CHAPTER 6

PRODUCTIVITY CHANGE IN NATIONAL ECONOMY

Measuring productivity change in the national economy in this study consists of analysis both at the aggregate national level and for the major sectors of the economy. Non-parametric growth accounting technique has been used to calculate the total factor productivity growth (TFPG) for the national economy. In the study, the contribution of each factor of production to the output growth has been determined and termed as 'sources of growth'. Besides, the potential factors constituting the contribution of total factor productivity (TFP) to the output growth, termed as 'sources of productivity growth', are discussed.

This study calculates TFPG at the aggregate national level using capital stock data from Alam et al. (2005). The main reason of using this data set is that the data is available at the division level enabling regional productivity analysis too. No other data set contains data for the regions of Bangladesh.

Since the analyses in this study use a capital stock series from a source other than the national publications (i.e. Alam et. al. 2005), it seems necessary to conduct an alternative analysis using an alternative series of capital stock – at least at the national level – to investigate whether the overall positive trend for the national economy and for the major sectors of the economy shows positive trend with other capital stock data too. For this purpose, an alternative analysis using a series of capital stock estimated from Nehru and Dhareshwar (1993) data set was conducted in this study. This analysis is shown in Appendix C. This alternative analysis also shows similar results as the analysis using Alam et al. (2005) data of capital stock.

6.1 Sources of Growth for Bangladesh

6.1.1 Sources of Growth in the National Economy

The results of the analysis at the aggregate national level are shown in Table 6.1. The results show an overall increase in the TFP, specially in the late nineties. Table 6.2 shows the contribution of each factor of production to output growth. The analysis involving the whole period shows that, major portion of the output growth (56%) comes from TFP, whereas growth in capital stock among other factors of production has significant contribution (30%) to output growth during the period. Also, contribution of labor to output growth is observed to decrease constantly with time, while contribution of capital is more in later two sub-periods than in the first. This is indicative of a change of production technology from a labor-intensive to a capital-intensive one happening for Bangladesh in this early stage of development.

Table 6.1

Results of the analysis at aggregate national level

Period		Percentage Growth Per Annum				
From	To	GDP	Capital	Land	Labor	**TFP**
1984-85	1989-90	4.44	2.05	1.39	2.26	**2.386**
1989-90	1995-96	4.85	5.61	-0.65	1.48	**1.854**
1995-96	1999-00	6.39	3.45	1.40	1.59	**4.016**
1984-85	1999-00	6.54	4.51	0.57	1.92	**3.667**

It should be noted here that, the period under study is also characterized by a high growth rate of the annual production of the major crop (rice) of Bangladesh agriculture and a very high increase in export volume with a rapid development of ready made garments industry. Hence, a positive trend in national TFP change indicates the technological progress in both agricultural and non-agricultural sector.

Table 6.2

Contribution of factors at aggregate national level

Period		Percentage Contribution			
From	To	Capital	Land	Labor	**TFP**
1984-85	1989-90	20.10	4.03	22.13	**53.73**
1989-90	1995-96	50.28	-1.73	13.27	**38.19**
1995-96	1999-00	23.48	2.84	10.83	**62.85**
1984-85	1999-00	30.01	1.12	12.81	**56.06**

6.1.2 Sources of Growth in the Agricultural Sector

The results of the analysis for the agricultural sector are shown in Table 6.3. The results show an overall increase in the TFP in the late nineties. Besides, TFPG score is positive in all sub-periods of the study. Table 6.4 shows the contribution of factors of production to the output growth in agricultural sector. TFP has very high contribution (81%) to the overall growth of output in the period. This exceptionally high contribution of TFP to output growth can be explained by three facts – invention of a number of high yield variety of rice by Bangladesh Rice Research Institute (BRRI), more intense use of land in the dry season following increase in access to irrigation facilities after trade liberalization of minor irrigation equipment, and higher use of fertilizers following a couple of changes in fertilizer policy.

First, there has been an overall adoption of modern varieties of rice in Bangladesh which is 65 percent at present, these varieties accounting for about 79 percent of the total annual rice production in the country, resulting in a boost in rice production (BRRI, 2007). BRRI has played a central role in this achievement. So far, BRRI has released 41 new varieties of high yielding rice. The BRRI modern varieties and technology packages played the key role in boosting annual rice production in Bangladesh from 10.82 million metric tons in 1970-71 to 24.30 million metric tons in 2001-02. Without BRRI modern varieties, rice production would have increased at the rate of 1.0 percent annually, almost half the rate at which the population grew during

this period. In fact, since early 1980s the import of food grains declined steadily and the country approached self-sufficiency by the nineties.

