



ECONOMETRIC ANALYSIS OF NATURAL DISASTERS' MACRO-ECONOMIC IMPACTS: AN ANALYSIS ON SELECTED FOUR OECD COUNTRIES

DOI: 10.17261/Pressacademia.2015313064

Ismail Sahin¹, Omer Yavuz²

¹Canakkale Onsekiz Mart University, Turkey. Email: ismails@comu.edu.tr

²Canakkale Onsekiz Mart University, Turkey. Email: omeryavuz@comu.edu.tr

Keywords

Economic growth,
Macro-economy,
Natural disasters,
OECD,
Time series analysis

ABSTRACT

The aim of this study is to investigate the macro-economic impacts of the disasters occurring in 4 countries which were selected as members of the OECD between 2005 and 2014. As macro-economic indicators, industrial production index, inflation and unemployment were used. In order to investigate the macro-economic impact of disasters empirically, the estimation model of each variable was found using autoregressive moving average method (ARIMA), which is the analysis of time series, and dummy variable was added to this model. In addition, Augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests, which are used for testing the stability of the series, were employed to be able to use autoregressive models. Considering the analysis results, it has been seen that the dummy variable is statistically significant for selected countries. This indicates that these countries provide increased production by increasing public spending in the context of disaster management after the earthquake. These results are also consistent with the literature on the economic impacts of natural disasters.

JEL Classification

C10,G30,M10

1. INTRODUCTION

Natural disasters are described as natural events which cause physical, economic and social losses on living and non-living things and affect daily life and human activities by disrupting totally or interrupting (Gündüz, 2009). Although natural disasters result from natural processes of Earth, their effects depend on human factor. Dimensions of damages take shape based on whether position of residential area is chosen appropriately, earthquake proof and resistant buildings are built; population density and efficiency of emergency rescue services. In other words human factor may have positive or negative impacts on results of any disaster (Laçiner and Yavuz, 2013).

In addition to deaths and woundings, disasters cause economic losses such as damages in infrastructure and superstructure, raise in unemployment ratio, raw material losses, production losses, increase in public spending within search and rescue and reconstruction periods and burden on public economy (Akar, 2013). Destruction resulted from disasters varies depending on characteristics of residential area, physical condition of

buildings, population density and disaster readiness. However natural disasters result in much more damage compared with disasters occurred at past because of the increase in global population, construction of new residential areas, unplanned urbanization, increase in global mobility, economies' getting more dependent on technology and climate change due to technological factors like greenhouse effect (Coppola, 2001; Atli, 2006; Yilmaz, 2003).

Economic impacts of disasters take shape in different ways as direct, indirect and macro-economic. Direct impact can be defined as first aid and temporary accommodation costs, treatment, food and clothing costs, destruction in infrastructure and superstructure, goods and material losses, livestock and agricultural losses and damages in public and private institutions (Ergünay, 2002). On the other hand indirect impact is comprehensive and complex compared to direct impact. Production losses due to destructions in workplaces and facilities and service losses resulting from public and private institutions are examples of indirect impact. Furthermore macroeconomic indicators such as GDP, employment rate, inflation, external debt stock, production, etc. are affected by disasters. Macroeconomic effect resulting from the disaster is directly related with development level of countries. Impacts of disasters on developing countries are far more destructive while any significant impact is not observed in developed countries (Mechler, 2007).

