Underlying Drivers of India's Potential Growth

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Global growth is expected to be tepid in the medium term and India will have to depend on domestic growth drivers. In order to better understand the future, a new methodological framework is proposed to estimate potential growth in India with a focus on capacity output till 2029–30. The domestic savings rate was identified as the most potent growth-augmenting driver.

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1 Introduction

Estimating potential future growth under alternative policy trajectories can be useful in making contemporary policy choices affecting future growth. Given tepid global growth prospects in the medium term, India will have to depend largely on its domestic growth drivers. In this paper, we have developed a methodology for examining India's future growth potential. Although a number of methods for estimating potential growth and their applications for India are available in the literature, most of these, with a few exceptions, look at the past rather than the future.

In Section 2, we briefly review selected studies estimating India's potential growth rates. In Section 3, we develop a methodology for estimating India's future potential growth and for highlighting the relative role played by its key drivers. Section 4 brings together key data relating to saving, investment, and sectoral growth using the new 2011–12 base gross domestic product (GDP) series. Section 5 highlights the basic characteristics of the base run, estimating India's potential growth up to 2029–30. Section 6 presents the results of simulations under alternative assumptions and provides a cross-simulation comparison. Section 7 provides concluding observations.

2 Estimating Potential Growth in India

Potential output in any given period refers to output achievable by the full utilisation of production capacity. Actual output may differ from potential output. When actual output exceeds potential output, inflation increases as it implies that aggregate demand is higher than aggregate supply consistent with full capacity utilisation. Potential growth is the growth in capacity output. In a dynamic setting, potential output increases as capacity expands.

A commonly used method of estimating potential growth is to estimate trend output using the history of actual outputs. Usually the trend path of actual output is captured by using statistical filters such as the H-P or band-pass filters. An alternative approach is to determine trend output by using a structural method such as the production function approach. Sometimes a statistical filter is combined with structural analysis. In most analyses, the focus is on determining the output-gap, that is, the difference between the actual output and potential output of an economy. In the group of structural methods, one popular method is to estimate, using a production function such as the Cobb–Douglas production function, the contribution of labour and capital and total factor productivity (TFP) growth, where the latter is derived as a residual.

In the Indian context, both methods have been used extensively. For example, Donde and Saggar (1999), Ranjan et al (2007), Bordoloi et al (2009), and Mishra (2013) use statistical filters to estimate the potential output. Bordoloi et al (2009), Goyal and Arora (2012), and Mishra (2013) have used structural value at risk (VAR) methods or other statistical filters for estimating potential growth. Ranjan et al (2007) have used a production function approach for deriving the contribution of TFP.

While most of these studies have estimated potential output/growth for selected historical periods, some have used specific assumptions regarding TFP growth and other determinants for specified future periods to make projections. Thus, using TFP growth at 2.5% and a capital share of 0.35, Rodrik and Subramanian (2004) project a potential growth of more than 7.0% for India up to 2025. Poddar and Yi (2007), taking TFP growth at 3.3%, find that India's potential growth could be about 8% until 2020. A recent review of these studies relating to India's potential growth is provided in Bhoi and Behera (2016).

The *Economic Survey 2015–16*, brought out by the Ministry of Finance, provides a technical discussion on estimating future potential growth by comparing China and India. It estimates India's potential growth to be in the range of 8% to 10% up to 2029–30 using a determinants-cum-convergence approach based on the empirical finding that institutions are a key determinant of long-term growth (North 1991). A strong relationship between institutional development and economic development has been empirically observed, but both India and China are outliers to this observed pattern.

While China has grown at an abnormally high rate, India has grown at a rate much slower than that warranted by its political and institutional development. Both countries are expected to "mean-revert" or converge to the observed average pattern. China is expected to normalise through a combination of slower growth and faster democratisation, while growth in India is expected to accelerate at a much faster pace. Setting the United States (US) as a benchmark, all countries are expected to converge to its per capita purchasing power parity (PPP) GDP level at an average pace of 2%. India's convergence coefficient is expected to be relatively higher since it has underachieved so far. On this basis, India's medium-term growth potential is estimated between 8% and 10%, while at the same pace of convergence, China's growth potential is estimated to be between 4% and 6%.

Burns (2016) provides estimates of potential output growth for a sample of 26 Asian economies, including India for the period 2015–40. Burns uses the production frontier approach but unlike many other estimates of TFP, in his study, the TFP estimates are net of the effects of structural change. Burns estimates a baseline scenario and then using South Korea as a benchmark, he examines the extent of improvement in potential growth compared to a baseline scenario. In the baseline scenario, India's potential output growth, which was 6.7% during 2010–15, falls to 4.1% in 2035–40 (Table 2; Burns 2016). This outcome can be improved by policy support along four dimensions. (i) Employment convergence where the labour participation rate is increased to reach Korea's labour participation rate in 2014; (ii) capital convergence where the capital–output ratios are increased to converge to Korea's current level; (iii) TFP convergence, net of restructuring, where TFP is increased to reach the current levels achieved in Korea; and (iv) convergence of economic structure, where firms and labour move from lower to higher productivity sectors. In this case, the economies are expected to follow the same pattern of evolution as that of South Korea.

Once the level concerned reaches Korea's level, it is held constant. The combined impact of policy support in all the four dimensions increases India's potential output by a little more than 50% compared to the baseline projection in 2035–40. Significant gains are obtained by increasing the labour participation rate and TFP. In this study, structural change is reflected in the movement of labour from lower to higher productivity sectors. In our paper, as we explain later, the role of saving and investment in affecting potential growth is emphasised as part of structural change.

Studies based on past data, using the H-P or other filters remain focused on analysing the past. Studies that have used the structural approach and made projections for the future are highly aggregative and their results depend on assumptions regarding the contribution of TFP. Their estimates of TFP differ widely. In these studies, due to the high level of aggregation, it is difficult to identify the relative role of different drivers of growth so as to draw useful policy lessons for the present. The use of the convergence approach, as given in the *Economic Survey 2015–16*, does not provide much guidance as to the process by which growth will be affected.

