Potential Output and Output Gap in Nepal

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Abstract

The potential output and output gap are key variables in identifying the scope for sustainable non-inflationary growth and assessment of the stance of macroeconomic policies. This paper estimates potential output and the output gap in Nepal by different methodologies. The different methodologies produce similar results followed by analysis and observations. The results show that the output gaps were within relatively narrower band since 1990s. The results also reveal some sign of overheating in recent years. The results from production function approach indicate that total factor productivity is declining continuously in the last decade limiting the scope for demand management policies to attain high and sustainable economic growth.

I. INTRODUCTION

Nation's potential output is the level of output which could be attained by the full employment of available resources. It, therefore, reflects the productive capacity of the economy. Supply side factors- capital stock, labour force and technology determine the level of potential output of an economy. Transitory movements in output caused by policy shocks do not count for potential output. 'It represents the steady-state level of output associated with the long-run aggregate supply curve-the level to which gross domestic product (GDP) reverts as the transitory effects of macroeconomic disturbances dissipate' (Kuttner, 1994). Since, real gross domestic product (GDP) is generally used as a conventional measure of a nation's output, potential real GDP stands as a natural candidate for measuring potential output. The deviation of the actual output from potential output is the output gap. Output gap are generally measured as the deviation of actual output from potential output relative to potential output.

Since potential output represents the maximum production without inflationary pressure, it is a natural target for macroeconomic policy. The level of actual output relative to the potential output determines whether economic policy should be directed toward raising aggregate demand or whether structural issues should be given more prominence (Cerra and Saxena, 2000). Potential output and output gap provide a framework for assessing the policy stance. If the economy is operating below the potential level there could be the scope for monetary policy to stimulate non-inflationary economic growth. If the economy is operating above the potential level there could be demand-pull inflationary pressure. In

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countries where inflation targeting framework is used, the output gap is the most important determinant of how loose or tight the monetary policy should be in order for the inflation target to be obtained at maximum growth. Though an inflation-targeting framework is not used in Nepal, price stability is one of the main responsibilities of the Nepal Rastra Bank (NRB) as per the NRB Act 2002[1]. Therefore, identification of output gap is believed to be helpful to discharge central bank's responsibilities. Similarly, output gap estimates also provide a framework for assessing the fiscal stance. An expansionary fiscal policy is desirable when output is below its potential level while contractionary fiscal policy is desirable when the economy is operating above its potential level. Therefore, reasonably accurate potential output and output gap estimates are necessary to conduct prudent monetary and fiscal policies. On the contrary, if an economy's growth performance is slow but is operating quite closer to its theoretical potential, issues of structural reform assume central importance.

Nepalese economy witnessed moderate growth performance during the last three decades. The emphasis on state's role and inward looking strategies, which were the core to the development strategies before mid-1980s, shifted towards a more liberal and outward oriented strategies from mid-1980s. The process got momentum after the political regime shift to multiparty democracy in early 1990s (Khatiwada and Sharma, 2002). These reform and liberalization measures boosted industrial activities, trade, domestic as well as foreign investment and helped to manage the then macroeconomic instability and push the economy from slow growth path of 1970s to a moderate growth path. The improvement in the growth performance, however, could not contribute much towards the reduction in state's mass poverty and narrow down the gap between haves and haves not (Khatiwada and Sharma, 2002). The nation encountered a long internal conflict and the use of the nation's scarce resources diverted towards security arrangements and public expenditure on development activities plunged sharply[2]. On the other hand, domestic private investment as well as foreign direct investment also affected, in the absence of conducive investment climate. These developments believed to have serious implications for the growth performance and potential output of the economy in the later years.

Reliable estimate of potential output and output gap are crucial to identify productive capacity of the economy and thereby help economic policy formulation. However, potential output is an unobserved variable. Because of this very nature, economists apply different methods to estimate potential output and come up with different estimates of output gap. This paper attempts to estimate potential output and output gap for Nepal applying two conventional approaches: Hodrick-Prescott (HP) filter and production function approach. The remainder of this paper is organized as follows. Section 2 presents an overview economic growth and income structure of Nepal. Section 3 presents conceptual discussion of potential output and output gap. Section 4 discusses the estimation methodology and data used in this paper. Section 5 presents estimates of potential output and output gap, and discusses the results. It also presents alternative

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1 Nepal has been following fixed exchange rate regime that is considered to be incompatible with inflation targeting framework.

2 The ratio of public sector gross fixed capital formation to GDP was 7.4 percent in the 1990s which declined to 3.3 percent in the period of 2001-2009 on the average.

medium term scenarios of growth of potential output. Section 6 concludes with discussions on the policy implications of the output gap estimates.

II. AN OVERVIEW OF NEPAL'S ECONOMIC GROWTH AND INCOME STRUCTURE

Nepal is traditionally considered an agricultural economy in terms of its significant contribution to income and employment. Though the contribution of this sector is gradually declining over the years, it still accounts for about one third of total GDP. Likewise, it offers employment to 73 percent of the total economically active population of Nepal (CBS, 2008).

Dominated by agriculture sector, the growth performance of the economy was quite slow in 1970s. In the first half of the 1970s, the annual average growth rate remained at 1.8 percent as the international oil shock dampened economic activities and fuelled inflation. In the second half of the 1970s, the annual GDP growth rate remained at 2.4 per cent on average (Khatiwada and Sharma, 2002). This means that the economy had grown at an average annual rate of about 2 percent in the 1970s. The 1980s witnessed an improvement in economic growth. The real GDP grew at an average annual rate of 5.25 percent during this decade due to impressive performance of the agricultural sector.

