Total Factor Productivity in Bangladesh: An Analysis Using Data from 1981-2014

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Sponsoring Agency: BIDS REF Fund

Summary:

Bangladesh has been experiencing a steady increase in the growth rate of real GDP since independence, accelerating from an average of less than 4% per year during 1972-1990 to 6.5% in 2010-2016. Bangladesh is one of the sixteen countries that have to strive for a journey to get herself out of LDC and at the same time to secure the middle income status (WDI 2016 database). This growth performance is overwhelming considering the low initial base. It is a matter of great surprise that it has successfully managed to continue 6% growth rate since 1996. Moreover, the country hits the highest 7.11% growth rate in fiscal year 2017-2018. The average growth rate of output for 1981-2014 is 4.89% while its population has grown by around 1.99% (source: http://data.gov.bd/dataset) every year over the same period.

Nonetheless, this performance is expected to gear up by ambitious endeavors of the government in recent times. The 7th FYP targeted achieving an 8% annual rate of GDP growth by 2015 and the Perspective Plan projected to further accelerate this growth to 10% by 2021 with 8% GDP growth per annum.

This expeditious movement of economy induces the needs of further cogitations; how realistic are these growth targets? What are the likely sources of growth and what will it take for Bangladesh to realize and sustain such growth targets over the next 15-20 years? How policy could favorably influence growth dynamics?

Middle Income Trap

In July 2015, Bangladesh stepped in to the lower-middle income economies (LMIEs) club with GNI per capita $1,080 against reference threshold of $1,045 for LMIEs (World Bank Atlas method). As soon as Bangladesh meets the LMIEs criteria, the plausibility of falling into “Middle Income Trap (MIT)” becomes a crucial concern. The past evidence of graduation phase of a number of developing countries demonstrates that getting stuck into graduated status became inevitable due to failure of sustaining their past growth momentum.\(^1\) Hence, this past experience of being trapped

\(^1\) It has been observed that many of the countries have fallen into Lower MIT; a few into Upper MIT. It took Turkey for 50 years to move from Lower Middle Income to Upper Middle Income with an average growth rate of 2.6%. While it took 19 years for South Korea to move from Lower Middle Income to Upper Middle Income with an average growth rate of 7.2%. It took less than 10 years for China Hong-Kong, Japan, Korea and Singapore to transit from upper middle income to high income countries with as low as growth rate of 4.7%. In contrast, it took for 40 years for Argentina to move from upper middle income to High income countries with an average growth rate of 1.2%. 
into any specific gradated status raises the concern for Bangladesh to take adequate measures for smooth transition from LMIE to UMIE and subsequently to HIE.

The forecast of per-capita GNI required to join the High Income Economies in the year 2041, using the extrapolation method based on the Per capita GNI ($) threshold level data spanning over 1987-2016 yields a figure of 6261 USD. This figure may seem to be underestimated because it falls short of by 5957 USD per capita GNI\(^2\). Based on 30 years of per capita GNI data (1987-2016), extrapolation\(^3\) method has been employed to predict a data 25 year ahead data point. Now with 1330 USD per capita GNI in hand in 2016, Bangladesh requires to achieve a compound growth rate of 6.39\% per year to join the High income country club within 25 years. Compared to 9.30\% growth rate of per-capita GNI that Bangladesh achieved over 2010-2016, the projected required growth rate of 6.39\% seems quiet achievable. However, Bangladesh should experience a growth rate of 9.28\% in per capita GNI even if the high income economies threshold level is fixed at 2016 level (i.e. 12236 USD).

Absence of required structural adjustments, existence of persistent economic vulnerabilities and failure to develop social capital were the underlying factors of being trapped into middle income growth trajectory for the MIT countries. Furthermore, inability to utilize the ‘demographic window of opportunity’ is one of the dominant contributing factors toward MIT. The motivation of this study is driven by this need of exploring the new dimensions areas that may increase long run growth and help to avoid the so-called Middle Income Trap

**Drivers of Growth in Bangladesh**

The surprising growth performance of Bangladesh naturally raises the interest of probing the major factors those had contributed to this remarkable growth phenomenon over time. This investigation process needs to respond the question “What are the major drivers of growth in Bangladesh?”

