EFFECTS OF GLOBAL CRISIS ON ECONOMIC GROWTH AND INVESTMENT RELATIONS IN EUROPEAN COUNTRIES

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Abstract

The global crisis that has started as a credit crisis in USA mortgage markets in mid 2007's and expanded through financial markets in 2008 then spread to whole world and affected the other countries as well. In this study firstly, the effect of crisis on USA and European Countries has been investigated using dummy variable. Nonetheless it is investigated if the economic growth and investment relation of the term before the crisis changed after the crisis. In the study panel OLS, fixed effect and panel causality econometric models have been used. The results displayed that the crisis has a significant effect on growth rate of European Countries. At the same time it has been determined that causality relationship from investments towards economic growth has weakened in the period of crisis.

Keywords: *Economic Growth, Investment, Panel Data, Crisis*

JEL codes: *C33, E22, G01, O40*

1. Introduction

It was when the US housing market indicators signaled 17.5 % annualized fall rate in the last quarter of 2007 that the very first warning received for the economic crisis. Then started the scenarios related to the number of some 2 million people who may loose their houses in 2008 due to their credit debts and how the markets would shrink. It should be noted that housing bubble was not an accident but careless decisions of regulators of the market

since they let corporate structures absorb profits and caused wage gape on the side of workers which also represent consumers. Workers were also encouraged to borrow in an aim to guarantee enough economic growth[1]. Sup-prime mortgage shares caused world-wide losses for the investors.

Europe was also affected by the crisis to a large extent due to exposure to financial markets of the US. European banks had to write off losses from the US sub-prime loans and fear and uncertainty spread. However, European banking system had some other problems as well. For instance, several banks in Europe had trouble in rising capital in the money markets since interbank interest rates increased due to reluctance of banks to lend money to each other. The crisis spread fast. Several banks had problems. For instance, UK mortgage bank Northern Rock took an emergency loan from the Bank of England in September 2007 and this triggered a run on the bank. The bank had liquidity problems and led to the nationalization of the bank in January 2008. HSBC wrote off 51 million US dollars a day and Royal Bank of Scotland wrote off 5,9 billion on investments in the first half of 2008[2]. Financial crisis turned into a global crisis after the collapse of financial markets of industrialized nations.

Economic growth rates of the region fell significantly in the last two years and projections for the years to come are still desperate. Euro area GDP growth rates demonstrate that Euro16 growth rate for 2008 third and fourth quarter were 0,4 and -1,8 respectively. Also, 2009 first and second quarter were -4.9 and -4,8 respectively. These figures represent percentage change compared with the same quarter of the previous year. The results are about the same for Euro 27 area[3]. Moreover, unemployment, another important indicator for the economic status of the region fell since the beginning of crisis. Euro area 16 unemployment rate was 7,2 while it was 6,7 for the Euro area 27 in March 2008. These figures increased to 9,6 for the Euro Area 16 and 9,1 for the Euro area 27 as of the second quarter of 2009[4].

This study aims to examine effects of the crisis on growth and investment relations using econometric models. Panel OLS, fixed effect, panel causality analysis have been used. Comparison of two periods, pre-crisis and the crisis period are evaluated in order to put

[1] Graham Turner, **The Credit Crunch, Housing Bubbles, Globalization and the Worldwide Economic Crisis**, Pluto Press, London, in Association with GFC Economics, 2008, p. 1-3.
[2] Patrick Roy, "The Financial Crisis Intensifies and Spreads", **International Economic Update**, Federal Reserve Bank of Dallas, October 30, 2008 (http://dallas-fed.org/institute/update/2008/int0808.cfm, Access date: October 11th, 2009).
[3] Eurostat, **Eurostat Press Release**, 144/2009.
[4] Eurostat, **Eurostat Press Release**, 139/2009.

forward the difference in the relationship between growth and investment under stable and unstable economic conditions.

2. The Theory of Economic Growth and Investment Relations

The classical economic understanding developed by Adam Smith and his followers assumes that economy is always in equilibrium in employment and inconsistencies of the economy are overcome within the structure of the economy. The classical school refers to the theory of economic growth on the explanation of how countries differ in the process of economic growth. Proponents of this approach points out that private sector investments have a positive effect on the economy compared to government investments. The classic school states two main determinants of economic growth. These are increase in the labor productivity and capital accumulation. A simple production function can be demonstrated as follows;

$$Y= f (K, L) \quad (1)$$

Here K represents capital and L for labor. While labor productivity is provided through labor division, capital accumulation results from increases in investments.

