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Output Gap and its Determinants: Evidence from Pakistan (1964-05)

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This study primarily aims at measuring the output gap for Pakistan's economy. The PF approach is applied for this purpose. The potential output of the economy is estimated by using potential employment and potential TFP. The analysis of the time-series data, 1964-2005, reveals that for many of the years the actual employment and TFP in Pakistan have been higher than their potential levels, but the trend is not reflected in the actual output of the economy which, very often, appears to be falling short of its potential level. In recent years, barring 2004-05, the output has for the most part been less than its potential level, despite higher than potential levels of employment and TFP. The study proceeds to determine the factors responsible for the output gap of Pakistan's economy. The output gap series is generated by using the estimated actual and potential output values. A regression model is formulated to regress the output gap against the macroeconomic variables which are believed to have a significant impact on the economy as a whole. The results show that money supply and imports significantly contribute to the escalation of the output gap, while exports and public sector investment help reduce the gap. Finally, the findings lead to the conclusion that macro management of Pakistan's economy does not appear to ensure the consistency of the interventions.

1. Introduction

The major focus of this study is to pin down the factors responsible for the existence of the output gap in the economy of Pakistan. The output gap is conceptually defined as the difference between the actual and

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potential output of an economy, measured as a percentage of the latter. Potential output is essentially conditional to optimal allocative efficiency of the resources. A negative or positive output gap is indicative of inefficient resource utilization since the optimal outcome must generate a zero or close to zero value of the gap. The output gap measure helps design the interventions to stabilize the economy when it is overheated or it needs a kick in the back.

Although the Classical economists denied the existence of output gap, the phenomenon has continued to be an important part of the post World War II macroeconomic theory which for quite a long time was dominated by Keynes's thought. Since 1980s, the neoliberalist challenge to Keynesian economics and the New Keynesian response to it also include the debate on the existence of output gap and the policies to curb it. The debate has produced a sizeable body of literature recently contributed on the phenomenon. This paper makes an attempt to estimate the output gap for the economy of Pakistan. The analysis is further extended to determine the relationship of the estimated gap with the macro variables contributing to it. The study is structured around three parts. Part I provides a brief of the existing body of theoretical and empirical literature on the output gap. Part II contains the information on the data utilized in this study and also explains the methodology applied for the empirical analysis. Finally, Part III presents the results and discusses the major findings.

2. Part I

The *genesis* of the output gap may be traced back to Ricardo (1817), who discussed the variables that partake in determining economy's natural level of output and employment in the long run. Ricardo's position on the natural output, which may be taken as a proxy for the potential output, appears to be an extension of Say's Law of Markets which is based on the famous dictum that *supply creates its own demand*.[2] Although the Classical economists did appreciate that markets do not always completely clear up and sometimes, for certain duration, the actual output either exceeds or falls short of its potential

[2] The gist of the Say's Law of Markets is that "products are paid for by the products", see Blaug (1962).

or natural level, they considered these fluctuations a temporary phenomenon which only existed in the short run. The Classical economists also suggested that the market, if left to its own devices, will fix the output back to its potential or natural level.

The views of the Classical economists prevailed in the 19th century which alternately experienced the text book peaks and troughs of the business cycles along with the short lived and infrequent bouts of depression. In the 20th century, the technological breakthrough identified with the *Ford Assembly Line* was followed by the breakdown of the world economic system. After 1929, the onset of the Great Depression shook the foundation of the production-driven paradigms of economics and the critics of the self-corrective market mechanism moved to the forefront. Keynes's *recipe* globally championed the post World War II macro management of the countries belonging to the so called *free world* during the first two decades of the cold war. Keynes (1936) turned the argument of the Classical economist on its head by postulating that *in the long run we all are dead*. According to him, the equilibrium level of output does not always reflect an economy's potential and, instead of the supply, it is the effective demand that needs to be *courted*, monitored and controlled. Keynes held that, rather than leaving it to the indifferent market forces, governments should find solutions to the short run problems which may cause irreparable social, if not material, damage.

