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THE IMPACTS OF THE ECONOMIC DEVELOPMENT INDICATORS ON THE GOVERNMENT DEBT: A CASE OF DEVELOPED COUNTRIES

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EKONOMİK GELİŞMİŞLİK GÖSTERGELERİNİN DEVLET BORÇLARI ÜZERİNDEKİ ETKİLERİ: GELİŞMİŞ ÜLKELER ÜZERİNDE BİR UYGULAMA

Öz

2008 Global ekonomik krizinden dolayı, gelişmiş ülkelerin borç seviyeleri son yıllarda artış göstermiştir. Bundan dolayı, ekonomik gelişmişlik göstergelerinin gelişmiş devletlerin borç seviyelerini nasıl etkilediklerinin bilinmesi önem arzetmektedir. Bu çalışmanın amacı, bu etkileri incelemektir. İlgili analizi gerçekleştirmek için, Belçika, Kanada, Finlandiya, Fransa, Yunanistan, İzlanda, İrlanda, Japonya, Norveç, İspanya ve İngiltere'den oluşan 11 gelişmiş ülkenin 1980-2011 dönemindeki verileri kullanılmıştır. Kişi başına gayri safi yurt içi hasıla, brüt ulusal tasarruflar, toplam brüt devlet harcamaları, brüt devlet gelirleri ve işsizlik değişkenlerinin toplam devlet brüt borcu üzerindeki etkilerinin belirlenmesi için Panel veri analiz yönteminden yararlanılmıştır. Analiz sonuçları, çalışmada kullanılan bütün değişkenlerin toplam devlet brüt borcu üzerinde etkiye sahip olduğunu ve bu değişkenlerden toplam brüt devlet harcamalarının en yüksek etkiye sahip olduğunu göstermektedir.

Anahtar Kelimeler: Ülke borcu, Ekonomik Göstergeler, Panel Veri Analizi

Abstract

Because of the 2008 global economic crisis, debt levels of the developed countries have increased in the recent years. So, it is very crucial to be understood how economic development indicators affect the government debt levels. The purpose of this article is to examine these effects. In order to accomplish this analysis, data of 11 developed countries (Belgium, Canada, Finland, France, Greece, Iceland, Ireland, Japan, Norway, Spain and United Kingdom) over the period 1980-2011 are used. Panel Cointegration method is employed to determine the impacts of GDP per capita, gross national savings, gross government total expenditure, gross government revenue and

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unemployment variables on the general government gross debt. The results of the panel cointegration analysis show that all of the variables analyzed have impacts on the gross government debt and the gross government total expenditure has the largest impact.

Key Words*:* Government Debt, Economic Indicators, Panel Cointegration

1. Introduction

The global financial crisis which was emerged in the US has caused developed countries to have more debts. Government debt levels of these developed countries especially, Italy, Greece and Spain has increased tremendously. So, this situation has attracted attention of the policy makers and researchers to search about whether there are impacts of economic development indicators such as GDP per capita, government savings, government revenues, government expenditures and unemployment on the government debt.

Although there are not enough studies about the impacts of economic development indicators on the government debt, most of these studies have been made about the impcats of GDP per capita on the government debt. As Peniwati and Hsiao (1987) stated, GDP per capita is the best known and most widely used economic indicator to measure economic development. There are a few studies about the impacts of the other economic development indicators such as government expenditure, government revenue, government savings and unemployment on the government debt. Furthermore, most of these studies also have been done in the developing countries not in the developed countries. Therefore, it is thought that this study can add important value to the literature about this area.

In terms of economic theory, at moderate levels of government debt, fiscal policy may cause growth, with a typical Keynesian behaviour. However, at high debt levels, the expected future tax increases will reduce the possible positive effects of government debt, decreasing investment and consumption resulting in less employment and lower output growth (Afonso and Jalles, 2013:384).

As Garcia Jimenez (2011) stated, the role and effects of government debt in the economy are still not clear. While, Balassone, Francese and Pace (2011) and Ferreira (2009) indicate that there are relations between economic growth (increase of GDP) and government debt levels, Shabbir (n.d.) presents opposite results.

The other studies such as Aliyu and Usman (2013), Kliesen and Thornton (2011) and Öztürk, Aras and Kadı (2012) about the impacts of government expenditure, government revenue, national savings and unemployment rate on the government debt level also indicate that the existence and direction of these impacts on the government debt is not clear. Although, the studies made in the developed countries are few, they indicate different results.

