

**CYCLICAL OUTPUT - UNEMPLOYMENT RELATIONSHIP: OKUN'S  
LAW PARAMETER FOR TURKEY\***

*AHMET TİRYAKİ\*\**  
*OBİD KHAKİMOV\*\*\**

**Abstract**

*The aim of this paper is twofold; to analyze the Okun's law for Turkey and whether there exists a structural change in the relationship between cyclical output and unemployment after 2001 financial and economic crisis by using quarterly data from 1993 to end of 2008. Based on its "gap" specification and using different filtering methods-HP filter 1997, Baxter-King 1995, and Unobserved Component Model,-different than the previous literature, the results show that there exists significant inverse relationship between unemployment and output for Turkey. However, the quantitative value of Okun's coefficient is relatively bigger than the developed countries' coefficient reported by original papers for whole period. Also, the claim about the Turkish cyclical output and unemployment faced structural change after 2001 crisis did not find any empirical support.*

JEL Classification: D50, E00

Keywords: Okun's law; Unemployment gap; Output gap; HP Filter; Turkey

\*Draft version of this paper is presented in EconAnadolu 2009-Anadolu International Conference in Economics, Eskişehir/Turkey-June 2009.

\*\*Anadolu University-Open Education Faculty, Economics Dept.-Eskisehir/Turkey

\*\*\* Westminster International University in Tashkent/Uzbekistan

## **Introduction**

The relationship between output and unemployment has been studied by several authors like Okun (1962), Smith (1975), Gordon (1984) and others. These studies found significant negative relationship between cyclical output and cyclical unemployment for several countries. These results were proved by different estimation techniques and methodologies. Even though there is a significant inverse relationship exists, the degree and sensitivity of the relationship changes for country to country and for tested time period.

As Ball et al. (2013) expresses, claims that Okun's law works or it is broken dawn matter for the interpretation of unemployment movements and for macro policy. Okun's Law is a model in which changes in aggregate demand cause changes in output, which in turn lead firms to hire and fire workers. It implies that when unemployment is high, it can be reduced through aggregate demand stimulus policies. Skeptics of Okun's Law question this policy view and stress labor market policies such as job training to reduce unemployment.

This study analyses the relationship between cyclical output and unemployment in Turkey for the period of 1993-2008. Unemployment is one of the major economic and social issues of Turkey and it is one of the top political agenda of the country. The regular level of unemployment of Turkish economy is extremely high for emerging economy and it is highest among OECD countries. After 2007-2008 global financial crisis, on February 2009, the unemployment level of Turkey reached historically high level 16.1 percent. Especially during the recent economic crisis the Turkish unemployment level became the most important economic and social concern of policy makers.

This study has two goals:

i). By using different filtering techniques it aims to test the relationship between cyclical output and unemployment and test for the robustness of results. These different filtering techniques provide different level of potential output and unemployment and recent literature has discussed the advantages and disadvantages of these methods.

ii). After 2001 financial crisis, Turkish economy faced significant reforms and relationship between number of economic variables faced structural changes. As a result many economists and politicians commented breaking up of the relationship between economic growth and employment growth. Visual representation of unemployment level and trends show that after 2001 the potential level of unemployment has changed (Figure-2). From the end of 2000 to 2003, the potential level of unemployment sharply increased and changed it's level. This level change was seen by some commentators as if the relationship between economic variables

weakened. This study, first attempt to test whether relationship between cyclical unemployment and output faced structural change after 2001.

Based on its “gap” specification and using different filtering methods-HP filter 1997, Baxter-King 1995, and *Unobserved Component Model*, our tests results based on all three models showed strong significantly negative relationship between cyclical output and unemployment level in Turkey for the period of 1993-2008. The absolute level of OLC is significantly higher than other industrial countries. Furthermore the initial hypothesis about structural change did not find any empirical support from all three testing methods.