Keynesian revolution was widely in vogue during 1950s and 1960s, but the stabilization policies recommended by the School lost effectiveness in the 1970s, as the Western world was exposed to oil price shocks. Unfortunately, the Keynesian failed to provide an adequate explanation of the phenomenon of stagflation and the New Classical counterrevolutionaries who opposed intervention in the market were back in the arena.[3] Indeed, the monetarists headed by Milton Friedman had held position against Keynesian economics long before its validity was undermined by the performance of the Western economies in the 1970s. Specifically, the monetarists refused to share Keynesian faith in the effectiveness of fiscal policy to help economy

[3] The most cited of the New Classical counterrevolutionary are Little *et al.* (1970), Bhagwati (1978) and Krueger (1978).

reach the natural level i.e. where actual output is equal to its potential level. The monetarist rather placed their optimism on the effectiveness of monetary policy for ensuring that the size of the nominal output reflects the presence of *sound money* while considering the real side of the economy [Friedman and Schwartz 1971; Friedman 1994]. On the other hand, the challenge posed by the New Classical counterrevolutionaries had already eroded the foundation of the Keynesian revolution. They promoted the viewpoint that only unexpected or unanticipated changes in economic variables affect the economy and, as the individuals are rational, the system should be regulated either by unexpected interventions or by rigid policy rules. In so far as the latter did not imply the use of discretionary fiscal and monetary policies, the New Classical economists of the modern times did not see, like their predecessors, for the government much of a role in the economy [See, Fischer1980]. However, the views held by both the monetarists and the New Classical counterrevolutionaries also failed to pass the time test. In 1982, the world economy slipped into ever worst recession that it had experienced since the dreadful decade of the 1930s. The changed circumstances provided the Keynesian an opportunity to develop a more viable theoretical explanation of the interplay of economic parameters in the contemporary world. The New Keynesian, thus, presented a convincing case for government intervention by synthesizing the apt concepts of both the monetarists and the New Classicals into a pragmatic theoretical framework [Gregory 1991; Gregory and Romer 1991; Julio 1987]. The belief that the inability of the markets to clear continuously causes the existence of a negative or positive output is essentially knitted into the New Keynesian theoretical framework. Finally, according to the New Keynesian economists, systematic fiscal and monetary policies would help stabilize the economy by reducing the output gap, even under the assumption of rational expectations.

The theoretical controversy on the output gap has been followed by the empirical studies of the phenomenon both for the developed and the developing countries. However, the work done so far is not even nearly enough. Most of the studies have focused on the measurement and determinants of the gap. The findings of these studies undoubtedly provide useful insight and guideline to the researchers and the policy makers. For example, a study conducted on Norwegian economy

discovered that in some periods some measurement methods diverge from the others with regard to the degree of fluctuation in the output gap [Bjornland *et al.* 2005).[4] The authors therefore warn against the risk of misjudging the economic situation, if the assessment of pressures in the economy is solely based on developments in the output gap as measured by one method. Musso and Westermann (2005) appear to share the apprehensions of Bjornland *et al.* (2005) from another perspective. They measured the potential output growth of the Euro area countries from 1981-03. Their findings show that the estimates of potential output growth will usually inevitably display some variations characterizing unsustainable developments and, in order to avoid misleading results, these variations must be taken into account. The recommendations of these authors differ from Billmeier (2004) who also applied various alternative methods while estimating the output gap of the Finnish economy.[5] However, the time period in that study varied from method to method depending on the availability of the required data. Although the average values of the output gap vary significantly for different methods, the author is of the view that the most appealing method is the Production Function (PF) approach, as it specifically focuses on the derivation of full capacity labor input and total factor productivity (TFP). Indeed, an earlier study for the Euro area countries applies the PF approach to estimate the potential output of the region [Willman 2002]. The production functions used are Cobb-Douglas Production Function and Constant Elasticity of Substitution (CES) Production Function. The author has reported almost similar output gaps estimated by both of the PFs. The PF approach has also been used to measure the output gap of Cyprus. Interestingly, the potential output growth of Cyprus, from 1985-01, turned out to be higher than that of the fifteen European Union (EU) member countries of that time [Haroutunian *et al.* 2003].

[4] The average value, from 1982-04, of output gap using the Hoderick Prescott (HP) Filter and Band-Pass (BP) Filter is –0.06. By applying Production Function (PF) approach the estimated average output gap is 0.70, while the average values of the gap obtained by using Multivariate Unobserved Component (MVUC) method and Structural Vector Auto Regression (SVAR) method is –0.17 and 0.10 respectively.

