Unlocking Bhutan’s Potential: Measuring Potential Output for the Small, Landlocked Himalayan Kingdom of Bhutan

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<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
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<tr>
<td>FY</td>
<td>fiscal year</td>
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<tr>
<td>GDP</td>
<td>gross domestic product</td>
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<td>Nu</td>
<td>ngultrum</td>
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<td>RMA</td>
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ABSTRACT

Bhutan’s rapid economic growth in the past 2 decades has been driven principally by large-scale, lumpy investments in the all-dominant hydropower sector. While growth rates have averaged 7.9% since 1981, they have also been quite volatile, making the economy very vulnerable to cyclical swings and external shocks. A key challenge for Bhutan is to channel the income generated by the hydropower sector for sustainable and inclusive growth. This has been particularly challenging when the majority of the population is employed in the low productivity and largely subsistence agricultural sector. This paper develops a macroeconomic model of Bhutan’s potential output and analyzes the impact of several policy options on potential growth for Bhutan over 2013–2030. The results show that while hydropower development will underpin future growth, higher investment in education, health, and efforts to diversify its economic base through promotion of tourism and other niche sectors can yield a much higher potential output.
1 INTRODUCTION

The nature and drivers of sustained medium and longer-term economic growth are central to policy-making domains in both developed and developing economies. Beginning in the 1950s, notably with Robert Solow and Trevor Swan, neoclassical economists began to analyze theories of why and how economies grow (Harberger 1978). While specific interest in the challenges facing the growth of developing countries reaches back to the 1940s and conceptions of investment coordination failure known as the “big push” theory of development, more general theories of development economics began with Sir William Arthur Lewis’ dual sector growth model published in 1954. This model conceptualized the fundamental dynamics of structural transition from low productivity, agriculture-based economies to higher productivity, industrialized economies. In the past few decades, analysis in economic growth and development literature has advanced on these foundations, with the objective of deriving policy measures that promote sustainable growth for both developing countries and economies in transition.

For developing countries in particular, and all economies in essence, the sustainability and maintenance of growth over time is key to economic growth translating into real advances in the standard of living of a country’s citizens. A core concept that encapsulates the rate of growth that can be sustained by an economy—given its resources, human capital, and technology—is potential output growth. The “potential output” concept is now widely employed to not only estimate the long-term growth potential of a country given its resources, but also as a key anchor for economic stability. It is defined as measuring an economy’s aggregate supply side capabilities as given by its production structure, available technology, and resources (ECB 2000). In other words, potential output is the maximum output an economy can sustain without overstretching its capacity, pushing up the prices of scarce production resources, and generating a rise in inflation. Thus, the expansion of this potential level of output through investment in capital and technology, and ultimately productivity growth, is necessary for persistent increases in growth rates over time.

The purpose of this paper is to estimate the potential output of the tiny, landlocked Himalayan Kingdom of Bhutan. Bhutan, an economy of less than 800,000 people living on $2,900 per year on average (IMF 2013'), has experienced remarkable growth and dramatic structural change over the last decades. However, while Bhutan’s economic growth over the past 3 decades has averaged more than a remarkable 7.9% per annum, its growth has simultaneously been highly volatile. The volatility of output in Bhutan derives from the highly nondiversified economy that is comprised largely of the capital-intensive and low domestic employment-generating hydropower sector. The agriculture and service sectors remain below potential but absorb the majority of the labor force.

Thus essentially, Bhutan’s current macroeconomic performance hinges on the performance of the hydropower sector and the government’s ability to manage and distribute the growth arising from this sector. It is an interesting case where remarkable rates of growth have been achieved without the traditional transition of a large part of the economy from agricultural to industrial production. Much of the sector’s growth has been possible due to external assistance—in particular, Bhutan’s close economic and trade links with India, which provide substantial budget support grants and concessional loans to fund investment so that it can benefit from Bhutan’s vast hydropower endowments. However, the reliance on Indian funding for such a large proportion of its economic activity exposes the economy

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1 World Economic Outlook Database, 2013.
to risks. Moreover, Bhutan’s choice of pegged exchange rate (which is fixed at 1-to-1 with the Indian rupee) and its large reliance on imported capital goods and even labor to build its hydropower industry make it further vulnerable to developments external to the economy itself. Accordingly, while Bhutan’s hydropower potential has arguably been of great benefit to Bhutan and driven its remarkable growth over recent decades, the level of dependency on this sector and on external funding exposes Bhutan to significant economic volatility and strongly influences its current and near-future economic and policy environment.

Within this context, this paper aims to analyze Bhutan’s growth performance in potential and actual output growth, and several policies available to pursue augmented potential growth. There are two basic approaches for estimating potential output: statistical filtering and estimation of structural relationships (Cerra and Saxena 2000, ECB 2000, Benes et al. 2010). The first approach isolates the trend and cyclical components of real output growth. The second method employs a supply-side model production function approach that relies on the structural relationships based on economic theory to construct output; it is essentially a bottom–up approach to the generation of an output series.

We employ a variant of this latter supply-side approach, which uses a growth accounting framework to take into account the dynamics of fundamental drivers of long-term growth. The growth accounting approach allows us to capture the relationship between potential output and its structural determinants—labor, capital, and productivity-related factors, including technical change. It is particularly suitable for our analysis, as Bhutan lacks available data to undertake other approaches; this is a commonly experienced constraint in estimating potential output in developing and transition economies. The chosen approach employs a Cobb–Douglas production function to explain the dynamics of growth drivers, and uses a Kalman filter to estimate the unobserved variables. The model also incorporates demand-side equations to capture the output gap through inflation dynamics. A key advantage of our approach is that it can be used to forecast potential output as well as the key factors influencing it, like employment, investment, and technological progress. The resulting model is employed to look at the impact of policy measures, some of which have been proposed as the result of a growth diagnostics study on Bhutan (Asian Development Bank [ADB] 2013), including increased investment in human capital and economic diversification on the production side of the economy. The trade-off between quantity of investment and quality of factor inputs in terms of their productivity is also extensively discussed. From this analysis, we recommend those policies deemed most effective for Bhutan to release its potential output from constraints.

The structure of the paper is as follows. Section 2 discusses the structural transformation of Bhutan by qualitatively describing the developments in the real, fiscal, monetary, and external sectors and identifying factors that may potentially be hindering Bhutan’s growth. Section 3 lays out a small structural macro model and specifies the estimation technique and data used in the paper’s analysis. Section 4 then reports the results of the model’s use in projecting potential output growth over the next 2 decades. A baseline model is first established and subsequently used as a benchmark scenario against which the impacts on forecast output of various potential shocks and policy options can be compared. The quantitative growth simulations are drawn upon to make policy recommendations, and concluding remarks regarding the removal of identified growth impediments are given in the final section.
2 BHUTAN’S STRUCTURAL TRANSFORMATION

Bhutan’s dramatic structural change over recent decades has directly impacted its potential growth and accordingly, its actual recorded growth rates. This section details the major developments in economic composition from a production and expenditure perspective, documents any transition in government fiscal policy, describes the changes that Bhutan has experienced with respect to its interaction with the external sector, and explains the key developments in the monetary and finance sector of the Bhutanese economy. Throughout this section, data to calculate and display the measures are taken from the National Statistics Bureau of Bhutan, the Royal Monetary Authority of Bhutan (RMA), and several annual reports from the Government of Bhutan.

2.1 Economic Growth

The phenomenal growth rates experienced by Bhutan over the last 3 decades are some of the highest seen anywhere over such a long period of time. The average annual growth rate in Bhutan over 1981–2012 was 7.87%, and on a per capita basis, 5.89% (Figure 1).

Figure 1: Annual Gross Domestic Product and Gross Domestic Product Per Capita Growth Rates for Bhutan, 1981–2012

![GDP Growth and GDP Per Capita Growth](image)

GDP = gross domestic product, HP = hydropower.
Source: Estimates based on data from the National Statistics Bureau and the Royal Monetary Authority of Bhutan.