On the other hand, Keynesian economic understanding strongly supports the importance of intervention to the economy to direct total demand in order to achieve economic growth. In his work “The General Theory of Employment, Interest and Money”, Keynes discusses poor levels of investments that cause stagnation should be overcome by public intervention. An increase in the investment will have positive effect on the economy by multiplier effect. Moreover, demand should be expanded in order to overcome recession and this could be achieved through the investments.

Harrod Domar’s model or Harrod-Domar Keynesian growth model examines economy in process and has a more dynamic understanding of the economy compared to Keynes’ economic growth understanding which is more static. The model is based on the idea that increased production capacity of an economy can be turned into production increase by increasing the demand. Demand increase triggers the production increase by investments.

The research on the sources of growth begins with Solow Model• in the 1950s. Solow Model, also known as exogenous growth model (or the Neo-classical approach) was adjusted from Harrod-Domar's model. First form of neo-classical growth model was used extensively in the literature for a long time and two waves of development in the model can be stressed in this manner. First one is the introduction of Solow Model in the 1950s and the second wave is the period after the 1980s[5]. Physical capital accumulation and productivity functions are given place in the model. The more the amount of gross national income per capita increases the more the economy grows. Therefore, investment spendings are encouraged in order to renew capital investments and increase capital accumulation.

In the 1980s the model gained a new dimension by endogenous growth theories which considered investment, human capital, technology, R&D, foreign policy, education, public spending and other various factors also had an effect on the growth of an economy. Romer's study (1986) is shown as the beginning of endogenous growth models in the literature[6]. His aim was to form a model that could process knowledge accumulation. Unlike exogenous models, endogenous models assume that growth is generated within the structure of an economy. Therefore factors such as human capital and technological improvements as well as investment spendings bear importance in the model.

3. Literature Review

There are several studies in the literature that examine the relationship between growth and investment. Khan and Reinhart (1990) examined the period from 1970 to 1999 and tested investment spending and economic growth relationship in 24 developing countries. Their study put forward a positive significant relationship between investment and economic growth[7]. In their study, De Long and Summers (1993) conduct a study of panel regressions of total factor productivity growth consisting of a large sample of developing countries. The findings of their study put forward a significant correlation between the ratio of equipment investment to GDP and total factor productivity growth. Authors also find negative coefficient

• A model in modern economics can be identified as a mathematical demonstration of some aspect of the economy (Charles I Jones, **Introduction to Economic Growth**, Stanford University, W.W. Norton G. Company, New York, London, 1998, p. 19.)

[5] Elhanan Helpman, **The Mistery of Economic Growth**, The Belknap Press of Harvard University Press, Cambridge, Massachusetts, and London, England, 2004, preface.

[6] Daron Acemoğlu, **Introduction to Modern Economic Growth**, Princeton University Press, Princeton and Oxford, 2009, p.398.

[7] Mohsin S. Khan and Carmen Reinhart, "Private Investment and Economic Growth in Developing Countries", **World Development**, Vol. 18, No. 1, January 1990, pp. 19-27.

for structures investment in the regressions[8]. Khan and Kumar (1997) examines the period between 1970-1990 using time series and panel data for 95 developing countries. The study proposes that public investment spending is positively significant in relation to growth as in private investment spending[9]. In his study Zou (2006) uses public and private sector investment spending as variables. The period examined consists of the years between 1957 and 1997. The study was conducted for Japan and the USA using time series model. The econometric models used in the study are granger causality Johansen co-integration and least squares methods[10].

There are also studies on the relationship of foreign direct investment and economic growth in the literature. Borensztein, Gregorio and Lee (1995) use foreign direct investment as their variable to examine the relationship between economic growth and investment. They observe 69 developing countries in panel and cross section data. Seemingly unrelated regression method was used to investigate the relationship. The study puts forward a positive significance between foreign direct investment and economic growth[11]. In his study Khawar (2005) examines the period 1970 to 1992 for developing countries using cross sectional data. Results of the least squares method leads to a positive significant relationship between foreign direct investment and economic growth[12]. Likewise Roy and Berg's study (2006) finds a positive significant relationship between foreign direct investment and economic growth[13]. Schmidt (2008) discusses the effects of foreign direct investment on the economic growth in his study where he uses partially non-linear model. The study supports that foreign direct investment positively affects economic growth. The study consists of 128 countries and three periods 1970-79, 1980-89 and 1990-99 have been discussed by using time series and regression models[14].

