Investigation of Economic Growth and Unemployment Relationship for G7 Countries Using Panel Regression Analysis

Hasan Alp ÖZEL, PhD.
Research Assistant
Canakkale Onsekiz Mart University
Biga Faculty Of Economics And Administrative Sciences
Economics Department
Ağaköy, Biga, Çanakkale
Turkey

Funda H. SEZGİN, PhD.
Associate Professor
Istanbul University
Faculty Of Engineering
Industrial Engineering Department
Istanbul University Avcılar Campus 34320
Avcılar-Istanbul, Turkey.

Özgür TOPKAYA, PhD.
Lecturer
Canakkale Onsekiz Mart University
Biga Faculty Of Economics And Administrative Sciences
Ağaköy, Biga, Çanakkale
Turkey

Abstract

Although there is a significant literature on the relationship between economic growth and unemployment, effect of economic growth over unemployment varies among the periods and countries. The study investigates the economic growth, productivity and unemployment data for seven industrialized countries (G7) between the years of 2000 to 2011. In addition to the mentioned period two sub-periods of 2000-2007 and 2008-2011 in which the effect of global financial crisis was felt most have been analyzed. Pre and post crisis periods have been compared to each other. The results of the study reveal that while the productivity and economic growth variables have significant and strong effects on the reduction of unemployment in the pre-crisis period, this effect of productivity becomes insignificant and small after the crisis whereas the effect of economic growth as a decreasing effect over unemployment continues and its impact level rises.

Key Words: Okun's Law, G7 Countries, Financial Crisis, Economic Growth, Productivity, Unemployment, Regression Analysis

1. Introduction

Economic growth and unemployment remain important problems of every country regardless of their economic development level. Countries target their economy policies towards establishing economic growth and reducing unemployment. Although, there is a wide literature about the relationship between economic growth and unemployment, there is not a consensus on the direction and intensity of the relationship. Differences in the economic structures of countries also reflect upon the relationship between economic growth and unemployment to a great extent.

The inverse correlation between economic growth and unemployment was first stressed by Okun (1962). Following studies have mostly proposed evidence that is parallel to Okun's study. It is possible to group these studies in the literature into two.

First group of studies establishes a symetrical tie between economic growth and unemployment and the second group which also includes the recent studies discusses asymetrical relationship between unemployment and economic growth. In most of the studies that support asymetrical relationship between economic growth and unemployment, the main idea is that economic growth and unemployment relationship is more intense in the economic downturn periods compared to economic expansion periods. The study uses economic growth, productivity and unemployment data from 7 industrialized (G7) countries. Selection of G7 countries is because of the important place of these countries in the world economy. The study first investigates the economic growth, productivity and unemployment relationship for 2001-2011 period. Then 2001-2007 and 2008-2011 periods have been examined in order to evaluate the changes occured in the process of global financial crisis. For the G7 countries it is seen that economic growth and productivity have significant and strong effect on the unemployment during the economic expansion period. However, in the crisis period while the effect of economic growth over unemployment continues, productivity loses its significance in the correlation. It is seen that implemented economy policies in G7 have slided from the productivity focus and centered on economic growth.

2. Literature Review

Okun (1962), proposed that an inverse relationship existed between real output level and unemployment level in his study in which he used data obtained from U.S. economy. Eventually, this idea was accepted as Okun's law in the economics theory and it assumed that in the periods when the economic growth is over 2,25%, each 1% increase in real output level caused 0,5% reduction in unemployment rate. Studies that examine the relationship between real economic growth and unemployment such as Smith (1975), Gordon (1984), Prachowny (1993), Palley (1993), Attfield ve Silverstone (1998), Apel and Jansson (1999), Harris ve Silverstone (2001), Sögner and Stiassny (2002), Huang and Lin (2008), Villaverde ve Maza (2009), Meyer ve Taşçı (2012), Huang and Yeh (2013) generally support the inverse relationship between economic growth and unemployment but the strength of relationship between economic growth and unemployment in the studies differ greatly depending on the sample and the context explored. Another group of studies propose an asymetrical relationship between economic growth and unemployment. Cuaresma (2003), proposed an asymetrical relationship between unemployment and economic growth in his study in which he used US economic data. The author found significant relationship between economic growth and unemployment during economic shrinkage periods. Silvapulle et al. (2004) stressed that the effect of economic growth over unemployment was more significant during the time of economic shrinkage in his study in which he used US economic data between 1947 to 1999.