Figure 1 depicts the annual growth rate of gross domestic product (GDP) and GDP per capita over 1981–2012. While average economic growth has been high, it has also been quite volatile over time. This variance is due to the high proportion of economic output pertaining to the hydropower sector and its rapid, albeit lumpy, growth. The observed growth spikes reflect peaks in activity observed during the construction and commissioning of hydropower projects. The most striking growth spike occurred in 1987 when the Chhukha Hydropower Plant was constructed, propelling Bhutan’s growth rate to over 28% that year. The most recent decade was also influenced by a number of large hydropower projects—particularly the operational opening of the Kurichhu and Tala plants. However, as more plants come into operation, the proportionate growth spikes caused by new hydropower construction projects have become smaller over time compared with larger overall output, and the average growth rate of the Bhutanese economy has become more stable as a result.
2.2 Sectoral Decomposition of Growth

The rapid growth of the Bhutanese economy has been characterized by commensurately rapid structural change. Table 1 shows the decomposition of economic growth by sector over 1980–2012 and Figure 2 graphically depicts the corresponding annual decomposition. The driving sector of Bhutan’s growth performance is clearly the industrial sector. In each of the three subperiods—1980–1990, 1991–2000, and 2001–2012—the growth rate in the hydropower-dominated industrial sector strongly exceeds the overall growth rate in the economy, reaching a peak decadal growth rate of 22.6% in the earliest period, and 6.7% and 10.3% per annum in the subsequent periods, respectively. This compares with growth rates of 10.1%, 5.0%, and 8.4%, over the respective periods for the total economy.

The second highest contributor to growth has been the service sector of the economy, which in recent years has comprised mainly of tourism and services related to tourism. The average annual growth rates in this sector have been strong and less volatile relative to the industrial sector. The service sector has achieved an average annual growth rate of 8.8% over the whole period, and thus its growth rate has also exceeded the total economic growth rate. Figure 2a shows the increasing contribution of the service sector to overall growth rates and Figure 2b shows the gradual, proportionate increase in the relative size of both the industrial and service sector over time.

| Table 1: Decomposition of Bhutanese Economic Growth by Sector, 1980–2012 |
|---|---|---|---|---|---|---|---|
| | Agriculture | Industry | Services |
| | GDP growth rate | Average Growth rate | Contribution to GDP growth | Average Growth rate | Contribution to GDP growth | Average Growth rate | Contribution to GDP growth |
| 1980–1990 | 10.1 | 5.6 | 26.1 | 22.6 | 45.4 | 10.5 | 26.9 |
| 1991–2000 | 5.0 | 1.7 | 9.9 | 6.7 | 43.7 | 6.7 | 43.3 |
| 2001–2012 | 8.4 | 2.2 | 5.6 | 10.3 | 47.6 | 9.1 | 39.4 |
| 1980–2012 | 7.9 | 3.1 | 14.7 | 13.0 | 46.0 | 8.8 | 35.2 |

GDP = gross domestic product.
Source: Author’s calculations based on data from the National Statistics Bureau.

GDP = gross domestic product.
Source: Authors’ estimates based on data from the National Statistics Bureau and the Royal Monetary Authority of Bhutan.
With the growth rate in the industrial and service sectors exceeding the economy-wide average growth rate, the agricultural sector has been steadily proportionately displaced. Growing at an average annual rate of 3.1%—less than half the economy-wide average over this period—agriculture comprised only 14.5% of the economy by 2012. Yet agriculture remains the major source of employment, with 62.2% of the labor force employed in what is mainly subsistence agriculture. Thus, while employment in agriculture has also seen a decline over recent decades (20 percentage points in the last decade), the fall in the proportion of employment in this sector has not been commensurate with that of the value of output. This mismatch between the value added and employment in the economy has implications for the distribution of income and welfare generated by the long growth upswing and is indicative of the need for future restructuring and up-skilling of the labor force to ensure that growth is more evenly distributed. In essence, the hydropower sector’s dominance in the Bhutanese economy has implications on the concentration and distribution of economic activities. In fact, even within the industrial sector, existing industries such as construction, cement, chemicals, wood-based, and metals industries (even though the latter four are shrinking proportionately) are also highly dependent on and synchronized with the hydropower sector, making much of the industrial activity itself highly correlated. Thus, the economy is quite vulnerable to any shocks impacting on the hydropower sector, which is highly dependent on grants and international financing.

2.3 Decomposition of Growth by Expenditure

In a similar way to the production side of the economy, the expenditure side (Figure 3) has also seen substantial changes over the last 3 decades. Previously the principal driver of GDP growth in the 1980s, household consumption expenditure has approximately halved in proportionate terms from its share in GDP of 85.1% to 43.3% in 2012. From being a consumption-led economy, Bhutan’s growth is now largely driven by capital expenditure. Capital accumulation now contributes more than half (57.9%) to GDP growth, with capital formation reaching average annual growth rates of around 10.7% over 1980–2012, much higher than the GDP growth rate of 7.9% over the same period. At the household level, however, expenditure is still overwhelmingly consumption based. Bhutanese households allocated over 46% of total household expenditure during 2001–2012 to non-durable goods (food and nonalcoholic beverages, clothing and footwear, and alcoholic beverages, tobacco, and narcotics) and more than 30% on durable goods, including housing, water, electricity, gas, household equipment, and home maintenance, on average.

**Figure 3: Composition of Expenditure in the Bhutanese Economy, 1980–2012**

GDP = gross domestic product.

The remarkably large contribution of capital investment to growth is driven by two main factors. The first is the relatively high cost of building hydropower capital in a country; and second, the demand and funding for Bhutanese hydropower investment comes from international sources—mainly from India—and thus investment ratios are not constrained by domestic savings. However, such a large proportion of expenditure on capital accumulation—and in particular, hydropower investment—over such a long period of time has important implications for the structural balance in the economy in Bhutan. More diversified expenditure patterns and productivity-enhancing investments are needed for increased stability and inclusivity of economic growth in the future.

2.4 Fiscal Developments

2.4.1 Decomposition of Government Expenditure

Fiscal policy plays an important role in managing the impact of output fluctuations as well as redistributing the income generated by the hydropower industry. Further, the composition of expenditure has an important influence on the potential output of Bhutan, both at the time of spending and in the future. For example, increased current expenditure relative to capital expenditure can be instrumental in shielding the economy from the impact of an economic downturn, but may come at the expense of increased potential output now or in the future (as expenditure on human capital has a positive impact in potential output, but with a lag). Thus both the level and the composition of expenditure play important roles in influencing potential output over time.

Over the period 1980–2012, the Government of Bhutan has varied the level of government expenditure as a proportion of GDP but has maintained relatively equal shares of non-hydropower related current and capital expenditure to total government expenditure, on average. The peak level of government expenditure relative to GDP occurred in the 1980s, with government expenditure reaching an average of 40.0% of GDP, with the trend slightly dipping in the 1990s. In the 2000s, government expenditure picked up again, averaging 38.0% of GDP.

Figure 4 displays the breakdown of government expenditure by category of expenditure, including hydropower sector-related expenditure. In terms of composition, the most recent figures for fiscal year (FY) 2012 show that proportionate government outlays on general services (roads and housing, among others) have nearly halved over the last 5 years, whereas those to hydropower sector development have increased sevenfold. The expenditure of the Bhutanese government on social services (comprising mainly of health and education) slightly declined in terms of proportionate total government expenditure. Transport and communication and agriculture and mining have all diminished slightly in terms of budgetary prominence.