[5] The methods applied by Billmeier(2004) include Linear Trend (LT), Quadratic Trend (QT), and Exponential Trend (ET) approaches; HP Filter; Frequency Domain (FD) Filter; Beveridge-Nelson Decomposition (BND); Blanchard-Quah (BQ) approach; and the PF approach.

Nonetheless, the problem of measurement error continues to cause concern for the researchers. The results of a study carried out for the Japanese economy suggest that the country's output gap is considerably larger than a simple Hoderick Prescott (HP) Filter method would generate [Haltmaier 2001]. Similar findings have been made by Cayen and Norden (2004) who investigated the reliability of current estimates of the output gap in Canada. They applied a variety of measures and obtained a broad range of output gap estimates.[6] The authors conclude that measurement errors in Canadian output gap estimates may be more severe than it has been suspected before.

Empirical studies on the output gap have also been conducted for the economies of the Australian Continent. Two of the studies, conducted for the New Zealand's economy, provide important insight into the factors responsible for the existence of output gap [Claus *et al.* 2000; Fox *et al.* 2003]. Though widely different in terms of methodology and suggestions, common focus of both studies happens to be the relationship of the output gap with the general price level. Claus *et al.* (2000) conclude that the output gap provides a link between the real economy and inflation thus remains an important indicator of future inflationary pressures.[7] On the other hand, Fox *et al.* (2003) treat the general price level as an explanatory variable. They conclude that, in some years of their sample period, the deviation of domestic prices from long-run trend was most responsible for the shortfall of the output from its potential level.[8]

The relationship between the output gap and inflation has also been empirically investigated for the Chinese economy [Gerlach and Peng 2006]. The findings suggest that the movements in inflation are at least partially triggered by the movements in aggregate demand as captured by the output gap.[9] A previous study on China by another author

[6] The methods used are LT; QT; HP Filter; BP Filter; MVUC; SVAR; BND; and PF approach.

[7] For estimating potential output they used HP Filter, SVAR approach and MVUC model.

[8] The methods applied included a Modified Diewert-Morrison Decomposition (MDMD) and a new Fisher-index decomposition.

[9] The authors have fitted the Philips curve model for the period 1982-03. The output gap is measured by using MVUC method and the HP Filter.

derived quarterly output gap series from 1978-02 [Scheibe 2003]. The author alternatively applied both univariate and multivariate methods. All methods showed that at the end of 2002, China had entered a period of economic upswing.

Other studies focusing on the output gap in the developing countries have empirically related the output gap with quite different macro variables. A study conducted for Israel, for example, has related the output gap with migration [Scacciavillani and Swagel 1999]. The authors suggest a high growth rate of potential output in periods of heavy migration. Similarly, another study on Israel has determined the relationship of the output gap with the import surplus and the results show a positive relationship between the two phenomena [Menashe and Mealeem 2000].

However, most of the studies for the developing countries economies are mainly limited to determining the output gap by estimating the potential output [DeSerres *et al.* 1995; Bautista 2000; Arora and Bhundia 2003; Filho 2004; Njuguna *et al.* 2005]. Interestingly, the scope of the span of these studies extends to three largest continents of the world, namely; Asia, Africa and South America. The findings by Bautista (2002) include the cross-country comparisons of the output gaps, from 1993-02, estimated for four Asian countries.[10] The work done by Filho (2004) on Brazilian economy merits the credit for having the largest number of observations, 1947-03, amongst all the studies reviewed by the authors of this paper. The Filho recommends a demand-led increase in investment to raise the effective and potential output levels of the country.[11] On the other hand, the analysis by DeSerres *et al* (1995) stands out for utilizing the quarterly data, from 1965-94, of Mexico to estimate the output gap of its economy.[12] Furthermore, the potential output they have calculated generates the

[10] The sample countries are Thailand, the Philippines, Indonesia and Malaysia. The author has used a Generalized Hamilton (GH) model to derive the output gaps.

[11] The methodology of the author appears to be similar to the approach adopted by Bjornland *et al.* (2005) i.e., checking the fluctuations in the potential output by alternatively applying various methods of estimation.

[12] The authors have applied SVAR method for estimation of the potential output.

output gap by taking into account the impact of the world oil shocks on Mexican economy.