Moose (1997) tested Okun's law in order to compare the reaction of economic growth to unemployment for G7 countries. The study revealed that Okun's coefficient was high for North America and it was low for Japan. This resulted from the differences of labor market rigidities. Lee (2000), discussed existence of a strong relationship between economic growth and unemployment in his study which supported Okun's law and was conducted for 16 OECD countries. Malley and Molana (2008) used quarterly data for G7 countries between the years of 1960 to 2001 and they stated that the relationship between economic growth and unemployment was more significant in the case of Germany. Pierdzioch et al. (2011) tested whether professional economists' forecasts of changes in the unemployment rate and the growth rate of real output were consistent with Okun's law for the period 1989-2007 for G7 and found the growth rate of real output and unemployment rate were consistent with Okun's law. Owyang and Sekhposyan (2012) investigated the degree of time variation in the unemployment and output fluctuations over the business cycle for U.S. case. They found a great degree of instability in the historical performance of Okun's law. The breakdowns in Okun's law seemed to be highly correlated with the business cycle. The detected break dates of the largest changes the coefficients appeared to be around recessions.

3. Model Selection

It is seen that the use of panel data sets have increased in 2000s compared to other types of data for its several important advantages (Baltagi, 2005: 12-13). Panel data analysis is conducted using a dependant variable, for groups in the number of N and time series data for the period of T. In this context a general panel data equation is written as follows;

All coefficients are kept fixed for all cross-sectional unit in the simplest form of panel data analysis. This equation estimates that all independent variables effect all units of cross section evenly. Another important issue is how to define the starting point (β_1).

$$y_{it} = \beta_{1it} + \beta_{2it} X_{2it} + \beta_{3it} X_{3it} + \varepsilon_{it} \quad t=1,\ldots,T \text{ ve } i=1,\ldots,N \tag{1}$$

$$y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + \varepsilon_{it} \tag{2}$$

The starting point is kept fixed for all units or different starting points for different cross sections are permitted by putting no constraints (Baltagi, 2005, 16). When the constraint for fixed starting point is eliminated two alternative methods namely fixed effects model (FEM) and random effects model (REM) are used. In the fixed effects model it is assumed that the starting point for all cross section units will have a different fixed value. Fixed effects model is also known as least squares dummy variable model. Performance test of coefficients that belong to dummy variable is based on F statistics. While zero hypothesis assumes classical least squares model (OLS) to be the effective estimation model which regards fixed cross-coefficient that belong to groups do not change, the alternative hypothesis states the appropriateness of fixed effects model (Baltagi, 2005, 21). Although fixed effects model is used intensively, existence of too many cross section cause loss of degree of freedom. Also another limitation of this model is that it is not suitable for variables that do not change in time. Therefore random effects model is proposed. Random effects model defines its starting point as random variable. Accordingly the starting points are the sum of β_1 fixed value and u_i random variable which has zero mean (Baltagi, 2005, 19).

$$y_{it} = \beta_{1i} + \beta_{2i} X_{2it} + \beta_{3i} X_{3it} + \varepsilon_{it} \qquad \beta_{1j} \neq \beta_{1i} \tag{3}$$

$$y_{it} = \beta_{1i} + \beta_{2i} X_{2it} + \beta_{3i} X_{3it} + \varepsilon_{it} \qquad \beta_{1j} \neq \beta_i + \mu_i \tag{4}$$