The study is organized as follows: The second part of the study discussed the literature review and current methodologies. The third part of the study discusses the data and estimation results. The last part discusses the concluding remarks of the study.

## **Literature Review**

The literature about the relationship between cyclical output and cyclical unemployment mainly focus on the Okun’s parameter and whether Okun’s law is symmetric or asymmetric. As indicated before, there exists various international and Turkish case studies and also there exists various different results. Most of the studies show the Okun’s law relationship with different parameters.

First of all, some studies such as Harris and Silverstone (2000) and (2001) found no Okun’s law relationship by using New Zealand data. However, there are many previous studies found significant negative relationship between cyclical output and cyclical unemployment for several countries.

Important breakthrough papers from Okun (1962), Smith (1975), Gordon (1984), and Ball et al. (2013) found significant negative relationship between cyclical output and cyclical unemployment. Studies using international data find different parameters and symmetrical or asymmetrical relationship during the cycle for Okun’s law Coefficient.(See Lee (2000)).

Moosa (1997) estimated the Okun’s law Coefficient (OLC) for G-7 countries. His estimation showed that OLC for G-7 countries varies from -0.08 (Japan) to -0.49 (Canada). Perman and Tavera (2005) also estimated OLC for 17 European countries and his results for OLC ranged from -0.26 (Ireland) to -1.45 (Sweden). He also showed that Nordic European countries has higher absolute values of OLC. Harris and Silverstone (2001) estimated OLC for seven developed countries. The results of the study showed that Australia had highest OLC -0.50 and Japan’s OLC was equal

to -0.09. Also, Cuerasma (2003) for the USA, Villaverde and Maza (2008) for Spain, Attfield and Silverstone (1998) for UK, Silvapulle, Moosa, and Silvapulle (2004) for the USA, Huang and Chang (2005) for Canada, Moosa (1997), Bernanke (2003), found Okun's law relationship.

Ball et al. (2013) tests Okun's Law for the United States and twenty advanced economies and find that even though the coefficient in the relationship varies substantially across countries, Okun's Law is a strong and stable relationship in most countries. Also they found that accounts of breakdowns in the Law, such as the emergence of "jobless recoveries," are flawed. Their estimated the Okun's law coefficient is -0.15 in Japan, -0.45 in the United States, and -0.85 in Spain.

Mankiw (2012) confirms Okun Law relationship and finds for the United States that a one percent deviation of output from potential causes an opposite change in unemployment of half a percentage point.

On the other hand, studies like Gordon (2011) and Meyer and Tasci (2012), Owyang and Sepkhosyan (2012), and Daly et al. (2012) question Okun's Law and indicated that the coefficient in Okun's Law unstable and varies over time. Cazes et al. (2011) has suggested that each of the last three U.S. recessions was followed by a "jobless recovery" and Okun's Law is unstable in many countries. McKinsey (2011) argues that Okun's Law has broken down because of problems in the labor market, such as mismatch between workers and jobs. However, Gali et al. (2012) rejects the idea that Okun's Law has broken down and because of "jobless recovery" in which unemployment did not fall as much as Okun's Law predicts and Okun's Law is unstable.

Some studies such as IMF (2010) also conclude that the coefficient has risen over time. For the Turkish economy, Yüceol (2006) and Barışık et al. (2010) find asymmetric Okun's law relationship and Barışık et al. (2010) finds economic growth doesn't create employment. Also, by using annual data Ceylan and Şahin (2010) find that Okun's law relationship exists in Turkey in the long run and the relationship is asymmetric.

### **Dataset and Methodology**

In this study, quarterly data is used, 1993:Q1 to 2008:Q3, from Economic Intelligence Unit. Determination of cyclical output is very sensitive to potential level of GDP and unemployment. If cyclical level of output is incorrectly determined, then output gap will be biased. In order to get more robust results output and unemployment levels should be filtered by various filtering methods. This way enables us to test the robustness of the relationship between cyclical output and unemployment.