In this study, in order to investigate the impacts of economic development indicators on the government debt levels, GDP per capita, gross national savings, gross government total expenditure, gross government revenue and unemployment variables are used as economic development indicators. All of these variables are also used as percentage of GDP, except unemployment rate. As a statistical technique, panel cointegration model has been applied for the data of 11 developed countries (Belgium, Canada, Finland, France, Greece, Iceland, Ireland, Japan, Norway, Spain and United Kingdom) over the period of 1980 - 2011.

The design of the article is structured as follws; First, a literature review about the impact of economic development indicators on the government debt levels is provided. Then, statistical method and data used in the analysis are presented. After that, the empirical analysis relating to the panel data techniques and finally conclusion part take place.

2. Literature Review

Some studies that focus on the developed and developing countries analyse the relation of economic development indicators, including GDP per capita, unemployment, national savings, government revenue and government expenditure with the government debt. The results of them are as follow;

Checherita and Rother (2010) investigated the average impact of government debt on per-capita GDP growth in twelve euro area countries over a period of about 40 years starting in 1970. They found that there is a non-linear relation between government debt (level or change) and private saving. Besides, according to the results of the analysis, after %82-92 percent of government debt/GDP ratio, the relation between government debt and private saving turns to the negative.

Aliyu and Usman (2013) investigated the impact of external debt, public debt and debt service on the gross national savings in Nigeria spanning

the period 1970 to 2010. This study applied the ADFGLS test for stationarity and the result indicates that series are stationary at first difference and integrated of order one. The Johansen Cointegration test also depicts a long run relationship between series. Vector Error Correction Model shows that Public debt and debt service have a positive and statistical significant effect on National Savings.

Kliesen and Thornton (2011) made an analysis about federal government revenues and expenditures over the past 60 years to determine whether the increase in the debt is the result of declining revenues, increased expenditures, or a combination of both. They have concluded that A large debt-to-GDP ratio is cause for concern: Countries with the lowest debt-to-GDP ratios tend to have the highest government revenue.

Öztürk, Aras and Kadı (2012) made an analysis to determine the proper economic measures to reduce the debt stock. With this aim, the years between 2000 and 2012 have been analysed in three-month segments and government debt stock has been analysed with macro economic indicators of Euro zone. VAR (Vector Auto Regressive) model is used for that. The series in the model were selected as quarter periods from European Central Bank data warehouse and they include the periods between the first quarter of 2000 and the second quarter of 2012. In the analysis, negative relationship between government debt stock and GDP and industrial production index has been determined. Besides, no significant connection between unemployment rate and debt stock has been identified.

Garcia Jimenez (2011) empirically assessed the effects of government debt on the labor demand in the United States for the period 1973-2010 by using quarterly data and a dynamic specification of an economic model. The results indicate that debt has positive effects on employed labor in the economy in the long run, and it has been found effective at retaining and decreasing the unemployment rate.

Afonso and Jalles (2013) applied a panel of 155 countries to assess the links between growth, productivity and government debt. Via growth equations they assess simultaneity, internality, cross-section dependence, nonlinearities, and threshold effects. They found a negative effect of the debt ratio on the growth and productivity for the OECD countries.

Balassone, Francese and Pace (2011) investigated the link between the government debt-to-GDP ratio and real per capita income growth in Italy over 1861-2009. They model their regression analysis on a standard

production function. The results show that there is a negative relation between public debt and economic growth.

Schclarek (2004) tried to explore the relationship between debt and growth for 24 industrial countries with data averaged over each of the seven 5-year periods between 1970 and 2002. All the variables used are averaged data over non-overlapping 5-year periods, as they wanted to capture the long run relationship between growth and debt. At the end of the study, they didn't find any significant relationship between gross government debt and economic growth.

The relationship between public sector foreign borrowing and economic growth is examined by the study of Wang (2009). Results indicate that only under circumstances of (1) moderate income tax rates to guarantee the solvency of external loans and (2) households having the patience to substitute consumption between different periods can domestic government finance fiscal deficits by borrowing abroad, and thereby enhance investment and economic growth. Otherwise, additional foreign borrowing is associated with higher indebtedness and slower economic growth.