Our focus is on determining the growth of capacity output by using a disaggregated approach so that the relative role of different factors affecting future growth of capacity output can be highlighted (for a similar approach, but in a limited form, see Rangarajan 2016). In particular, we highlight the relative roles of (i) differential prices of investment goods vis-à-vis all goods; (ii) growth of investible resources; (iii) sectoral allocation of investible resources; (iv) sectoral incremental capital–output ratios; (v) the changing weights of sectoral outputs in a dynamic setting; and (vi) buoyancy of net product taxes with respect to gross value added (GVA). We derive growth paths of India's potential growth under alternative assumptions so that policy options for driving the economy towards a suitable future growth path can be considered.

3 Proposed Methodology

Starting with the equilibrium condition that investible resources consisting of domestic savings and net inflow of capital will finance aggregate investment, we draw one key insight relevant to the Indian economy from the Harrod–Domar model—availability of capital is the binding constraint. Since financing of capital crucially depends on savings, we highlight the role of domestic savings in determining potential output in India in the contemporary context.

However, instead of taking an aggregative approach, we consider sectoral disaggregation as critical for determining India's potential growth because of crucial differences in sectoral shares in output and capital stock, and in their incremental capital–output ratios reflecting productivity. The supply of labour is not a constraint in the context of high growth of the working-age population. The availability of adequately-skilled human resources can potentially be a constraint, particularly for specific sectors, but its role is not considered separately in this analysis. Aggregate demand can play a role in forcing actual growth to settle below potential by forcing underutilisation of capacity. Our focus is on creation of potential capacity, and therefore on the supply side.

The symbols representing key variables used in this analysis are given below.

S: Savings at current prices
I: Investment (gross capital formation) at current prices (I= GFCF+NFC)
GFCF: Gross fixed capital formation at current prices
NFC: Investment in areas other than gross fixed capital formation (for example, investment in valuables, inventories)
NIC: Net inflow of capital at current prices (=sustainable current account deficit)
CFC: Consumption of fixed capital at current prices
NI: Investment in net fixed capital formation at current prices
GDP: Gross domestic product at constant (2011–12) market prices
Y: Gross domestic product at current market prices
y: Real gross value added at 2011–12 prices
PY: GDP deflator (base 2011–12 = 1)
PI: Investment goods deflator
α: Investment share in a given sector
C: Incremental output–capital ratio (in a given sector)
s: Savings rate (as % of nominal GDP)
nic: Net inflow of capital rate (as % of nominal GDP)
g_S: Nominal growth rate of savings (% per annum)
g^*_S: Real growth rate of savings (% per annum)
g_{NIC}: Nominal growth rate of net inflow of capital (% per annum)
g^*_{NIC}: Real growth rate of net inflow of capital (% per annum)
Π_{PI}: Rate of inflation of investment goods deflator (% per annum)
g_{GVA}: Growth rate of real GVA (% per annum)
g_{GDP}: Growth rate of real GDP (% per annum)

3.1 Derivation of Investible Resources

The total investible resources as a ratio of income (GDP at current market prices) are given by the following equation:
Investment in gross capital formation

$$I = S + NIC \quad \text{... (1)}$$

Investment here refers to gross capital formation. From this, investment contributing to the net fixed capital formation can be derived.[1] In the 2011–12 base national income account series, sector-wise data on capital formation is available only in gross rather than net terms. Also, it adjusts for valuables and errors and omissions, but not for inventories. Hence, we use equation 1 except for the adjustment for investment in valuables and errors and omissions. This relation can be expressed as percentage of GDP at current market prices (*Y*). Thus,

$$I/Y = (S+NIC)/Y \quad \text{... (2)}$$

Here, *I, S, NIC*, and *Y* are measured at current prices.

We can convert these at constant prices using deflators for gross capital formation (*PI*) and gross domestic product (*PY*). Thus,

$$(I/PI)/(Y/PY) = [(S + NIC)/PI]/[Y/PI] \text{ or}$$
$$(I/Y) * (PY/PI) = (PY/PI) * \{(S + NIC/Y\} \quad \text{... (3)}$$

Thus, the savings and net capital inflows, when translated into investible resources at constant prices, also reflect a differential price effect, if the inflation rates based on investment deflators and GDP deflators are different. Generally, the saving rate (*S/Y*) and the rate of net capital inflow (*NIC/Y*) are taken as parameters. However, since *Y*, that is, GDP at current market prices is the key endogenous variable to be determined in the system, we have taken the respective growth rates of saving, g_S, and net capital inflows, g_{NIC}, as the parameters. Thus,

$$S = \{1+g_S\} S_{-1} \quad \text{... (4), and}$$

$$NIC = \{1+g_{NIC}\} NIC_{-1} \quad \text{... (5)}$$

3.2 Sectoral Allocation of Capital

We consider eight sectors of the economy.
(i) Agriculture, forestry and fishing, (ii) mining and quarrying (iii) manufacturing, (iv) electricity, gas, water supply, and other utility services, (v) construction, (vi) trade, hotels, transport, storage, and communications, (vii) financial, real estate, and professional services, and (viii) public administration, defence, and other services.

Let total investment (gross capital formation) be divided among these sectors by a parameter given by *α*. Thus, investment in sector *i* is given by

$$I_i = \alpha_i I \quad \text{... (6)}$$

We have $\sum \alpha_i = 1$ to ensure that sectoral investments add to the total available resources.