Fig. 1

Annual Average Growth of Real GDP

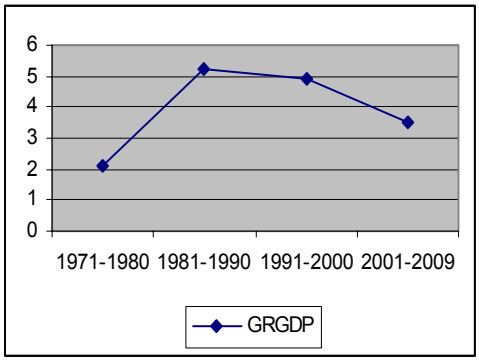
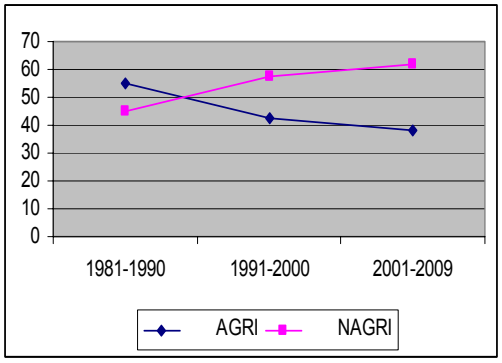


Fig. 2

Relative Share in GDP



Nepal further accelerated economic liberalization and reform processes in the first half of 1990s. They include deregulation of trade, industry, finance and foreign exchange regime; streamlining of administrated price and subsidies; privatization of public enterprises, and rationalization of tax and tariff structure. These liberalization and reform measures helped to promote private sector investment. Consequently, impressive growth in non-agriculture sector helped to maintain overall economic growth to about 5 percent in the face of sluggish performance of agriculture sector. Policy shift from import substitution to outward looking strategy and other liberalization measures led to surge in external trade. The trade (merchandise plus service)/GDP ratio, which was about 34 percent in 1980s, surged to about 57 percent in 1990s.

Social conflicts, political instability emerged in mid-1990s and accelerated in later years, however, distorted investment climate by the beginning of the 21st century. In addition, the increased imbalance between power (electricity) supply and demand in the recent

years not only added additional complication to the industrial and business activities but also badly hurt daily household activities. As a consequence, gross fixed capital formation shrinked to about 20 percent of GDP in the last nine years on average from 22 percent of the previous decade. Export/GDP ratio contracted by about 8 percentage point to 15.6 percent from 23.5 percent in the previous decade. Slowdown in the industrial sector pushed the economic growth down to 3.5 percent in the period of 2001-2009. On the contrary, trade gap intensified and crossed 15 percent of GDP on account of weak export and high import to meet the increased consumption backed by escalated inflows of workers' remittances. The substantial inflows of remittances during the last decade not only supported external sector stability by financing widening trade gap but also helped to pull out many families from the state of absolute poverty.

Fig. 3

Trend in Capital Formation (% of GDP)

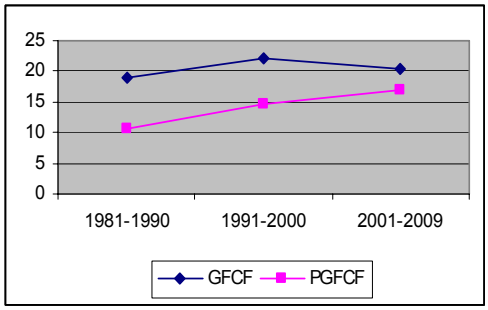
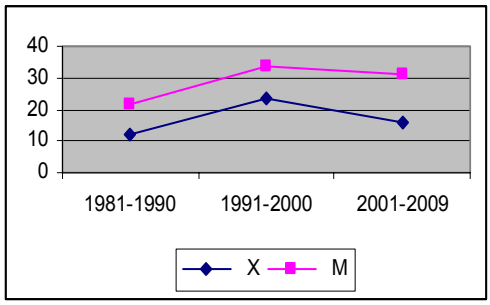


Fig. 4

Trend in Exports and Imports (% of GDP)



Such a transfer income, however, can not support the economic stability for a long time in the absence of sustainable economic growth. To ensure that Nepal maintains a high and sustainable growth path and sets the foundation for achieving double digit growth, it is essential that monetary and fiscal policy be given accurate information regarding the state of the economy in relation to its theoretical potential. The next section discusses potential output and output gap.

III. Conceptual Discussion on Potential Output and Output Gap

Potential output is the level of output which can be produced with the full employment of economy's available resources[3]. This means that, it is the level of output consistent with the productive capacity of the economy. Productive capacity of an economy depends on the capital accumulation, human resource and level of technology. If an economy's investment exceeds the amount of depreciation, it adds to the productive capacity of the economy leading to expansion in potential output. Likewise, an increase in the quality and quantity of workforce (human resource) widens the productive capacity. Advancement in technology and good governance and other multifold factors help to improve total factor productivity leading to increase in potential output.

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3 Full employment does not necessarily mean no unemployment. Economists prefer to define a certain rate of unemployment as natural rate of unemployment to be consistent with full employment.

