Test of Okun’s Law in Some Asian Countries
Co-Integration Approach

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Abstract

The purpose of this paper is to estimate the Okun’s coefficient, and check the validity of Okun’s law in some countries of a Asian region, for this purpose we have used time series annual data during the period 1980 to 2006 and used Engle Granger(1987) co integration technique to find long run relationship between variable and error correction mechanism for short run dynamic. After empirical research It can be said that, Okun’s law interpretation may not be applicable in some Asian developing countries. Our result support noble prize awarded Austrian economist Paul Krugman.

Keywords: Okun’s law, Validity, cointegration
Jel Classification Codes: R11; R15

Introduction:

Okun’s Law is a macroeconomic inverse relationship between cyclical fluctuations in output and the change in unemployment rates, where the value of rate of change varies from country to country and from period to period. It is the feature of supply side in macroeconomics, as output increases in a recovery phase – unemployed workers are hired, as output falls in recession – workers are laid off from their jobs. In our investigation for Okun’s Law coefficient there are some Asian countries i.e. Pakistan, India, China, Sri Lanka and Bangladesh, have been clearly shown the magnitude of Okun’s coefficients are far from being uniform.
“In earlier studies, Okun found that the relationship was about 3 to 1: that is 1 point of unemployment for every 3 points of GDP gap. However, more recent data and more advanced econometrics techniques suggest that the 2 to 1 (or perhaps 2.5) gearing ratio between output and the unemployment rate is more representative for recent periods.” [Samuelson and Nordhaus, 15th Ed.]

LEOPOLD SOEGNER and ALFRED STIASSNY 2002, found that Okun’s law postulates a negative relationship between movements of the unemployment rate and the real gross domestic product (GDP). CHRISTIAN E. WEBER 1996, found that, Okun’s law, which conventionally associated estimates of the output gap to the unemployment rate has been one of the key stylized facts of the business cycle. José Villaverde, Adolfo Maza 2008 argued that, the quantitative values of Okun’s coefficients are quite different, a result that is partially explained by regional disparities in productivity growth. These differences imply that, when it comes to policy issues, conventional aggregate demand/supply management policies should be combined with region-specific policies. Dany Lang and Christian de Peretti 2009 enlightened that, the link between fluctuations in unemployment and growth, the most important past growth shock exerts an influence on the current unemployment rate. Christian Pierdzioch, Jan-Christoph Rulke and Georg Stadtmann, 2009, found that a significant negative relationship between the expected change in unemployment rate and the expected growth rate of real output. Roger Perman, Christophe Tavera 2005, observed that the Okun’s Law coefficient constitutes a key macroeconomic parameter underlying the sensitivity of unemployment variations to fluctuations in economic activity. Ho-Chuan Huanga, and Shu-Chin Lin 2006, examined that an inverse association is detected between cyclical unemployment and cyclical output, confirming the validity of Okun’s law. Another interesting observation is also found that the tradeoff between cyclical output and cyclical unemployment is rather small (large) when the output gap is small (large) in magnitude. NICHOLAS APERGIS and ANTHONY REZITIS 2003, found that Okun’s relationship undergoes a structural change, unemployment becomes less responsive to output changes. More particularly, policy makers must place more emphasis on deregulating certain sectors in the economy, particularly, the labour market. This will lead to higher labour productivity and competition, which in turn, will increase the productivity of the overall economy and decrease unemployment.

HUBERT GABRISCH & HERBERT BUSCHER 2006, suggested that the transition of labour markets can be regarded as completed since unemployment responds to output changes and not to a changing institutional environment that destroys jobs in the state sector. Technological progress leads to job reduction and to weak job creation in industry, which is not linked to systemic transition. The objective of reducing unemployment by more than it has been to date would require an output growth rate significantly higher than the growth rate of productivity. This would necessitate a higher component in aggregate demand growth. ENGELBERT STOCKHAMMER 2004 pointed out that the latter the equilibrium rate of unemployment determines unanticipated inflation in the short run and actual unemployment and output in the long run. The real balance effect plays the pivotal role in the transition from the short run to the long run.