3.3 Output–capital Ratios

The third step involves using the sectoral output–capital ratios to derive sectoral outputs. Sectoral output–capital ratios should refer to potential output–capital ratios. Year-to-year output–capital ratios show considerable variations. In years when actual output is below potential, there will be underutilisation of capacity, and the actual output–capital ratio will be below the potential output to capital ratio. The underlying trend in the series of actual output–capital ratios can be seen as indicating the potential output–capital ratio. The incremental output–capital ratio measured in real terms, that is, the ratio of change in real output (indicated by *y*) to change in capital (investment measured at constant prices) for the *i*th sector is given by

$$\Delta y_i/(I_i/PI) = C_i = \Delta y_i/\alpha_i (I/PI)$$

where C_i is the incremental output–capital ratio as given by the available technology, we then have

$$\Delta y_i = C_i * \alpha_i (I/PI) \quad \text{... (7)}$$

3.4 Growth Rate: Weighted Average of Sectoral Growth Rates

We can write the growth rate for GVA as

$g_{GVA} = \Delta y/y_{-1} = (\Delta y_1 + \Delta y_2 + \ldots \Delta y_n)/y_{-1}$

For the *i*th sector,

$$\Delta y_i / y^i_{-1} = C_i * \alpha_i * (I/PI)/y^i_{-1}$$

where α_i is the share of investible resources in total investment allocated to the *i*th sector ($=I_i/I$) and, $(I/PI)/y^i_{-1}$ is the aggregate investment at constant prices with respect to the GVA of the *i*th sector in the previous year, and C_i is the incremental output–capital ratio for the *i*th sector.

Thus, growth for the *i*th sector is

$$g^i_{GVA} = \left(1/_{y^i_{-1}}\right) C_i * \alpha_i * [I/PI] \quad \ldots (8)$$

where *i* varies from 1 to 8 covering sectors listed earlier.

If actual C_i is used, the model will reproduce actual sectoral growth. However, if *Ci* is replaced by a normative C^*_i, which can be the trend incremental output–capital ratio or average or maximum over a selected period, the corresponding growth projection can reflect potential growth or peak potential growth.[2] We may allow these to change over the years to reflect productivity changes due to innovations. Thus, a revised version of equation (8) can be used for estimation of potential growth as given below.

$$g^i_{GVA} = \left(1/_{y^i_{-1}}\right) \alpha_i * C^*_i * [I/PI] \quad \ldots (9)$$

Sectoral growth rates are given by $(\Delta y_i/y^i_{-1})$ and the overall growth rate is a weighted sum of the sectoral growth rates and their respective shares in output. Thus,

$$g_{GVA} = \Delta y/y_{-1} = (\Delta y_1/y^1_{-1}) * (y^1_{-1}/y_{-1}) + (\Delta y_2/y^2_{-1}) * (y^2_{-1}/y_{-1}) \ldots + (\Delta y_n/y^n_{-1}) * (y^n_{-1}/y_{-1})$$

In other words, aggregate growth rate is the sum of sectoral growth rates weighted by their respective shares in GVA.

$$g_{GVA} = \Sigma W_i . g^i_{GVA} \quad \ldots (10)$$

where $W_i = y^i_{-1}/y_{-1}$, that is, the share of output of sector *i*, in the total output.

Thus, the aggregate growth rate depends on (i) sectoral investment shares in total investment, (ii) sectoral output shares in total output, (iii) sectoral (normative) incremental output to capital ratios, and (iv) differential price deflators for investment goods vis-à-vis other goods and services. Sectoral investment shares may be considered as determined by policy. Sectoral output shares are determined endogenously. Differential sectoral growth rates in the current year will change the sectoral shares for the next year. This imparts a dynamic element to the exercise. In translating GVA growth to GDP growth, we can also take into account the effect of buoyancy of product taxes net of product subsidies or net product taxes with respect to GVA, as explained below.

3.5 From GVA to GDP

Since output is measured in terms of GVA, this analysis gives us results in terms of GVA growth. GVA growth can be translated into GDP growth by adjusting for product taxes net of product subsidies (NPT). If we assume β to be the buoyancy of real net indirect taxes with respect to real GVA, GDP growth can be linked to GVA growth as follows.

$$\beta = (\Delta NPT/NPT_{-1}) * (y_{-1}/\Delta y)$$

Writing the GVA growth rate as $g_{GVA} = \Delta y/y_{-1}$, we can derive

$$NPT = NPT_{-1} * \{1 + \beta . g_{GVA}\} \quad \ldots (11)$$

and

$$GDP = y + NPT$$

It can further be shown that growth of GDP, say g_{GDP} can be written as

$$g_{GDP} = \frac{g_{GVA} * [y_{-1} + \beta NPT_{-1}]}{GDP_{-1}} \quad \ldots (12)$$

The system is driven by growth rate of nominal saving and nominal inflow of capital, which provide the current levels of saving and investment. These investments are converted into output through a technological relationship captured by the sectoral capital–output ratios. Sectoral allocation of investment as well as price deflators for output and investment are exogenous. This implies that the weights attached to sectoral growth rates keep changing in favour of sectors with relatively high output–capital ratios.

Equations 1, 3, 7, 8, 10 and 12 describe the system for determining GDP growth. Bringing together different components, we can write the real growth of GDP as given by:

$$g_{GDP} = \left[\frac{1}{y_{-1}} \Sigma \alpha_i * C^*_i\right] * \left[\frac{PY_{-1}}{PI_{-1}}\right] * \left[s_{-1}\left[1 + \frac{g^*_s}{(1+\pi_{PI})}\right] + nic_{-1}\left[1 + \frac{g^*_{nic}}{(1+\pi_{PI})}\right]\right] * (y_{-1} + \beta NPT_{-1})$$

In this system, the parameters are α_i, C_i, g^*_S, g^*_{NIC}, *PY*, *PI*, β and π_{PI}. The endogenous variables are *S*, *I*, *NIC*, *NPT*, *y*, g_{GVA}, and g_{GDP}. The lagged endogenous variables are S_{-1}, NIC_{-1}, NPT_{-1}, and y_{-1}.

Overall growth in capacity output can be seen to depend on the following factors.

Investible resources: The level of *S* and *NIC* relative to income *Y* as captured by their growth rates. The higher the level of investible resources relative to income, the higher would be growth rate, given other things.

Differential price effect: If prices of investment goods are rising less slowly that the overall income, for the same volume of nominal savings, a relatively larger volume of real capital is generated compared to a situation where the two deflators are moving in tandem.