**Labor Force in Bangladesh**

Two dimensions of labour force can contribute to growth of economy: increased participation rate of labor and increased productivity of labour. Labour force participation rate had been increased by 1.2 times since 1990; (from 47\% in 1989-90 to 57\% in 2013) followed by a persistent increasing trend over time. The composition of sectoral employment of labour force also shows variation; with decreased participation in agriculture and increased participation in industry and service.

\(^2\) A country is said to join High Income Economies club if it has per-capita GNI 12236 USD in the year 2016 while this figure for Bangladesh for the same year is 1330 USD.

\(^3\) The advantage of using extrapolation method in economic forecasting is that it takes into account the fluctuations in data (economic business cycle in this specific case) occurred in the past years. That is why, the projected value is found to be smaller than that of present threshold level. Hence, it is assumed that the predicted per-capita GNI to join the high income economies of 6261 USD is obtained after considering the probable business cycle patterns
Labour has also become more productive over time; according to Labor Productivity Index of ADB, the value of index doubled in 2014 compared to 1980.

Accumulation of Physical Capital

The share of Investment to GDP follows a rising trend since 1986 to 2010 and then starts falling. The contribution of private investment has always out weighted the contribution of public investment to GDP. The contribution of public investment to GDP had been more or less steady over time (between 5% to 6%). On the other hand, the share of private investment to GDP had increased over time.

Hence, one of the notable facts is the declined contribution of investment in GDP in recent five years as well as the slower growth in capital stock. Moreover, the role of private investment to GDP was bit steady compared to increased share of public investment. Labour force suffers from lack of quality; skills gap yet presents the need for a fundamental policy challenge for future growth strategy. 21.3 % of employed population has no education at all. Only 30.6% and 6.1% of employed population has secondary and tertiary education respectively.

Considering the stagnant Investment-GDP ratio, large pool of unskilled labor with low participation in secondary education, it is necessary to explore the contribution of labor and capital stock in Bangladesh’s growth that incidentally raises the urge of revealing the contribution of TFP as well. Being endogenous in nature, TFP can be influenced by government policies. Apart from estimating the contributions of labour, capital and TFP to economic growth, exploration on determinants of TFP also becomes an obvious exercise. This study had been carried out with two major objectives; estimation of TFP in Bangladesh as well as exploration of determinants of TFP.

Estimation of Total Factor Productivity in Bangladesh

This study intends to use Solow Model for describing the dynamics of growth of Bangladesh economy based on its worth use of explaining the production mechanism of an economy.

Estimation of The Production Function

This study utilizes the Cobb-Douglas Production function with Harrod-neutral technical progress and constant returns to scale assumption as a beginning step to analyze the Solow growth model for conducting the growth accounting exercise. The Growth Accounting Exercise (GAE) has been performed with the obtained share of factors of production from the estimated Cobb-Douglas production function to determine the contribution of factor accumulation on growth. The discrepancy between the realized growth rate and growth due to factor accumulation yields the TFP series. This study then seeks to find out the determinants of TFP with its underlying causes and explain the relevance of these determinants in the Bangladeshi context.
To estimate the Cobb-Douglas production function in a time series set-up, it is necessary to check for the unit root tests for the concerned variables. The major four unit root tests (i.e. ADF, PP, KPSS & DF-GLS(ERS)) tests have been performed in this regard on the variables with both level and first difference form. Besides, to be more accurate, variables are tested with both constant with trend and without trend forms.

OLS result provides capital share ($\alpha$) to be 0.68 along with labor share of around 0.30. The FMOLS estimate gives share of capital as high as 0.69. The ARDL estimate of $\alpha$ is found to be 0.654 while the VEC model yields the share of capital to be around 0.49. The coefficients of the share of capital along with labor share are found to be highly significant in all of the four cases. It implies that in the production processes both labor and capital play a significant role. The next interest was to observe whether the Cobb-Douglas production function exhibits the constant returns to scale assumption. CRS assumption varies across the methods used. The first difference OLS method supports the CRS assumption while the FMOLS does not. Since there is no straight way to conclude whether the CRS assumption holds in the production processes this study intends to incorporate both the CRS and non-CRS assumption to be in safe side.

It is observed that in the intensive production form also the share of capital resonates the magnitude and significance level of the aggregate production function. The share of capital ranges from around 0.47 to 0.71 across the different methods with all of the coefficients retaining the significant levels. To sum up, the share of capital varies between the range of 0.47 to 0.70. The empirical studies of many growth accounting exercises reports the share of capital to be approximately one-third.