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4. Methodology

Methodology includes the data set and the econometric model used in the study. While data set is about the source of the data where and how they are obtained the econometric method discusses how the data is processed and how the results are obtained.

4.1. Data Set

The data of the study; growth rate of real GDP (RGDPGR, %), growth rate of labour productivity per person employed (LPROGR, %), and growth rate of gross fixed capital formation (GFCGR, %), growth rate of long-term interest rates (INTRGR), total gross fixed capital formation (total investment) expressed as a percentage of GDP (IGDP) and growth rate of total investment of GDP (IGDPGR) have been obtained from Eurostat15 database. Also, we used crisis dummy as CRISIS. Panel data consists of 31 countries in total. There is labor productivity data for 26 of 31 countries. There is also long-term interest rate data for 19 of 31 countries and this data encompasses the period between the years of 1999-2007. Therefore, the equations where LPROGR variable are used consists of 26 cross sections. The equations where INTRGR variable are used consists of 19 cross section and encompasses 1999-2008 period.

4.2. Econometric Method

Stationary variables are required for the model both in time series and the panel data. Because in equations which are estimated by unit root variables cause spurious relations to occur. Therefore whether the variables bear stationary characteristics or not have been investigated primarily. Stationary characteristics of variables or whether the variables consist of unit root or not have been investigated by using individual unit root process proposed by Maddala and Wu (1999)[16], Choi (2001)[17]. The process assumes that there is a unit root process. The variables have also been tested by using Fisher-ADF stationary test and the LLC stationary test developed by Levin, Lin and Chu (2002)[18] and that assume that there is a common unit root process. The results have been summarized in Table 1.

[15] http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home.

[16] G.S. Maddala. and S. WU**,** "A Comperative Study of Unit Root Tests With Panel Data and A New Simple Test", **Oxford Bulletin of Economics and Statistics**, Vol. 61, 1999, pp. 631-52**.**

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Table 1: Fisher-ADF and LLC Tests (Individual Intercept)

Variables	Fisher-ADF	LLC
RGDPGR	88.01[b]	-5.10[a]
LPROGR	128.89[a]	-11.34[a]
GFCGR	101.17[a]	-6.55[a]
INTRGR	107.18[a]	-10.20[a]
IGDP	78.73[c]	-3.68[a]
IGDPGR	111.68[a]	-8.21[a]
It is used Akaike information criteria, a, b and c significant in 1%, 5% and 10%.		

Fisher-ADF test results points out 5% significance level for RGDPGR and 1% for all the other variables. LLC test results demonstrate that all variables are significant at the level 1% which means that they are all stationary.

While panel data has some advantages such as availability for more observation on the data compared to time series and taking into consideration both cross section and the period dimensions of the data, it also has some disadvantages such as individual effects caused by cross section and the period. These disadvantages can be overcome by using fixed effect method. The equation which is estimated by using cross section or fixed effect method unitary effects can be eliminated. In order to eliminate specific effects of the countries in the study, estimations have been made by taking into consideration the EGLS cross section fixed effect. Redundant fixed effect test has been conducted in order to test the necessity for a fixed effect model in the equation.

$$RGDPGR_{it} = \beta_0 + \beta_1 LPROGR_{it} + \beta_2 GFCGR_{it} + \beta_3 CRISIS_{it} + \varepsilon_{it} \qquad (2)$$

The relationship between economic growth and investment has been investigated by using simple production function. First of all the period of 1999-2007 has been estimated and then same equation has been used to estimate the period of 1999-2008. The results are given in the following table.

Table 2: Equations of Economic Growth

(Dependent Variable: RGDPGR, Panel EGLS-Cross Section Fixed Effect)*

	Period		
Independent Variable	**(1999-2007)**	**(1999-2008)**	
LPROGR	0.12[a] (3.80)	0.20[a] (5.59)	0.18[a] (5.43)
GFCGR	0.12[a] (9.58)	0.15[a] (12.43)	0.14[a] (12.27)
C	2.73[a] (22.99)	2.27[a] (20.77)	2.48[a] (22.37)
CRISIS	-----	-----	-1.34[a] (-6.67)
Country	26	26	26
n	206	232	232
R^2	0.80	0.73	0.79
DW	1.84	1.67	1.65
RFE χ^2	7.74[a]	4.67[a]	5.94[a]
J-B Normality	0.86 [0.65]	1.30 [0.52]	0.01 [0.99]

a and b significant in 1% and 5%, t statistics in parentheses, probability in brackets, * it is estimated panel EGLS and GLS weight is cross-section weight.