Some statistical tests have been conducted to make a selection for possible estimation methods in the applications. Since all the variables in the models change among countries and periods the basic question is whether or not the data can be combined among countries and periods. Chow test is used in order to identify common significance of country specific effects and time specific effects. While effective estimator under null hypothesis is pooled OLS, effective estimator under alternative hypothesis is fixed effects model. In addition, Breusch Pagan test is used to check that the null hypothesis do not have random effect and test significance of random individual effect. Rejection of null hypothesis indicates that random effect model should be preferred compared to pooled OLS model.

Finally, Hausmann test is used to decide the appropriateness of fixed effect model or random effect model for the model selection. In this test, null hypothesis states that individual effects has no relationship with other regressors in the model (existence of random effect). Rejection of null hypothesis indicates that fixed effects model should be preferred instead of random effect model.

4. Data Set

The study has identified effective variables to analyze unemployment, gross domestic product and productivity in G7 countries between 2000-2011 period by reviewing the literature. The variables have been obtained from OECD and World Bank data bases. The data used in the study are given in Table 1.

As in all time series analyses, variables of panel data analyses which processes both time and cross section analysis together need to be fixed to prevent fake relationship among the variables. Eviews version 7.1 and Stata version 10.0 are used for the analyses.

5. Empirical Results

While the study investigated common unit root processes using panel unit root test of Levin, Lin and Chu's (2002), it also tested unit root process for each unit (country) using Im, Pesaran and Shin's (2003) test. Stability in the series that are independent from the units was examined using generalized Dickey- Fuller (1979) unit root test method (ADF). Data to be used in panel regression was first analyzed for stability analysis and their results are given in Table 2. All the variables in the study were obtained stable i.e. I (1) when the first level state was taken into consideration. All variables at the first level state were then taken into analysis by tramo/seats filtering in order to obtain seasonally adjusted data.

Panel data methods as stated in Baltagi (2004) are conducted by pooled, fixed and random effects. The study used various statistical tests to select among the estimation models. Since all the variables in the models changed among countries and periods the basic question was whether or not the data could be combined among countries and periods.

Chow test was used in order to identify common significance of country specific effects and time specific effects. While effective estimator under null hypothesis was pool OLS, effective estimator under alternative hypothesis was fixed effects model. As can be seen in Table 3, F test p values are $p<0.05$ for each period. Therefore H_1 hypothesis is accepted and fixed effects model alternative was used.
Second stage includes the decision between random effects model and fixed effects model. For this test, Ho: There are random effects and H_1: There are no random effects that can be stated.

As can be seen in Table 4, $p<0.05$ for each period and therefore H_1 hypothesis has been accepted and fixed effects model is used. Thus fixed effects for the analysis of each period has been determined. Period SUR algorithm has been used for each period. GDP and productivity explain the level of unemployment about 84%. GDP has 35% decreasing and significant effect over unemployment. Productivity has 6% decreasing and significant effect over unemployment. When the data in Table 5 is examined it is seen that real production increase and productivity affects unemployment significantly with the percentage of 84%. In other words, increase in real production and productivity are related to unemployment at the rate of 84%. While increase in the real production has 35% decreasing and significant effect over unemployment, productivity increase has 6% decreasing and significant effect over unemployment. With respect to these results when the 2001-2011 period is considered as a whole one unit increase of real production decreases unemployment 0,35 unit. This result is similar to the generally accepted inverse relationship theory between real output level and unemployment. Moreover, one unit increase in the productivity decreases unemployment 0,06 unit. As it is seen, increase in real output is more effective over unemployment compared to the productivity.

The results given in Table 6 demonstrate that productivity has 7% decreasing effect over unemployment and GDP has 24% decreasing effect over unemployment. It is seen that for G7 countries each unit of increase in real output between 2001 and 2007 had 0,24 units of decreasing effect over unemployment. Each unit of increase in productivity had 0,007 points of decreasing effect over unemployment. Finally, in the light of the 2001-2007 data it is seen that while productivity has significant effect over unemployment; determinant factor over unemployment is change in the level of real output.