GDP in developing countries falls within the year in which the disaster take place or one year later and then raises with increases in investments. Increase in public spending and decrease in taxation revenue contribute to budget deficit and cause deterioration in balance of trade. Intensity of disaster and also macroeconomic impact based on economic, social and political structure of the country where disaster occurs, change and long term impacts should be observed (Mechler, 2007). Although impacts of disasters on economic indicators are mostly negative, sometimes positive impacts are seen. These impacts are indirect ones rather direct (Erkan, 2010). In this study, macroeconomic impacts of disasters that occurred in Canada, Chile, Greece and Turkey between 2004 and 2013, four OECD countries have been investigated. Natural disasters' impact on industrial production index, inflation and unemployment rate are within the scope of the study. Primarily, macroeconomic impacts of natural disasters were observed with literature review. Then what kind of impact natural disasters have on certain macroeconomic variables has been analyzed. Considering the analysis results, it has been seen that the dummy variable is statistically significant for selected countries. This indicates that these countries provide increased production by increasing public spending in the context of disaster management after the earthquake. These results are also consistent with the literature on the economic impacts of natural disasters. In fact, according to the literature, disasters cause adverse effects in production as soon as they occur in the short term; however, they create a positive impact on production as a result of the public expenditure made after the disaster in the long term.

2.LITERATURE REVIEW

Lazzoroni and Bergeijk (2013) researched which factors significant or non-significant impacts of disasters in countries where they occur are related by investigating empirical studies which were published in recent years and focused on macro-economic impacts of

natural disasters. According to the result of the study, the population is the main factor affecting the intensity of disasters.

Cunado and Ferreira (2014) investigated the macroeconomic impacts of natural disasters specific to flooding. Flood that occurred in 135 countries between 1985 and 2008 were used as data in this study. According to the results of the study, flooding has positive impacts on economic growth. This positive impact is observed especially in agriculture economy. Furthermore it affects GDP per capita in a positive manner. However this impact is limited to developing countries and average floods. In developing countries floods have positive impacts on both agricultural and non-agricultural growth.

Padli and Habibullah (2009) investigated the relationship between death toll due to natural disasters in ten Asian countries between 1970 and 2005 and economic development, land area, population and years of schooling. According to the results of the study, there exists an inverse proportion between economic development and disaster resistance. So countries with low level of development are more disaster resistant while highly developed countries are less disaster resistant. As the level of education raises, death toll because of disaster decreases and larger population increases death toll. On the other hand larger land area decreases the death toll.

According to Noy (2009), when compared with bigger economies, smaller economies are more fragile against natural disasters. A disaster of similar magnitude affects a developing country more significantly than a developed one. Findings in Noy's research indicates that factors such as higher literacy rate, better institutions, higher per capita income, higher degree of openness to trade and a strong government are important in preventing negative impacts of natural disasters on macroeconomic indicators. Furthermore, changes in amount of foreign exchange reserves, domestic credit levels and rate of increase in per capita income are the financial factors that affect fragility of countries against disasters.

Toya and Skidmore (2007) researched whether human and economic losses could be decreased with economic development. According to the results, economic development is not enough alone in order to decrease damages. Together with economic development, increase in level of education, raise in disaster awareness, financial sector's getting stronger and local governments' being allowed to have higher power decrease the damages of disasters.

Kim (2010) investigated the economic impacts of disasters in the long run in his study. There is a positive relationship between disasters and long-run economic growth. This study interpreted through which channels disasters affect economic growth.

Akar (2013), researched on the effects of natural disasters on public economy and macro economy in Turkey specific to earth quakes which are disasters occurring most frequently and harms most. According to findings of the research, disasters cause decrease in GDP, losses in stocks due to uncertainty and deterioration in balance of trade because of increase in imports and decrease in exports. Moreover natural disasters affect public economy by resulting in increase in public spending and decrease in taxation revenue in countries where they take place.

Results of the study in which Karagöz (2007) investigated the negative impacts of the 1999 Marmara Earthquake are parallel with ones of other studies. According to this, the 1999 Marmara Earthquake decreased GDP while increasing public spending and domestic debt stock.

Akturk and Albeni (2002) investigated how the 1999 Marmara Earthquake affected the economic performance of Turkey by comparing economic pre-economic and post-economic indicators. In the study, the earthquake's economic impacts were discussed by classifying into 7 groups which were impacts on economic infrastructure, manufacturing sector, agricultural sector, exports and imports, tourism sector, education and health of the earthquake and fiscal impacts of the earthquake. According to the results, economic indicators after the earthquake are worse than ones before the earthquake. However it cannot be claimed negative indicators are utterly originated from the earthquake.