Paramsothy Silvapulle, Imad A. Moosa, Mervyn J. Silvapulle 2004, found the proposition that the output-unemployment relationship as represented by Okun's law is asymmetric. Okun's coefficients are defined based on a dynamic model that allows for asymmetry in the relationship between cyclical output and unemployment.

RICHARD G. SHEEHAN, FRANK ZAHN 1980, supported the hypothesis that changes in labor productivity are the single most important factor influencing the magnitude and variability of the coefficient with direct changes in average weekly hours, induced changes rates following in labor force participation order of importance. Jim Malley, Hassan Molana 2008, demonstrated one of the consequences of labour and product market imperfections is that labor productivity can vary in response to fluctuations in unemployment. As a result, it is feasible to expect an economy to move between a ‘high-effort’ and a ‘low-effort’ state. It follows that the effect of typical demand side macroeconomic policies targeted at reducing unemployment depends on which state prevails, and that such policies are unlikely to yield the expected result when the economy is in a low-effort state. CLIFFORD L.F. ATTFIELD,BRIAN SILVERSTONE 1998, inquired that the Okun coefficient
relating the output gap to the unemployment gap can be relatively easily estimated as the cointegrating co-efficient between the variables.

DONALD G. FREEMAN 2000 explained as a rule of thumb, Okun's law provides policy makers with a rough guide to the employment effects of higher output growth. While Okun's original estimate of a three-point increase in real output for every one-point decrease in unemployment has been reduced to 2.0-2.5. Masanao Aoki and Hiroshi Yoshikawa 2003, found that the GDP responds to changes in demand patterns among the sectors. In addition, a relation between unemployment rates and GDP similar to that of the Okuns' law in its business cycle fluctuations. This Okun's coefficient increases as the average GDP increases. Martin F. J. Prachowny 1991, concluded that the marginal contribution of a 1 point reduction in unemployment is only about 2/3% increase in output. Changes in weekly hours and capacity utilization have independent effects on the output gap in U.S economy. Clifford L. F. Attfield and Brian Silverstone 1997, found strong evidence for a cointegrating relationship between the output and the unemployment gap variables with an estimate of the Okun coefficient close to -2.25 in U.S economy. FARROKH NOURZAD AND YASER ALMAGHRBI 1996, analyzed that when expectations are not incorporated into a model of Okun's Law, the rate of growth of output required to reduce the unemployment rate by one percentage point is underestimated.

Unemployment is a great concern in all over the world. Every year hundreds of thousands students are coming out from college and university. Though it is one of the major responsibilities of the Government to provide job to those young generation but the Government is failed to meet the job demand among the large population. Only a tiny fraction of total jobless is managed by different government offices and private organization but a majority remain unemployed.

Many Asian developing countries are the bright example in the World who is successful to remove the unemployment problem successfully. Korea, Malaysia, Singapore are the newest of them. They are growing rapidly because there is no Political crisis. Government assured the foreign investor about political calm environment. So many American, European and Japanese company are investing in those regions spontaneously. As a result they are developing very fast. Government and political leaders of Asian countries should learn from those Asian countries.

The aim of this paper is to test the Okun’s law validity in Asian countries like China, Pakistan, India, Sri lanka and Bangladesh. Since present study appears to be initial attempt to identify the links between the unemployment gap and output gap in the case of developing economies. We have considered above countries because labor characteristics, political, geographical and natural resource conditions are same of these countries. We have used output gap and unemployment gap data of period 1980-2006. we empirically estimated whether a statistically significant relationship exist between measures of unemployment gap and output gap in long-run as well as in short run and which country is satisfy okun’s law for this purpose we apply unit root, co integration and error correction mechanism for stationary, long run relationship and short run dynamics.

We are working to find the correct natural unemployment rate in developing countries specially Asian region where inflation rate is very high like Pakistan and India which distort the non accelerating inflation rate of unemployment (NAIRU) principle.