It is worth to note that various filtering methods have advantages and disadvantages. For example Hodrick-Prescott (1997) filtering, which is mostly used filtering method and according to this method, output  $y_t$  has two components. The first component of output is trend  $\tau_t$ , and the second is cyclical component  $c_t$  and  $\lambda$  is penalty factor. Using this information, the methodology minimizes the following objective function  $Min \sum_{t=1}^T (y_t - \tau_t)^2 + \lambda((\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1}))^2$ .

French (2001)<sup>1</sup> describes the drawbacks of the HP filtering method as: a) the residual term is normally distributed with zero mean and constant variance, b) time series has to be in I(2) order, c) analysis is purely static and the filter has misleading predictive power. Existence of permanent shocks or split growth, generate shifts of unnecessary trends.

Considering these disadvantages of HP (1997) filter, economists offered Baxter-King (1995) filtering method. This filtering method uses dynamic filtering method and predictive power is better than HP (1997). According to Baxter-King (1995), band-pass filter, extracts the cyclical components of time series data. The filter is considered as symmetric centered moving average where  $\tilde{y}_t = \sum_{j=-K}^{j=K} a_j L^j y_t$ , where  $\tilde{y}_t$

is filtered series from original time series  $y_t$ , and  $a_j$  are weights and they are obtained from minimization problem.<sup>2</sup> When Baxter and King (1995) calibrated their filter they assumed that minimum and maximum duration of US business cycle equal to 6 and 32 quarters.

Furthermore we used the Unobserved Component Model (UCM), developed by Harvey and Koopman (1997) and (2000)<sup>3</sup>. Using this methodology, one can divide time series into several stochastic components such as trend, level, irregular, and cyclical stochastic components.

Before showing our estimation results we would like to discuss the dynamics of output and unemployment level during 1993 to 2008. Additionally we will provide the visual evidence about the performance of different filtering methods.

---

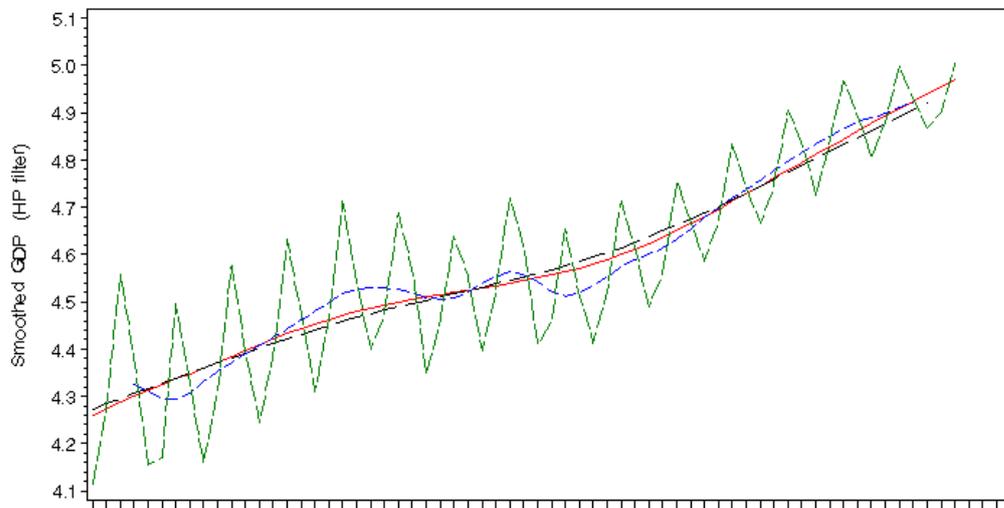
<sup>1</sup> French, Mark., (2001), Estimating changes in trend growth of total factor productivity: Kalman and H-P filters versus a Markov-switching framework, Sep.