Tourism sector is one the sectors indirectly affected by disasters. Tours and reservations cancelled due to disasters and tourists' leaving the country over fear of disaster have negative influences on the sector. The sector is affected by disasters not only in the disaster area but also all over the country unlike other sectors. Tourist planning to visit the country before the disaster cancelled their plans without taking in which area the disaster takes place (Yavuz, 2014).

Murat et al. (2013) discussed whether number of tourists from different nations is influenced by economic crisis, terrorist acts and natural disasters in their study. According to the findings, especially tourists visiting Australia, Iran and Russia are under permanent effect of these kinds of crisis.

3.DATA AND METHODOLOGY

Reviewing macroeconomic impacts of disasters empirically, the relationship between disaster periods and macroeconomic indicators has been tested by defining dummy variable for disaster periods. Inflation, industrial production index and unemployment data of Canada, Chile, Greece and Turkey have been worked on as macroeconomic indicators. The reason that these four countries have been chosen are their being members of the OECD. Dummy variable has been added to the expected model of each macroeconomic variable which has been obtained with autoregressive integrated movingaverages (ARIMA) method, time series analysis of each indicator.

Post-disaster period has been defined as "1" while pre-disaster period as "0". Series should be stationary in order to use autoregressive models. Augmented Dickey Fulley (ADF) and Phillips Perron (PP) tests have been employed for testing of stationarity.

3.1.ADF Test

It is important that series must be stationary in the studies where time series data are used. In time series analysis, the result of the constituted regression is not realistic when working with non-stationary series and the use of non-stationary series lead to spurious relationship between the variables subjected to regression. In this case, calculated standard t statistics and R2 values come out higher than they are. Even if there is no

meaningful relationship between the variables, it seems that there are. Therefore, stationarity of the series should be tested first, when working with the series. Furthermore, a temporary shock occurred in non-stationary series cause permanent memory. Hence, this inhibits series to approach a certain value i.e. its stationarity. That is why; stationarity analysis of the series should be conducted at the first step when working with time series (Dickey and Fuller, 1979).

If the mean, variance and co-variance of a time series remain stable during the time, it can be said that the series is stationary. The terms of being stationary of any Y_t series can be summarized as follows:

$$\text{Constant arithmetic mean} \quad : E(Y_t) = \mu \quad (1)$$

$$\text{Constant Variance} \quad : \text{Var}(Y_t) = E(Y_t - \mu)^2 = \sigma^2 \quad (2)$$

$$\text{Co-variance related to delay distance} \quad : \gamma_k = E[(Y_t - \mu)(Y_{t-k} - \mu)] \quad (3)$$

The difference between two consecutive values in a time series does not originate from the time itself, but originated from the time interval only. Because of this, the average of the series does not change by the time. However, most of the time series in real world are not stationary, so the average of series changes by time. In order to put time series in an appropriate model, these series should be made stationary.

It is said that the series is not stationary when one of these conditions are not provided. Non-stationary series include unit root. The number of unit root in a series is equal to the difference needed to be taken until the series becomes stationary. If Y_t series becomes stationary when first difference is taken, the series is called as first order stationary and shown by $I(1)$. Generally, if the series becomes stationary when the difference is taken d times, it is called order- d stationary and shown by $I(d)$ (Madloola, 2002).

There are two ways to understand whether a series is stationary or not (Gujarati, 1995)

- 1- Examination of correlogram of series,
- 2- Application of unit root tests.