Finally, the methodology adopted by Arora and Bhundia (2003) and Njuguna *et al.(*2005) is similar to that of Bjornland *et al.*(2005) and Filho(2004). Arora and Bhundia (2003) have estimated the output gap of the Kenyan economy from 1972-01, while the Njuguna *et al.(*2005) have carried out the work on the post-apartheid South Africa from 1980-01. Both studies have reported significant variations in the sign and size of the average output gap, as estimated by applying different methods.

3. Part II

This study applies the PF approach to estimate the potential output of Pakistan's economy. The process involves the determination of the full employment level of output using the natural rate of unemployment or NAIRU. The analysis is based on time series data, from 1964-05, accessed from different secondary sources provided by national and international agencies.[13] Additionally, the study also utilizes Pakistan's capital stock series generated by Nehru *et al.* (1993), after having converted the data from calendar year to the fiscal year of the country. Since this series is available only up to 1990, the values for subsequent years, 1991-05, are generated by the authors by using Perpetual Inventory Method as given in the following equation:

$$\boldsymbol{K_t = I_t + (1-\delta)K_{t-1}}$$

Where I_t stands for inflation adjusted Gross Fixed Capital Formation (GFCF) in the current year, K_{t-1} is the capital stock in the previous year and δ is the depreciation rate, which in Pakistan's case is 0.05 or 5%.[14]

[13] Because of the unavailability of a single data source for all the variables included in the analysis, the study has utilized three annually published data sources including *Economic Survey of Pakistan* (published by the Government of Pakistan), *Handbook of Statistics on Pakistan's Economy* (published by the State Bank of Pakistan [SBP]) and *International Financial Statistics (IFS)*, Published by the International Monetary Fund (IMF).

[14] The value of depreciation rate is adopted from Hjerppe *et al.* (2005), Norris *et al.* (2002), Forstner *et al.* (2001) and Evenson (1997).

The function given above is, therefore, rewritten as:

$$K_t = I_t + (0.95)K_{t-1}$$

The general form of the PF is:

$$Q_t = f(A, L_t, K_t)$$

Where, Q_t is the GDP, *A* is total factor productivity (TFP), L_t is the employed labor force and K_t is the total capital stock.

The basic form of the Cobb-Douglas production function used in this study is:

$$\mathbf{Q} = \mathbf{A}\mathbf{L}^{\beta}K^{\alpha}$$

Where, α and β, are the shares of capital and labor in total production respectively.

In order to estimate PF, the first assumption applied on the model is that of constant returns to scale, that is:

$$\beta + \alpha = 1 \quad Or$$

$$\beta = 1 - \alpha$$

The PF therefore becomes:

$$\mathbf{Q} = A\mathbf{L}^{1-\alpha}K^{\alpha}$$

After having divided both sides by L, the PF is converted into an input share equation of the following form:

$$\frac{\mathbf{Q}}{\mathbf{L}} = A\frac{L^{1-\alpha}}{L}K^{\alpha}$$

$$\frac{\mathbf{Q}}{\mathbf{L}} = A\left(\frac{K}{L}\right)^{\alpha}$$

Taking natural log on both sides transforms the above function as:

$$\ln\left(\frac{\mathbf{Q}}{\mathbf{L}}\right)_t = \ln A + \alpha \ln\left(\frac{K}{L}\right)_t \qquad \textbf{(1)}$$

Equation (1) is estimated for the value of α, which is the share of capital in total GDP relative to labor.[15]

Next step is calculation of the TFP and this is performed, as given in the following, by using the estimated value of α, and actual values of L, K and Q:

$$\ln A_t = \ln\left(\frac{Q}{L}\right)_t - \alpha \ln\left(\frac{K}{L}\right)_t$$

$$\ln A_t = \ln Q_t - \ln L_t - \alpha\left(\ln K_t - \ln L_t\right)$$

$$\ln A_t = \ln Q_t - \ln L_t + \alpha \ln L_t - \alpha \ln K_t$$

$$\ln A_t = \ln Q_t - (1-\alpha)\ln L_t - \alpha \ln K_t \qquad \textbf{(2)}$$

For estimating the potential level of TFP (tfp^*) and NAIRU, the trend values of the two series are derived by using the HP Filter,[16] symbolically:

[15] The function is estimated after having checked the entire data set for stationarity. The Augmented Dickey-Fuller (ADF) Test is performed on both the original and first differenced values of the variables on both sides of the equation. The results of the ADF test are reported in Appendix, Table A1.