<sup>2</sup> For detailed information check Baxter M., and King R., (1995), Measuring Business Cycles: Approximate Band Pass filters for economic time series, NBER, Working Paper 5022

<sup>3</sup> Harvey, A.C., and S.J Koopman (2000). Signal Extraction and the Formulation of Unobserved Components Models, *Econometrics Journal*, 3, 84-107.  
 Harvey, A.C., S. J. Koopman, and M. Riani (1997). The Modeling and Seasonal Adjustment of Weekly Observations. *Journal of Business and Economic Statistics* 15: 354-68.

Figure-1 describes the evolution of logarithmic real GDP level of Turkey from 1993 to 2008.<sup>4</sup> The figure shows the actual logarithmic output and trend levels derived from three filtering methods. As we can see the performance of Unobserved Component Model and HP model are identical. They do not show significant sensitivity of potential output to post crisis periods. Contrary, output trend derived by Baxter-King (1995) filtering method, shows higher sensitivity in output trend. The significant difference between Baxter-King and other filtering methods can be observed during 1998-2004.

**Figure -1. Actual logarithmic real GDP and filtered series.**

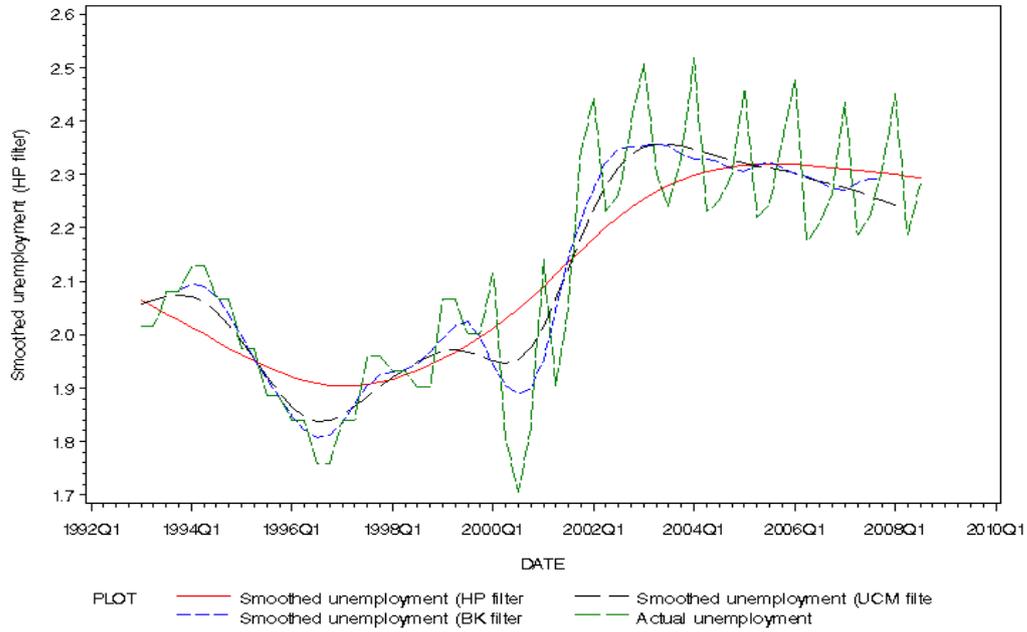


Next graph describes the actual logarithmic unemployment level and trend levels derived by above-mentioned three filtering methods. The graphs shows significant volatility in unemployment level of Turkey. During the 1993-2000 the volatility of unemployment level was high. After 2001, the volatility of unemployment relatively decreased but the level increased to its higher points. After 2001 crisis period, the potential level of unemployment faced slight decrease.

Unlike to output filtered series, all three filtering methods gave different results. The result derived from HP filtering method generated highest cyclical unemployment levels compare to Baxter-King (1995) and Unobserved Component Model.