Unit root test is the most valid method to determine whether a variable is stationary or the stationarity order of a variable. While doing unit root testing by using ADF (Augmented Dickey Fuller) statistics, the main idea is making error term successive independent. By this method, unit root testing is researched with these operations.

$$Y_t = \rho Y_{t-1} + \sum b_i \Delta Y_{t-i} + \varepsilon_t \quad (4)$$

without constant and trend,

$$Y_t = \alpha + \rho Y_{t-1} + \sum b_i \Delta Y_{t-i} + \varepsilon_t \quad (5)$$

with constant and without trend,

$$Y_t = \alpha + \rho Y_{t-1} + \delta t + \sum b_i \Delta Y_{t-i} + \varepsilon_t \quad i = 1, 2, \dots, k \quad (6)$$

By finding regressions with constant and trend, ADF (Augmented Dickey Fuller) statistics are obtained together with them (Tari, 2011). Calculated ADF statistics are compared with

critical values developed by MacKinnon (1991). If the absolute value of ADF statistics is less than the absolute value of MacKinnon critical values according to various significance levels, it is inferred that the series is not stationary, but if it is greater, then it means that the series is stationary.

Dickey-Fuller Test assumes that error terms are statistically independent and they have constant variance. While using this methodology, it is needed to be sure that there is no correlation between error terms and they have constant variance.

3.2.PP Test

Phillips and Perron (1988) enlarged the Dickey-Fuller's assumption related with error term. In order to understand it better, this regression is taken into consideration.

$$Y_t = a_0 + a_1 Y_{t-1} + \mu_t \quad (7)$$

$$Y_t = a_0 + a_1 Y_{t-1} + a_2 (t-T/2) + \mu_t \quad (8)$$

Here, T stands for number of observation and μ_t stands for distribution of error terms. Expected mean of this error term is equal to zero. However, serial correlation between error terms or assumption of homogeneity is not needed here. In this respect, independence and homogeneity assumptions of Dickey-Fuller test is accepted as weak dependence and heterogeneous distribution of abandoned error terms in Phillips-Perron (PP) test. Thus, Phillip-Perron did not consider the limitations about assumptions of error terms while developing Dickey-Fuller t statistics (Enders, 2004). In this study, both ADF and PP unit root tests which support each other in terms of assumptions were used together.

3.3.ARIMA Model

The most important aim of the econometric analysis is to predict the future values of variables, in another word forecasting. One of the common ways of stationary time series modeling is "auto regressive integrated moving average" or simply ARIMA method. This approach which was developed by George Box and Gwilym Jenkins is also called Box – Jenkins (BJ) method. The main point of Box-Jenkins method is to explain time series with only their own past values and stochastic error term. In the method generally denoted as ARIMA (p,d,q) , parameters p, d, and q refer to the auto regression process, order of stationarity and moving average parts of the model respectively. If autocorrelation function of the examined series decreases exponentially and partial autocorrelation function shows significant bulges belongs to p lags, then the model be AR(p), otherwise MA(q). Both autocorrelation and partial autocorrelation function decrease exponentially, the model will be determined as ARIMA (p,q) (Bilgili, 2002). When the correlogram of the series is studied, it has been seen that the values on third lags in autocorrelation and partial autocorrelation functions stayed out of band. In this case, it has been decided that the model is ARIMA (3,1,3) and AR and MA coefficients in constructed model were found significant within 1% error margin and it has been seen that no value was found out of the band in the residuals of the model. The general demonstration of the model is as below:

$$Y_t = a_0 + a_1 Y_{t-1} + a_2 Y_{t-2} + \dots + a_n Y_{t-n} + u_t + b_1 u_{t-1} + \dots + b_p u_{t-p}$$

4.RESULTS

Whether they were stationary series were tested by Augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests and analysis results were summarized in Appendix 1. Whether they were stationary series in terms of level was examined by three different regression models of ADF and PP tests including "constant term", "constant term and trend" and "without constant term and trend (none)". When examining the results in the table, it is seen that all series are not stationary in terms of level. Looking at the series of graphs, since series might include the impact of trends, trend models were estimated for each series. Except for the unemployment series for Greece and Turkey, trend effect was seen in all other series. It was seen that the series irrespective of trend effect are stationary from the point of level. Variables with no trend effect have been made stationary by taking the difference of the first order. The most proper ARIMA model for series whose stability conditions was identified, was determined according to Information Criteria. Dummy variable related to disasters added to determined model for each macro-economic indicators and probability values of the coefficients and coefficients of the models were summarized in Table 2, 3 and 4.