2.4.2 Government Revenue and Net Borrowing

One of the major benefits of the expansion of the hydropower sector has been the fiscal space it has brought to the government. From 5.7% of GDP in the 1980s, tax revenues have increased by 260%; tax revenues reached 14.8% of GDP in FY2013. As a share of total revenue, from 32.9% in the 1980s, tax revenue stood at 71.2% of total revenue in FY2013. The increasing sales tax revenue from electricity sold to India, royalties from the use of natural resources for hydropower, and corporate taxes from hydropower corporations have been the major drivers of increased government revenues over the recent decade as more hydropower plants have come online.
Because of this, from a very volatile and more sizable fiscal deficit averaging around 5% of GDP in the early 2000s, the government has maintained a more stable debt position of late, resulting in budget balances and even surpluses for most years since 2006. The stability of the fiscal position has been strongly supported by the growth of grant and donor support in recent years. Indeed, for the period FY2000–2013, grants contributed a sum equal to nearly 37% of total expenditure or almost 70% of capital expenditure, with the majority of these grants coming from India for hydropower investment. Nevertheless, public debt has increased over time from 60.6% of GDP in FY2002 to 93.7% in FY2013. Further, most of this debt has been sourced externally (93.7%). Of the outstanding public debt, however, around 59% is accounted for by the hydropower sector and, as the sector develops, should be paid as investments mature. Figure 5 details the main sources of revenue and the resulting net budget position over FY1999–2013.

**Figure 5:** Composition of Government Revenue and the Budget Position, Fiscal Year 2000–2013

GDP = gross domestic product, rhs = right hand side.

Source: Authors’ estimates based on data from the Ministry of Finance and the Royal Monetary Authority of Bhutan.
2.5 The Real External Sector

2.5.1 Major Trade Developments

As with the broader Bhutanese economy, the balance of payments is also strongly associated with the performance and needs of the hydropower sector. Both exports of electricity output and inputs of capital goods for new hydropower investment are large components of the current account. Hydropower exports have comprised nearly 35% of total exports on average over the last decade and more than 39% of exports to India,² Bhutan’s major trading partner (receiving around 80% of Bhutanese exports and providing about 70% of their imports).

Figure 6: Electricity as a Proportion of Total and Indian Exports from Bhutan, Fiscal Year 2003–2012

Source: Authors’ calculations are based on the Balance of Payments data lifted from the Annual Report of the Royal Monetary Authority (various years).

Figure 6 displays hydropower exports as a proportion of total exports and of exports to Bhutan’s major trading partner, India. As expected, both measures move strongly in line and coincide with major developments in the hydropower sector. With more hydropower plants coming online, however, the proportional movement in exports over time is less volatile than it was in the earlier phases of hydropower development,³ and the Bhutanese economy is starting to see less volatility in both its exports and its output. This evolution can be seen in Figure 7.

Figure 8 displays the volatile service trade deficit as a proportion of the total current account deficit that Bhutan has with its trading partners. The volatility of this balance is driven by the variation in the performance of the underlying sectors themselves. The major spike in deficit, however, in this case, is more to do with the falling denominator rather than an increase in imports of services. In general, Bhutan has been a net importer of construction and travel services (except in FY2008), a net exporter of transport services (which is due to Bhutan’s ownership of the only flight services licensed to carry passengers to and from Bhutan), and a mixed trader of insurance services.

² Bhutan also exports substantial ferroalloys and copper wire to India.
³ In the earlier years of the development of the sector, export levels would jump up to 85% in a year as it did with the commencement of operation of the Chhukha Plant in 1987, which also contributed nearly half of the GDP growth at that time.
2.6 The Financial External Sector

While the finance sector’s role is theoretically to facilitate transactions in the real sector, oftentimes the behavior and composition of finance sector flows can independently impact on real sector outcomes. By constraining or amplifying real sector behavior, the finance sector often influences the path of actual output and its long-term path and can even play a part in affecting investment, and in turn, potential output.

Figure 9 displays the proportionate composition of Bhutan’s capital account over FY1999–2012, the dates for which the breakdown in contribution is available. For much of Bhutan’s earlier phase of global integration, Bhutan’s heavy reliance on imported goods was largely financed through grants and capital transfers, mainly through India and international development banks and...
partnerships. However, in line with Bhutan’s economic development, the proportion of capital transfers making up total capital inflows have declined over time. Comprising 61.9% in 1999, capital transfers have steadily declined to under 20% of capital inflows. Conversely, investment inflows in the form of capital loans to the Bhutan government (mainly from India) have largely replaced the capital grants that funded Bhutanese investment projects in the past. Portfolio investment flows are the only outgoing category of capital in net terms, and this only occurred once in 2000. While foreign direct investment is a very small proportion of capital inflows in nearly all years (excepting a one-off large inflow in 2006), this component has also been steadily growing in proportion over time. Hence, as Bhutan continues its path of economic development, market-based financing and investment are becoming more prominent in the economy.

**Figure 9: Composition of Bhutan’s Capital Account, Fiscal Year 1999–2012**

![Composition of Bhutan’s Capital Account, Fiscal Year 1999–2012](image)

Sources: Authors’ calculations are based on the Balance of Payments data lifted from Annual Report of the Royal Monetary Authority (various years).

Figure 10 displays a breakdown of the balance of payments for Bhutan over the period FY1996–2012. As can be seen, the balance of payments is actually mostly in surplus as funding—in the form of capital transfers originally, then progressively outright investment—and has been adequate to finance the import bill over time. However, the composition of the accounts has been quite volatile due to the aforementioned drivers of the external transactions for Bhutan.

### 2.7 Monetary Sector and Reserves

The behavior of Bhutan’s monetary sector is driven largely by two main factors. Firstly, Bhutan has a one-to-one fixed exchange rate peg between the Bhutanese ngultrum and the Indian rupee, the currency of its main trading partner. Secondly, the banking and finance sector in Bhutan is still quite undeveloped, which has implications for liquidity and credit growth management and thus, ultimately investment and output.
2.7.1 Foreign Currency Market

Since the ngultrum was first introduced in 1974, its value has been kept at par with the Indian rupee. Due to the increasing economic integration of Bhutan with the international community as well as remarkable growth in the imported capital-intensive hydropower sector, the stability of Bhutan’s Indian rupee reserve holdings has come under stress in recent years. In particular, capital imports aside, reserve management has been intensified by a confluence of factors operating through the banking system and interacting with growing incomes and demand for credit. Of key importance has been the short-term depositing of inflows of still unused funding for hydropower projects and proceeds of operational plants by the government into the banking system. The funding deposits, alongside deposits from state-owned enterprises required to hold their revenues in demand deposits, have injected substantial liquidity into the banking system in recent years. These factors, in addition to the growing level of deposits from Bhutanese households with increased incomes, have meant that Bhutanese banks have found themselves flooded with liquidity at times. These circumstances provide incentives for banks to leverage their funding positions and extend loans to the growing consumer market, in turn stimulating imports of consumer goods and further exacerbating the net rupee reserve holding position.

Indeed, the significant imports of capital and consumer goods have caused sizable current account deficits at times; as recently as 2011, the current account deficit widened to about 23.5% of GDP, in large part due to considerable import requirements for the development of Punatsangchhu and Mangdechhu hydropower plants. In fact, the widening of the current account deficit in 2011 unravelled the rupee shortage (known as the liquidity crisis), which prompted the RMA to sell $400 million of international reserves on two occasions and avail of a rupee overdraft loan from India to meet current account requirements. Import controls have also been temporarily implemented since

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4 Rashid (2012) notes in his study of the Bhutanese liquidity crisis that the major trigger for the decline in rupee holdings in the first place is thought to have stemmed from the construction of the Tala hydropower project during 2004–2005, which necessitated large capital imports, at times accounting for up to 70% of the current account deficit.
2011 to constrain the purchase of foreign currency. Thus, the considerable capital inflows funding the hydropower sector expansion require ongoing supervision and provision of appropriately composed reserve holdings, management of system liquidity (particularly that due to the substantial incoming government grant and loan funds), and regulation and monitoring of banking activity and credit supply.