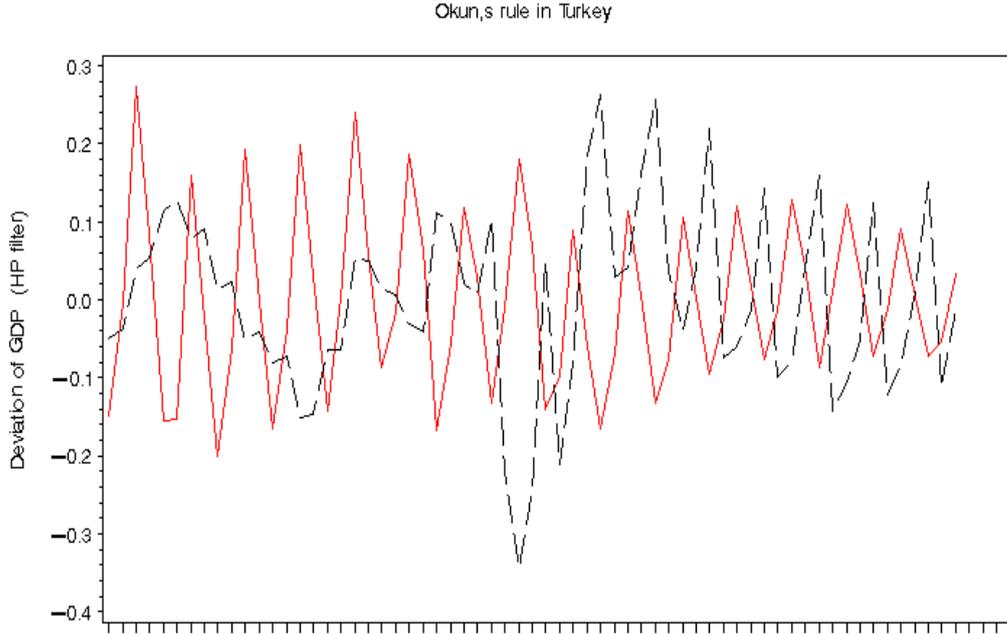
<sup>4</sup> Original GDP were in billion US dollars.

**Figure -2. Actual logarithmic unemployment and filtered series.**



Our next figure (Figure-3) shows the historical dynamics of cyclical output and unemployment levels. From the graph we can observe countercyclical relationship between cyclical output and unemployment. More interestingly we can detect that after 2001 crisis, the counter cyclicity of two series changed and became more systematic. This visual observation let us to question whether the relationship between these two series changed after 2001 financial crisis. Further empirical evidences of this test will show us whether Turkish economy faced structural change after 2001.

**Figure -3. Deviation of output gap and unemployment gap.**



**Estimation results**

Before running our estimations we briefly discuss the nature of our variables. First, cyclical unemployment and output levels are dynamic in nature. Second, our test results show that these two series are simultaneously determined. Thus, considering Moosa (1997) and Ball et al. (2013), our main estimation equations are:

$$Y_t - \hat{Y}_t = \alpha_0 + \alpha_1(Y_t - \hat{Y}_t)_{t-1} + \alpha_2(U_t - \hat{U}_t) + \alpha_3(D_1(U_t - \hat{U}_t)) + e_t$$

$$U_t - \hat{U}_t = \beta_0 + \beta_1(U_t - \hat{U}_t)_{t-1} + \beta_2(Y_t - \hat{Y}_t) + \beta_3 D_1 + u_t$$

where  $Y_t$  - the logarithmic output level at time  $t$ ,  $\hat{Y}_t$  - logarithmic potential level of output at time  $t$ ,  $U_t$  - the logarithmic unemployment level at time  $t$ ,  $\hat{U}_t$  - logarithmic potential level of unemployment at time  $t$ ,  $D_1=1$  if observation belongs to post 2001 period otherwise equal to zero, and  $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \beta_0, \beta_1, \beta_2,$  and  $\beta_3$  are parameters of the model. The coefficient  $\alpha_2$  represent the relationship between cyclical output and unemployment and it is called also Okun's law coefficient (OLC). This coefficient is the main focus of this study. Additionally, the significance of  $\alpha_3$  coefficient indicates the structural change in the relationship between cyclical output and unemployment after 2001. The significance of  $\beta_3$  shows whether level of cyclical unemployment faced structural change after 2001.