The output gap is defined as deviations of actual output from potential output[4]. A negative output gap indicates that the economy is operating below its potential level. It indicates the scope for demand management policies to improve economic growth without inflationary pressure. On the contrary, the positive output gap put limitation for demand management policy to increase growth without inflationary pressure. This signifies the importance of measurement of potential output and output gap.

Measurement of potential output is a difficult task because it is an unobserved variable and no one knows the exact level of potential output at least in real time. The very nature of the potential output offers a wide space to the economists for vigorous but never ending exercise to come up with best methodology and estimate of output gap. The exercise has enriched literature on potential output and output gap. Accordingly, there are several ways of estimating the output gap. They can be classified into two broad methods: statistical detrending method and estimation of structural relationships. The statistical detrending methods, such as linear trend method, HP filter and unobserved component methods, attempt to separate a time series into permanent and cyclical components. They provide a straightforward measure of potential output. The methods that estimate structural relationships, such as production function approach and structural VAR use economic theory to isolate the effects of structural and cyclical influences on output while estimating output gap (Cerra and Saxena, 2000).

Linear Trend Method

The linear trend method is the simplest method to estimate potential output and output gap. It assumes that observed output may be decomposed into a cyclical component and linear function of time. The later component is the so called potential output which can be estimated by using following linear equation:

$$Y_t^* = \alpha + \beta\tau \tag{1}$$

where Y* is potential output, α is the intercept, β is the coefficient for the trend of potential output and τ is a time trend.

Linear trend method is a simple statistical procedure and does not rely on economic theory. The main assumption of this method that potential output grows at a constant rate is not practical in real life. The estimates of the output gap subject to end sample bias, which undermines the credibility of the estimates obtained from this method (Gounder and Morling, 2000).

Hodrick-Prescott (HP) Filter Approach

The Hodrick-Prescott (HP) filter is a simple smoothing procedure that has become increasingly popular because of its flexibility in tracking the characteristics of the fluctuations in trend output. For example, smaller value of the restriction parameter (λ), which captures the importance of cyclical shocks to output relative to trend output

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4 The output gap is defined as actual output minus potential output relative to potential output, (y-y*)/y*, in percent.

shocks, indicates a lower importance of cyclical shocks and yields more volatile series of potential output and thereby output gap (Cerra and Saxena 2000).

The HP filter estimates potential output by minimizing a combination of the gap between actual output an trend output and the rate of change in trend output for the whole sample of observations;

$$Min\sum_{t=0}^{T}(Y_t - Y_t^*)^2 + \lambda\sum_{t=2}^{T-1}[(Y_{t+1}^* - Y_t^*) - (Y_t^* - Y_{t-1}^*)]^2 \quad (2)$$

where Y* is potential output, Y is actual output and λ is the restriction parameter that determines the degree of smoothness of the trend (Cerra and Saxena 2000). Typically the value of λ is set at 1600 for quarterly data and 100 for annual data. This choice comes from the business cycle work of Burns and Mitchell (1944), who found that the length of business cycles in the United States varied between two and eight years (Gounder and Morling, 2000).

The advantage of the HP filter is that it renders the output gap over a wide range of smoothing values and it allows the trend to change over time. The HP filter has several shortcomings, including the arbitrary choices of the business cycle frequency and the smoothing parameter λ, the neglect of structural breaks and regime shifts and the inadequate treatment of nonstationary dynamics (Scacciavillani and Swagel, 1999).

Unobserved Components Approaches

The unobserved components approach estimates unobserved variables such as potential output using information from observed variables. This approach has the advantage of specifying explicit relationships between output, unemployment and inflation. The relationships are first written in state space form such that the observed variables are specified as a function of the unobserved state variables in the measurement equation and a separate transition equation specifies the autoregressive process for the state variables. Then the unobserved state vector can be estimated using the Kalman filter. It uses guesses for the unobserved variables to create predictions for the observed variables and then updates the guesses based on the prediction errors. The approach has the disadvantage of requiring considerable programming. In addition, the results are often sensitive to the initial guesses for the parameters (Cerra and Saxena 2000).

Production Function Approach

Another conventional method used to estimate potential output and output gap is the production function approach. Production function approach models potential output as a function of potential labor and capital inputs, as well as of potential total factor productivity (TFP). Cobb-Douglas production function characterized by constant returns is widely used to represent the technology.

$$Y_t^* = A_t^* L_t^{*\alpha} K_t^{*(1-\alpha)} \quad (3)$$

Where, Y* is potential output, L* and K* refer to potential (or full-employment) labor and capital inputs respectively, A* is potential TFP, and α is the elasticity of output with respect to labour or share of labour in output.

The production function approach of estimating output gap has certain advantages over other approaches. First, it relates inputs to outputs, a quite intuitive and accepted fact by economists. If investment increases, the economy's productive capacity will also increase. The same thing happens if there is an increase in the amount of labour. Second, TFP estimates are obtained during the estimation of potential output which is important indicator of aggregate economic efficiency and one of the central determinants of economic growth. Third, the production function method is quite flexible, because it can deal with different assumption about technology and can incorporate some advances of the new growth theory, such as changes in the quality of inputs, such as human capital (Filho, 2000). Additionally, the production function method allows enough flexibility so that policymakers can exercise their judgment about how the key variables will evolve and, therefore, affect growth. However, the estimation of potential output involves a lot of uncertainty in this approach as well.