Effect of financial crisis that started late 2007 show itself in the 2008-2011 data of G7 as it is seen Table 7. When the 2001-2011 period is examined as a whole, productivity has 6% significant and decreasing effect over unemployment. But during the 2008-2011 sub-period of the research the relationship between productivity and unemployment rate becomes statistically insignificant. This result is important since it shows the effect rate of productivity in G7 countries in the period when the effects of crisis started to spread. Real output increase on the other hand have become more significant and more effective nature in this period. Each unit of increase in GDP in G7 countries during the financial crisis period has 0,25% effect over unemployment. As a result; while productivity becomes insignificant over unemployment in the crisis period, real production increase becomes more significant and effective over unemployment. This finding is similar to Boeri et al. (2012). The authors reported that financial recessions affect labor markets and Okun's elasticity over the business cycle. They found that highly leveraged sectors and periods are associated with higher employment-to-output elasticisities during banking crises and this effect explains the observation of higher Okun's elasticities during financial recessions.

As in all time series analysis, autocorrelation is an important issue in panel data analysis too. As it is known, one of the basic assumptions in regression analyses is that there is no correlation between same errors for different observations. If the error terms are correlated to each other this is called the state of autocorrelation or correlation series. Whether or not an autocorrelation existed in the panel data has been examined using Wooldridge (2002) autocorrelation test. Existence of changing variance problem in the model has also been investigated by using the Heteroskedasticity test developed by Greene (2003). Test results of each estimated model are given in Table 8.
According to Wooldridge test result, null hypothesis as "there is no autocorrelation" has been accepted since $p>0.05$ for each period. According to Greene's heteroskedasticity test result null hypothesis which assumes the equality of variances has been accepted since $p>0.05$. It has been found that there is no deviation from assumptions for all periods and that the results are statistically reliable and could be interpreted.

6. Conclusion

Level of real output and reducing unemployment are basic economic problems of every country regardless of their development levels. Therefore policies of states to provide real economic output and to reduce unemployment have an important effect on the general economic balance of countries. Although, there is a wide consensus about the significance of inverse correlation between real output and unemployment in the literature, there is no widely accepted view on exact intensity rate of this correlation. Basic reason for the intensity difference of correlation between real output level and unemployment for different country groups and countries arises from domestic economic differences of the country groups or countries investigated. Different industrial, labor and capital structure of countries lead to implementation of different economy policies for countries. These various economy policies implemented in turn change the intensity of correlation between real output and unemployment for each country and country groups. In addition to real economic output, labor productivity also affects unemployment to a great extent. In this context, productivity has also been added to the model as another variable that affects unemployment like the real economic output. Real output and productivity explain unemployment at the rate of 84% for the period between 2001-2011. While each one unit increase in real production reduces unemployment 35% alone, increase in productivity reduces unemployment 6%. When the 2001-2007 sub-period is examined, it is seen that each unit of increase in real output in G7 countries cause 0,24 unit of decrease in unemployment. In the same period, productivity also has significant and intense effect over unemployment. Each unit of increase in unemployment cause 0,07 unit of decrease in unemployment. In contrast, productivity loses its significance in the second sub-period 2008-2011. When the effects of financial crisis started to spread, changes in productivity causes statistical insignificance over unemployment. Yet, the effect of real economic output continues to correlate unemployment at 25% level.

The investigation of 2001-2011 period as a whole reveals significant correlation between productivity and unemployment. Productivity–unemployment relationship becomes statistically insignificant during 2008-2011 which indicates a deviation from productivity target of economy policies of the G7 states during the crisis period. As a result, the study puts forward similar results both for economic growth period and for the crisis period parallel to Okun (1962)'s study that proposed inverse relationship. Another result of the study is jobless growth implementations are not valid for G7 countries both in economic expansion and economic crisis period. In this context, it can be argued that if the economy policies towards improving real output levels backed up with policies aiming to improve productivity, these policies would have stronger effects over unemployment.