### 2.7.2 Banking Sector and Monetary Policy

As earlier prefaced, the demand for rupees has been on the increase, alongside income growth; expenditure of disposable income goes largely toward imported consumption goods. However, credit growth to the private sector has amplified these trends, with credit to the private sector growing at an average of 25.5% per annum over the last 4 years. Much of this credit has gone to fund purchases of personal durable consumer goods (up more than 6 percentage points as a proportion of total private sector credit), credit cards, and transport, making up most of the increase in credit over the last 5 years. In fact, credit to industry, agriculture, tourism, construction, and trade and commerce—mostly domestically anchored activities—has fallen over the same time period. Thus, while the supply of credit was stimulated through the abovementioned channels, there has also been a growing demand for private, household credit. In effect, there is evidence of a growing disconnect between the industries driving growth in the economy and consumer-based household economy. Accordingly, as shown in Figure 11, the supply of bank reserves has not kept pace with credit supply (for a more complete description of the liquidity crisis and the banking sector’s role, see the reference by Rashid, 2012).

**Figure 11: The Growth in Money, Banking Reserve, and Domestic Credit, 1992–2013**

The coexistence of a pegged exchange rate and large capital flows alongside a relatively underdeveloped banking system and absence of a capital market creates a difficult environment in which to manage reserve holdings and their composition. Attempts to manage the liquidity flows by the RMA in September 2012 included introducing both a policy interest rate and a base rate for bank lending. However, due to the pegged exchange rate, the policy and base rate system will be constrained; any deviation of interest rates from market rates will create a cross-border arbitrage opportunity encouraging capital flows, which will, in turn, have further impacts on reserve management. Thus, longer-term policy development regarding liquidity management—given the growing linkages between the finance and real sector—needs to give careful attention to the interaction between the tradable sector, government use of the banking system, banking incentives, and exchange rate policy.
3 MODEL, ESTIMATION TECHNIQUE, AND DATA

This section provides a simple framework for estimating and analyzing the country’s potential output, a useful concept for examining the stability and soundness of Bhutan’s structural transition and rapid economic development over the past 3 decades. We adopt a structural approach to measuring potential output, the method commonly used by the Organisation for Economic Co-operation and Development (Giorno et al. 1995), the International Monetary Fund (De Masi 1997), and the United States Congressional Budget Office (2001). Its rationale is to obtain potential output from the steady state levels of its structural determinants such as productivity and factor inputs.

3.1 The Model

The paper broadly follows Rungcharoenkitkul (2012) in employing a model of potential output that combines both the supply-side production function approach with demand-side equations. The supply-side specification has the advantage of enabling us to capture the dynamics of the different growth drivers to Bhutan’s potential output, while the demand-side equations enable us to trace the dynamics of near-term fluctuations around the country’s potential output (Figure 12). The original model is modified to capture the specific nature of the Bhutanese economy, namely its large reliance on international grants and loans.

Figure 12: Estimating Potential Output from a Small Macro Model

![Diagram of potential output model](image)

Supply-side information is captured by modelling Bhutan’s potential GDP, $\bar{Y}_t$, as a Cobb–Douglas production function,

$$\bar{Y}_t = A_t K_t^a L_t^{1-a}$$  \hspace{1cm} (1)

where $K_t$ is Bhutan’s stock of physical capital, $L_t$ is the country’s labor force, and $A_t$ is its productivity level at year $t$.

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The dynamics of the stock of physical capital is described by the capital accumulation equation,

\[ K_t = (1 - \delta)K_{t-1} + i_tY_t \]  

(2)

where \( \delta \) is the depreciation rate, \( i_t \) is the investment-to-GDP ratio (identical to the savings rate plus foreign loans and grants for investment), and \( Y_t \) is the GDP.

Capital stock is estimated using an augmented Perpetual Inventory Method (Nehru and Dhareshwar 1993). In order to apply this method to calculate the current capital stock, there is a need for (i) a time series of investment data, (ii) information on the initial capital stock at the time when the investment time series starts, and (iii) information on the rate of depreciation of the existing capital stock (Berlemann and Wesselhöft 2014). In this paper, the capital stock is unobserved and is extracted through a filtering mechanism discussed in the succeeding section.

Investment can be financed either by domestic savings or foreign financing, thus,

\[ i_t = s_t + f_t \]  

(3)

where \( s_t \) is domestic-saving-to-GDP ratio and \( f_t \) is the ratio of foreign loans and grants to GDP. \( s_t \) and \( f_t \) are assumed to be first-order autoregressive processes as follows:

\[ \hat{s}_t = \rho_s\hat{s}_{t-1} + \epsilon_t^s \]  

(4)

\[ \hat{f}_t = \rho_f\hat{f}_{t-1} + \epsilon_t^f \]  

(5)

where a hat over the variable indicates the variable's deviation from its steady state, and \( \epsilon_t^s \) and \( \epsilon_t^f \) are white noise disturbance terms.

The dynamic behavior of the labor force is characterized by

\[ \log L_t = l + \log L_{t-1} + \epsilon_t^L \]  

(6)

where \( l \) is the expected value of the rate of change in the labor supply, and \( \epsilon_t^L \) is a white noise process. The productivity variable is a composite of three subcomponents,

\[ A_t = AG_t^{bo}AM_t^{bo}AO_t^{bo} \]  

(7)

where \( AG_t \), \( AM_t \), and \( AO_t \) denote, respectively, the agriculture, manufacturing, and other sectors' productivities. We use the dominant hydropower sector as a proxy for manufacturing sector. These sectoral productivities are assumed to evolve according to the following dynamic equations:

\[ \log AG_t = c_G + \log AG_{t-1} + \epsilon_t^{AG} \]  

(8)

\[ \log AM_t = c_M + \log AM_{t-1} + \epsilon_t^{AM} \]  

(9)
The demand-side information is summarized by two equations. The first equation is the output gap equation, which summarizes how far the current period’s actual GDP has deviated from the potential output of the country:

\[ \log AO_t = c_o + \log AO_{t-1} + \varepsilon_t^{AO} \]  \hspace{1cm} (10)

It is assumed that the output gap is a stationary first order autoregressive process where both the magnitude of the lagged output gap and the relative deviation of inflation from its target or, equivalently, steady-state value are used to determine the divergence of the economy from its potential output capacity. The following equation defines this relationship and forms the first of the two equations used to model the demand side of the economy:

\[ \log(\hat{Y}_{t} / \bar{Y}_{t}) \]  \hspace{1cm} (11)

\[ \text{gap}_t = \beta \text{gap}_{t-1} - \beta_{\pi} (\pi_{t-1} - \bar{\pi}) + \varepsilon_t^{\pi} \]  \hspace{1cm} (12)

where \( \pi_{t-1} \) is lagged domestic inflation, \( \bar{\pi} \) is target inflation, and \( \varepsilon_t^{\pi} \) is the white noise demand shock. Note the negative effect of the previous period’s inflation deviations from target on demand. This is included to capture cost-push effects.\(^6\)

### 3.2 Estimation Technique

Bayesian time series methods have been employed to estimate the above system of equations. The estimation strategy consists of log-linearizing the above equations around the balanced growth path; solving the system by first order linear approximations; casting them into a state space structure; and given some observed variables, employing the Kalman filter to estimate the unobserved state variables and the parameters.

Essentially, the Kalman filter is used on a system of relevant state equations to produce an estimated series that is optimal given the underlying system and observed information. In other words, the variables of interest generated are consistent with the steady state or full-capacity interpretation of output, which is unobserved but representative of the economy operating in system equilibrium.