Structural VAR Approach

This method stems from the traditional Keynesian and neoclassical synthesis, which identifies potential output with the aggregate supply capacity of the economy and cyclical fluctuation with changes in aggregate demand. Based on the vector autoregression (VAR) for output and unemployment, structural supply and demand disturbances are identified by assuming that the former have a permanent impact on output while the later can have only temporary effects (Cerra and Saxena, 2000).

Compared with other multivariate detrending techniques, this method relies on clear theoretical foundations and does not impose undue restrictions on the short-run dynamics of the permanent component of output. In addition, the output gap estimates are not subject to any end-sample biases. One obvious drawback of this approach lies in the identification of shocks because a supply shock may increase demand and a demand shock may produce long run supply side effects (Cerra and Saxena, 2000).

Comparative Review of Approaches

Measurement of potential output is a difficult task because it is an unobserved variable. Economists have continued vigorous but never ending exercise to estimate accurate output gap. Accordingly, there are several ways of estimating the output gap. However, yet no one probably knows which estimate is the correct one, especially in real time. Hence, different technique or model that comes with a different output gap profile should be regarded as one estimate.

The linear trend method is simplest to calculate but it is quite simple statistical detrending without any theoretical foundation. It assumes that potential output grows at constant rate which is not realistic. It also suffers from high end-sample bias. Unobserved components approach requires considerable programming and the results are often sensitive to the initial guesses for the parameters (Cerra and Saxena, 2000). Compared with other multivariate detrending techniques, the structural VAR method relies on clear theoretical

foundations and does not impose undue restrictions on the short-run dynamics of the permanent component of output. In addition, the output gap estimates are not subject to any end-sample biases. However, the main problem with this method is the identification of shocks and the failure to do so may produce misguiding results (Cerra and Saxena, 2000).

The HP filter is the most commonly used statistical method because of its simplicity in estimation and the flexibility in tracking the fluctuations of trend output (Cerra and Saxena, 2000). Another conventional approach, the production function approach, has clear advantages over other approaches. It relates inputs to outputs on pure theoretical ground; provides with the estimates of TFP: indicator of aggregate economic efficiency and a central determinants of economic growth; and allows for dealing with different assumption about technology. Moreover, it allows enough flexibility so that policymakers can exercise their judgment about how the key variables will evolve and, therefore, affect growth.

IV. ESTIMATION METHODOLOGY AND DATA

This paper uses these two widely used methods: statistical detrending method represented by Hodrick-Prescott filter and production function approach to estimate potential output and output gap in Nepal. The HP filter estimates potential output by minimizing the sum, over the sample period, of squared distances between actual and potential output at each point in time, subject to a restriction on the variation of potential output. Potential output and the output gaps are estimated by applying the HP filter represented by equation (2) to the annual real GDP series for 1975/76–2008/09[5]. The restriction parameter λ is set at 100, as suggested in the literature for annual time series.

Another conventional method used to estimate potential output and output gap in this paper is the production function approach. This approach provides estimates based on theoretical foundation and information crucial for policy purposes such as TFP, labour share and potential level of factor inputs. Following Konuki (2008), the input-output relationship represented by Cobb-Douglas production function specified in equation (3) of the preceding section is used to estimate potential output and output gaps. Estimating potential output from this method requires identifying full-employment capital and labor input levels, potential TFP, and the labor share.

The data set used for the estimation of potential output are taken from various issues of Economic Survey, Ministry of Finance, Government of Nepal (GON), Population Census, Central Bereau of Statistics (CBS), GON, and Nepal Labour Force Survey, CBS, GON. Consistent data on real GDP are available on annual basis only after 1975/76. Therefore, the data span of the study covers a period of 34 years from Fiscal Year 1975/76 to 2008/09. The time series data on capital stock that are required for applying the production function approach are not readily available. This is the case of most of the developing countries. Following, the empirical literature, a perpetual inventory method was applied to derive required data on capital stock by using data on gross fixed capital formation. Likewise, time series data on labour force employment are also not available.

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5 Nepali fiscal year begins from 16th July and ends 15th July of the following year.

The Population census conducted every ten year provide data on economically active population only on the ten years interval. Such data available on interval basis were interpolated to come up with annual series. It is also supplemented by data on recent Nepal Labour Force Survey by CBS.

V. ESTIMATION RESULTS AND DISCUSSIONS

Potential Output and Output Gap from H-P Filter

Output gaps using potential output estimated by the HP filter indicate that the Nepalese economy was operating above its potential level reflecting positive output gap before 1979. The positive output gap gradually narrow down in the subsequent years and turned negative by 1979. The negative output gap substantially crosses the one standard deviation band in 1980 as reflected in the large downward swing. Though, the output gap narrowed sharply in the following two years, the negative gap expanded remarkably in 1983 again crossing the one standard deviation band. The negative output gap again crossed the one standard deviation band in 1987. The results indicate that in the decade of 1980s (1981-1990), the actual output fell below the potential level by more than one percentage point in 1983 and 1987. However, the actual output exceeded one percent of potential only in 1985. The output gaps were within the one standard deviation band in the 1990s (1991-2000). However, output gap crossed one percent in 1993, 1994 and 2000. The former year had negative output gap while the later two years characterized by positive output gap. In the period of 2001-2009, there were only four years with less than one percent deviation in actual output from the potential output. However, the gap crossed one stand deviation band only in 2001 in this period.