Table 2: ARIMA Model Analysis Results of the Inflation Data

Coefficients	Canada	Chile	Greece	Turkey
b0	0,028 (0,87)	0,02114 (0,97)	-0.837864 (0,54)	0.174270 (0,54)
AR(1)	0.485980 (0,00)*	1.440530 (0,00)*	1.926784 (0,00)*	-0.132794 (0,00)*
AR(2)	-	-0.501319 (0,00)*	-1.818221 (0,00)*	-0.267161 (0,00)*
AR(3)	0.802578 (0,00)*	-	0.840010 (0,00)*	0,428526 (0,00)*
AR(4)	-0.629067 (0,00)*	-	-	-
MA(1)	0.586006 (0,00)*	-	-1.352323 (0,00)*	1.196333 (0,00)*
MA(2)	0.450299 (0,03)**	-	0.953888 (0,00)*	1.314127 (0,00)*
MA(3)	-0.462772 (0,01)*	-	-	0.598465 (0,00)*
DUMMY	-0.079497 (0,58)	0.162752 (0,21)	-0.094894 (0,62)	0.543005 (0,03)**

Note: Values in parentheses are the probability values of coefficients. "*" 1%, "***" expresses significant coefficients according to 5% level of significance.

Looking at the results in table 2, it is seen that the coefficient of dummy variable is statistically significant for only Turkey. Being positive coefficient and statistically significant of dummy variable identified as "0" for the 1-year period before the natural disaster which have occurred in Turkey between the years 2005-2014 and has caused great damage and identified as "1" for after the 1-year period implies that a significant increase of inflation occurred in post-disaster period compared to the previous period. Coefficient of the

dummy variable is quite small, negative and statistically insignificant for Canada and Greece. Coefficient realized larger and positive for Chile. Although the coefficient was not found statistically meaningful, positive sign of coefficient for Chile indicates an upward trend in inflation for the period after the disaster. Equations in table 3 shows the relationship between the industrial production index of Canada, Chile, Greece and Turkey and dummy variable related to disasters. When we look at the results of the analysis, dummy variable is considered to be statistically significant for Canada, Chile and Greece. While coefficients for Canada and Greece have been positive, they have been negative signed for Chile. According to these results we can say that industrial production in Chile in the period after disaster decreased compared to the period before disaster. However, the positive coefficient value of Canada and Greece implies that these countries have provided production increase by increasing their public expenditure. These results match up with the literature about economic effects of natural disasters. In fact, in the literature, it is stated that when they occur disasters cause adverse effects in production in the short term, but in the long run they have positive impacts on production due to post-disaster public spending. In this case, it can be said that such an impact was observed in Canada and Chile, within one year from the disaster.

Table 3: ARIMA Model Analysis Results of the Industrial Production Index Data

Coefficients	Canada	Chile	Greece	Turkey
b0	0.059698 (0,96)	0.862725 (0,3558)	-0,209821 (0,17)	0.136657 (0,63)
AR(1)	0.941357 (0,01)*	0,511924 (0,00)*	1,062053 (0,00)*	0.348808 (0,00)*
AR(2)	-0.794950 (0,00)*	0,200428 (0,00)*	0,209309 (0,04)**	1.294611 (0,00)*
AR(3)	1.138684 (0,00)*	-	-0,343134 (0,00)*	-
AR(4)	-0.229277 (0,00)*	-	-	-0.740960 (0,00)*
AR(6)	-0.211131 (0,00)*	-	-	-
MA(1)	-	-	-0,984043 (0,00)*	0.443512 (0,00)
MA(2)	0.994990 (0,00)*	-	-	-0.790826 (0,00)*
MA(3)	-	-	-	-