Table 1: Variables Used in the Analysis

Variables	**Variables**
Unemployment, Total (% of total labor force)	UR
Gross Domestic Product (GDP) Growth (annual %)	GDP
Productivity	PR

Table 2: Panel Unit Root Test Results

	DUR(1)		**DGDP(1)**		**PR(1)**	
Method	**Statistic**	**Prob.**	**Statistic**	**Prob.**	**Statistic**	**Prob.**
Levin, Lin & Chu t	-6.987	0.0000	-10.002	0.0000	-4.887	0.0001
Im, Pesaran and Shin W-stat	-3.343	0.0437	-3.276	0.0051	-4.006	0.0317
ADF – Fisher Chi-square	22.113	0.0221	25.091	0.0000	28.339	0.0188

Table 3: Chow Test Results for the Periods

	Tests	Statistical values	d.f.	p value
2001-2011				
	Cross-section F	12.708810	(6,64)	0.0000
	Cross-section Chi-square	65.903363	6	0.0000
	Period F	2.118972	(11,64)	0.0312
	Period Chi-square	26.087622	11	0.0063
	Cross-Section/Period F	5.834881	(17,64)	0.0000
	Cross-Section/Period Chi-square	78.628228	17	0.0000
2001-2007				
	Cross-section F	27.269864	(6,34)	0.0000
	Cross-section Chi-square	86.239086	6	0.0000
	Period F	1.682318	(6,34)	0.0055
	Period Chi-square	12.738095	6	0.0474
	Cross-Section/Period F	14.582606	(12,34)	0.0000
	Cross-Section/Period Chi-square	88.980665	12	0.0000
2008-2011				
	Cross-section F	11.709774	(6,16)	0.0000
	Cross-section Chi-square	47.173324	6	0.0000
	Period F	9.036398	(3,16)	0.0010
	Period Chi-square	27.752131	3	0.0000
	Cross-Section/Period F	11.605768	(9,16)	0.0000
	Cross-Section/Period Chi-square	56.522533	9	0.0000

Table 4: Hausman Test Results

	Tests	χ^2 statistics	d.f.	p value
2000-2011				
	Cross-section random	13.678	2	0.001
	Period random	11.772	2	0.000
	Cross-section and period random	19.553	2	0.000
2000-2007				
	Cross-section random	22.009	2	0.022
	Period random	15.397	2	0.001
	Cross-section and period random	11.565	2	0.001
2008-2001				
	Cross-section random	25.654	2	0.0000
	Period random	21.023	2	0.0022
	Cross-section and period random	19.566	2	0.0011

Table 5: 2000-2011 Estimation Results

Dependent Variable: UR
Method: Panel Least Squares
Sample: 2000 2011
Periods included: 12
Cross-sections included: 7
Total panel (balanced) observations: 84
Period SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PR	-0.069499	0.020036	-3.468671	0.0009
GDP	-0.350929	0.107125	-3.275890	0.0017
C	12.63040	1.582770	7.979933	0.0000
	Effects Specification			
Cross-section fixed (dummy variables) Period fixed (dummy variables)				
R-squared	0.844726	Mean dependent var		6.941808
Adjusted R-squared	0.827066	S.D. dependent var		1.539532
S.E. of regression	0.952688	Akaike info criterion		2.945198
Sum squared resid	58.08732	Schwarz criterion		3.523964
Log likelihood	-103.6983	Hannan-Quinn criter.		3.177857
F-statistic	89.34231	Durbin-Watson stat		2.571447
Prob(F-statistic)	0.000000			