Fig. 5

Potential Output from HP Filter

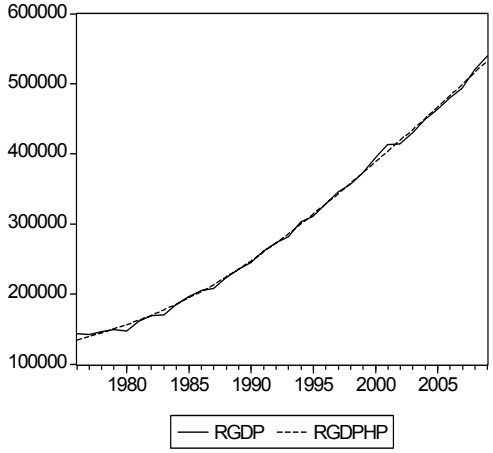
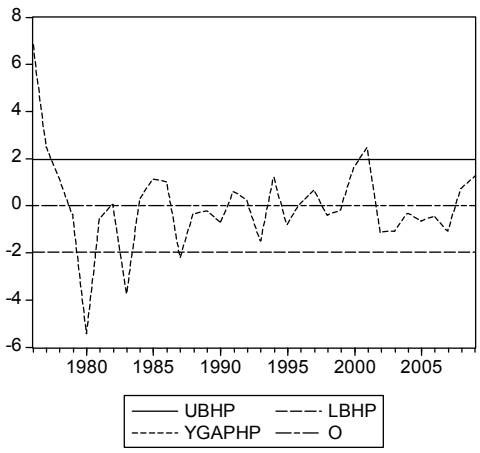


Fig. 6

Output Gap from HP Filter



The observation of actual and potential output in recent years reveals that the output gap were negative during 2002-2007. It reflects that the economy was operating below its

potential in those years. However, some sign of overheating can be observed in 2008 and 2009 as reflected in the positive output gap of around one percent.

Potential Output and Output Gap from Production Function Approach

Since production function approach models potential output as a function of potential labor and capital inputs, as well as of potential total factor productivity (TFP), the estimation of these apparatus is the precondition for estimation of potential output and output gap.

Labour and Capital Inputs

As in the case of many developing countries, all the time series data required for the above specification are not readily available for Nepal. Due to the unavailability of data on actual employment, the data on economically active population is used as a proxy for labour force. The data on economically active population from census and labour force survey, which are available only on interval basis, were interpolated to derive annual time series. The trend underlying the series of economically active population derived by applying HP filter is used as the proxy for potential labor input.

Actual total capital stock, following the literature, is assumed to be equal full-employment capital stock. As in the case of data on employment, the data on actual capital stock are also not readily available. Total capital stock is estimated by applying perpetual inventory method. First, to estimate the initial level of the real capital stock at end-1975, the real gross fixed capital formation in 1975 was divided by the average growth rate of real gross fixed capital formation during 1976–2009[6]. The ratio of real capital stock to real GDP in 1975 calculated in this way is 2.7, which is similar to the ratio estimated in other empirical literature. Second, to get the real value of capital stock after 1976, the following standard formula was applied:

$$K_{t+1} = K_t + I_{t+1} \tag{4}$$

where K is the real value of total capital stock and I is real gross fixed capital formation[7].

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6 Reliable estimate of rate of depreciation are not available for which the author is unable to clean series allowing for depreciation while deriving data on capital stock.

7 The incremental capital output ratio (ICOR) was found to be 5:1 for the period of 1977-2009 on an average.

Fig. 7

Labour Input

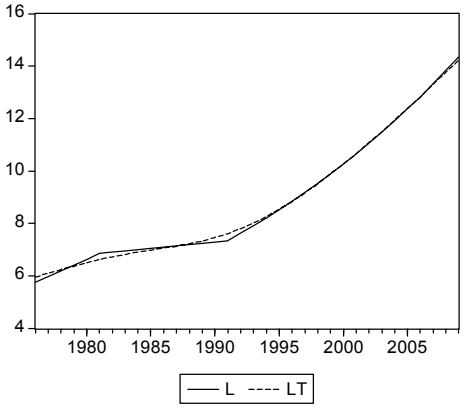
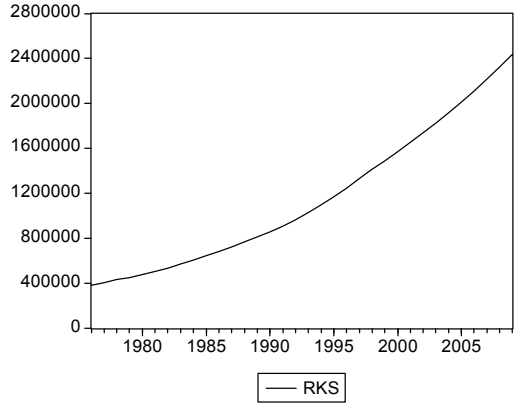


Fig. 8

Real Capital Stock



Total Factor Productivity and Labour Share

The estimation of TFP requires the determination of labour share and share of capital in output. To estimate the labour share, the following form of Cobb-Douglas production function derived from equation (3) is used.