Sectoral allocation of investment: Sectoral investment can be affected at least partly by policy. We expect that for a given level of investible resources, in the short run, the higher the allocation to sectors that have lower capital–output ratios (higher output–capital ratios), the higher will be the aggregate growth rate.

Incremental output–capital ratios: This depends on the state of technology in each sector. If output–capital ratios increase due to technological improvements, the higher will be the growth rate for the same level of investible resources. This also depends on the efficiency of capital use, which is determined by multiple factors.

Sectoral output shares: The shares of sectoral outputs in total output in respective preceding years also affect the overall growth since it is the weighted sum of sectoral growth rates, and the weights are given by the sectoral output shares. Output here refers to GVA.

Output–capital ratios: Note that output–capital ratios are measured in relation to real GVA, whereas the measure of growth one is generally interested in is with respect to real GDP. This requires relating real GVA growth to real GDP growth by adding the growth of real product taxes net of product subsidies. GVA growth can be translated to GDP growth by using the buoyancy of net product taxes with respect to real GVA. The higher the value of this buoyancy, the higher would be the real GDP growth for any given level of real GVA growth.

4 Saving, Investment, and Output: 2011–12 to 2014–15

The National Income Accounts for India underwent major methodological changes when the base year was changed to 2011–12. Several doubts have arisen concerning the new series. The Central Statistics Office (CSO) has not yet taken the series backwards. Further, due to these major methodological changes, simple splicing does not provide comparable series before 2011–12. The CSO has, however, provided estimates for saving and investment from 2011–12 onwards consistent with the new series sectoral allocation of gross capital formation (GCF). Our analysis is based on these series.

Table 1 indicates that the saving and investment ratios have fallen since 2011–12 but real growth rates have increased.[3] This trend is reflected in the lowering of the capital–output ratio (Appendix 1, p 77). We also note that the inflation rate based on the GCF deflator is lower than that for GDP for each year from 2012–13 to 2015–16. In estimating the potential growth rate, a call will have to be taken on the appropriate capital–output ratio that should be used for the estimation of potential growth.

Table 1: Aggregate Saving and Investment Ratios: New Series (2011–12 Base)

Item	2011–12	2012–13	2013–14	2014–15	2015–16
Gross savings to GDP ratio at current prices	34.65	33.81	33.04	32.96	NA
Net capital inflow to GDP ratio at current prices	4.31	4.80	1.65	1.28	NA
Gross capital formation to GDP ratio at current prices*	38.95	38.62	34.70	34.24	NA
Gross capital formation to GDP ratio at current prices**	39.58	38.26	34.66	34.09	32.61
GVA growth at 2011–12 prices	NA	5.43	6.29	7.08	7.30
GDP growth at 2011–12 prices	NA	5.62	6.64	7.24	7.57
GDP deflator-based inflation rate		7.85	6.23	3.30	0.99
GCF deflator-based inflation rate		5.70	3.76	2.80	–1.62

* As per Statement 1.1; ** As per Statement 5.
Source: National Income Accounts: Ministry of Statistics and Programme Implementation (first revised estimates 2014–15, released on 29 January 2016).

Table 2 gives sectoral shares in investment for the period 2011–12 to 2014–15 at constant 2011–12 prices. In terms of the average investment share, the highest is in financial, real estate, and professional services at 25.5%, followed by manufacturing at 18%, and trade, hotels, transport, storage, and communications at 16.7%.

Table 2: Sectoral Shares in Investment at 2011–12 Prices

Sectors	2011–12	2012–13	2013–14	2014–15	Average (2011–12 to 2014–15)
1 Agriculture, forestry and fishing	8.6	7.6	8.1	7.1	7.8
2 Mining and quarrying	2.1	2.3	4.0	3.3	2.9
3 Manufacturing	19.2	18.4	17.4	16.9	18.0
4 Electricity, gas, water supply and other utility services	9.6	9.1	8.6	9.2	9.1
5 Construction	7.2	7.7	5.5	5.4	6.5
6 Trade, hotels, transport, storage, and communications	14.1	18.0	16.8	18.0	16.7
7 Financial, real estate, and professional services	26.8	24.8	25.9	24.6	25.5
8 Public administration, defence, and other services	12.4	12.1	13.8	15.4	13.4
Total	100.0	100.0	100.0	100.0	100.0

Source: Basic Data: National Income Accounts, CSO, Ministry of Statistics and Programme Implementation.

Table 3 gives incremental output–capital ratios. We notice that the output–capital ratio has been increasing over the period, or that the capital–output ratio has been falling. This is especially so for sectors whose share in total investment has increased. For example, the sectoral share in investment as well as the output–capital ratio has increased particularly in two service sectors—trade, hotels, transport, storage, and communication, and public administration, defence, and other services (Tables 2 and 3).

Table 3: Incremental Output–capital Ratios at 2011–12 Prices

Sector	2012–13	2013–14	2014–15	Average (2012–13 to 2014–15)	Maximum
1 Agriculture, forestry and fishing	0.089	0.230	-0.015	0.101	0.230
2 Mining and quarrying	-0.017	0.056	0.246	0.095	0.246
3 Manufacturing	0.138	0.142	0.144	0.141	0.144
4 Electricity, gas, water supply and other utility services	0.017	0.031	0.049	0.032	0.049
5 Construction	0.019	0.194	0.185	0.133	0.194
6 Trade, hotels, transport, storage, and communications	0.227	0.210	0.253	0.230	0.253
7 Financial, real estate, and professional services	0.175	0.190	0.220	0.195	0.220
8 Public administration, defence, and other services	0.104	0.102	0.214	0.140	0.214
Total GVA at basic prices	0.132	0.158	0.178	0.156	0.178

Source: Basic Data: National Income Accounts, CSO, Ministry of Statistics and Programme Implementation.

In 2014–15, except for two sectors—agriculture and construction—for all other sectors, the 2014–15 incremental output–capital ratios are the highest. In the case of agriculture, it is negative because of a deficient monsoon. In the case of construction, it is slightly lower than its maximum value. In calculating the potential growth rate, therefore, we propose to use the average incremental output–capital ratio for the period concerned. Agriculture is subject to volatility, and it is best to estimate its potential at an average so as to be consistent with a normal monsoon year. For all other sectors, we propose to use the maximum values of the incremental output–capital ratios from 2012–13 to 2014–15.