In almost all model runs, only loose priors about the parameter values are imposed to allow data ample room to speak, by setting large prior standard deviations and wide minimum–maximum

---

\(^6\) Essentially, the second demand-side equation captures the inflation dynamics via a modified Phillips curve, thus,

\[ \pi_t = \gamma \pi_{t-1} + (1 - \gamma) \left[ \theta (\text{gap}_t + \bar{\pi}) + (1 - \theta) \pi_{t-1}^{*} \right] + \varepsilon_t^{*} \]

where \( \varepsilon_t^{*} \) represents the white noise cost-push shock. This equation specifies that the current rate of inflation is a weighted average of the last year’s inflation, and the new developments in the current year relating to Bhutan’s output gap and India’s inflation, \( \pi_{t-1}^{*} \). The parameter \( \gamma \) measures the amount of inertia in Bhutan’s inflation dynamics, while \( (1 - \gamma) \) indicates how responsive Bhutan’s inflation is to the current year’s output gap and India’s inflation rates. More specifically, \( (1 - \gamma) \theta \) captures how sensitive Bhutan’s inflation rate is to its own demand pull shocks, while \( (1 - \gamma) (1 - \theta) \) captures how sensitive Bhutan inflation is to the inflation that passes through from India. Domestic prices in Bhutan closely track those in India, its major trading partner, with the ngultrum pegged one-to-one with the Indian rupee. Oil, fuel, and food products (particularly rice and other cereals) are among the top commodities imported from India. The pass through of India’s price developments to Bhutan’s inflation is high, with about 70% of price shocks passed through within one quarter and full price shock passed through by the fourth quarter. Thus, a positive shock to India’s price causes Bhutan’s consumer price to increase, and the effect remains statistically significant two periods or quarters after the shock.
bounds. The Metropolis–Hastings algorithm is then employed to generate an estimate for the entire
distribution of the parameters. Table 2 describes prior distributions used in the estimation, as well as
the posterior estimates generated by the Bayesian estimation of the model.

Table 2: Priors and Posterior Estimates of Parameters

<table>
<thead>
<tr>
<th>PRIOR</th>
<th>POSTERIOR*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mode</td>
</tr>
<tr>
<td><strong>Model parameters</strong></td>
<td></td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.44</td>
</tr>
<tr>
<td>$\delta$</td>
<td>0.05</td>
</tr>
<tr>
<td>$l$</td>
<td>0.03</td>
</tr>
<tr>
<td>$h^\prime$</td>
<td>0.003</td>
</tr>
<tr>
<td>$h^\prime$</td>
<td>0.03</td>
</tr>
<tr>
<td>$h^\prime$</td>
<td>0.044</td>
</tr>
<tr>
<td>$c^\prime$</td>
<td>0.01</td>
</tr>
<tr>
<td>$c^*\prime$</td>
<td>0.23</td>
</tr>
<tr>
<td>$\beta$</td>
<td>0.5</td>
</tr>
<tr>
<td>$\beta^\prime$</td>
<td>0.5</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>0.9</td>
</tr>
<tr>
<td>$\theta$</td>
<td>0.5</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>0.08</td>
</tr>
<tr>
<td>$\rho^\prime$</td>
<td>0.9</td>
</tr>
<tr>
<td>$\rho^\prime$</td>
<td>0.9</td>
</tr>
</tbody>
</table>

| **Standard deviations of transition shocks** **| Mode  | Lower Bound | Upper Bound | Distribution | Remarks |                   |
|------|-------|-------------|-------------|--------------|---------|                   |
| $c^\prime$ | 0.01  | −0.1        | 5           | logdist.invgamma(0.01,2) | 0.03170 |                   |
| $c^\prime$ | 0.01  | −0.1        | 5           | logdist.invgamma(0.01,2) | 0.03170 |                   |
| $c^\prime$ | 0.01  | −0.1        | 5           | logdist.invgamma(0.01,2) | 0.03170 |                   |
| $c^\prime$ | 0.01  | −0.1        | 5           | logdist.invgamma(0.01,2) | 0.03170 |                   |
| $c^\prime$ | 0.01  | −0.1        | 5           | logdist.invgamma(0.01,2) | 0.03170 |                   |
| $c^\prime$ | 0.001 | −0.1        | 5           | logdist.invgamma(0.01,2) | 0.03170 |                   |
| $c^\prime$ | 0.001 | −0.1        | 5           | logdist.invgamma(0.01,2) | 0.03170 |                   |

invgamma = inverse gamma, logdist = logistic distribution.

* Parameters in model object estimated using posterior maximization.

** Standard deviations adjusted for the common variance factor.

Source: Authors’ calculations based on data from the Labor Force Survey Report, various years; National Statistics Bureau, Consumer Price Index report, various issues; World Development Indicators, National Statistics Bureau, National Accounts Statistics; Asian Development Bank Key Indicators, various years.

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7 The above estimation procedure is done using iris (see http://www.iris-toolbox.com).
3.3 Data

The observed variables include real GDP \( (Y_t) \), labor force \( (L_t) \), investment-to-GDP ratio \( (i_t) \), ratio of foreign loans and grants to GDP \( (f_t) \), agricultural productivity \( (AG_t) \), manufacturing productivity \( (AM_t) \), output gap \( (gap_t) \), Bhutan’s inflation rate \( (\pi_t) \), and India’s inflation rate \( (\pi^*_t) \) (Table 3). All are annual observations. The full estimation period is 1980–2012. Table 3 shows the data definitions and sources for the observed variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Data Description</th>
<th>Period Covered</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Y_t )</td>
<td>Real GDP (LCU 2000=100)</td>
<td>1980–2012</td>
<td>WDI</td>
</tr>
<tr>
<td>( gap_t )</td>
<td>HP-filtered cycles, deviation of real GDP to HP-filtered trend</td>
<td>1980–2012</td>
<td>Authors’ calculations</td>
</tr>
<tr>
<td>( L_t )</td>
<td>Total labor force</td>
<td>1990–2010</td>
<td>WDI</td>
</tr>
<tr>
<td>( i_t )</td>
<td>Ratio of gross fixed capital formation to GDP</td>
<td>1980–2012</td>
<td>WDI</td>
</tr>
<tr>
<td>( f_t )</td>
<td>Ratio of foreign loans and grants to GDP</td>
<td>2001–2012</td>
<td>Ministry of Finance</td>
</tr>
<tr>
<td>( AG_t )</td>
<td>Cereal yield (kg per hectare)</td>
<td>1980–2011</td>
<td>WDI</td>
</tr>
<tr>
<td>( AM_t )</td>
<td>Electricity production (kWh)</td>
<td>1980–2012</td>
<td>ADBKI</td>
</tr>
<tr>
<td>( \pi_t )</td>
<td>Inflation, consumer prices (annual %)</td>
<td>1980–2012</td>
<td>WDI, National Statistics Bureau</td>
</tr>
<tr>
<td>( \pi^*_t )</td>
<td>India wholesale price inflation, WPI (annual %)</td>
<td>1980–2012</td>
<td>WDI</td>
</tr>
</tbody>
</table>

ADBKI = Asian Development Bank Key Indicators (various years), GDP = gross domestic product, HP = Hodrick Prescott, kg = , KWh = kilowatt per hour, LCU = local currency unit, WDI = World Development Indicators (World Bank 2013), WPI = wholesale price index.

Sources: World Development Indicators 2013, World Bank; Asian Development Bank Key Indicators, various years.

4 RESULTS AND GROWTH SIMULATIONS

This section undertakes an analysis of potential output growth for Bhutan. It begins by historically outlining the model’s estimates of potential growth and then generates a baseline forecast of potential GDP growth from 2013 to 2030. A breakdown of the contributing sectors and factors to growth over the full period is then presented. The baseline forecast and contributions are subsequently used as a benchmark to compare the impacts of various possible policy and shock scenarios on the long-term forecast potential growth path. Subsection 4.2 looks specifically at a positive shock to investment and total productivity, increasing human capital and thus labor productivity. Subsection 4.3 looks at the existing Bhutanese government hydropower development agenda (as outlined in government projections) and the potential output growth that these plans would produce, all else constant. Subsection 4.4 examines the increased government spending on education and its impact on boosting human capital and, ultimately, productivity. Finally, a scenario analyzing an improvement in economic diversification is presented. This case specifically looks at an expansion of the tourism-heavy service sector, the sector best positioned to support a relative expansion in the near to mid-term future. Each scenario is compared with the baseline scenario, and where relevant, the other examined scenarios to
analyze the relative advantages and opportunity costs of pursuing or encountering one scenario over another.  

4.1 Scenario 1: Baseline Results

The model is employed to estimate historical potential GDP growth up to 2012, as well as to forecast potential and actual real GDP growth from 2013 up to 2030. By having an estimate of Bhutan’s potential output, the stability and sustainability of the country’s economic growth path can be evaluated in reference to this potential measure. Given the model’s construction, the estimation is also able to highlight sectoral growth patterns and the structural features of the economy that have contributed to economic imbalances, which were previously discussed in descriptive terms in Section 2.