Model Specification
There are two standard model specifications of Okun’s law, first is difference model and second is the “gap” model. According to the first-difference model, the relationship between the natural log of observed real output \((y_t)\) and the observed unemployment rate \((u_t)\) is given by the expression

\[
y_t - y_{t-1} = \alpha + \beta (u_t - u_{t-1}) + \epsilon_t
\]

(1)

The second specification is “gap” model, the specification is given by the expression

\[
y_t - y^* = \alpha + \beta (u_t - u^*) + \epsilon_t
\]

(2)
where \( y_t^* \) represents the log of potential output, \( u_t^* \) is the natural rate of unemployment. where \( \alpha \) is the intercept, \( \beta \) (\( \beta < 0 \)) is Okun’s coefficient measuring - how much changes in the unemployment rate bring into being changes in output, and \( \epsilon \) is the disturbance term.

We have chose gap model for further analysis of the okun’s law. In this specification, the left-hand side term represents the output gap, whereas \( (u_t - u_t^*) \) captures the unemployment gap.

In other words, the difference between the observed and potential real GDP captures the cyclical level of output. Likewise, the difference between the observed and natural rate of unemployment represents the cyclical rate of unemployment.

Data Sources, Measurement and Description

Data of unemployment (\( u_t \)) and output, Gross Domestic Product (\( y_t \)) and GDP deflator are directly obtained from the World Bank dataset (WDI).

Nominal GDP is deflated by the GDP deflator, for potential output \( y_t^* \)

We regress \( y_t \) with trend variable and consider fitted value as potential output. In equation no.2 output gap variable is difference between real GDP and potential GDP and unemployment gap \( (u_t - u_t^*) \) is difference between the observed and natural rate of unemployment represents the cyclical rate of unemployment.

Econometrics Methodology

Empirically it has been also shown that the most of the macro variables are non-stationary series with conventional technique of ordinary least square (OLS) give rise the possibility of spurious regression or co movement between variable. Differencing of time serious variable can remove the non stationary in the variable. Other objects the same on the ground that such a process involves loss of potential long run information on the data.

In this context, co integration and Error correction modeling which retains long run information has been suggested. Co integration technique confronts spurious regression and Error correction provides short run dynamics and tries to direct causal relationship.

A series which is stationary are differencing “d” and denoted as I (d). Augmented Dickey Fuller (ADF) test also known as unit root test are used for testing the stationary and non stationary of the series. ADF testing following regression equation.

\[
\Delta Y_t = \alpha + \beta Y_{t-1} + t + \sum \beta_k \Delta Y_{t-k} + \mu_t
\]  

Where \( Y_t \) is time series, \( \Delta \) is first difference operator \( T \) is linear trend \( \alpha \) is constant and \( \mu \) is error term. The null hypothesis of existence of unit root is \( \beta = 0 \). If any variable is found to be non stationary it will be tested for stationary in its first difference form. If each variable is achieved stationary after first difference then bivariate co integration test will be used to know the relationship between variable.

Fully Modified Ordinary Least Square (FMOLS)

When order of integration is decides than for the long run elasticities, utilize the FMOLS method. FMOLS was originally designed first time by [Philips and Hansen, (1990); Pedroni, (1995, 2000); and, Philips and Moon, (1999)] to provide optimal estimates of Co-integration regressions (Bum and Jeon, 2005). This technique employs kernal estimators of the Nuisance parameters that affect the asymptotic distribution of the OLS estimator. In order to achieve asymptotic efficiency, this technique modifies least squares to account for serial correlation effects and test for the endogeneity in the regressors that result from the existence of a Co-integrating Relationships 4. Although this non-parametric approach is an elegant way to deal with nuisance parameters, it may be problematic especially in fairly very
small samples. To apply the FMOLS for estimating long-run parameters, the condition that there exists a Cointegration relation between a set of I(1) variables is satisfied.

In our study we have used Engle Granger (1987) test procedure for co integration. Co integration is used for knowing the number of co integration vector (Kerry Patterson). Engle and Granger (1987) co-integration technique is employed because we have bivariate model for multivariate model we have to use Johnson’s or ARDL co integration techniques.