*Why does this study find the share of capital varying in the domain of half to around two-third for Bangladesh instead of the stylized value of one-third for the developed countries?*

The higher productivity of capital, lack of better data management tool in recording capital accumulation, inflated share of capital demeaning the contribution of technological progress in developing countries compared to developed countries might be attributed for this higher capital share. The share of capital estimates for Bangladesh is found to be around 0.41 over the period 1960-1994 by the FMOLS method from the Senhadji (2000). This figure of capital share seems to be deviated from the stylized value of share of capital of one-third set for the developed countries. Besides, Rao and Hassan (2009) also found capital share of output as high as 0.53 over the period 1970-2007 obtained by the LSE-Hendry General to Specific (GETS) method in the calculation of intensive form production function. Hence, the results of these studies testify that the share of capital gets an increasing tendency as recent time periods are taken into account. Hence, it is of no surprise to find an increasing share of capital as recent periods are considered.

**Determinants of TFP**

The million dollar question for Bangladesh in the impending periods is how this spectacular growth can rate can be increased and sustained? With this end in view, it is necessary to look for variables that are identified for determining TFP and justify the relevance of those variables in the context of Bangladesh.
The literature and empirical analysis on the determinants of TFP considers it to be a function of a host of macro, institutional and even micro level variables. The empirical research on the endogenous growth model has marked a lot of variables to be the determinants of TFP for individual as well as cross-country analysis. Taking all of these facts into account, Durlauf et al (2008) have concluded that literature on factors determining the growth always encompass into economic institutions, culture, climate, legal political systems, geographical isolation and ethnic fractionalization. Hence, selection of variables with a view to determining factors causing TFP growth remains a subjective task. Besides, many of the variables have no secondary let alone primary causal links to growth. In this regard, it is worth noting that Failure to meet the policymakers demands of suggesting policies for developing countries on how to increase growth rate result from this subjectivity in choosing variables (Prichette, 2006). Hence, taking into account the realistic view in terms of suggesting policies, this study adopts Senhadji’s (2000) approach in which he showed some variables of being capable of increasing the growth rate of TFP with response to various policy measures. The major conclusion of the study by Senhadji (2000) include identification of factor accumulation is to be the driver of growth for the 46 developing countries with negligible or no impact of TFP in cases and proof of conditional convergence. Senhadji (2000) uses a total of 10 variables from 6 broad categories for determining the source of cross-country differences in total factor productivity (TFP) levels in panel data set-up for 88 countries over 1960–94.

This study exploits both the macroeconomic variables and institutional quality indicator variables with a view to analyzing the determinants of TFP for Bangladesh. The contribution of this paper in the literature lies in the fact that, this study attempts to incorporate the institutional quality indicator variables to determine TFP for the first time in Bangladesh context. Taking into account of only 32 data points (1982-2014), this study selects a total of 10 relevant TFP determining variables in the context of Bangladesh covering 2 broad categories (7 macro-level variables and 4 institutional quality indicator variables). The TFP determining 7 macro-level variables are noted along with the expected priori signs in parenthesis: Government expenditure on schooling as percentage of GDP (positive), credit (positive), broad money as percentage of GDP (positive), Government consumption net of schooling as percentage of GDP (positive), inflation deflator (negative), remittance as percentage of GDP (positive), globalization index (indeterminate). While the 4 institutional quality indicator variables included are: voice and accountability (positive), rule of law (positive), regulatory control (negative), control of corruption (positive).

The unit root tests reveal the nature of I(1) and I(0) property of the potential TFP determining variables. Hence by making all of the variables into I(0), the estimates of the determinants of TFP is obtained by running OLS method. Instead of running a single model for the determinants of TFP, this study runs for 3 different specifications of the models each of which includes 9 independent variables out of a total of 11 selected variables. This exercise is aimed at ensuring robustness of the significance of the impacts of the variables on TFP

The TFP series obtained from Aggregate production function estimates with Non-CRS assumption estimated by four methods: OLS, VEC, FMOLS and ARDL respectively are used as dependent variable. The results show that the significance of the variables along with the same sign remains
roughly same across the models. Government expenditure on schooling becomes insignificant only with the dependent variable of TFP estimated by the VEC model. On the contrary, remittance is found to be significant only in the model in which TFP is estimated by the OLS method. The same set of independent variables is regressed over the TFP series obtained from aggregate production function with CRS assumption by the four methods. It is noted that the significance of all of the variables across the models remain the same with no sign of the variables toggling across the models. The same line of interpretation is resonated from Intensive form production function estimates.