Table 4: Sectoral GVA Shares and Growth Rates (2011–12 Prices)

Sectors	Shares in GVA			Growth Rates		
	2012–13	2013–14	2014–15	2012–13	2013–14	2014–15
Agriculture, forestry and fishing	17.84	17.48	16.29	1.5	4.2	-0.2
Mining and quarrying	3.04	2.94	3.05	-0.5	3.0	10.8
Manufacturing	17.50	17.39	17.14	6.0	5.6	5.5
Electricity, gas, water supply, and other utility services	2.25	2.21	2.23	2.8	4.7	8.0
Construction	9.15	9.01	8.79	0.6	4.6	4.4
Trade, hotels, transport, storage, and communications	18.13	18.38	18.85	9.7	7.8	9.8
Financial, real estate, and professional services	19.61	20.30	20.97	9.5	10.1	10.6
Public administration, defence, and other services	12.49	12.28	12.69	4.1	4.5	10.7
Total GVA at basic prices	100.00	100.00	100.00	5.4	6.3	7.1

Source: Basic data: National Income Accounts, CSO.

Table 5: Sectoral Contribution to Overall GVA Growth

Sectors	Percent per Annum			Percent Share of Contribution in Total GVA Growth		
	2012–13	2013–14	2014–15	2012–13	2013–14	2014–15
Agriculture, forestry and fishing	0.3	0.8	0.0	5.1	12.2	-0.6
Mining and quarrying	0.0	0.1	0.3	-0.3	1.5	4.4
Manufacturing	1.1	1.0	0.9	19.4	15.4	13.0
Electricity, gas, water supply, and other utility services	0.1	0.1	0.2	1.2	1.7	2.8
Construction	0.1	0.4	0.4	1.1	6.8	5.6
Trade, hotels, transport, storage, and communications	1.7	1.4	1.8	31.0	22.4	25.4
Financial, real estate, and professional services	1.8	1.9	2.1	32.9	31.0	30.2
Public administration, defence, and other services	0.5	0.6	1.3	9.5	9.0	19.1
Total GVA at basic prices	5.4	6.3	7.0	100.00	100.00	100.00

Source: Basic data: National Income Accounts, CSO.

Table 4 gives sectoral GVA growth rates for 2012–13 to 2014–15 with reference to the 2011–12 base national income accounts. The highest growth rates maintained over the three years are for the two main service sectors—trade, hotels, transport, storage; and communications and financial, real estate, and professional services.

Table 5 gives sectoral contributions to aggregate GVA growth. Three services sectors—trade, hotels, transport, storage, and communications; financial, real estate and professionals services; and public administration, defence, and other services account for more than 70% of the overall growth and the contribution of manufacturing was in the range of 13% to 19% from 2012–13 to 2014–15.

Using 2014–15 values for all the relevant parameters, we have confirmed that the model generates a GVA growth of 7.1% in 2014–15, that is, it estimates the actual growth rate for 2014–15.

5 Characteristics and Estimation of the Base Run

We now construct a base run from 2015–16 to 2029–30 to isolate the influence of different factors, either individually or in combination. Inflation rates for both the GCF and the GDP deflators are kept at 4% per annum consistent with the midpoint of the target range of inflation rate of 2%–6%. Keeping these equal in the base run is with a view to highlighting the impact of the differential rates in the simulations. The base run is characterised by the following assumptions.

(i) The sectoral investment ratios are kept constant at 2014–15 levels.

(ii) The incremental output–capital ratios are taken at 2014–15 levels, which are also the maximum, except for agriculture and construction. For agriculture, we take the average value. For construction, we take the maximum value.

(iii) For the buoyancy of net product taxes with respect to GVA, measured using variables at both current and constant prices, we use the actual buoyancy for 2014–15 and 2015–16 and then keep it at 1 for the remaining forecast period.

(iv) The nominal saving growth rate is kept at actual levels for 2014–15 and 2015–16 and at 12.5% for the remaining period.

(v) The net capital inflow is grown at 12.5% from 2016–17 onwards. This gives a level of net capital inflow of a little less than 1.3% of GDP, which may be considered as sustainable (Rangarajan and Mishra 2013; Rangarajan 2016).

Compared to actual GDP growth rates of 7.3% and 7.6% for 2014–15 and 2015–16, the estimated potential GDP growth rates are 7.6% and 8% for these years. Since the excess of potential over actual growth rates is very small, there is not much scope for increasing stimulus in the economy right now. The potential growth rate increases to 8.1% in the base run.

Table 6: Potential Growth Simulations: Base Run

Year/Unit of Measurement	Nominal Growth Rate of Gross Savings	Saving Rate	Net Capital Inflow Rate	Investment Rate	GCF Deflator Inflation Rate	GDP Deflator Inflation Rate	Buoyancy of NPT wrt GVA	GVA Growth Rate	GDP Growth Rate
	Percent per Annum	Ratio to GDP at Current Prices			Percent per Annum		Number	Percent per Annum	
2014–15	10.5	32.9	1.3	34.1	2.80	3.30	1.3	7.4	7.6
2015–16	8.4	32.7	1.3	33.9	-1.62	0.99	1.5	7.7	8.0
2016–17	12.5	32.7	1.3	34.0	1.00	4.00	1.0	8.0	8.0
2017–18	12.5	32.8	1.3	34.0	4.00	4.00	1.0	8.0	8.0
2018–19	12.5	32.8	1.3	34.1	4.00	4.00	1.0	8.0	8.0
2019–20	12.5	32.9	1.3	34.2	4.00	4.00	1.0	8.0	8.0
2020–21	12.5	32.9	1.3	34.2	4.00	4.00	1.0	8.0	8.0
2021–22	12.5	33.0	1.3	34.3	4.00	4.00	1.0	8.0	8.0
2022–23	12.5	33.0	1.3	34.3	4.00	4.00	1.0	8.0	8.0
2023–24	12.5	33.1	1.3	34.3	4.00	4.00	1.0	8.1	8.1
2024–25	12.5	33.1	1.3	34.4	4.00	4.00	1.0	8.1	8.1
2025–26	12.5	33.1	1.3	34.4	4.00	4.00	1.0	8.1	8.1
2026–27	12.5	33.1	1.3	34.4	4.00	4.00	1.0	8.1	8.1
2027–28	12.7	33.2	1.3	34.5	4.00	4.00	1.0	8.1	8.1
2028–29	12.7	33.3	1.3	34.6	4.00	4.00	1.0	8.1	8.1
2029–30	12.5	33.3	1.3	34.6	4.00	4.00	1.0	8.1	8.1

Source: Authors' estimates.