[16] The HP Filter derives trend values for the variables by minimizing weighted average of the gap between actual values and trend values and the rate of change in trend values [see, Njuguna *et al.* 2005; Haroutunian *et al.* 2003].

$$\min \frac{1}{T}\sum_{t=1}^{T}\left(\ln Y_t - \ln Y_t^*\right) + \frac{\lambda}{T}\sum_{t=2}^{T-1}\left[\left(\ln Y_{t+1}^* - \ln Y_t^*\right) - \left(\ln Y_t^* - \ln Y_{t-1}^*\right)\right]^2$$

Where, T is the number of observations and λ is the factor determining the smoothness of trend and penalizing shocks. For annual data, it is generally 100 [Scheibe 2003; Filho 2004]. Y is the actual variable and Y* is the trend value.

Potential employment is derived by using the following formulation:

$$PE_t = (1 - U_t^*)lbf_t \qquad (3)$$

Where, PE_t is potential employment, U_t^* is the NAIRU and lbf_t is the total labor force.

This is followed by the estimation of the potential Gross Domestic Product (GDP) by using the following formulation:[17]

$$PGDP_t = tfp_t^* \times (PE_t)^{\beta} \times (K_t)^{\alpha} \qquad (4)$$

Where, $PGDP_t$ is the potential GDP, TFP_t^* is potential total factor productivity, K_t is total capital stock and PE_t is the potential employment.

Finally, the output gap is determined for the economy of Pakistan by using the following formula:

[17]The underlying assumption of this formulation is that potential capital stock is the same as the actual capital stock.

$$OG_t = \frac{Q_t - PGDP_t}{PGDP_t} \times 100 \qquad (5)$$

The last step in methodology is the determination of the relationship of output gap with theoretically relevant macro variables. Following specific form model is estimated for this purpose: [18]

$$OG_t = \alpha + \beta_1 PI_t + \beta_2 EE_t + \beta_3 IE_t + \beta_4 HE_t + \beta_5 MS_t + \mu_t \qquad (6)$$

Where,

$PubG_t$= public sector investment

$ExpG_t$= export earnings

$ImpG_t$= import expenditure

$HERG_t$= higher secondary enrollment

MSG_t= money supply

μ_t= stochastic error term

4. Part III

Computer package E-View 5 is used for all estimations reported in this study. The estimated values of the PF equation are given below in Table 1.

[18] The value of each explanatory variable is taken in terms of its growth rate.

Table: 1 Estimated Cobb-Douglas Production Function
Pakistan: 1964-05

Dependent variable = $\ln\left(\frac{Q}{L}\right)_t$		No. of observations = 41
Variable	**Coefficient**	**t-Statistics**
Constant	0.0111**	2.2403
$\ln\left(\frac{K}{L}\right)_t$	0.5444***	3.7038
R^2=0.395	***Adjusted*** R^2=0.379	***D.W.***= 1.756

**Significant at 5%, ***Significant at 1%.

The estimated coefficient for the share of capital listed in Table 1 appears to suggest that, relative to the share of labor, share of capital in the total output of Pakistan is higher. Although the finding conforms to previously reported results on the subject, [Senhadji 2000; Naqvi 2003; Sabir and Ahmed 2003], it is questionable for a labor abundant developing country like Pakistan. It may, however, be argued that the relative size of the estimated coefficients reflects definitional problems in that a large number of producers in Pakistan are self-employed in petty businesses. The petty self-employment very often distorts the determination of the relative share of capital and labor in the output, especially, if the functional distribution of output fails to adjust the opportunity cost of production of the resources contributed by the self-employed person. The opportunity cost of production must take into account the return on the personal labor of the self-employed producers, which is very often calculated as profit, thus erroneously inflating the relative share of capital in the output. This aspect, though beyond the scope of present study, is very important for a labor abundant country like Pakistan, hence merits researchers' attention.