Figure 13 below plots the model’s estimates of potential GDP against actual GDP growth over the period 1980–2012 and the forecast values of the same over the period 2013–2030. The recursive nature of the model generates a process whereby the value of actual and potential output both converge to a steady state of around 6.6% growth per annum. However, these projections are based on very steady behavior with no policy changes or economic shocks taking place. These forecasts are useful as a benchmark, representative of a convergence to steady state based on the underlying current fundamentals of the economy. As can be seen, observed actual behavior of the economy in the past has seen marked variability of both historical real GDP and the estimated historical potential GDP. This strong variability has been due to the dominating presence of hydropower in the economy and the lumpy nature of hydropower investment. For example, the large spikes in both the actual and potential output in the mid-1980s were due to the Chhukha Plant, while the substantial increases in the actual and potential output around 2007 were to a large extent due to the Tala Plant. In trend terms, potential output growth has gradually declined from its peak of 8.4% in 2007, with the baseline potential output forecast predicting a declining potential output trend post-2012.

Figure 13: Baseline Forecasts, Output Growth (%)

HP = hydropower.
Source: Authors’ calculations.

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8 Note that the Appendix on “Building Scenarios” fully explains the assumptions and transmission channels through which the interventions have impacted potential and actual GDP growth scenarios.
4.2 Factor and Sector Contributions to Potential Output and Productivity Growth

Figure 14 presents the factor contributions to growth and drivers of Bhutan’s economy. On average during the sample period, capital accumulation contributed about 4.2% to potential growth, 1.8% to labor, and about 1.6% to total factor productivity growth. The forecast of potential output is moderate, as proportional capital accumulation—mainly investment in hydropower—is expected to slow.

![Figure 14: Contributions to Potential Growth](image)

Source: Authors’ calculations.

As Figure 14 shows, Bhutan’s potential growth has not been driven much by productivity growth. Further, Figure 15 shows that, in spite of the manufacturing sector’s large capital investment and dominant role in the economy, manufacturing sector productivity has not contributed much to Bhutan’s overall productivity growth. Instead, it has been the steadily growing service sector that has led productivity developments in the Bhutanese economy. Of concern, the agricultural sector—the main sector of employment—remains a drag on total productivity growth.

4.3 Scenario 2: Investing in Physical and Human Capital

With the baseline model as a benchmark, it is interesting to investigate the relative impacts of several scenarios on potential output, given the underlying structural relationship of the economy as determined by the model.
4.3.1 Doubling of the Investment Rate

As mentioned in Section 2, Bhutan’s economic growth spikes have been nearly totally attributed to large hydropower investments. However, while physical capital stock has seen dramatic increases over the last decades, the productivity improvements as a result of this investment have been small. In other words, Bhutan has focused strongly on hydropower investment but it now needs to focus on distributing the income generated through such investment in improving in human capital—education.
and health services. The scenario examined in this subsection therefore asks the question of how potential GDP responds to a doubling of the investment rate. This scenario will then be used to compare the case where productivity growth rates are doubled instead of doubling physical capital accumulation rates.

With this backdrop as motivation, Figure 16 presents the results of the model's simulation of the impact of a doubling in Bhutan's investment rate on the country's potential output. It shows that a doubling of the physical capital investment rate will cause the country's potential output growth rate to increase to 8.0%, higher than the 7.4% predicted by the baseline model. The simulated results show a gradual decline in potential output growth over time as the potential output returns back toward a steady-state level of potential growth of approximately 6.8% in 2030, higher than the 6.6% in the corresponding baseline case. The cumulative nature of the impact of growth rates on output levels means that such an increase in investment rates today would have a significant and persistent effect on potential output relative to the baseline scenario.

![Figure 16: Baseline vs. Investment Boost, Potential Output Growth (%)](image)

Source: Authors' calculations.

### 4.3.2 Doubling Productivity Growth

While hydropower investment has been the lifeline of Bhutan's phenomenal growth over the past decades, the opportunity costs of continuing with this strategy into the future is worth investigating. The next set of simulations shows that potential output can be raised if Bhutan undertakes reforms and policy measures to bridge the gap between productivity and factor accumulation. While doubling productivity growth sounds like a daunting challenge (as Subsection 4.1.1 showed), productivity growth is highly concentrated in the service sector and there is a large scope for productivity gains throughout the broader economy. The model results show that in a scenario where Bhutan doubles productivity growth, potential output growth would initially spike to 10.1% in 2014, which is a three percentage point gain on the baseline scenario. Moreover, the gains from such a productivity growth scenario are quite persistent, as potential output growth exceeds the baseline scenario by about 1 percentage point even after a decade (Figure 17), with steady-state potential growth settling at about 7.4% in 2030. The improvement in the capacity for economic development in Bhutan from such a boost is therefore very significant over time.
Comparing the two scenarios—a doubling of physical capital investment and a doubling of productivity growth—yields some important insights into preferred policy options for Bhutan. For ease of comparison, the potential output growth rates for both scenarios are plotted against the baseline scenario on the same axes in Figure 18. It is clearly seen that enhancing productivity growth not only dramatically improves on the baseline scenario but is more beneficial than just the physical capital accumulation boosting scenario. Indeed, the output differential between the productivity and investment boost scenarios at 2030 is projected to be 22%; the productivity enhancing path yields potential output levels that are 22% higher than that of the investment boost path. This result occurs because of the cumulative nature of the impact of growth rates for the level of economic output over time.
According to these results, Bhutan policy makers should consider augmenting their current strategy of physical capital stock accumulation—mainly in the hydropower sector—with specific productivity enhancing measures. Investment in capital embodying higher technology is one way to do this, with this strategy having the largest impact if it is targeting those sectors where productivity is currently low and which employ the largest amount of people. In this case, that sector would be agriculture. The other way to boost productivity over the longer term is to strongly invest in human capital. Thus, education and health expenditure should also be prioritized in policies aimed at improving economic output and living standards in the future.

4.4 Scenario 3: Current Government Projections of Investment in Hydropower

The government’s projections of growth going forward are based largely around the current hydropower investment projections, with aggregate growth expected to be very volatile. Specifically, growth rates are projected to fluctuate between 3.4% and 16.9%. While this also translates to high potential output growth—reaching an average growth rate of 7.5% during the forecast period 2013–2030—it also projects actual output that is quite volatile (Figure 19). Such volatile growth rates can have severe negative impacts, particularly on the economy’s most vulnerable, both directly and through real and finance sector interaction effects that amplify economic fluctuations (see Loayza et al. 2007 for an overview of related literature).

Figure 19: Baseline vs. Bhutan Government Output Forecast, Actual Output Growth (%)

To the extent that the growth path is found to be largely driven by hydropower investment, it is constructive to look at the impact that projected investment in the hydropower sector will have on Bhutan’s economy. Thus, this section examines the impact of the existing Government of Bhutan’s hydropower development agenda on potential output growth of the economy. The past completed and projected hydropower plant construction pipeline activities are summarized in Table 4. Notably, the Bhutanese government projects electricity revenue from the hydropower plants to reach about Nu1,718 billion over the period. This projection includes electricity from the four currently operating hydropower plants (Chhukha, Basochhu, Kurichhu, and Tala) and the 12 hydropower plants in the pipeline.
### Table 4: Summary of Completed Hydropower Plants and Hydropower Projects in the Pipeline