In order to test these two equations we proceed as follows. Firstly, we derived cyclical components of output and unemployment by using abovementioned filtering methods. Second, we tested the stationarity of these series by using Augmented

Dickey Fuller test. The test results showed that all cyclical series are stationary. Next we run the above mentioned two simultaneous equations.

Tables 1 through 3 represents the regression results of abovementioned two equations by using different filtering methods. Table-1 represents the estimation results by using HP filtering method. According to this estimation result the OLC is significant and negative at one percent confidence level. The value of OLC is equal to -0.53. Moosa (1997) estimated the OLC for G7 countries. His estimation showed that OLC for G7 countries varies from -0.08 (Japan) to -0.49 (Canada). Perman and Tavera (2005) also estimated OLC for 17 European countries and his results for OLC ranged from -0.26 (Ireland) to -1.45 (Sweden). He also showed that Nordic European countries has higher absolute values of OLC. Harris and Silverstone (2001) estimated OLC for seven developed countries. The results of the study showed that Australia had highest OLC -0.50 and Japan's OLC was equal to -0.09. The results show that the relationship coefficient between cyclical output and unemployment is relatively higher for Turkey compare to developed countries. Additionally this regression result showed that, the relationship between two series did not face the structural change after 2001. The coefficient  $\alpha_3$  was not significantly different from zero.

Table-2 represents the regression results using BK filtering method. As we indicated above this method is more sensitive to shocks compare to other methods. The OLC coefficient of this regression model is equal to -0.96, which is significantly higher than previous regression model. The OLC is significant at 1 percent significance level. This regression results also did not show any empirical evidence about structural change after 2001.

Table-3 shows the regression results by using UCM methodology. The OLC coefficient derived from this regression coefficient was equal to -0.83 and statistically significant at 1 percent significance level. We did not observe any empirical evidence about post 2001 structural change in OLC.

In summary, all three models showed strong significantly negative relationship between cyclical output and unemployment level. The absolute level of OLC is significantly higher than other industrial countries. Furthermore the initial hypothesis about structural change did not find any empirical support from all three testing methods.

## **Conclusions**

This paper analyzed the Okun's law Coefficient (OLC) for Turkey and whether there exists a structural change in the relationship between cyclical output and

unemployment after 2001 economic crisis by using data from 1993 to 2008. Based on its “gap” specification and using HP filter 1997, Baxter-King 1995, and Unobserved Component Model filtering methods the study finds that there exists significant inverse relationship between unemployment and output for Turkey. However, the quantitative value of Okun’s coefficient is relatively bigger than the developed countries’ coefficient reported by original papers for whole period.

On the other hand, the claim about the Turkish cyclical output and unemployment faced structural change after 2001 crisis did not find any empirical support.

Working of Okun’s law indicates that when unemployment is high, it can be reduced through aggregate demand stimulus policies. The study results indicate that expansionary aggregate demand policies can be used to reduce unemployment in Turkey.

**Table – 1: The results of regression model using HP filtered series**

<b>Independent variables</b>	<b>Cyclical deviation of logarithmic output</b>	<b>Cyclical deviation of logarithmic unemployment level</b>
Constant term	0.005 (0.36)	-0.011 (-0.61)
Lagged dependent variable	0.059 (0.53)	0.173 (1.50)
Cyclical deviation of logarithmic unemployment level	<b>-0.534</b> <b>(-3.58)***</b>	
Cyclical deviation of logarithmic output level		<b>-0.639</b> <b>(-5.28)***</b>
Cyclical unemployment*Dummy for post 2001 period	-0.158 (-0.70)	
Dummy for post 2001 period		0.029 (1.11)
<b>Adjusted R square</b>	<b>0.0647</b>	<b>0.129</b>