After obtaining the values of α and β, Equation (2) is used for calculating the TFP. The values thus obtained are reported in the Appendix by plotting Figure A1 which compares the TFP growth rate

of the economy of Pakistan with the growth rate of her GDP. A high degree of consistency observed in the relative movement of the two variables helps endorse the validity of the method applied for calculating the TFP. Furthermore, the observed increasing trend of TFP for the recent years also conforms to the findings of Khan (2006).

As mentioned earlier in Part II, the HP Filter is used for estimating the potential level of TFP and NAIRU. Trend values of the two series are derived. These trend values are also considered potential values since they, in the absence of shocks and instability, represent the steady state of TFP and unemployment.

Trend values of NAIRU helped calculate the potential employment in Pakistan by numerically solving Equation (3). Once the values on both potential TFP and potential employment were available, the numerical solution of Equation (4) became possible, thus providing the estimates of potential output for the economy of Pakistan. Finally, the formula given by Equation (5) was applied to determine the output gap of the country. The average annual output gap turned out to be –0.0128. The average figure appears to suggest close proximity of the actual and the potential output, hence not warranting a corrective policy intervention. However, a close look at Figure 1, which graphically depicts the yearly output gap from 1964-05, tells quite another story. It is observed that 24 of the 42 observations, lying both in the positive and negative zones, register the output gap higher than one percent. Two highest values of the series, both positive, are observed for 1969-70 and 2004-05, 4.13% and 4.16% respectively. On the other hand, the closest comparable proximity of the negative output gap is observed for the year 1976-77, -3.17%.

Output gap, as depicted in Figure 1, appears to be a persistent phenomenon in the economy of Pakistan; hence it merits to be probed further in terms of its determinants. This is accomplished by estimating Equation (6) which regresses the fiscal policy, external trade, monetary policy and education on the output gap of Pakistan. The fiscal policy is represented by the public sector investment, $PI_{t.}$ In developing countries context, latter happens to be one of the most strategic macro variables in terms of its impact on aggravation or

diminution of the output gap. It is basically the part of government revenue spent on infrastructure development and other critically required investment ventures where private investors are either hesitant or fail to deliver the social optimum of the physical capital. The impact of human capital is also estimated in the model by including higher secondary enrollment as one of the explanatory variables of the formulation. Export earnings and import expenditure are used as proxies to capture the impact of external sector on the output gap. Theoretically, exports are expected to control and reduce the negative output gap, while an increase in imports may widen it. Finally, money supply is included as a regressor to test the monetarist view regarding the role monetary policy plays in the economy. Theoretically, money supply also aggravates or reduces the output gap by failing or succeeding respectively to provide the sound money in the economy.[19] The results are reported in Table 2.

Barring higher secondary enrollment, $HE_{t,}$ all variables turn out to be significant in the estimated Equation (6). The significant variables happen to carry theoretically expected signs, though the size of each coefficient is quite small which is consistent with the small size of the average annual output gap in Pakistan. The sign of the estimated coefficient of public investment, PI_t, is negative and significant at one percent level, showing that each one percent increase in public investment reduces the output gap by 0.0033 percent. This appears to support the findings by Naqvi (2003) who compared the productivity of public and private capital in Pakistan. His results show that public capital is more productive than the private capital since an exogenous shock to the latter takes almost twice as long to subside as an equivalent shock to the former. The lower vulnerability and higher reliability of the public sector investment makes it a favorable stimulus for output, thus helps reduce the output gap[20].

[19] For this purpose data on current monetary aggregate (M2) is accessed. The M2 is composed of currency in circulation, other deposits with SBP, demand deposits, time deposits and Resident Foreign Currency Deposits of the scheduled banks[see, Khan and Hussain 2005]

[20] Findings by Naqvi (2003) appear to negate the significance of the *crowding out* hypothesis advanced by the Classical economists. The hypothesis happens to be in vogue in the contemporary world ruled by the neoliberlaist views.