The steps of the procedure are as under: Note that all the variables are in natural logarithm.

**Step 1:** Pretest each variable to determine its order of integration. Co integration technique requires that the variables should be integrated of the same order. If the variables are integrated of different order, it is possible to conclude that they are not co-integrated. Moreover, if the variables are stationary at level then there is no need to proceed. The Dickey-Fuller, Augmented Dickey-Fuller can be used to infer the number of unit roots (if any) in each of the variables.

**Step 2:** If the results of the first step indicate that the variables are integrated of same order, the next step is to estimate the long run relationship in the form: where left hand site is the output gap and right hand site is unemployment gap and $\mu$ is the white noise disturbance term. If the sequence of residuals from this regression is stationary, the sequences OG and UG are said to be co-integrated of order $(1, 1)$. On the other hand, if these residuals are non-stationary, we conclude that there is no long run relationship or no co integration between output gap and unemployment gap.

If the variable is co integrated there must exist an error correction representation that may take the following form

$$\Delta Outputgap_t = \alpha + \beta_2 \Delta unemp{}gap_t + \beta_3 \mu_{t-1} + \epsilon$$

Where the error correction term are stationary residual form co integration equation. In ECM we checked the $\mu_{t-1}$ coefficient significant it can be negative and positive which shows short run dynamics of the model. Technically, Error Correction Method measure the speed of adjustment back to Co-integrated relationships. The ECM posited to be a force affecting the integrated variables to return their long-run relation when they deviate from the deviation

**Empirical Results**

**Unit root test**

**Table 1:**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>P-Value</th>
<th>Lags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gdp gapP</td>
<td>5.3*</td>
<td>0.00</td>
<td>2</td>
</tr>
<tr>
<td>Gdp gapB</td>
<td>4.4**</td>
<td>0.00</td>
<td>6</td>
</tr>
<tr>
<td>Gdp gapI</td>
<td>3.8*</td>
<td>0.00</td>
<td>2</td>
</tr>
<tr>
<td>Gdp gapS</td>
<td>4.2*</td>
<td>0.01</td>
<td>6</td>
</tr>
<tr>
<td>Gdp gapC</td>
<td>3.3*</td>
<td>0.02</td>
<td>6</td>
</tr>
<tr>
<td>U.E gapP</td>
<td>5.7*</td>
<td>0.00</td>
<td>7</td>
</tr>
<tr>
<td>U.E gapB</td>
<td>2.7**</td>
<td>0.09</td>
<td>6</td>
</tr>
<tr>
<td>U.E gapI</td>
<td>3.8*</td>
<td>0.00</td>
<td>2</td>
</tr>
<tr>
<td>U.E gapS</td>
<td>4.2*</td>
<td>0.01</td>
<td>6</td>
</tr>
<tr>
<td>U.E gapC</td>
<td>3.2*</td>
<td>0.02</td>
<td>6</td>
</tr>
</tbody>
</table>

*show the first difference stationary and ** show second difference stationary

The results in table-1 report the stationary variables on different form. However, the stationary is found in the same differencing level of the variables (output gap and unemployment gap) of same country that fulfill the Engle granger requirement.
Engle and Granger

Table 2:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients(t-value)</th>
<th>P-Value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1(Pak)</td>
<td>5.6**</td>
<td>0.00</td>
<td>Co-integrated</td>
</tr>
<tr>
<td>U2 (Bangla)</td>
<td>3.3*</td>
<td>0.02</td>
<td>Co-integrated</td>
</tr>
<tr>
<td>U3 (India)</td>
<td>3.8*</td>
<td>0.00</td>
<td>Co-integrated</td>
</tr>
<tr>
<td>U4 (Lanka)</td>
<td>7.1*</td>
<td>0.01</td>
<td>Co-integrated</td>
</tr>
<tr>
<td>U5 (China)</td>
<td>6.2**</td>
<td>0.00</td>
<td>Co-integrated</td>
</tr>
</tbody>
</table>

Table 2 summarizes the results of Co-integration analysis between output gap and unemployment gap for considering countries. Engle and Granger result support existence of long run relationship, error term of both equations become stationary at level and first difference as well as, that provides evidence of co-integration. The presence of co-integration vector shows that there exists a long run relationship among the variables to test for Co-integration.