MA(4)	-	-	-	0.264176 (0,00)*
DUMMY	+0.664207 (0,01)*	-6,16253 (0,00)*	1,917065 (0,02)**	0.254878 (0,89)

Note: Values in parentheses are the probability values of coefficients. "*" 1%,"**" expresses significant coefficients according to 5% level of significance

Table 4: Analysis of Unemployment Data with the ARIMA Model

Coefficients	Canada	Chile	Greece	Turkey
b0	-0.015438 (0,55)	0.070760 (0,82)	0.272975 (0,11)	0.219555 (0,18)
AR(1)	1.915892 (0,00)*	0.486688 (0,00)*	1.226141 (0,00)*	-0.155573 (0,00)*
AR(2)	-0.940720 (0,00)*	0.555509 (0,00)*	0.250082 (0,00)*	-0.558564 (0,00)*
AR(3)	-0.984750 (0,00)*	-	-	0.710840 (0,00)*
AR(4)	-	0.210669 (0,03)**	-	0.156169 (0,08)***
AR(5)	-	-	-	0.615506 (0,00)*
MA(1)	-0.984750 (0,00)*	1.12245 (0,00)*	-0.832441 (0,00)*	0.601908 (0,00)*
MA(2)	-	0.954933 (0,00)*	-	1.124684 (0,00)*
MA(3)	-	-	-	-0.227805 (0,00)*
MA(4)	-	-	-	-0.682558 (0,00)*
DUMMY	0.012964 (0,86)	-0.20362 (0,00)*	-0.090551 (0,40)	-0,021117 (0,84)

Note: Values in parentheses are the probability values of coefficients. "*" 1%,"**" expresses significant coefficients according to 5% level of significance.

Equations in table 4 shows the relationship between unemployment and dummy variable related to disasters for Canada, Chile, Greece and Turkey. According to the analysis results dummy variables were significant for only Chile. The negative coefficient, namely the decrease in unemployment in the post-disaster period, is a remarkable situation. This is a result of the loss of lives occurred in the aftermath of a disaster. In fact, based on the results although it is not statistically significant, coefficient for Greece and Turkey is seen to be negative.

5.CONCLUSION

Natural disasters are the events that cannot be prevented to occur. The occurrence of natural disasters cannot be prevented but minimizing the impacts is of course possible. Besides the physical and social effects, one of the biggest impacts of natural disasters is macroeconomic effect. In this study, the econometric evidence is presented on that disasters have effects on economic indicators. By summarizing analysis results of the generated models in the study, those are as follow seen that: increase in inflation after the disaster, economic growth resulting from the increase in public spending or decrease in production took place and disasters caused loss of labor force arising from deaths.

Macroeconomic impacts of disasters vary depending on countries. One of the most important reasons of these differences is about disaster readiness. If every country takes precautions according to the types of expected natural disasters, negative impacts can be decreased. This is a well-known but neglected fact. Measures that should not be neglected to prevent bottlenecks experienced in the aftermath of disasters are that priority should be given to measures that could prevent life losses; fund resources required for post-disaster period should be madeready in the pre-disaster period.