6 Simulations and Policy Implications

Using the base run as the benchmark, we consider the effects of specified changes individually, as summarised in Table 7.

The basic features of the simulations are described below.

Simulation 1: The implicit price deflators differ for GCF vis-à-vis the overall GDP deflator. In particular, a wedge of 1% point is introduced between the inflation rates for investment goods as compared to the overall GDP from 2017–18 to 2029–30. The GCF deflator-based inflation is kept at 3.5%, while the GDP deflator-based inflation is kept at 4.5% for this period. A lower GCF deflator relative to the GDP deflator implies that for the same amount of investment in real terms, rela tively lower amount of sacrifice in real terms of consumption is needed.

Table 7: Simulation Designs

Simulation	Description
1	A 1% point wedge between inflation rates for GCF and GDP is introduced. The former is lowered to 3.5% and the latter is increased to 4.5%.
2	The growth rate of nominal saving is increased progressively from 12.5% to 16%. This reflects the likely positive impact of India's demographic dividend. It leads to a saving rate close to the peak already achieved in 2007–08.
3	Technological innovation leading to productivity growth implying that higher incremental output-capital is introduced. It is done for two sectors, viz manufacturing and financial and real estate and business services, trade, hotels, transport, storage and communications where the incremental output-capital ratios are increased by given margins.
4	The buoyancy of net product taxes with respect to GVA is increased to 1.2

Simulation 2: The growth rate of saving is progressively increased from 13% per annum to more than 16% throughout the period from 2017–18 to 2029–30, resulting in an increase in the saving rate from 32.3% to 38.3% of GDP in 2029–30.[4] A savings rate of close to 38% was achieved in 2007–08 as per the 2004–05 base GDP series.

Simulation 3: Improvement in productivity is introduced by changing the incremental output–capital ratio. In particular, the incremental output–capital ratio for manufacturing is increased progressively from 0.15 in 2016–17 to 0.20 in 2029–30.

Simulation 4: The buoyancy of net indirect taxes to GVA is kept at 1.2 from 2017–18, compared to the base run where it is kept at 1 for this period. A buoyancy level of higher than 1 of indirect taxes will ensure a progressively increasing tax-GDP ratio, which is required to finance much-needed expenditures on social sectors. The *Economic Survey 2015–16* has also noted that India's tax–GDP ratio is less than comparable benchmarks by at least 3%–4% points.

The impact of these changes on the GDP growth rate is summarised in Table 8.

The highest positive impact on the growth rate comes from increasing the saving rate. This is followed by the positive effect of differential prices for investment goods vis-à-vis the overall GDP. Increasing productivity and keeping buoyancy of net product taxes at 1.2 also has a positive impact.

In the context of current policy formulation, some of the implications are very clear. First, the steady fall in the saving rate, as exhibited by the savings data from 2011–12 to 2014–15, was accompanied by an increase in the output–capital ratio. This may mean better capacity utilisation though there is no direct evidence of this. If the trend of falling saving rate continues, it will be most detrimental for India's potential growth rate. Raising the savings rate will also mean control over the fiscal deficit since public savings is a component of savings.

Improving productivity would require a sustained effort on the part of the government in improving ease of doing business, facilitating better supply chains (through the Goods and Services Tax; GST) and overcoming infrastructure deficiency. It will also require sustained action on the part of businesses in terms of innovations, better supply chain management, and training. It may be noted that under all scenarios, the share of industry will be going down and that of services will increase.

In interpreting these results, certain caveats should be kept in mind. First, while we have focused on potential growth, we

Table 8: Growth of GDP under Alternative Policy Configurations

Year/Unit of Measurement	Base Run	Simulation 1	Simulation 2	Simulation 3	Simulation 4
Changes Introduced	As in Table 6	Differential GCF and GDP Deflators	Growth Rate of Saving	Output-capital Ratio	Buoyancy of Net Indirect Taxes
2014–15	7.6	7.6	7.6	7.6	7.6
2015–16	8.0	8.0	8.0	8.0	8.0
2016–17	8.0	8.0	8.0	8.0	8.0
2017–18	8.0	8.0	8.0	8.0	8.1
2018–19	8.0	8.1	8.1	8.0	8.1
2019–20	8.0	8.1	8.1	8.1	8.1
2020–21	8.0	8.2	8.2	8.1	8.2
2021–22	8.0	8.2	8.3	8.2	8.2
2022–23	8.0	8.2	8.4	8.2	8.2
2023–24	8.1	8.3	8.6	8.2	8.2
2024–25	8.1	8.3	8.7	8.3	8.2
2025–26	8.1	8.3	8.9	8.3	8.2
2026–27	8.1	8.4	9.0	8.4	8.2
2027–28	8.1	8.4	9.2	8.5	8.3
2028–29	8.1	8.4	9.4	8.5	8.3
2029–30	8.1	8.5	9.6	8.6	8.3

Source: Authors' calculations.