Figure 1

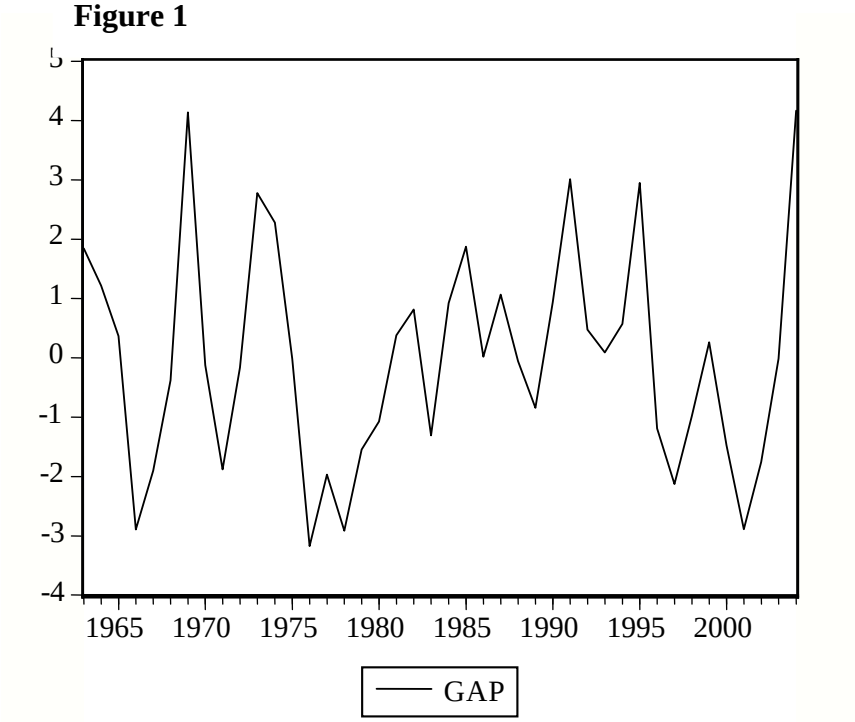

Table: 2 Determinants of Output Gap in Pakistan

(1964-05)

Dependent Variable = OG_t, No. of observations = 41

Variable	Coefficient	t-Statistics
Constant	-0.6515	-1.4057
PI_t	-0.0033***	-10.4475
EE_t	-0.0287*	-1.901
IE_t	0.0533***	2.5995
HE_t	0.0889	1.4244
MS_t	0.0026***	8.7177
R^2=0.32	Adjusted R^2=0.22	D.W.=1.89

*Significant at 10%, **Significant at 5%, ***Significant at 1%.

The variable for growth in export earnings, EE_t, also carries a negative sign in estimated Equation (6). The size of its coefficient is, however,

larger than that of the public investment, PI_t, suggesting that a one percent increase in export earning reduces the output gap by about 0.03 percent. This result is significant at ten percent level. The estimated coefficient of the variable for import expenditure, IE_t, is the largest of all significant variables. It carries a positive sign with a significance level of one percent, showing that a one percent increase in imports of Pakistan increases the output gap of the country by 0.053 percent. Keeping in view the size of the coefficient of EE_t, this is an alarming result since Pakistan is increasingly liberalizing its external sector, largely under the pressure of international financial institutions and other donor agencies. Finally, the results suggest that the monetary policy in Pakistan has failed to provide the sound money to the economy, as the variable for growth of money supply, MS_t, is also significant at one percent level and its positive sign indicates that every one percent increase in money supply is responsible for increasing the output gap by about 0.003 percent.

The results reported in Table 2 do not provide the evidence of a strong relationship of the dependent variable with the right hand side variables. The size of the adjusted R^2 is 0.22, much less than the acceptable level of the goodness of fit, showing that only 22% of the variations in the output gap of Pakistan is explained by the explanatory variables discussed above. That said, the estimated fit must be considered while keeping in perspective that, given the complexity of the phenomenon, it is not possible to conceptualize and/or operationally define all the variables responsible for the existence of the output gap. Finally, estimated Equation (6) has been checked for all specifications. The results reported in Table 2 appear to be highly reliable, as no evidence of misspecification was found in the estimated model.

5. Conclusion

Though theoretically controversial, output gap is one of the most critical macro indicators widely applied to depict the state of an economy. Hardly any school of thought denies the undesirability of the output gap, may it be positive or negative. In so far as it provides the information regarding the economy's position on the business cycle, the estimation of output gap greatly helps improve macro management of a country.