Table 6.3

Results of the analysis of the agricultural sector

Period		Percentage Growth Per Annum			
From	To	GDP	Land	Labor	**TFP**
1984-85	1989-90	2.40	1.39	-0.14	**1.650**
1989-90	1995-96	1.47	-0.65	1.00	**1.428**
1995-96	1999-00	6.31	1.40	1.55	**4.850**
1984-85	1999-00	3.51	0.57	0.79	**2.850**

Table 6.4

Contribution of factors at the agricultural sector

Period		Percentage Contribution		
From	To	Land	Labor	**TFP**
1984-85	1989-90	33.64	-2.43	**68.79**
1989-90	1995-96	-25.82	28.56	**97.26**
1995-96	1999-00	12.94	10.26	**76.80**
1984-85	1999-00	9.42	9.38	**81.20**

Second, the government waived the standardization requirement on imported irrigation equipment in 1988, thus allowing cheap imports from China and South Korea. The coverage of irrigation has expanded fast, from 24 to 60 percent of cultivated land during the period from 1987 to 2000. This change is largely believed to have decisively spurred the growth of rice production.

Third, private imports of fertilizer of all types were legalized for the first time in 1992 in Bangladesh. Before that, direct sales of urea by fertilizer factories to private traders was allowed for the first time in 1989, enabling a rapidly increasing

number of private traders to move large quantities of urea across the country (Samad et al. 1989). The enhanced use of fertilizers played an important role in very high increase in rice production.

Hence, the above factors contributed significantly in higher production of rice, specially in nineties. Since rice is the major crop of the country, technological progress in its production will result in high TFP growth for the agricultural sector too. In fact, rice is central to Bangladesh economy and agriculture accounting for nearly 18 percent of the GDP, while the rice area totals about 10 million hactor accounting for about 75 percent of the total area of agricultural crops and 93 percent of the total area planted to cereals (International Rice Research Institute, 1998-99). This technological progress in rice production, thus, may explain the very high contribution of TFP to growth in the agricultural output.

Besides, a decline in the use of land is observed in Table 6.3 which is during the second sub-period, i.e. during the period from 1989-90 to 1995-96. There is a consequent negative contribution from land in this sub-period, which is observed in Table 6.4. This may be due to decline in availability of arable land in the face of industrialization and housing boom as reported in Chowdhury et al. (2006). However, use of land increased again after 1995-96, which may be due to a greater increase in cultivation of land during the dry season with increased availability of irrigation facilities as indicated in Hossain et al. (2003). A more detailed discussion on this issue is presented in Appendix E for curious readers.

6.1.3 Sources of Growth for the Non-Agricultural Sector

The results of the analysis for the non-agricultural sector are shown in Table 6.5. The results show an overall increase in the TFP, specially in the late nineties. Table 6.6 shows the contribution of each factor of production to output growth. The analysis involving the whole period shows that, major portion of the output growth (46%) comes from TFP, whereas growth in capital stock among other factors of production has significant contribution (29%) to output growth during the period. Also, contribution of labor to output growth is observed to decrease constantly with time, while contribution of capital increased constantly. This is indicative of a change

of technology from a labor-intensive to a capital-intensive one happening for Bangladeshi industries in this stage of development.

Table 6.5

Results of the analysis of the non-agricultural sector

Period		Percentage Growth Per Annum			
From	To	GDP	Capital	Labor	**TFP**
1984-85	1989-90	5.90	2.05	8.66	**0.941**
1989-90	1995-96	6.95	5.61	2.36	**2.776**
1995-96	1999-00	6.42	3.45	1.66	**3.766**
1984-85	1999-00	8.71	4.51	4.96	**4.005**

Table 6.6

Contribution of factors at non-agricultural sector

Period		Percentage Contribution		
From	To	Capital	Labor	**TFP**
1984-85	1989-90	19.43	64.64	**15.94**
1989-90	1995-96	45.11	14.96	**39.93**
1995-96	1999-00	30.01	11.36	**58.62**
1984-85	1999-00	28.95	25.09	**45.95**

The positive trend in TFP growth is accompanied by the initiatives taken by the government in nineties to open up the economy gradually. From that time, eight Export Processing Zones (EPZ) were established so far in Dhaka and Chittagong to attract foreign investments. Besides, the positive trend in TFP in non-agricultural sector can largely be attributed to the development of garment industry in Bangladesh during the period. The ready made garments industry has experienced unprecedented growth in the nineties. Exports from this sector accounted for approximately 76 per cent of total export earnings in 2000-01, the industry accounting for 9.5 per cent of

the GDP and 29.7 per cent of the manufacturing GDP. The Bangladeshi garment sector has been enjoying preferential treatment because of the country's special status as a least developed country, which helped the rapid development of this sector during the period under study.

6.2 Sources of Productivity Growth for Bangladesh

6.2.1 Identification of Sources of Productivity Growth

From the results of the analyses presented in the previous section, positive trend in productivity growth can be observed in all sectors of the economy of the country. Since TFPG can be interpreted as a residual representing the unexplained part of growth, different factors may contribute to this residual. Human capital, degree of openness of the economy, development of financial sectors, etc. are often cited as contributors to TFP growth. In this study, human capital, export of goods and services, import of capital goods and materials for capital goods, policy reforms towards trade liberalization and financial sector development, and development of infrastructure are considered as potential sources of productivity growth for the national economy. Each of the factors is discussed below.