Policy Recommendations and Conclusions

The major two objectives of this study attained through the empirical exercise allow the opportunity for policy implications. The estimation exercise ends up with comparatively larger share of capital in produced output of economy. This result might seem surprising at first glance as the production technology of Bangladesh is conventionally recognized as labour-augmented one; the studies carried out so far (Rao & Hassan, Mahajan, Khatoon & Afroz) validates the higher share of labour over capital. However, Mujeri (2004) found the higher share of labour (0.65) over capital for the period 1997-2006.

IMF World Economic Outlook (April 2017, chapter 3) documents and analyses the downward trend of labour in the labour share of income since the early 1990s. The study documents that in a sample of 54 emerging market and developing economies (for which, on average, the decline in the labor share over the sample period is concentrated in the early 1990s), the labor share declined in 32 economies, which accounted for about 70 percent of 2014 emerging market GDP, while rising or remaining roughly constant in the rest. Global integration, and more specifically, participation in global value chains, appears to be an important factor behind the decline in the labor share of income. The lower labour share in this study can also be explained with same reasoning in this regard. Another explanation of the higher income share of capital can be depicted by the elasticity of substitution between capital and labor; a key parameter that influences the factor shares of income. Bairam (1991) showed that the elasticity of substitution varies from sector to sector and greater than unity in the service and heavy industry sectors of Bangladesh. The sectoral shift in the composition of GDP in last decade (with higher share of service sector and lower share of agriculture) allows the room for displacing workers performing routine tasks.

The second objectives of the study, exploring the determinants of TFP provides the scope of policy implications in designing the periodical planning of development of the economy. TFP and government expenditure are interrelated through the channel of development of human capital.

Increased public expenditure on schooling is one of the building block of skilled labour force equipped with better education and expertise, popularly called as human capital. Hence, increased public expenditure affects TFP growth through enhancement of education spending.

Establishing as well as ensuring voice and accountability in the society turned out to be a facilitating factor for productivity growth. No prior evidence on positive impact of voice and accountability over growth of overall economy had been found; however, Lasagni, Nifo and
Vecchione (2015) established the positive effect of voice and accountability over individual firms’ productivity.

Hence, voice and accountability can affect the overall economy’s production technology with the force of establishment of social cooperatives and associations, degree of participation in election, number of books published and number of purchase in bookshops. In the same way, minimizing the regulatory control may create such a conductive environment that will increase the growth rate of Bangladesh.

The impact of Broad money on TFP is found to have a significant negative impact for Bangladesh over the period 1981-2014, a contradiction to priori sign. The financial sector of Bangladesh is lagging far behind in terms of maturity like many other developing countries. A bulk amount of idle money in the banks, money laundering and loan defaulting can be marked as the common characteristic of financial system in the recent time of Bangladesh.

The impact of globalization on the growth of Bangladesh is found to have a significant negative impact. These finding raises up the heated debate topic whether Bangladesh was relay ready to brace the crosswinds generated by globalization wave. However, not all of the developing countries have been able to reap the benefits of globalizations. So, it is not true that all effects of this phenomenon are positive. Because, globalization has also exposed to new challenges like environmental pollution, greater uncertainty in commercial and financial markets, skewed wealth distribution across nations.

This study finds an inverse relationship of remittance-growth nexus. This result conforms to the findings of Rao and Hasaan (2009). Although Bangladesh is a labor abundant country, the country feels the dire need of skilled and semi-skilled labor.

Due to the dominance of brain-drain effect, the impact of remittance on TFP may be found to be negative. Influx of remittances when not used in productive activities merely builds up the foreign exchange reserves. The soaring unused foreign exchange reserves makes Bangladeshi Currency, Taka, appreciate compared to the other currencies which in turn deteriorates export competitiveness of the country.

Another variable, inflation is found to have a significant negative impact on growth as expected. Inflation erodes long-run efficiency of investment and productivity of capital.

The findings regarding the income share of input shows a new dimension when substitutability between labour and capital is concerned. All the possibilities behind lower labour share stated so far are not tested; so the effect of global integration vs substitutability need to be explored before any policy action is undertaken. Global integration allows the room for more digitalization and automation in Bangladesh; but the question is if this really replaces routine labour activities with extensive use of technology (capital).