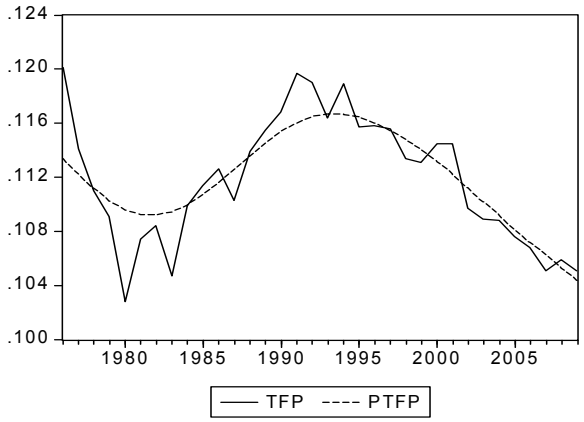
$$y_t = a + (1-\alpha)k_t \tag{5}$$

where, small case letters y is output per worker and k is capital per worker both in natural logarithms.

The estimation of equation (5) using time series data on actual output per worker and actual capital stock per worker for the period 1975/76-2008/09 yields the estimate of labour share to be 0.42. Then, the actual TFP (A) was calculated by pluging in actual employment, real capital stock, real GDP, and the labor share (α) in equation (4).

Fig. 9

Total Factor Productivity



The trend underlying the actual TFP is assumed to be potential TFP which is estimated by applying the HP filter. The estimated TFP indicates that the TFP is surprisingly low ranging between 0.12 and 0.10. Another interesting outcome is that the TFP is declining continuously in the last decade. TFP reached highest ever of 0.12 in 1991.The estimate also reveals that the TFP was relatively higher in the 1990s as compared to the decade of 1980s and the period of 2001-09.

Potential Output and Output Gap

Potential output was then derived by plugging in the full-employment labor (L*) and capital (K*) inputs and potential TFP (A*) estimated above in equation (3). The plot of the actual output (RGDP) and potential output (PRGDP) derived by using production function approach are presented in the following figure.

Fig. 10

Potential Output from PFA

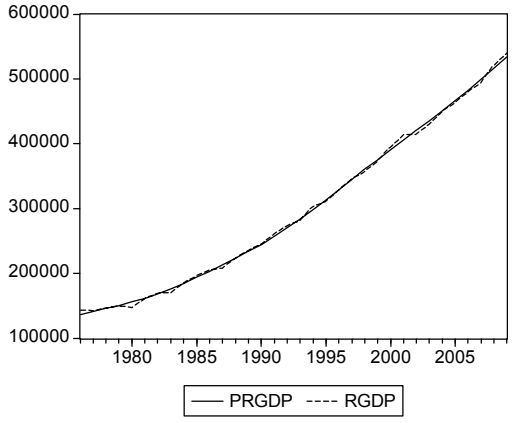
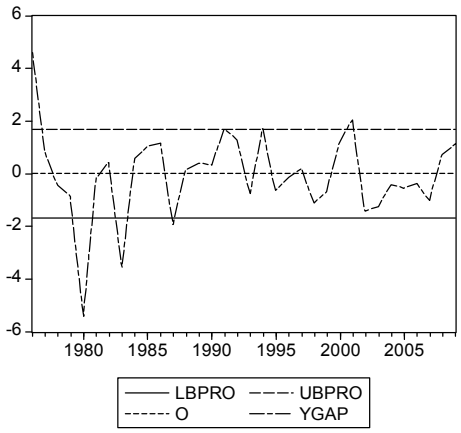


Fig. 11

Output Gap from PFA



The level of potential output derived from production function approach highly correlates with that from previous one[8]. As in the case of HP filter, the output gaps estimate derived from production function approach imply that the Nepalese economy was operating close to potential output with smaller fluctuations in output gap in 1990s and in the period of 2001-2009 relative to 1990s and the period of 1976-1980. The role of agriculture, whose performance depends largely on monsoon condition, was relatively dominant in GDP before 1990s. This is believed to be one of the important factors for such a high fluctuations in output gap before 1990s. The economic liberalization that got momentum in the early years of 1990s helped to weaken the role of agriculture as the share of industry and service sector in GDP increased substantially.

As in the case of HP filter, the results from the production function approach also show large downward swing in output gap in 1980, 1983 and 1987. The negative output gap exceeded the one-standard deviation lower bound with output gap of respectively 5.4 percent, 3.6 percent and 1.9 percent in those years. Similarly, the output gaps in 1976,

8 Correlation coefficient was found to be 0.99 for the two series of potential output.

1991, 1994 and 2001 crossed the upper one-standard deviation band. The output gap estimates for the respective years are 4.6 percent, 1.7 percent, 1.7 percent and 2 percent. The observation of the output gaps in the recent years shows that the economy is operating below its potential during 2002-2007 reflected in negative output gap. However, the gaps turn positive in 2008 and 2009. The observation of the results indicates that the economy went through the process of overheating in the last two years; 2008 and 2009 after six consecutive years of demand deficiency. Though the high inflation in the last two years believed to be driven mainly by supply side factors, the results support the argument that the roll of excess liquidity can not be completely ruled out as the monetary expansion was far beyond the target in those years.

A very high degree of correlation (0.93) is observed between output gap estimates from the two approaches. The production function approach was also constrained by statistical detrending to come up with the potential level of inputs and TFP while estimating potential output. Therefore, this outcome is neither just a coincidence nor a surprising event, rather an expected outcome. However, relatively high deviation in output gap from HP filter towards the end samples indicates one of its weaknesses that this method suffers from end sample bias to some extent. The standard deviation of output gaps from HP filter is relatively higher compared to that of output gap from production function approach.