*Note : \*\*\* significant at 1 percent level, \*\* significant at 5 percent, \*significant at 10 percent*

**Table – 2: The results of regression model using BK filtered series**

<b>Independent variables</b>	<b>Cyclical deviation of logarithmic output</b>	<b>Cyclical deviation of logarithmic unemployment level</b>
Constant term	-0.002	-0.00507

	(-0.17)	-0.38
Lagged dependent variable	0.120 (1.07)	-0.2003* (-1.83)
Cyclical deviation of logarithmic unemployment level	<b>-0.9673</b> <b>(-4.68)***</b>	
Cyclical deviation of logarithmic output level		<b>-0.722</b> <b>(-7.62)***</b>
Cyclical unemployment*Dummy for post 2001 period	0.046 (0.18)	
Dummy for post 2001 period		0.006885 (0.37)
<b>Adjusted R square</b>	<b>0.13</b>	<b>0.19</b>

Note : \*\*\* significant at 1 percent level, \*\* significant at 5 percent, \*significant at 10 percent

**Table – 3: The results of regression model using UCM filtered series**

<b>Independent variables</b>	<b>Cyclical deviation of logarithmic output</b>	<b>Cyclical deviation of logarithmic unemployment level</b>
Constant term	0.008 (0.58)	0.002 (0.10)
Lagged dependent variable	0.127 (1.17)	-0.054 (-0.45)
Cyclical deviation of logarithmic unemployment level	<b>-0.830</b> <b>(-4.30)***</b>	
Cyclical deviation of logarithmic output level		<b>-0.638</b> <b>(-6.39)***</b>
Cyclical unemployment*Dummy for post 2001 period	-0.056 (-0.22)	
Dummy for post 2001 period		0.012 (0.58)
<b>Adjusted R square</b>	<b>0.09</b>	<b>0.08</b>

Note : \*\*\* significant at 1 percent level, \*\* significant at 5 percent, \*significant at 10 percent

**REFERENCES**

**Attfield, C. L.F., Silverstone, B.,(1998)** “*Okun's Law, Cointegration And Gap Variables*”, Journal Of Macroeconomics, Volume 20, Issue 3, Summer 1998, Pages 625-637

**Ball, L. M., Leigh, D., and P. Loungani, (2013)**, “*Okun's Law: Fit at Fifty?*” NBER Working Paper, No. 18668

**BARIŞIK, S., ÇEVİK, E. İ., and N.K.ÇEVİK, (2010)**, “*Türkiye’de Okun Yasası, Asimetri İlişkisi ve İstihdam Yaratmayan Büyüme: Markov-Switching Yaklaşımı*”, Maliye Dergisi, Sayı 159, Temmuz-Aralık 2010

**Baxter M., and King R., (1995)**, “*Measuring Business Cycles: Approximate Band Pass filters for economic time series*”, NBER, Working Paper 5022

**Bernanke, B.S., (2003)** “*The Jobless Recovery*”, Global Economic and Investment Outlook Conference at Pittsburgh

**Cazes, S., Sher V., and F. Al-Hussami (2012)**. “*Diverging trends in unemployment in the United States and Europe: Evidence from Okun’s law and the global financial crisis.*” Employment Working Papers, ILO.

**Ceylan, S., B. Y. Şahin (2010)**, “İşsizlik ve Ekonomik Büyüme İlişkisinde Asimetri”, Doğu Üniversitesi Dergisi, C. 11, Sayı: 2.

**Cuerasma, C. J.,(2003)**, “*Okun’s Law Revisited*”, Oxford Bulletin of Economics and Statistics, 65(4), 439-451

**Daly, M. C., Fernald, J. G., Jordà, Ö., and F. Nechio, (2014)**, “*Output and Unemployment Dynamics*”, Federal Reserve Bank of San Francisco Working Paper Series, Working Paper: 2013-32.