In the estimation for 1999-2007 it is seen that economic growth has a positive significant relationship with both labor productivity and the investments. The results of the estimations for 1999-2009 periods demonstrate that labor productivity and investment coefficients are positive and statistically significant.

Differently from 1999-2007 periods, when the year 2008 included in the equation, labor productivity and investment coefficients have increased. Thus it can be interpreted that labor and investment are used more efficiently in the period of crisis and these two variables are more effective on the economic growth. Coefficient of dummy variable for the crisis is negative and significant as expected. Results are similar to the expectations. R^2 of the equations are at acceptable levels. While DW statistic is valid for fixed effect it also points out that there is no auto-correlation in the equations, RFE test points out that fixed effect can be used in the equations and JB normality test points out that error terms are normally distributed.

However, the rate of investments in GDP is one of the variables that show relative importance of investments in an economy for a country. While increased rates of investments in GDP demonstrate that the amount and importance of the investment in an economy is

increased, contrary situations demonstrate that the level and importance of the investment in an economy is decreased. Economic growth rate, current investment rate, changes in long term interest rates and crisis dummy have been used for the determinants of the investment changes in an economy. Results are given in table 3.

Table 3: Equations of Growth Rate of INVGDP
(Dependent Variable: IGDPGR, Panel EGLS-Cross Section Fixed Effect)*

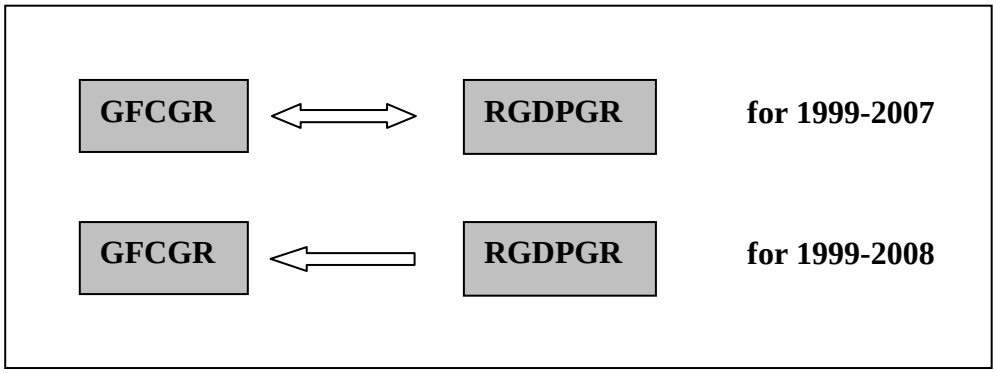
	Period		
Independent Variable	**(1999-2007)**	**(1999-2008)**	
RGDPGR	1.51[a] (5.65)	1.33[a] (10.88)	1.27[a] (9.22)
INVGDP	1.10[a] (4.83)	0.69[a] (5.24)	0.72[a] (5.45)
INTRGR	-0.05[b] (-1.96)	-----	-----
CRISIS	-----	-----	-0.88 (-1.35)
C	-27.61[a] (-5.71)	-19.57[a] (-6.79)	-20.02[a] (-6.98)
Country	19	31	31
n	149	277	277
R^2	0.45	0.50	0.51
DW	1.76	1.74	1.72
RFE χ^2	3.97[a]	4.82[a]	4.73[a]
J-B Normality	1.55 [0.46]	3.17 [0.21]	3.01 [0.22]

a and b significant in 1% and 5%, t statistics in parentheses, probability in brackets, * it is estimated panel EGLS and GLS weight is cross-section weight.

Results in Table 3 demonstrate that while change of investment levels in GDP is positively effective and significant to economic growth and current investment rate, interest rate is negatively effective and significant. The mark of the crisis dummy is negative as expected yet it is statistically insignificant. The level of income and current investment coefficients decrease when the year 2008 included in the period investigated. This situation points out that less levels of income is transferred to investments or income is less effective during crisis period and as a result these two variables are less effective on the investments. DW, RFE and J-B tests proves that there are no diagnostic problems in the equation.