Ferreira (2009) analyzed the Granger-causality relationship between the growth of the real GDP per capita and the public debt. Ratio of the current primary surplus/GDP and the ratio of the gross Government debt/GDP were used in the analysis. Using annual data for 20 OECD countries between 1988 and 2001 the author concluded that there is always bi-directional relation between GDP per capita and Government debt.

Empirical studies investigating the effect of external debt on economic growth, some end up finding a negative impact on economic growth while others do not find any significant relationship between economic growth and external debt. Most of these studies used real GDP and GDP growth rate as dependent variables and tried to explore the direct impact of external debt servicing on GDP growth rate. However, a few studies focused on assessing the impact of external debt on per capita GDP. Nevertheless, the findings of these studies are mixed; therefore, in this scenario it is hard to say whether external debt has positive, negative or any significant impact on economic growth (Shabbir, n.d.)

As it is seen from the literature, the relation between economic development indicators and government debt is not conclusive. These results are harmonious with the statement of Kumar and Woo (2010) saying that despite the importance of the issue, there is little systematic

evidence on the extent to which large debts are likely to reduce economic growth.

3. Method and Data

In this study, Johansen Fisher panel cointegration technique (Fisher Combined Johansen) is applied. For this kind of analysis, Pedroni (1999), Kao (1999) which is Engle-Granger (1987) two step residual based test, and a Fisher which is a combined Johansen test are used.

Johansen (1988) proposes two different approaches, one of them is the likelihood ratio trace statistics and the other one is maximum eigenvalue statistics, to determine the presence of cointegration vectors in non stationary time series. Using Johansens (1988) test for cointegration, Maddala and Wu (1999) consider Fisher's suggestion to combine individuals tests, to propose an alternative to the two previous tests, for testing for cointegration in the full panel by combining individual cross-sections tests for cointegration (Morshed, 2010:17-18).

The econometric procedure in this study consists of Levin, Lin & Chu panel unit root test, Johansen Fisher panel cointegration test, correlated random effects - hausman test, redundant fixed effects tests and panel least squares model.

Empirical researches in economics are based on time series. So, it is standard to view time series as the realisation of a stochastic process. Model builders can use statistical inference in constructing and testing the equations that characterise relationships between economic variables. The two central properties of many economic time series are nonstationarity and time-volatility. These two properties have led to many applications in both economics and statistics (Ssekuma, 2011:2).

For the time series, the first step is to see whether the series is stationary or non-stationary. Stationarity is a variable's average, variance and otocovariance's being stationary in time. Serie's stationarity is important in time series which follows a stochastic period. In stationary series, possible fluctuations will be temporary. The impact of fluctuations will decrease gradually and series will be back to long term average level. In nonstationary series, there will be no long term avarage that the series can go back after the fluctuations. Series' stationarity is determined by unit root test (Öztürk, Aras and Kadı, 2012:346). Once the stationarity properties of the individual series are established, linear combinations of

the integrated series are tested for co-integration (Ngbede and Akintola, 2009:28)

In this study, first the Levin, Lin & Chu panel unit root test is used to search whether the series are stationary or not. After that, the Redudant Fixed Effects test is used to test unobserved heterogeneity. After this, the Johansen Fisher panel cointegration test is applied to determine the short-run and long-run relationships between variables. And then, Correlated Random Effects - Hausman test is applied to determine which model (fixed-effects or random-effects) will be used. Finally, the Panel Least Squares model is applied to estimate the coeficients of the variables.

The random effects model assumes that the random effects are uncorrelated with the explanatory variables – otherwise there would be an endogeneity problem, which in turn would make the estimators inconsistent. The Hausman Test for Correlated Random Effects tests this hypothesis (Bouwel, 2013:12). Another word, the Hausman test is based on the vector of differences of two estimators. It is usually assumed that one of the estimators is fully efficient, since this simplifies calculation of the test statistics (Creel, 2003:1).

The econometric software program used for this research is Econometric Views 7.0. In measuring the impact of economic development indicators on government's gross debt, six variables of the 11 developed countries (Belgium, Canada, Finland, France, Greece, Iceland, Ireland, Japan, Norway, Spain and United Kingdom) are used. The countries are selected from the IMF advanced countries list. Although this list is composed of 35 advanced countries, just 11 countries' data are avaliable for the 1980-2011 period. The source of the data is from the Data and Statistics database of the IMF. All of the variables are used as percent of Gross Domestic Products (GDP), except unemployment rate. The explanation of these variables are as follow (IMF, 2013):

General government gross debt (GGD); Gross debt consists of all liabilities that require payment or payments of interest and/or principal by the debtor to the creditor at a date or dates in the future. This includes debt liabilities in the form of SDRs, currency and deposits, debt securities, loans, insurance, pensions and standardized guarantee schemes, and other accounts payable.