Table 6: 2001-2007 Estimation Results

Dependent Variable: UR
Method: Panel Least Squares
Sample: 2001 2007
Periods included: 7
Cross-sections included: 7
Total panel (balanced) observations: 49
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PR	-0.079274	0.017579	-4.509478	0.0001
GNP	-0.249707	0.035441	-7.045650	0.0000
C	8.142742	0.375507	21.68464	0.0000
	Effects Specification			
Cross-section fixed (dummy variables) Period fixed (dummy variables)				
R-squared	0.828287	Mean dependent var		6.915433
Adjusted R-squared	0.806405	S.D. dependent var		1.922797
S.E. of regression	0.728623	Akaike info criterion		2.451465
Sum squared resid	18.05032	Schwarz criterion		3.030594
Log likelihood	-45.06089	Hannan-Quinn criter.		2.671185
F-statistic	21.44811	Durbin-Watson stat		2.632399
Prob(F-statistic)	0.000000			

Table 7: 2008-2011 Estimation Results

Dependent Variable: UR
Method: Panel Least Squares
Date: 04/17/13 Time: 14:48
Sample: 2008 2011
Periods included: 4

Cross-sections included: 7
Total panel (balanced) observations: 28
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PR	-0.097154	0.094076	-1.032722	0.3171
GDP	-0.257553	0.113838	-2.262451	0.0379
C	27.11270	8.882966	3.052213	0.0076

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.822149	Mean dependent var	6.951992
Adjusted R-squared	0.818002	S.D. dependent var	1.359707
S.E. of regression	0.580068	Akaike info criterion	2.046183
Sum squared resid	5.383654	Schwarz criterion	2.617127
Log likelihood	-16.64656	Hannan-Quinn criter.	2.220726
F-statistic	12.03211	Durbin-Watson stat	2.436429
Prob(F-statistic)	0.000009		

Table 8: Test Results of Wooldridge Autocorrelation Test and Greene Heteorskedasticity Test

	Wooldridge Autocorrelation Test		**Greene Heteroskedasticity Test**	
	F Value	Probability	Chi2 (1)	Prob>Chi2
2001-2011	223.007	0.113	303.872	0.217
2001-2007	202.008	0.2567	298.345	0.114
2008-2011	121.032	0.115	229.458	0.156

References

Adanu, Kwami (2005), "A Cross-Province Comparison of Okun's Coefficient for Canada", **Applied Economics**, Volume 37, Issue 5, pp. 561-570.

Apel, Mikael, Jansson Per (1999), "A Theory-Consistent System Approach for Estimating Potential Output and The NAIRU", **Economic Letters**, Vol. 64, pp. 271-275.

Attfield, Clifford L. F., Silverstone Brian (1998), "Okun's Law, Cointegration and Gap Variables", **Journal of Macroeconomics**, Vol.20, No. 3, pp. 625-637.

Baltagi, Badi H.(2005), **Econometric Analysis of Panel Data**, John Wiley & Sons, Canada.

Cuaresma, Jesus Crespo, "Okun's Law Revised", **Oxford Bulletin of Economics and Statistics**, 65/4, pp. 439-451.

Dickey, D.A., Fuller, W.A. (1979), "Distribution of the Estimators for Autoregressive Time Series with a Unit Root", **Journal of the American Statistical Association**. 74, 427-431.

Gordon, Robert J. (1984), "Unemployment and Potential Output in the 1980s", **Brookings Papers on Economic Activity**, No:2, pp. 537-568.

Greene, W.H. (2003), **Econometric Analysis,** 5th Ed., Chapter 13. Pearson Education Inc, 2003.

Harris, Ricard, Silverstone, Brian (2001), "Testing for Asymmetry in Okun's Law: Cross-Country Comparison", **Economics Bulletin**, Vol. 5, No. 2, pp. 1-13.

Huanng, Ho-Chuan, Yeh, Chih-Chuan (2013), "Okun's Law in Panels of Countries and States", **Applied Economics**, 45, Routledge, Taylor&Francis Group, pp. 191-199.