REFERENCES

- Akar, S., 2013, "The Impact of Natural Disasters on Public Finance and Macroeconomy: Turkey Case", *Journal of Management and Economic Research*, 21, 185-206.
- Aktürk İ. and M. Albeni, 2002, "Doğal Afetlerin Ekonomik Performans Üzerine Etkisi: 1999 Yılında Türkiye'de Meydana Gelen Depremler ve Etkileri", *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Dergisi*, 7(1), 11-18.
- Atlı, A., 2006, *Afet Yönetimi Kapsamında Deprem Açısından Japonya Ve Türkiye Örneklerinde Kurumsal Yapılanma*, Ankara: Asil Yayın.
- Bilgili, F., 2002, "Var, Arıma, Üstsel Düzleme, Karma ve İlave-Faktör Yöntemlerinin Özel Tüketim Harcamalarına Ait Ex Post Öngörü Başarılarının Karşılaştırılması", *Dokuz Eylül University Faculty of Economics and Administrative Journal*, 17(1), 185-211.
- Coppola, D. P., 2011, *Introduction to International Disaster Management*, (2nd ed.), Burlington: Butterworth – Heinemann.
- Cunado, J. and S. Ferreira, 2014, "The Macroeconomic Impacts of Natural Disasters: The Case of Floods", *Land Economics*, 90(1), 149-168.
- Dickey, D. A. and W. A. Fuller, 1979, "Distribution of the Estimators for Autoregressive Time Series with a Unit Root", *Journal of the American Statistical Association*, 74, 427-431.
- Enders, W., 2004, *Applied Econometric Time Series*, New York: John Wiley & Sons.
- Ergünay, O., 2002, *Afete Hazırlık Ve Afet Yönetimi*, Ankara: Türkiye Kızılay Derneği Genel Müdürlüğü Afet Operasyon Merkezi.
- Erkan, E. A., 2010, *Afet Yönetiminde Risk Azaltma Ve Türkiye'de Yaşanan Sorunlar*, Ankara: DPT.
- Gujarati, N., 1995, *Basic Econometrics*, New York: McGraw-Hill.
- Gündüz, İ., 2009, *Dünyada ve Türkiye'de Afet Yönetimi*, İstanbul: ErdemYayınları.
- Karagöz, K., 2007, "1999 Marmara Depremlerinin Ekonomik Etkileri: Ekonometrik Bir Yaklaşım", *TMMOB Afet Sempozyumu*, 5-7 Aralık, Ankara, 423-432.
- Kim, C. K., 2010, "The Effects of Natural Disasters on Long-Run Economic Growth", *The Michigan Journal of Business*, 41, 15-49.
- Laçiner, V. and Ö. Yavuz, 2013, "Van Earthquake in Case, Post Disaster Reliefs And Their Legal Framework", *Dicle University Social Science Journal*, 5, 114-135.
- Lazzaroni, S. and P. Bergeijk, 2013, Nature Disasters Impact, Factors of Resilience and Development: A Meta-Analysis of the Macroeconomic Literature, *ISS Working Paper- General Series 554*, The Hague: International Institute of Social Studies of the Erasmus University Rotterdam (ISS).
- Mackinnon, J. G., 1991, "Critical Values for Cointegrationtests" In Engle R.F. and Granger, C.W.J (Eds.), *Long-Run Economic Relationships: Readings in Cointegration*, Oxford University Press, 267-276.
- Madloola, N. A., R. Saidura, M. S. Hossaina and N. A. Rahim, 2011, "A Critical Review on Energy Use And Savings in the Cement Industries", *Renewable and Sustainable Energy Reviews*, 15, 2042-2060.

- Mechler, R., 2007, “Doğal Afetlerin Makroekonomik Etkileri”, In Erkan N. et al. (Eds.), *Afet Risk Yönetimi Risk Azaltma ve Yerel Yönetimler*, İstanbul: Beta Basım.
- Murat, S., S. Şener and V. Yılcı, 2013, “İktisadi Krizler, Doğal Afetler, Terör Faaliyetleri Türkiye’ye Gelen Turistler Üzerinde Etkili Mi?”, *İktisat Fakültesi Mecmuası*, 63, 1-15.
- Noy, I., 2009, “The Macroeconomic Consequences of Disasters”, *Journal of Development Economics*, 88, 221-231.
- Padli, J. and M. S. Habibullah, 2009, “Natural Disaster Death and Socio-Economic Factors in Selected Asian Countries: A Panel Analysis”, *Asian Social Science*, 5(4), 65-71.
- Philips, P.C.B. and P. Perron, 1988, “Testing for a Unit Root in Time-Series Regression”, *Biometrika*, 75, 335-346.
- Tarı, R., 2011, *Ekonometri*, Kocaeli: Umuttepe Yayınevi.
- Toya, H. and M. Skidmore, 2007, “Economic Development and the Impacts of Natural Disasters”, *Economics Letters*, 94, 20-25.
- Yılmaz, A., 2003, *Türk Kamu Yönetiminin Sorun Alanlarından Biri Olarak Afet Yönetimi*, Ankara: Pegem A Yayıncılık.
- Yavaş, H., 2005, *Doğal Afetler Yönüyle Türkiye’de Belediyelerde Kriz Yönetimi*, Ankara: Orion Yayınevi.
- Yavuz, Ö., 2014, *Afetler Sonrası Yapılan Yardımlar ve Hizmetler*, İstanbul: İdeal Kültür Yayıncılık.