Panel data can be examined by using Granger causality relationship test developed by Holtz-Eakin et al. (1988)[19]. Fixed effect is eliminated in this method by taking difference in equation and equation is estimated by using instrument variable method. Besides using various variables as instrument variable, lags of variables or their differences can be used. According to the tests conducted the results obtained are given in Graph 1 below.

Graph 1: Causality Relationships



GMM method was used in implementing causality test. For instrument variables first lag of interest rate, second and third lags of growth and investment variables have been used. J stat demonstrate that the variables are acceptable. While there is a two-way causality between the variables in 1999-2007 periods, there is a one way causality relationship from economic growth to investments in 1999-2008 periods.

Conclusion

Financial crisis that started in the US housing markets has turned into a global crisis spreading to Europe and other regions of the world. Crisis has affected many banks and investments in Europe and caused decreases in economic growth rates of countries. This study has investigated economic growth and investment relations by taking into consideration the crisis for the periods of 1999-2007 and 1999-2008 using panel data, fixed effect and causality analyses.

The study concludes that when the crisis year 2008 is added to growth equation it is seen that effect of investments and labor productivity on economic growth increases. This

[19] D. Holtz-Eakin, W. NEWEY and H.S. ROSEN, "Estimating Vector Autoregressions with Panel Data", **Econometrica**, 56(6), November 1988, pp. 1371-1395.

situation can be interpreted that investments and the labor are used more productively in the current period when the crisis occurred. Thus, unproductive workers are dismissed and the capital used in unproductive areas is reduced during the crisis period. Moreover, it is found from the investment equation that while current level of investment affects the investment level in the economy positively, interest rate affects it negatively. It is also seen that income and current levels of investment are insufficient in explaining the change in investments. Reasons for this can be given as decrease in income, increase of uncertainty which is the most important determinant of crisis and delay of new investments. When causality relations are examined it is seen that there is a two way relation between growth and investment in the period of 1999-2007. However, causality is one way from income to investments when the year 2008 is included in the period. When it is considered that the investment decision is given in the long term, it is expected that the causality relationship is to be maintained from income to investments. Because most of the investment decisions given in the past terms have still been implemented it is also normal to expect therefore that the income earned in the past periods has a causality relationship with the future investments. While the effect from the income to investments weakens during the current period which is the crisis period, the causality relationship can be maintained through the income that is acquired from the past investments. The causality relationship between the income earned in the past periods to economic growth can disappear due to the sudden decrease of income from positive to negative or to a level close to zero. Moreover, the causality relation from investments to growth can also disappear because of the low levels of effective and productive use of past investments due to low capacity use and low production levels of the current period.

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APPENDIX

APPENDIX A: Abbreviations Used in the Study

RGDPGR	Real GDP Growth Rate (%); Percentage Change on Previous Year.
LPROGR	Labour Productivity per Person Employed; GDP in Purchasing Power Standards (PPS) per Person Employed Relative to EU-27 (EU-27 = 100)
GFCGR	Gross Fixed Capital Formation (Investments) Growth Rate; Millions of Euro (From 1.1.1999)/Millions of ECU (Up to 31.12.1998).
INTRGR	Long-Term Interest Rates Growth Rate, 10-Year Government Bond Yields, Secondary Market. Annual Average (%).
IGDP	Total Gross Fixed Capital Formation (GFCF) Expressed as a Percentage of GDP (%), for the Public and Private Sectors.
IGDPGR	Growth Rate of Total Gross Fixed Capital Formation (GFCF) Expressed as a Percentage of GDP (%), for the Public and Private Sectors.
CRISIS	Crisis Dummy Variable, 2008 is 1, the Others are 0.

APPENDIX B: Countries Evaluated in the Study

COUNTRIES (31)	
Belgium	Malta
Bulgaria	Netherlands
Czech Republic	Austria
Denmark	Poland
Germany	Portugal
Estonia	Romania
Ireland	Slovenia
Greece	Slovakia
Spain	Finland
France	Sweden
Italy	United Kingdom
Cyprus	Turkey
Latvia	Iceland
Lithuania	Norway
Luxembourg (Grand-Duché)	Switzerland
Hungary	