Table 9: Share of Industry under Alternative Policy Configurations

Fiscal Year	Base	Scenario 1	Scenario 2	Scenario 3	Scenario 4
2014–15	31.6	31.6	31.6	31.6	31.6
2015–16	31.1	31.1	31.1	31.1	31.1
2016–17	30.7	30.7	30.7	30.7	30.7
2017–18	30.3	30.3	30.3	30.3	30.3
2018–19	29.9	29.9	29.9	29.9	29.9
2019–20	29.6	29.6	29.6	29.6	29.6
2020–21	29.3	29.2	29.2	29.3	29.3
2021–22	29.0	28.9	28.9	29.0	29.0
2022–23	28.7	28.7	28.7	28.8	28.7
2023–24	28.4	28.4	28.4	28.6	28.4
2024–25	28.2	28.2	28.1	28.5	28.2
2025–26	28.0	27.9	27.9	28.3	28.0
2026–27	27.8	27.7	27.7	28.2	27.8
2027–28	27.6	27.5	27.5	28.2	27.6
2028–29	27.4	27.4	27.3	28.1	27.4
2029–30	27.2	27.2	27.1	28.1	27.2

Source: Authors' calculations.

have not examined the influence of demand side considerations, which will eventually determine the actual growth around a path describing potential growth. We have also assumed that the output–capital ratios are constant for the period under consideration, or they change very slowly in selected sectors.

7 Concluding Observations

In this paper, a methodological framework for estimating India's potential future growth has been proposed. This approach focuses on the supply side and the determination of the growth path of capacity output up to the period 2029–30. In particular, we highlight the relative roles of (i) growth of investible resources comprising domestic savings and net capital inflow; (ii) differential prices of investment goods vis-à-vis consumption goods and services; (iii) sectoral incremental capital–output ratios; (iv) the changing weights of sectoral outputs in total output due to sectoral growth rate differentials; and (v) the buoyancy of net product taxes. We derive growth paths of India's potential growth under alternative assumptions with a view to considering policy options in the present for driving the economy towards a suitable future growth path. In interpreting these results, certain caveats should be kept in mind. First, while we have focused on potential growth, we have not examined the influence of demand side considerations, which will eventually determine the actual growth around a path describing potential growth.

Improving productivity would require sustained effort by the government to improve ease of doing business, facilitate better supply chains (through GST), and overcome infrastructure deficiency. It will also require businesses to do better in innovations, supply chain management, and training.

The most potent growth augmenting source remains an uplift of the domestic saving rate. The phase of high growth that India achieved during three consecutive years—2005–06, 2006–07, and 2007–08—was characterised by (i) high savings and investment rates, and (ii) low incremental capital–output ratio. In these three years, real growth rate for GDP at 2004–05 market prices were, respectively, 9.3%, 9.3%, and 9.8%. Although growth in exports at constant prices was at 26.1% and 20.4% in 2005–06 and 2006–07 respectively, it fell to 5.9% in 2007–08, which was the year of highest growth among the three. In all years, real imports grew at rates higher than the exports, so that net exports were negative. The high growth was, therefore, mainly due to high saving and investment rates and lower incremental capital–output ratios. In these three years, the saving rates relative to GDP, both measured at current prices, were 33.4%, 34.6%, and 36.8% respectively. The investment rates, measured at 2004–05 prices, were 34.9%, 36.2% and 39%. The incremental capital–output ratios (ICORs) at 2004–05 prices were respectively, 3.9%, 3.6%, and 3.8%.

In contrast, in the current scenario, the saving and investment rates have fallen and the ICOR is higher. In 2015–16, we estimate it to be 4.4, which is the lowest in recent years but still higher than 2005–08 levels. Although export growth is currently negative, imports have fallen even faster, leading to net exports contributing positively to GDP growth in 2013–14 and 2014–15, although by a very small margin. Yet in a scenario where exports are falling or show low growth, reliance has to be more on domestic consumption. In such a situation, it will be quite a challenge to uplift the savings rate significantly. This will require lowering of the government's revenue deficit from its current levels. The key to higher growth would therefore be lower ICOR. Policies that lead to higher productivity would support higher growth in the short term. However, over the medium term, high growth can be sustained only by raising the savings and investment rate.

NOTES

1 Ideally, we need to work with fixed capital formation. Adjustments are needed to account for investment in valuables and inventories, capital consumption, and errors and omissions. Thus, investment in net fixed capital formation is given by:

$$NI = [S + NIC - CFC - NFC]$$

Here, NFC includes investment in valuables, inventories, and adjustment for errors and omissions.

2 We use this term to indicate maximum attainable real growth for a given level of real savings/investment. This would be consistent with full capacity utilisation and derived by using the maximum levels of the incremental output–capital ratios for all sectors over a reference period.

3 Doubts have been expressed about the reliability of the growth estimates in the new GDP series.

4 Since India is entering into a demographic dividend window where the share of working age population to total population will keep increasing up to 2029–30 and a few years beyond, we expect the growth in nominal saving to keep increasing progressively.

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Appendix 1

Incremental Capital–Output Ratios with Respect to Gross Capital Formation and Gross Fixed Capital Formation at 2011–12 Prices

Serial No	Sector/with Respect to Gross Capital Formation	2012–13	2013–14	2014–15	Average (2012–13 to 2014–15)	Minimum
1	Agriculture, forestry and fishing	11.2	4.3	-65.0	-16.5	-65.0
2	Mining and quarrying	-57.4	17.8	4.1	-11.8	-57.4
3	Manufacturing	7.2	7.0	7.0	7.1	7.0
4	Electricity, gas, water supply and other utility services	58.2	32.5	20.6	37.1	20.6
5	Construction	52.9	5.1	5.4	21.2	5.1
6	Trade, hotels, transport, storage, and communications	4.4	4.8	4.0	4.4	4.0
7	Financial, real estate, and professional services	5.7	5.3	4.5	5.2	4.5
8	Public administration, defense, and other services	9.6	9.8	4.7	8.0	4.7
9	Total GVA at basic prices	7.6	6.3	5.6	6.5	5.6
	With respect to gross fixed capital formation* (at 2011–12 prices)					
10	Total GVA at basic prices	6.3	5.3	4.6	5.4	4.6
11	GDP at constant (2011–12) market prices	6.1	5.0	4.5	5.2	4.5

*Sector-wise gross fixed capital formation data are not yet available in the 2011–12 base series.