Fig. 12

Output Gaps from HP and PFA

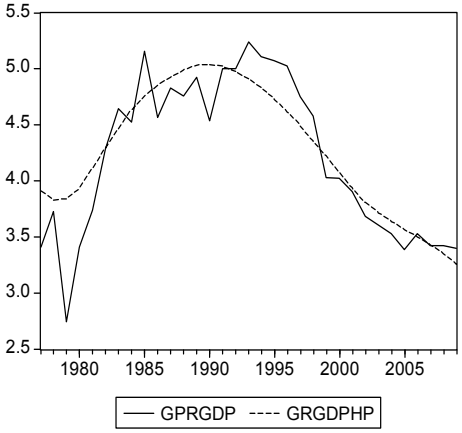
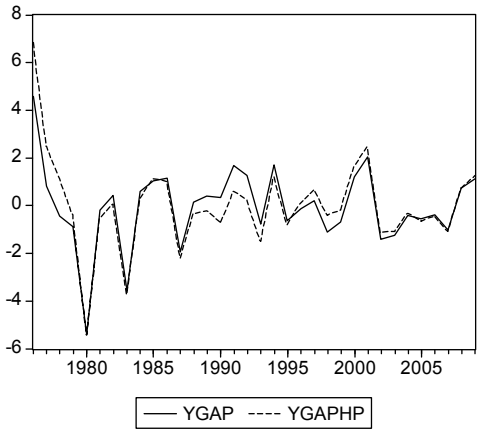


Fig. 13

Potential Output Growth from HP and PFA



The potential output estimated by HP filter and Production function approach both indicate that the potential output growth is falling continuously especially after mid-1990s. The fall in the growth of potential output is fairly explained by the movement in TFP which also slowed down during this period.

Alternative Medium-term Scenarios of Potential Output Growth

Three different scenarios are assumed regarding growth of TFP and growth of real gross fixed capital formation for the next three years: a) TFP declines as the same 2007-2009 average rate-1.0%; and real GFCF increases by 5.0%, b) TFP growth increases to 1.0%

and real GFCF increases by 10.0%, and c) TFP growth increases to 1.5 and the real GFCF increases by 15.0%. Regarding labour input, it is assumed that the labour force will grow at the same average rate of 2001-2009, 3.8%. Table 1 shows the results for potential output growth rates during the 2010-2012 period, according to each scenario considered.

Table 1: Projected Alternative Medium-term Scenarios

No. of Scenarios	TFP Growth (%)	RGFCF Growth (%)	Growth Rate of Potential Output (%)		
			2010	2011	2012
1	-1.0	5.0	3.5	3.5	3.5
		10.0	3.6	3.7	3.9
		15.0	3.7	4.0	4.3
2	1.0	5.0	5.5	5.5	5.5
		10.0	5.7	5.8	6.0
		15.0	5.8	6.1	6.4
3	1.5	5.0	6.1	6.1	6.1
		10.0	6.2	6.3	6.5
		15.0	6.3	6.6	6.9

Depending upon pair of TFP and RGFCF growth, potential output will grow between 3.5% and 6.9% in the period of 2010-12 period. In the most optimistic scenario, in which investment and TFP are assumed grow by 15 percent and 1.5 percent respectively, potential output growth is likely to grow by 6.3 percent in 2010, 6.6 percent in 2011 and 6.9 percent in 2012 without overheating. However, if TFP and investment growth can't improve from the last three years average, potential output growth will be limited to only 3.5 percent in each next three years.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

Potential output and output gap measurements are an integral part of economic policy formulation. Monetary and fiscal policies both should take into account the development in output gap to attain reasonable economic growth without unwanted inflationary pressure.

The estimated output gaps in this study indicate that the actual output of the economy was below its potential during 2002-2007. This suggests that there was some scope to ease monetary and fiscal policy to stimulate economic growth without the fear of inflationary pressure. However, the situation was contrary in 2008 and further aggravated in 2009 as the economy exhibits sign of overheating reflected in the positive output gap of around one percent. It indicates that monetary policy relaxation is likely to produce inflationary pressure rather than adjustment in national output. This development calls for tighter stance of monetary policy to control inflation.

An important finding of the study is that the potential output growth is falling over the last decade. It indicates the limited scope for GON to run a budget deficit without the fear of inflation. Hence, fiscal policy must also bear in mind the declining potential output growth that the economy has been experiencing.

Since the results indicate limited scope for the use of expansionary fiscal and monetary policies, the focus should be directed at structural issues that would reverse the declining

growth of productivity. The medium term scenarios projected under different assumptions also indicates that high economic growth is not attainable without enhancing TFP. Though the determinants of the TFP and its growth are beyond the scope of this study, some cases can be made from general observation. The capital expenditure of the GON has contracted sharply in the last decade which could have implication for TFP growth because it also influences the productivity of private investment. Therefore, one of such areas could be the reform in the fiscal structure of the government expenditures with a bias towards higher spending in productive investments. It helps to weaken the supply side constraints. Labour market, governance, trade promotion and technology could be the other potential areas for reform. A detail study on determinants of TFP could only precisely point out the necessary reform to revert the slowdown in TFP.

Finally, since uncertainties are inevitable in the estimation of output gap, other additional information especially the developments in field should also be considered while taking policy decisions.

REFERENCES

Araujo, C.H. Vasconcelos, Areosa, M.B. Moreira, Guillén, O. T. de C., 2004, "Estimating Potential Output and Output Gap for Brazil." *Banco Central do Brasil Working Paper*.