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Chhukha</td>
<td>336</td>
<td>1974–1978</td>
<td>IG</td>
<td>38.14</td>
<td>80.36</td>
<td></td>
</tr>
<tr>
<td>2 Basochhu</td>
<td>64</td>
<td>1997–2004</td>
<td>IG</td>
<td>5.80</td>
<td>9.41</td>
<td></td>
</tr>
<tr>
<td>3 Kurichhu</td>
<td>60</td>
<td>1995–2001</td>
<td>IG</td>
<td>6.64</td>
<td>10.92</td>
<td></td>
</tr>
<tr>
<td>4 Tala</td>
<td>1,020</td>
<td>1997–2006</td>
<td>IG</td>
<td>80.71</td>
<td>151.47</td>
<td></td>
</tr>
<tr>
<td>5 Dagachhu</td>
<td>126</td>
<td>2009–2014</td>
<td>PPP (DGPC, NPPF &amp; TPCL)</td>
<td>8.61</td>
<td>24.40</td>
<td>0.35</td>
</tr>
<tr>
<td>6 Punatsangchhu-I</td>
<td>1200</td>
<td>2008–2016</td>
<td>IG</td>
<td>70.37</td>
<td>222.14</td>
<td>6.47</td>
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<tr>
<td>7 Punatsangchhu-II</td>
<td>1,020</td>
<td>2010–2017</td>
<td>IG</td>
<td>54.95</td>
<td>163.99</td>
<td>7.34</td>
</tr>
<tr>
<td>8 Mangdechu</td>
<td>720</td>
<td>2010–2017</td>
<td>IG</td>
<td>37.06</td>
<td>94.29</td>
<td>4.36</td>
</tr>
<tr>
<td>9 Sankosh Storage</td>
<td>2,585</td>
<td>2013–2019</td>
<td>IG</td>
<td>61.09</td>
<td>221.08</td>
<td>17.21</td>
</tr>
<tr>
<td>10 Kuri-Gongri</td>
<td>3,400</td>
<td>2014–2022</td>
<td>IG</td>
<td>69.19</td>
<td>280.47</td>
<td>55.14</td>
</tr>
<tr>
<td>11 Amochhu Storage</td>
<td>540</td>
<td>2013–2019</td>
<td>IG</td>
<td>18.04</td>
<td>71.28</td>
<td>10.54</td>
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<tr>
<td>12 Wangchhu</td>
<td>570</td>
<td>2013–2019</td>
<td>JV with Indian PSU</td>
<td>27.32</td>
<td>105.33</td>
<td>na</td>
</tr>
<tr>
<td>13 Bunakha Storage</td>
<td>180</td>
<td>2013–2019</td>
<td>JV with Indian PSU</td>
<td>18.05</td>
<td>55.90</td>
<td>1.87</td>
</tr>
<tr>
<td>14 Kholongchu</td>
<td>600</td>
<td>2013–2019</td>
<td>JV with Indian PSU</td>
<td>25.49</td>
<td>59.97</td>
<td>2.2</td>
</tr>
<tr>
<td>15 Chamkharchhu-I</td>
<td>770</td>
<td>2013–2020</td>
<td>JV with Indian PSU</td>
<td>28.78</td>
<td>127.41</td>
<td>7.26</td>
</tr>
</tbody>
</table>


Source: Annual Report 2012–2013, Royal Monetary Authority of Bhutan; and Ministry of Finance.

The results from feeding Bhutan’s current Macroeconomic Framework Coordination Technical Committee projections of hydropower investment into the model and simulating the projected potential output can be seen in Figure 20. Impacts for potential output growth over the period 2013–2030 are mixed. If all these plants come on stream as planned, taking into account only the construction of these plants, it shows that Bhutan’s potential output is expected to peak at 8.4% in 2016 due to the investment surge, and decline to below the baseline forecast—indeed below 6.0%—in the later years.

On the other hand, factoring in both the construction of the hydropower projects, as well as the associated electricity sales forecasts, potential output growth could sustain an upward momentum of around 7%–8%; but eventually goes below the baseline potential output growth starting 2026 onwards (Figure 21).
Figure 20: Baseline vs. Government of Bhutan Pipelined Hydropower Construction, Potential Output Growth (%)

GoB = Government of Bhutan.
Source: Authors’ calculations.

Figure 21: Baseline vs. Pipelined Hydropower Construction and Electricity Sales, Potential Output Growth (%)

Source: Authors’ calculations.
4.5 Scenario 4: Impact of Increased Government Spending on Education

The previous simulations have provided evidence to suggest that productivity enhancing investment such as investment in human capital will provide a large boost to the economic growth potential. Improvements in human capital stock not only raise productivity directly but also improve the labor force’s skills and improve the productivity of capital in the economy. Both of these advances can have large impacts on the capacity of an economy to produce, innovate, and diversify as well as to reap benefits from knowledge transfer opportunities that may arrive due to incoming foreign direct investment and trade. Moreover, a healthy and well-trained labor force is also likely to be more adaptable and flexible to market conditions and better placed to deal with the large macroeconomic fluctuations that Bhutan is prone to experiencing.

Investment in human capital takes place through the channel of the provision of increased levels and quality of education and health services. It is interesting to look at how Bhutan has fared in their human capital investment. Although the government’s social expenditure has been increasing over time in absolute terms, it has not kept pace with the economy’s expansion. As a percentage of GDP, it has declined over the past years. In particular, government current and capital spending on education, as a proportion of GDP, has been showing a declining trend, which has implications on productivity and overall development (Figure 22).

Figure 22: Government of Bhutan’s Expenditure

GDP = gross domestic product.
Source: Authors’ estimates based on data from the Ministry of Finance.

A recent ADB publication, Bhutan: Critical Development Constraints (2013), has identified several critical growth constraints facing Bhutan. The publication emphasises that to achieve strong, balanced, resilient, and inclusive growth, the relaxation of several critical constraints should be the priority focus of policy interventions, namely: (i) inadequate and poor quality infrastructure, particularly in transport and connectivity and especially in the rural areas; (ii) narrow fiscal space, particularly in the medium to long-term; (iii) lack of access to finance by micro, small, and medium enterprises; (iv) presence of market failures that limit product diversification and competition; and (v) limited and unequal access to quality education (particularly secondary, tertiary, and vocational education) and labor market mismatches. Scenarios 5 and 6—increased government spending on education and promotion of economic diversification in particular through the support of tourism sector growth (the second largest and growing industry in the Bhutanese economy after electricity production), respectively—reflect the broad thrust of the fourth and fifth identified critical growth constraints in the diagnostic study referred to above. While these are only two of the five identified critical constraints, these are the only two scenarios that we can analyze with our model given the data limitations.
To understand the impact of declining educational investment in Bhutan, the current projections for future expenditure on education from the government—which show a declining trend—can be fed into the model and the potential output from the simulation can be plotted against the baseline scenario. Our simulations show that relative to the baseline scenario, where there is a maintenance of the past trend of spending on education, dropping educational spending to the government’s projected levels will largely reduce potential output. Indeed, the current projection of spending on education is not enough to maintain output growth, as potential output growth dips to 5% in 2014 and 2017 and potential output remains below the baseline benchmark for most of the remainder of the 2013–2030 period analyzed (Figure 23).\(^{10}\)

The case of interest to policy makers might therefore be that of increasing expenditure on education, and accordingly, we tested this scenario (Figure 24). The scenario tested is that of raising government expenditure on education by 10%. Feeding this into the model shows that, relative to the above-described case of reduced education expenditure, the increased investment in human capital will result in a much more stable output growth path. Under this scenario, potential output growth averages 7.5% during the forecast period (2013–2030) and remains well above baseline potential output for the duration.\(^{11}\)

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\(^{10}\) The nature of education is that there is often a lag between expenditure on education and the output growth impacts, particularly if the expenditure is targeted at improvements across the full-level spectrum. However, given the small number of observations over which the simulation of projections are generated, there is little room to allow for large lag effects in the model. Accordingly, the model’s simulations can be read either as increased expenditure on higher level education or a “compression” of the benefits from a boost to education expenditure that takes place over all educational levels.

\(^{11}\) Another feature of the model is that it also cannot capture the interaction effects of expenditure on education with that of expenditure on higher technology capital. For example, the effect of higher education levels in combination with higher levels of capital investment—particularly in capital stock embodying technological advances or that which is designed to be allocated to an undercapitalized sector such as agriculture—could result in a dramatic increase in output. That is, the two investments complement each other, and just promoting one without the other does not yield nearly as much of an output boost.
4.6 Scenario 5: Economic Diversification—the Role of Tourism

From the previous discussion in Section 2 as well as the simulations undertaken in this section, this paper has identified the economy’s narrow economic base as a constraint and source of vulnerability to changes in the external environment. The lack of diversification also leads to constraints on the economy to generate employment for its rapidly expanding and increasingly educated labor force.