Source: National Income Accounts: MOSPI (First revised estimates of national income, consumption expenditure, saving, 2014–15, released on 29 January 2016).

Appendix 2

$GDP = GDP_{-1}[(1+g_{GDP})]$ and $y = y_{-1}[(1+g_{GVA})]$

$GDP = y + NPT$

$GDP_{-1}[(1+g_{GDP})] = y_{-1}[(1+g_{GVA})] + \{NPT_{-1}[1+\beta g_{GVA}]\}$

$$g_{GDP} = \frac{[GDP_{-1}[(1+g_{GDP})] + \{NPT_{-1}[1+\beta g_{GVA}]\} - GDP_{-1}]}{GDP_{-1}}$$

$$g_{GDP} = \frac{[\{y_{-1} + NPT_{-1}\} + g_{GVA}\{y_{-1} + \beta NPT_{-1}\} - GDP_{-1}]}{GDP_{-1}}$$

$$g_{GDP} = \frac{g_{GVA} * [y_{-1} + \beta NPT_{-1}]}{GDP_{-1}}$$

Appendix 3

From equation (7),

$\Delta y_i = \alpha_i * C_i\ (I/PI)$

Substituting the value of I from equation (1),

$\Delta y_i = \alpha_i * C_i[\{S+NIC\}/PI]$

Using equation (8), where growth rate of *GVA* is referred to as g_{gva}, and replacing C by C^*

$$g^i_{GVA} = \left(1/y^i_{-1}\right) \alpha_i * C_i^* * [\{S+NIC\}/PI]$$

Taking a weighted average of sectoral *GVA* growth rates,

$$g_{GVA} = \Sigma\left(y^i_{-1}/y_{-1}\right) * \left(1/y^i_{-1}\right) \alpha_i * C_i^*[\{S+NIC\}/PI]$$

$$g_{GVA} = \left(1/y_{-1}\right)\Sigma\alpha_i * C_i^* * [\{S+NIC\}/PI]$$

From equation (12),

$$g_{GDP} = \frac{\{(1/y_{-1})\Sigma\alpha_i * C_i^*[\{S+NIC\}/PI] * [y_{-1} + \beta NPT_{-1}]\}}{GDP_{-1}}$$

Where y is real *GVA*, *GDP* is real *GDP* and *S* and *NIC* are at current prices.

We can write $GDP_{-1} = Y_{-1}/PY_{-1}$ and $PI = PI_{-1}[(1+\pi_{PI})]$

Where *Y* is *GDP* at current prices and *PY* is the *GDP* deflator. π_{PI} is the rate of inflation of the investment goods deflator. Thus,

$$g_{GDP} = \left[\frac{1}{y_{-1}}\Sigma\alpha_i * C_i^*\left\{\frac{(S+NIC)}{PI_{-1}(1+\pi_{PI})}\right\}\right] * \left[\frac{PY_{-1}}{Y_{-1}}\right] * (y_{-1} + \beta NPT_{-1})$$

Bringing the $(S+NIC)\ /\ [PI_{-1}(1+\pi_{PI})]$ term outside the summation sign since it is common for all sectors, we can write

$$g_{GDP} = \left[\frac{1}{y_{-1}}\Sigma\alpha_i * C_i^*\right] * \left(\frac{S+NIC}{Y_{-1}}\right) * \left[\frac{PY_{-1}}{PI_{-1}}\right] * \left[\frac{1}{1+\pi_{PI}}\right] * (y_{-1} + \beta NPT_{-1})$$

Using growth rates of nominal savings, g_s and nominal net inflow of capital, g_{nic}, we have

$$g_{GDP} = \left[\frac{1}{y_{-1}}\Sigma\alpha_i * C_i^*\right] * \left[\frac{S_{-1}[1+g_s] + NIC_{-1}[1+g_{nic}]}{Y_{-1}}\right] * \left[\frac{PY_{-1}}{PI_{-1}}\right] * \left[\frac{1}{1+\pi_{PI}}\right] * \left(y_{-1} + \beta NPT_{-1}\right)$$

Further, $s_{-1} = S_{-1}/Y_{-1}$ and $nic_{-1} = NIC_{-1}/Y_{-1}$.

Therefore, we have

$$g_{GDP} = \left[\frac{1}{y_{-1}}\Sigma\alpha_i * C_i^*\right] * \left[s_{-1}(1+g_S) + nic_{-1}(1+g_{NIC})\right] * \left[\frac{PY_{-1}}{PI_{-1}}\right] * \left[\frac{1}{1+\pi_{PI}}\right] * \left(y_{-1} + \beta NPT_{-1}\right)$$

$g_S = (1+\pi_{PI}+g_S^*)$ and $g_{NIC} = (1+\pi_{PI}+g^*_{NIC})$

Where g_s is the nominal growth rate of savings and g^*_s is the real growth rate of savings. Similarly, g_{nic} is the nominal growth rate of net inflow of capital and g^*_{nic} is the real growth rate of net inflow of capital. So, we obtain

$$g_{GDP} = \left[\frac{1}{y_{-1}}\Sigma\alpha_i * C_i^*\right] * \left[\frac{PY_{-1}}{PI_{-1}}\right] * \left[s_{-1}\left(\frac{1+\pi_{PI}+g_S^*}{1+\pi_{PI}}\right) + nic_{-1}\left(\frac{1+\pi_{PI}+g^*_{NIC}}{1+\pi_{PI}}\right)\right] * \left(y_{-1} + \beta NPT_{-1}\right)$$

$$g_{GDP} = \left[\frac{1}{y_{-1}}\Sigma\alpha_i * C_i^*\right] * \left[\frac{PY_{-1}}{PI_{-1}}\right] * \left[s_{-1}\left[1 + \frac{g_S^*}{(1+\pi_{PI})}\right] + nic_{-1}\left[1 + \frac{g^*_{NIC}}{(1+\pi_{PI})}\right]\right] * \left(y_{-1} + \beta NPT_{-1}\right)$$

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