Appendix 1: Unit Root Test Results

		ADF			PP		
		CONSTANT TERM	CONSTANT TERM AND TREND	NONE	CONSTANT TERM	CONSTANT TERM AND TREND	NONE
Canada (CA)	Inflation	-1,19(-3,60)	-3,58**(-3,58**)	3,78(-3,62*)	-1,19(-3,33**)	-3,3(-3,30**)	3,74(-3,34*)
	Industrial production	-1,86(-2,82**)	-0,75(-2,83)	-0,32(-2,83*)	-1,64(-2,32)	-1,31(-2,29)	-0,38(-2,33**)
	Unemployment	-1,25(-2,23)	-1,41(-2,23)	-0,25(-2,24**)	-1,47(-2,74**)	-1,62(-2,73)	-0,2(-2,75*)
Chile	inflation	-1,25(-2,40)	-2,19(-2,38)	2,96(-2,41**)	-1,11(-2,59**)	-1,89(-2,21)	3,59(-2,26**)
	Industrial production	-2,14(-6,61*)	-2,7(-6,57*)	0,6(-6,64*)	-2,62(-6,62*)	-3,64(-6,58*)	0,89(-6,65*)
	Unemployment	-1,58(-1,83)	-1,83(-1,79)	-1,13(-1,85**)	-1,49(-1,79)	-1,77(-1,74)	-1,21(-1,81**)
Greece	inflation	-1,58(-2,45)	-0,69(-2,01)	-1,04(-2,54**)	-1,54(-4,66*)	-3,9(-4,67*)	2,64(-4,69*)
	Industrial production	-0,02(-4,29*)	-2,39(-4,28*)	-2,02(-4,31*)	-0,18(-8,16*)	-3,61**(-8,12*)	-1,94**(-8,19*)
	Unemployment	1,75(-3,16**)	-1,53(-3,17**)	3,01(-3,18*)	2,03(-8,01*)	-1,45(-8,02*)	3,55(-8,03*)
Turkey	inflation	0,95(-4,78*)	-3,48**(-4,76*)	7,92(-4,81*)	3,18(-3,27**)	-2,62(-3,25**)	18,22(-3,29*)
	Industrial production	-0,85(-2,79**)	-2,07(-2,75)	1,41(-2,81*)	-2,87(-8,62*)	-6,71*(-8,59*)	1,33(-8,65*)
	Unemployment	-1,82(-4,56*)	-1,84(-5,81*)	-0,37(-2,66*)	-1,55(-4,37*)	-1,58(-5,79*)	-0,22(-3,38*)
Critical Value	1%	-3,49	-4,05	-2,58	-3,49	-4,05	-2,58
	5%	-2,89	-3,45	-1,94	-2,88	-3,45	-1,94
	10%	-2,58	-3,15	-1,61	-2,58	-3,15	-1,61

Note: Values in parentheses are the values related series irrespective of trend. Because of unemployment series don't include trend effects for Greece and Turkey, the values in parentheses which are related to that series are unit root test results for the first-degree difference. "**", "***" and "****" symbols respectively represent significant coefficients according to significance levels of 1%, 5% and 10%.