Huang, Ho-Chuan, Lin, Shu-Chin (2008), "Smooth-Time-Varying Okun's Coefficients", **Economic Modelling**, Vol. 25, pp.363-375.

Im, K.S., Pesaran, M.H., Shin, Y. (2003), "Testing for Unit Roots in Heteregeneous Panels" **Journal of Econometrics**, 115, 53-74.

Lee, Jim (2000), "The Robustness of Okun's Law: Evidence from OECD Countries"**, Journal of Macroeconomics**, Vol.22, No.2, pp. 331-356.

Levin, A., Lin, C.F., Chu, C.S.J.(2002), "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties", **Journal of Econometrics**. 108, 1-24.

Malley, Jim, Molana Hassan (2008), "Output, Unemployment and Okun's Law: Some Evidence from the G7", **Economics Letters**, Volume 101, Issue 2, November, pp. 113-115.

Meyer, Brent, Tasci, Murat (2012), "An Unstable Okun's Law, Not The Best Rule of Thumb", **Economic Commentary**, Number 2012-08, Federal Reserve Bank of Cleveland, Cleveland, Ohio, United States of America, pp.1-6.

Moosa, Imad A. (1997), "A Cross-Country Comparison of Okun's Coefficent", **Journal of Comparative Economics**, No:24, ss.335-356.

Okun, Arthur M. (1962), "Potential GNP: Its Measurement and Significance", **Cowles Foundation Paper 190**, pp. 1-7.

Owyang, Michael T. and Sekhposyan, Tatevik (2012), "Okun's Law Over the Business Cycle: Was the Great Recession All That Different?", **Federal Reserve Bank of St. Louis REVIEW**, 94 (5), pp. 399-418.

Palley, Thomas I. (1993), "Okun's Law and the Asymmetric and Changing Cyclical Behaviour of the USA Economy", **International Review of applied Economics**, Volume 7, Issue 2, pp. 144-162.

Pierdzioch, Christian, Rülke, Jan-Christoph and Stadtmann, Georg (2011), "Do Professional Economists' Forecasts Reflect Okun's Law? Some Evidence for the G7 Countries", **Applied Economics**, 2011, 43, Routledge, Taylor&Francis Group, 1365-1373.

Prachowny, Martin F.J. (1993), "Okun's Law: Theoretical Foundations and Revised Estimates", **The Review of Economics and Statistic**, Vol:75, No.2, pp. 331-336.

Silvapulle, Paramsothy, Moosa Imad A. and Silvapulle Mervyn J. (2004), "Asymmetry in Okun's Law", **The Canadian Journal of Economics**, Vol. 37, No. 2, pp. 353-374.

Smith, Gary (1974), "Okun's Law Revisited", **Cowles Foundation for Research in Economisc**, **Cowles Foundation Discussion Paper No. 380**, pp. 1-31.

Sögner, Leopold, Stiassny, Alfred (2002), "An Analysis on the Structural Stability of Okun's Law-A Cross-Country Study", **Applied Economics**, No.14, pp. 1775-1785.

Sögner, Leopold, Stiassny Alfred (2000), "A Cross-Country Study on Okun's Law", **Vienna University of Economics and Business Administration Working Paper Series**, Working paper No. 13, pp. 1-24.

Villaverde, Jose, Maza Adolfo (2009), "The Robustness of Okun's Law in Spain, 1980-2004 Regional Evidence", **Journal of Policy Modeling**, Volume 31, Issue 2, March-April 2009, pp. 289-297.

Wooldridge, J.M.(2003), **Solutions Manual and Supplementary Materials for Econometric Analysis of Cross Section and Panel Data,** MIT Press, Cambridge.

Woolridge, J.M. (2002), **Econometric Analysis of Cross Section and Panel Data,** The MIT Press, Cambridge.