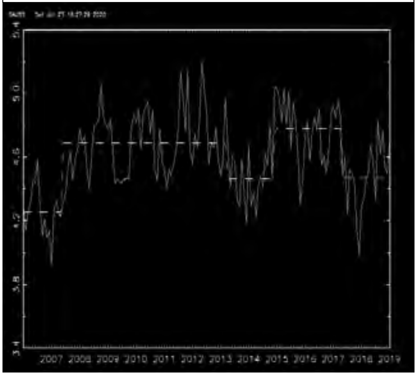
LnVOL Series Level Value Chart



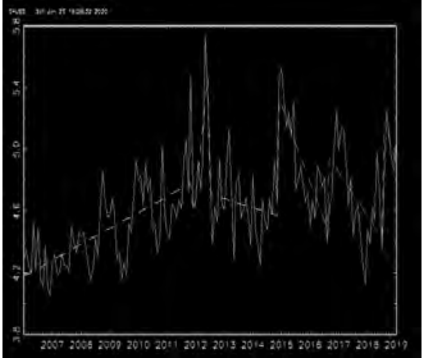
LnEPU Series Level Value Chart



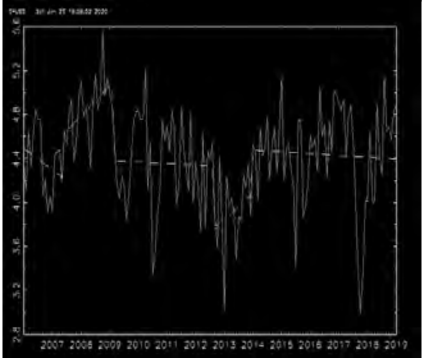
LnEU Series Level Value Chart



LnPOLU Series Level Value Chart

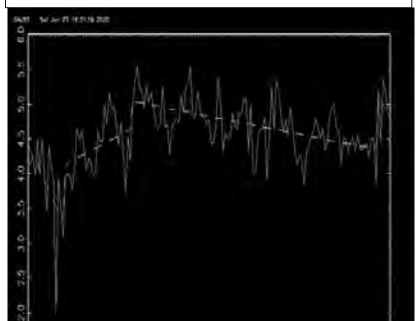


LnEPUM Series Level Value Chart



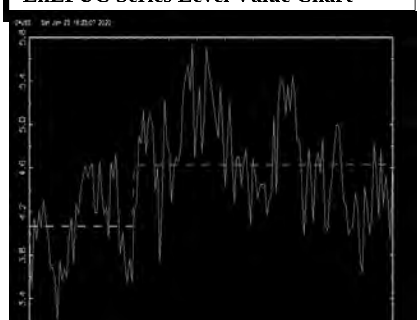
LnEPUF Series Level Value Chart

LnEPUD Series Level Value Chart

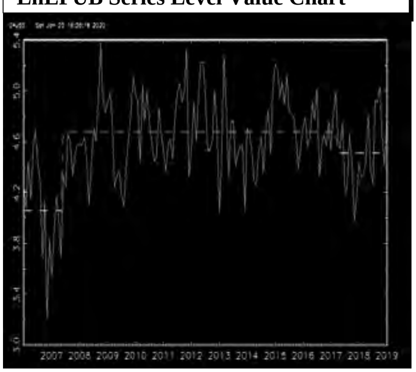


LnEPUT Series Level Value Chart

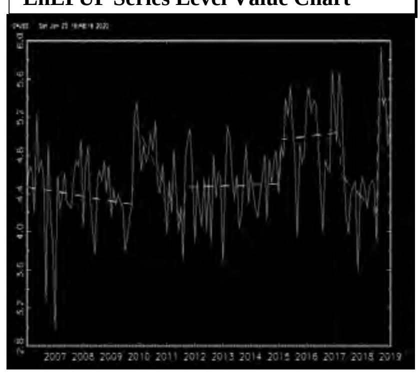
LnEPUC Series Level Value Chart



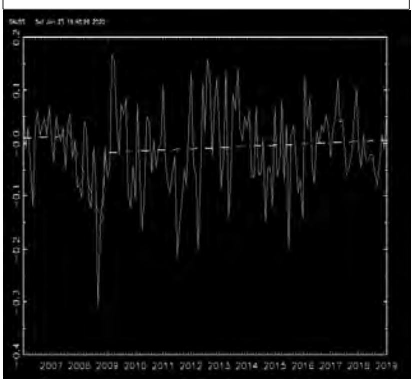
LnEPUB Series Level Value Chart



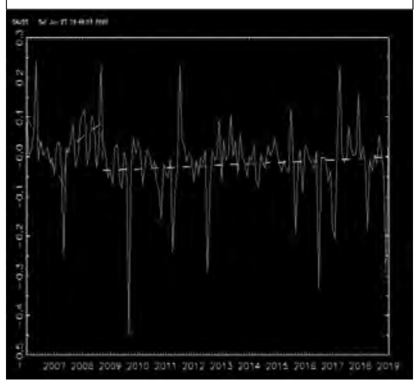
LnEPUP Series Level Value Chart



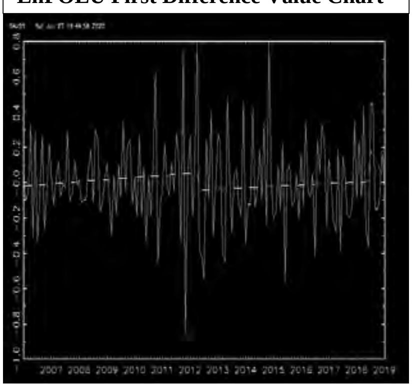
LnASE First Difference Value Chart



LnVOL First Difference Value Chart



LnPOLU First Difference Value Chart



LnEPUC First Difference Value Chart