CBS, 2008, "Nepal Labour Force Survey", Central Bureau of Statistics, Government of Nepal.

CBS, 2004, "Nepal Living Standard Survey", *Statistical Report, Vol. I and II*, Central Bureau of Statistics, Government of Nepal.

Cerra, Valerie; Saxena, Sweta Chaman, 2000, "Alternative Methods of Estimating Potential Output and the Output Gap: An Application to Sweden", *IMF Working Paper*, WP/00/59.

Filho, Tito Nicias Teiseira da Silva, 2002, "Estimating Brazilian Potential Output: a Production Function Approach", *Banco Central do Brasil, Working Paper*, 17.

Gounder, Kavi and Morling, Steven, 2006, "Measurement of Potential Output in Fiji", *Reserve Bank of Fiji Working Paper*, 2000/06.

Konuki, Tetsuya, 2008, "Estimating Potential Output and the Output Gap in Slovakia", *IMF Working Paper*, WP/08/275,

Khatiwada Yuba Raj, Sharma, Suman K., 2002, "Nepal: Country Study Report", submitted to Institute for Integrated Development Studies, Kathmandu.

Kuttner, Kenneth N., 1994, "Estimating Potential Output as a Latent Variable", *Journa of Business and Economic Statistics* 12: 361-368.

Nachega, Jean-Claude and Fontaine, Thomson, 2006, "Economic Growth and Total Factor Productivit in Niger", *IMF Working Paper,* WP/06/208.

NRB, 2009, "Quarterly Economic Bulletine", Nepal Rastra Bank.

NRB, 2009, "Current Macroeconomic Situation", Nepal Rastra Bank.

Tahari, Amor; Ghura, Dhaneshwar; Akitoby, Bernardin; Aka, Emmanuel Brou., 2004, "Sources of Growth in Sub-Saharan Africa", *IMF Working Paper*, WP/04/176.

Appendix 1: Data Set used in estimation of Potential Output and Output Gap

Year	RGDP (Rs. in Million)	RKS (Rs. in Million)	EAP (in Million)	RGDPHP (Rs. in Million)	TFP	PRGDP (Rs. in Million)	YGAP (in %)	YGAPHP (%)
1976	143101	380602	5.77	133923	0.120	136818	4.59	6.85
1977	142628	403240	5.97	139157	0.114	141483	0.81	2.49
1978	146115	429368	6.18	144483	0.111	146755	-0.44	1.13
1979	149453	449118	6.39	150027	0.109	150776	-0.88	-0.38
1980	147473	473921	6.62	155932	0.103	155914	-5.41	-5.42
1981	161439	501174	6.85	162335	0.107	161742	-0.19	-0.55
1982	169385	533054	6.90	169289	0.108	168674	0.42	0.06
1983	170244	568433	6.95	176837	0.105	176505	-3.55	-3.73
1984	185594	603075	6.99	185024	0.110	184496	0.60	0.31
1985	196020	644874	7.04	193828	0.111	194014	1.03	1.13
1986	205239	681584	7.09	203234	0.113	202873	1.17	0.99
1987	208566	722435	7.14	213247	0.110	212667	-1.93	-2.20
1988	223115	763880	7.19	223895	0.114	222780	0.15	-0.35
1989	234681	809399	7.24	235156	0.116	233749	0.40	-0.20
1990	245169	852118	7.29	247002	0.117	244357	0.33	-0.74
1991	260925	904331	7.34	259400	0.120	256584	1.69	0.59
1992	272847	960584	7.62	272299	0.119	269426	1.27	0.20
1993	281394	1025427	7.91	285662	0.116	283548	-0.76	-1.49
1994	303113	1093513	8.20	299458	0.119	298032	1.70	1.22
1995	311147	1166960	8.51	313615	0.116	313148	-0.64	-0.79
1996	328456	1245862	8.84	328095	0.116	328878	-0.13	0.11
1997	345193	1325788	9.17	342838	0.116	344509	0.20	0.69
1998	356275	1408411	9.52	357784	0.113	360286	-1.11	-0.42
1999	372237	1484197	9.88	372899	0.113	374802	-0.68	-0.18
2000	394586	1565573	10.25	388135	0.115	389876	1.21	1.66
2001	413429	1650324	10.64	403434	0.115	405109	2.05	2.48
2002	414091	1735187	11.04	418807	0.110	420026	-1.41	-1.13
2003	429699	1823256	11.46	434360	0.109	435161	-1.26	-1.07
2004	448654	1914205	11.90	450155	0.109	450515	-0.41	-0.33
2005	463165	2005632	12.35	466207	0.108	465768	-0.56	-0.65
2006	480435	2107202	12.82	482515	0.107	482206	-0.37	-0.43
2007	493604	2210714	13.30	499049	0.105	498698	-1.02	-1.09
2008	519574	2320472	13.81	515756	0.106	515754	0.74	0.74
2009	539319	2436703	14.34	532532	0.105	533281	1.13	1.27

RGDP: Real GDP, RKS: Real Capital Stock, EAP: Economically Active Population, RGDPHP: Potential GDP estimate from HP filter, TFP: Total Factor Productivity, PRGDP: Potential GDP estimate from production function approach, YGAP: output gap estimate from production function approach, YGAPHP: Output gap estimate from HP Filter.