Therefore our annual data (1980-2006) appears to support the proposition that in Pakistan, Bangladesh, India, Sri Lanka and China exist long run relationship among output gap and unemployment gap.

Having found the long-run relationship exists between the output gap and unemployment gap, in this section our goal is to estimate long-run elasticities. We achieve this through by using, Phillips and Hansen (1990) fully modified ordinary least squares (FMOLS)

Fully Modified Least Squares (FMOLS)

Table 3:

<table>
<thead>
<tr>
<th>Countries</th>
<th>Coefficient</th>
<th>T-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakistan</td>
<td>-0.03</td>
<td>2.08</td>
<td>0.02</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>-0.08</td>
<td>3.05</td>
<td>0.06</td>
</tr>
<tr>
<td>India</td>
<td>-0.29</td>
<td>1.95</td>
<td>0.08</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>-0.12</td>
<td>1.66</td>
<td>0.11</td>
</tr>
<tr>
<td>China</td>
<td>-0.56</td>
<td>1.75</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Table 3 shows the results of same order stationary series, results are not satisfy Okun’s law. Srilanka and China results are statistically insignificant t and p value show insignificant results. How over in particular developing countries data problem always exist.

Error Correction Method Result

Table 4:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Std Error</th>
<th>t–Value</th>
<th>Prob- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UT.P(-1)</td>
<td>-0.05</td>
<td>0.056</td>
<td>8.4</td>
<td>0.00</td>
</tr>
<tr>
<td>UT.B(-1)</td>
<td>-0.07</td>
<td>0.03</td>
<td>1.9</td>
<td>0.01</td>
</tr>
<tr>
<td>UT.I(-1)</td>
<td>-0.09</td>
<td>0.12</td>
<td>1.89</td>
<td>0.08</td>
</tr>
<tr>
<td>UT.S(-1)</td>
<td>-0.14</td>
<td>0.09</td>
<td>2.3</td>
<td>0.03</td>
</tr>
<tr>
<td>UT.C(-1)</td>
<td>-0.39</td>
<td>0.03</td>
<td>2.1</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Table 4 reports the result of Error Correction Model formulation of equation above. Short run behavior does not show hopeful picture, which indicates our variables out put gap and unemployment gap of all countries are long run phenomena, shows insignificant results. The estimated lagged error correction terms UT.P(-1) for Pakistan, UT.B(-1) for Bangladesh, UT.C(-1) for china, UT.S(-1) for Srilanka and UT.I(-1) for India are negative and highly significant. This result supporting the
cointegration among the variables represented in table-2. The feedback coefficients UT(-1), which suggests a slow adjustment process, coefficient of UT(-1) show the percentage of the disequilibria of the previous period’s shock adjust back to the long run equilibrium in the current year.

The most interesting results (Table) are as follows: Firstly, Okun’s law is confirmed for 3 out of 3 regions when the first two detrending

**Conclusion**

The importance of Okun’s law lies in its implications for economic policy. Economists need to forecast of further development of unemployment for a given anticipated growth level, which is further development of unemployment for a given expected growth level, which is furthermore important to predict unemployment costs. But our results do not support the implications of Okun’s Law in some developing countries because of asymmetric problems.

It can be said that, Okun’s law interpretation may not be applicable in developing countries. Many Asian developing countries are the bright example in the World who is successful to remove the unemployment problem successfully. Korea, Malaysia, China, Singapore are the newest of them. They are growing rapidly because there is no Political crisis. Government assured the foreign investor about political calm environment. So many American, European and Japanese company are investing in those regions spontaneously. As a result they are developing swiftly. Pakistan, Bangladesh, Sri lankan, and Indian Government and political leader should learn from those Asian countries.

**Literature Review**

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