Gross government revenue (GGREV); Revenue consists of taxes, social contributions, grants receivable, and other revenue.

Gross government total expenditure (GGTEX); Total expenditure consists of total expense and the net acquisition of nonfinancial assets.

Gross national savings (GNS); Gross national saving is gross disposable income less final consumption expenditure after taking account of an adjustment for pension funds

GDP per capita (PC); GDP per capita is expressed in current U.S. dollars per person. Data are derived by first converting GDP in national currency to U.S. dollars and then dividing it by total population.

Unemployment rate (UNEMP); Unemployment rate gives the number of unemployed persons as a percentage of the labor force (the total number of people employed plus unemployed)

All of these variables were transformed into natural logarithm form. Apart from that, the data of these variables consists of yearly data from 1980 until 2011.

The "General government gross debt" is used as a dependent variable and the other variables are used as independent variables in the model. Descriptive statistics of the variables are presented in the Table 1.

Table 1: Descriptive Statistics of the Variables Used in The Analysis

	GNS	UNEMP	PC	GGTEX	GGREV	GGD
Mean	9.919	8.810	16.859	10.692	10.626	10.944
Median	9.941	8.961	16.971	10.705	10.618	10.926
Maximum	10.607	10.090	18.396	11.085	10.975	12.344
Minimum	7.646	6.921	15.292	10.227	10.089	9.289
Std. Dev.	0.317	0.664	0.626	0.165	0.196	0.551
Skewness	-1.898	-0.752	-0.359	-0.304	-0.342	-0.149
Kurtosis	12.934	3.287	2.755	2.680	2.356	3.005
Jarque-Bera	1654.213	34.394	8.455	6.924	12.954	1.308
Probability	0.000	0.000	0.014	0.031	0.001	0.519
Sum	3481.710	3101.245	5934.528	3763.717	3740.605	3852.579
Sum Sq. Dev.	35.3669	155.165	137.722	9.624	13.578	106.728
Observations	352	352	352	352	352	352

4. Results of the Analysis

In order to search the impacts of independent variables on the dependent variable, the analysis process consists of five steps. These are; Levin, Lin & Chu (LLC) panel unit root test, redundant fixed effects test, Johansen Fisher panel cointegration test, correlated random effects - hausman test and panel least squares model. The first test is the LLC unit root test.

Table 2: The LLC Unit Root Test

Variables		**Level**	**First Difference**
GGD	Statistics	1.169	-3.627
	Probability	0.121	0.001*****
GGREV	Statistics	0.830	6.287
	Probability	0.203	0.000*****
GGTEX	Statistics	0.133	3.642
	Probability	0.446	0.001*****
GNS	Statistics	0.830	8.496
	Probability	0.796	0.000*****
PC	Statistics	0.313	7.982
	Probability	0.376	0.000*****
UNEMP	Statistics	0.644	7.261
	Probability	0.259	0.000*****

* Shows that the variables are significant or stationary at %1 confidence level.

The results of the LLC unit root test in the Table 2 show that all of the variables are non-stationary at level. The means and variances of the all variables were constant once they were transformed into first difference. In other words, all of the variables are integrated at the first order. The next test is the Redundant Fixed Effects tests.

Table 3: Redundant Fixed Effects Tests

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistics	d.f.	Prob.
Cross-section F	89.833	(10,335)	0.000*
Cross-section Chi-square	457.473	10	0.000*

* Shows that the variables are significant at %1 confidence level.

After the unit root test, Redudant Fixed Effects test is used to test unobserved heterogeneity. In the Table 3, The p-values associated to the F-statistic and the Chi-square statistics are both 0.000, which provides strong evidence against the null hypothesis that the fixed effects are all equal to each other. This suggests that there is unobserved heterogeneity. Therefore, it is accepted that there is country effect. The next test is the Johansen Fisher Panel Cointegration test.