**French, Mark., (2001)**, “*Estimating changes in trend growth of total factor productivity: Kalman and H-P filters versus a Markov-switching framework*”, Fed Publications.

**Galí, J., Smets, F., and R. Wouters (2012)**, “*Slow Recoveries: A Structural Interpretation.*” NBER Working Paper, No. 18085.

**Gordon, R. J. (2010)**, “*Okun’s Law and Productivity Innovations.*”, American Economic Review: Papers & Proceedings, vol. 100, no. 2, pp. 11-15. 2010.

**Harris, R. and Silverstone, B., (2000)**, “*Asymmetric Adjustment of Unemployment and Output in New Zealand: Rediscovering Okun’s Law*”, Department of Economics Working Paper Series, No. 2/00, Hamilton, New Zealand

**Harris, R. and Silverstone, B., (2001)**, “*Testing For Asymmetry In Okun's Law: A Cross–Country Comparison*”, Economics Bulletin, Vol. 5, No. 2 pp. 1–13

**Harvey, A.C., and S.J Koopman, (2000)**, “*Signal Extraction and the Formulation of Unobserved Components Models*”, Econometrics Journal, 3, 84-107.

**Harvey, A.C., S. J. Koopman, and M. Riani (1997)**, “*The Modeling and Seasonal Adjustment of Weekly Observations*”. Journal of Business and Economic Statistics 15: 354-68.

**Huang, H. and Chang, Y., (2005)**, “*Investigating Okun’s Law by the Structural Break with Threshold Approach: Evidence from Canada*”, The Manchester School, 75(5), 599-611

**IMF (2010)**, “*Unemployment Dynamics in Recessions and Recoveries*,” World Economic Outlook, Chapter 3, April 2010.

**Lee, J., (2000)**, “*The Robustness Of Okun's Law: Evidence From OECD Countries*”, Journal Of Macroeconomics, Volume 22, Issue 2, Spring 2000, Pages 331-356

**Mankiw, N. G. (2012)**, *Principles of Macroeconomics*, 6th edition.

**McKinsey Global Institute (2011)**, “*An Economy That Works: Job Creation and America’s Future*”, June 2011 report.

**Meyer, B., and M. Tasci, (2012)**, “*An unstable Okun’s Law, not the best rule of thumb*.” Economic Commentary June 7 (2012).

**Moosa, I.A., (1997)**, “*A Cross-Country Comparison of Okun’s Coefficient*”, Journal Of Comparative Economics 24, 335–356, Article No. Je971433

**Okun, A. M. (1962)**, “*Potential GNP: Its Measurement and Significance*.” Reprinted as Cowles Foundation Paper 190.

**Owyang, M. T., and T. Sekhposyan, (2012)**, “*Okun’s law over the business cycle: was the great recession all that different?*” Federal Reserve Bank of St. Louis Review 94, no. 5, 399-418.

**Perman, R. And Tavera, C. (2005)**, “*A cross-country analysis of the Okun's Law coefficient convergence in Europe*”, Applied Economics, Volume 37, Issue 21, pages 2501-2513

**Silvapulle, P., Moosa, I. A. and Silvapulle, M.J., (2004)** “*Asymmetry in Okun's Law*”, Canadian Journal of Economics / Reveu canadienne d'Economique, Vol.37, No.2

**Villaverde, J. and Adolfo, M., (2008)** “*The Robustness of Okun's Law in Spain, 1980-2004 Regional Evidence*”, Journal of Policy Modeling 31, pp. 289-297

**Yüceol, H.M., (2006)**, “*Türkiye Ekonomisinde Büyüme ve İşsizlik İlişkisinin Dinamikleri*”, İktisat İşletme Ve Finans, Vol. 21(243), Pages 81-95