The findings reported in this study show that the actual output growth in Pakistan frequently and inconsistently deviates from the estimates of the potential output growth of her economy. Unfortunately, those responsible for macro management of the country appear to have been engineering the policy prescriptions which very often happen to be tinkering disguised as fine tuning. This is most evident by the relative sizes and signs of the coefficients of the variables for exports and imports. The positive coefficient of the latter happens to be almost double of the negative coefficient of the former. The finding suggests that liberalists' solution of trusting auto-corrective mechanism of the market should not be relied upon in Pakistan's case: The counterweight of the aggravation in output gap caused by increase in import expenditures happens to be almost twice as much as the diminution of the gap resulting from an increase in export earnings. On the other hand, the statistically significant observed role of public investment in Pakistan merits the mirth promised by the Keynesian economists. That said, the performance of public investment in Pakistan must be weighed against the fact that public savings of the country happen to be negative since the early 1970s, and the entire capital budget is financed by borrowing both internally and externally. Resultantly, the size of debt services appears to be increasingly becoming unsustainable: Although some further moratorium was recently granted to Pakistan on her external liabilities, the debt services account for about a quarter of the current expenditure of the national budget. Finally, the study also lends support to the monetarists' views and those responsible for providing the sound money to the economy of Pakistan must ensure the consistency of the respective interventions, especially in the contemporary milieu where the financial liberalization happens to be in vogue.

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APPENDIX

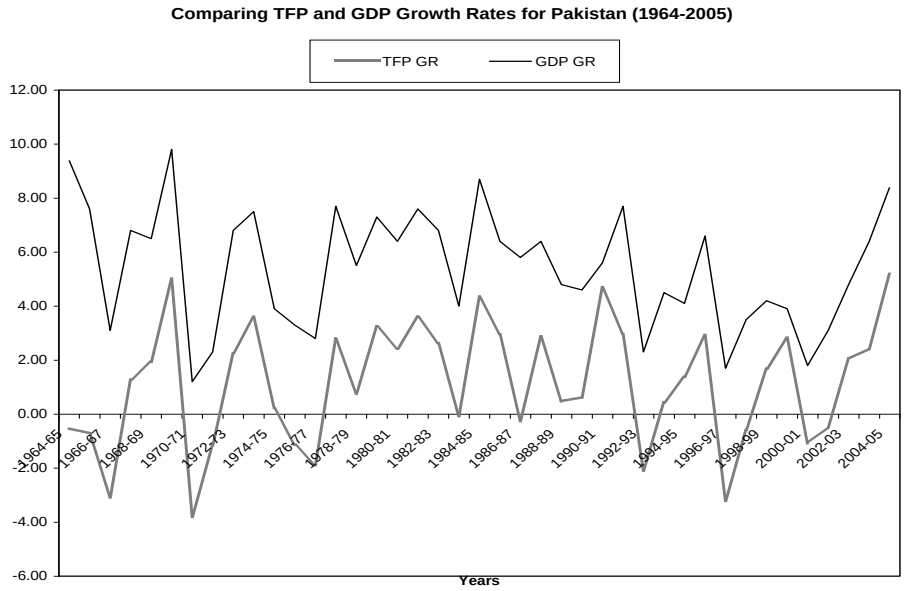
Table A1(a) **Cobb-Douglas Production Function: ADF Statistics**

Variable	***At Level***	***At first difference***
$\ln\left(\frac{Q}{L}\right)_t$	-1.749653	-5.602562
$\ln\left(\frac{K}{L}\right)_t$	-5.795212	-4.383954
Critical values	1% level	-3.605593
	5% level	-2.936942
	10% level	-2.606857

Table A1(b) **Determinants of Output Gap: ADF Statistics**

Variable	**Test Statistic**	**Critical Value (5%)**
OG_t	-5.003071	-2.936942
EE_t	-7.773356	-2.935001
IE_t	-6.374959	-2.935001
PI_t	-7.082277	-2.935001
HE_t	-5.369094	-2.935001
MS_t	-6.995194	-2.936942

Figure A 1


Comparing TFP and GDP Growth Rates for Pakistan (1964-2005)
TFP GR
GDP GR
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
-6.00
1964-65
1966-67
1968-69
1970-71
1972-73
1974-75
1976-77
1978-79
1980-81
1982-83
1984-85
1986-87
1988-89
1990-91
1992-93
1994-95
1996-97
1998-99
2000-01
2002-03
2004-05
Years