Table 4: Johansen Fisher Panel Cointegration Test

Series: GGD GGREV GGTEX GNS PC UNEMP
Trend assumption: Linear deterministic trend (restricted)
Lags interval (in first differences): 1 2

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat. (from trace test)	Prob.	Fisher Stat. (from max-eigen test)	Prob.
None	834.4	0.000*	735.8	0.000*
At most 1	501.9	0.000*	240.7	0.000*
At most 2	321.2	0.000*	204.8	0.000*
At most 3	202.2	0.000*	108.2	0.000*
At most 4	114.6	0.000*	71.50	0.000*
At most 5	69.37	0.000*	69.37	0.000*

* Shows that the variables are significant at %1 confidence level.

In order to investigate if the variables have long run relationship, it is pursuaded to make Johansen Fisher panel cointegration test. It is seen from the Table 4 that both Fisher trace test and Fisher max-eigen test are significant at %1 confidence level. Since there won't be dummy regression relation after the cointegration relations among the variables are determined, model is estimated. The next tes is the Correlated Random Effects - Hausman test.

After the Johansen Fisher panel cointegration test, Correlated Random Effects - Hausman test is applied to determine which model (fixed-effects or random-effects) will be used. As it is shown in the Table 5, the Hausman test rejects the null hypothesis at %1 confidence level. This provides evidence that the assumption that the random effects should be uncorrelated to the explanatory variables is not true for this dataset.

Therefore, fixed effects model is accepted. The final analysis is the Panel Least Squares Method.

Table 5: Correlated Random Effects - Hausman Test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	39.304	5	0.000*

* Shows that the variables are significant at %1 confidence level.

Table 6: Panel Least Squares

Dependent Variable: GGD
Method: Panel Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GGREV	0.514	0.195	2.627	0.009*
GGTEX	1.140	0.199	5.725	0.000*
GNS	0.150	0.070	2.143	0.032**
PC	0.221	0.024	9.018	0.000*
UNEMP	0.493	0.047	10.468	0.000*
C	-16.305	2.458	-6.632	0.000*

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.832	Mean dependent var	10.944
Adjusted R-squared	0.824	S.D. dependent var	0.552
S.E. of regression	0.231	Akaike info criterion	-0.047
Sum squared resid	17.888	Schwarz criterion	0.128
Log likelihood	24.354	Hannan-Quinn criter.	0.022
F-statistic	110.859	Durbin-Watson stat	0.217
Prob(F-statistic)	0.000		

* Shows that the variables are significant at %1 confidence level.
** Shows that the variables are significant at %5 confidence level.

According to the Panel Least Squares method, in Table 6, while 4 variables are significant at %1 confidence level, one variable is significant at %5 confidence level. Besides, a one-unit increase of the gross government revenue, gross government total expenditure, gross national savings, GDP per capita and unemployment rate increase the gross government debt respectively by 0.51, 1.14, 0.15, 0.22 and 0.49 unit.

5. Conclusion

Since the developed countries started to have more debt after the global economic crisis, it became important to know whether there are impacts of economic development indicators on the government gross debt. Therefore, the aim of this study is to search the impacts of GDP per capita, gross government total expenditure, gross government revenue, gross national savings and unemployment rate on the gross government debt. For this analysis, data of 11 developed countries spanning 1980-2011 period was used.

This study applied the Levin, Lin & Chu test, Johansen Fisher Panel Cointegration test, Correlated Random Effects - Hausman Test, Redundant Fixed Effects Tests and Panel Least Squares Method to investigate the impacts of these variables on the government gross debt. The results of the Levin, Lin & Chu test indicate that series are stationary at first difference, In addition, the Redundant Fixed Effects Tests shows that there is country effect. Morever, the results of the Johansen Fisher Panel Cointegration test depicts a relationship between variables and the Correlated Random Effects - Hausman Test indicates that fixed-effect model is suitable and finally, Panel Least Squares method indicates that all of the variables have impacts on the government gross debt.

The results also show that all of the variables have positive impacts on the gross government debts. If each of the the gross government revenue, gross government total expenditure, gross national savings, GDP per capita and unemployment rate increase a one-unit the government gross debt increases respectively by 0.51, 1.14, 0.15, 0.22 and 0.49 unit. As it is seen, the gross government total expenditure has the largest impact on the gross government debt.

Although there are not enough studies related to the the subject of this study in the literature, the results of them are also not similar. So it is hard to make conclusion with the comparison of the results of this study and

the literature. But, since most of the developed countries have very high debt levels, it seems that the results of this study are logical.

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