While the hydropower sector will continue to be the bedrock of the country’s economy, the government has recognized the diversification challenge, and in the 11th Five-Year Plan has identified policies to promote self-reliance and accelerate growth. It has tentatively identified various sectors for promotion to diversify its production mix. These sectors are those such as tourism, agroprocessing, non-hydropower related construction, manufacturing, mining, and small and cottage industries, including textiles, arts, and crafts.

Tourism is certainly an industry that has grown strongly over the recent decade and is well placed to support expanded growth prospects for Bhutan’s economy, especially given the superior productivity growth seen in this sector. The government has recognized this and has projected a planned expenditure boost for the sector. If we feed these projected expenditure increases in the model, results show that the path of potential output growth reveals a modest uptick relative to the baseline scenario. The model projects potential growth will average 7.4% over the next decade with potential growth only falling to and below the baseline projections in the last few years of the 17-year forecast horizon (Figure 25).
However, if the government achieves a 15% growth in gross value added in the tourism sector, it would generate a higher output growth path—7.8% on average for the period 2013–2024—and support the country’s diversification efforts (Figure 26).

**Figure 25:** Baseline vs. Government of Bhutan Forecasted Tourism Gross Value Added, Potential Output Growth (%)

GoB = Government of Bhutan, GVA = gross value added.
Source: Authors’ calculations.

**Figure 26:** Baseline vs. Diversification via 15% Growth Rate in Tourism Gross Value Added, Potential Output Growth (%)

GVA = gross value added.
Source: Authors’ calculations.
5 CONCLUSION

Bhutan’s rapid economic growth in the past 2 decades has been driven by large investments in the hydropower sector. These investments are lumpy in nature with long gestation periods. As a result, the growth pattern is volatile with output expansion spiking in the years during the construction and installation of a new hydropower plant and then falling until the next hydropower plant comes on stream. This trend, along with a narrow domestic economic base, makes the economy vulnerable to cyclical swings and external shocks.

Given Bhutan’s projections regarding hydropower investment, Bhutan’s growth prospect for the next 20 years will likely be underpinned by further development of its ample hydropower resources. Our model simulations show there will be diminishing marginal returns to capital investment in hydropower unless the revenues generated and some of the new capital investment is directed toward raising future productivity.

The model suggests that this can be achieved by better targeting of public expenditure and pursuing economic diversification through the expansion of the tourism sector and by identifying new drivers of growth. In particular, the results support higher spending on human capital—education being a key case in point—and putting in place policy measures to enhance productivity in sectors other than hydropower. Spending on higher education today can make a difference even in the near to medium-term, especially if it is vocational in nature and directed toward improving skills that are being used by emerging sectors in the economy.

Clearly, there is a need to improve the quality of the factors of production via investment in education and skills of labor, and speed up the diffusion of technology to improve efficiency. As the economy climbs up the technology ladder, shortage of skilled labor will become a more prominent binding growth constraint. Given the lag in human capital investment’s impact on the economy, there is a pressing need to speed up investment in human resources now to meet the future needs of the growing economy. At the same time, the government should sustain investment in public infrastructure to lower transaction (particularly in transportation) costs. This will also provide a significant boost to productivity, especially for the manufacturing sector.

In terms of implementation priorities, sectors that have greater room to benefit from productivity growth should be identified and promoted upfront. In general, however, Bhutan should aim to move up the value chain of the dominant industry, build upon the comparative advantage of existing industries (through the development of industries such as agribusiness), identify new industries with potential linkages to regional and global value chains, and pursue diversification into other sectors like tourism. This process—essentially the process of structural change from an agriculture-based society to one that encompasses a broader and more productive production base—needs to be a long-term vision for the economy. Putting in place the right policies and priorities in the current period can go a long way to sustain economic growth, and ultimately living standard development of the small, landlocked Kingdom of Bhutan.
BUILDING THE SCENARIOS

**Projection Scenario 3**

*How will the pipelined hydropower constructions and/or projects affect the growth paths of potential and actual output for the period 2013–2024?*

Hydropower projects get captured into gross domestic product (GDP) as increases in investments (measured by gross fixed capital formation [GFCF]).

**Model specification for investment:**

Investment can be financed either by domestic savings or foreign financing, thus,

\[ i_t = s_t + f_t = \frac{GFCF}{Y} = \text{gross savings rate} \]

where \( GFCF \) refers to gross fixed capital formation and \( Y \) is actual output (GDP) and *gross savings rate* is the aggregate of \( s_t \) domestic-saving-to-GDP ratio and \( f_t \) is the ratio of foreign loans and grants to GDP.

Therefore, we need to have a projection of *gross savings rate* = \( S \), which incorporates the effect of the pipelined hydroprojects.

This study’s approach is to compute the share to GFCF of the pipelined hydroprojects (\( S_{h\text{const}}^{13–24} \)) then add this to the projections of the model (the \( S \) projections from the baseline forecast only captures information in time \( t – 1 \) and do not capture yet the effect of pipelined hydroprojects).

\[
S_{h\text{const}}^{13–24} = \frac{h\text{const} \ GVA^h}{Y^h} \rightarrow \text{series from 2013 to 2024}
\]

\[
S_h^f = S_{h\text{const}}^h + S_{\text{base model}}^h \rightarrow \text{forecast series from 2013 to 2024}
\]

**Projection Scenario 4**

*How will the Government of Bhutan’s education spending plans affect the growth paths of potential and actual output for the period 2013–2024?*

The government’s education spending plans have significant impact on Bhutan’s general level of productivity, \( A_t \). Consequently, productivity gains will result in output growth.

\[
A_t = f(RGoB \ educ \ spending_t) \rightarrow GDP_t = f(A_t)
\]

Therefore, we need to have a projection of productivity, \( A \), which incorporates the information on government’s future spending on education. In order to estimate the contribution of education to
productivity, \( A_i \), we regress \( A_i \) against government spending on education, health, and infrastructure. Then we do a dynamic forecast of \( A_i \) for each education spending series (the existing government planned education spending and the 10% hypothetical increase) using the above-established linear relationship.

**Projection Scenario 5**

*How will the projected gross value added in tourism affect the growth paths of potential and actual output for the period 2013–2024?*

One critical constraint to Bhutan’s economic growth is its high dependence on the hydropower sector. The country needs to pursue an economic strategy, which will encourage and/or promote a more diversified pool of production sectors. Bhutan’s tourism sector is seen as having high potential in contributing to output growth.

This study investigates the impact of the projected tourism value added to future GDP and uses this to simulate the path of potential output.

\[
GDP = f(Tourism \text{ GVA}, \text{ Industry GVA}) \rightarrow \text{Potential Output}
\]

To establish this relationship, we regress GDP against three sectoral breakdown—agriculture, industry, and tourism. Then we do a dynamic forecast of GDP for each tourism series (the existing government projection of tourism gross value added and the 15% hypothetical increase) using the above-established linear relationship.
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Unlocking Bhutan’s Potential
Measuring Potential Output for the Small, Landlocked Himalayan Kingdom of Bhutan

Bhutan’s rapid economic growth in the past 2 decades has been driven principally by the hydropower sector. A key challenge is to channel the income generated by this sector for sustainable and inclusive growth. This paper develops a macroeconomic model of Bhutan’s potential output and analyzes the impact of several policy options on potential growth for Bhutan over 2013–2030. The results show that while hydropower development will underpin future growth, more investment in education and health as well as efforts to diversify Bhutan’s economic base through the promotion of tourism and other niche sectors can yield a much higher potential output.

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ADB’s vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region’s many successes, it remains home to approximately two-thirds of the world’s poor: 1.6 billion people who live on less than $2 a day, with 733 million struggling on less than $1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.