Unfortunately, the potential sources of productivity growth for the economy cannot be tested statistically due to limitation of data. The observations are too few to allow a regression analysis. However, this study investigates the trends in different potential sources of productivity growth and tries to relate them to the trend observed in this study in productivity growth.

6.2.2 Human Capital

Level of education is considered as an important indicator of human capital in this study. Percentage of employed labor force by level of education at the aggregate national level and for the major sectors is presented in Table 6.7. It can be observed that, percentage of employed labor has increased constantly for almost all levels of education for both national level and for the sectors. Hence, it can be inferred that

growth of human capital in terms of educational attainment has been a potential source of productivity growth in the period.

Table 6.7

Percentage distribution of the employed labor force by educational level at national level and for the major sectors

Observation	LFS Year	No Literacy	Primary Level	Secondary Level	Higher Secondary	University Equivalent
National	1989	64.49	17.88	10.74	4.89	1.99
	1990-91	57.85	21.34	12.03	6.26	2.52
	1995-96[a]	51.93	25.28	13.91	6.38	2.50
	1999-00	46.64	27.13	12.64	10.85	2.74
Agriculture	1989	69.83	17.21	9.79	2.62	0.55
	1990-91	65.19	20.29	10.57	3.20	0.75
	1995-96[a]	59.77	25.01	11.81	3.08	0.34
	1999-00	53.20	27.28	15.67	3.29	0.57
Non-Agriculture	1989	54.61	19.13	12.51	9.10	4.65
	1990-91	43.36	23.41	14.90	12.32	6.00
	1995-96[a]	38.59	25.75	17.49	12.00	6.16
	1999-00	35.76	26.89	7.62	23.38	6.34

Note:

a Comparison of education level is reported for employed labor of age 15 years and above, while other surveys states employed labor of age 10 years and above

Sources: Various issues of Labor Force Surveys

Table 6.8 shows the literacy rate in different years for the entire population. Literacy rate of population of all ages can be another indicator of human capital. The table shows that, literacy in Bangladesh has increased significantly over the years.

Table 6.8

Literacy rate in Bangladesh

Year	Literacy Rate (%)		
	Age 15+	Age 7+	all age
1984-85	29.2	n.a.	n.a.
1991	37.2	32.4	24.9
1995	45.3	44.3	n.a.
2001	47.5	45.3	45.3

Sources: (i) Report on Sample Vital Registration System 1999-2002 (by BBS) and
(ii) Population Censuses (1991 and 2001)

Table 6.9 shows school attendance rate for different age groups from 5 to 24 years as reported in last three population censuses. It can be seen that, school participation has increased substantially for all of the age groups throughout the period.

Table 6.9

School attendance rate in different censuses

Census Year	Age Group			
	5 to 9	10 to 14	15 to 19	20 to 24
1981	22.50	33.30	17.00	7.00
1991	41.00	54.20	28.40	9.90
2001	49.69	63.95	38.16	13.10

Sources: Population Censuses (1981, 1991, and 2001)

Table 6.10 shows percentage of birth attended by nurse or doctor, infant mortality rate and life expectancy (at birth) estimates in different years. These health indicators can represent human capital of a country, too. The table shows that, all of these health indicators in Bangladesh have indeed improved over the years.

Table 6.10

Health indicators for Bangladesh

Year	Birth Attendance by Nurse or Doctor (percent)	Infant Mortality (per 1000 live birth)	Life Expectancy Estimate at birth (years)
1993	6.0	84	57.7
1995	14.7	71	58.7
1998	17.6	57	60.6

Sources: (i) Report on Sample Vital Registration System (by BBS) and
(ii) Bangladesh Sample Registration System (by BBS)

Since all of the different indicators of human capital show improvement in Bangladesh over the years, it can be concluded that the improvement in the human capital has been a potential source of productivity growth in the national economy.

6.2.3 Export of Goods

Firms can be internationally integrated by virtue of selling their products in foreign markets. Besides this, growth of exports can lead to the development of infrastructure, transport and communications in developing countries which in turn can facilitate the production of other goods and services (Balassa, 1978). Export volumes of goods for the years considered as reference points in this study are shown in Table 6.11. The table also presents export to GDP ratio for these points in time. Growth in export volume in the sub-periods considered in this study is shown in Table 6.12. It can be observed from these tables that, both volume of export and export to GDP ratio has increased continuously during the period. Hence, it can be inferred that growth of export has been a potential source of productivity growth in the period.

Table 6.11

Export of goods from Bangladesh

Year	Consumer Goods		Export Vol.	Export/GDP
	(mil.tk.)	(% of total)	(mil.tk.)	ratio
1984-85	18344	69.90	26225	0.065
1989-90	39016	75.88	51415	0.051
1995-96	126435	87.49	144521	0.087
1999-00	228444	92.30	247415	0.104

Source: Foreign Trade Section of BBS

Table 6.12

Growth in export volume

Year		Avg. Growth/annum (%)	
From	To	Consumer Goods	Total Export
1984-85	1989-90	22.54	19.21
1989-90	1995-96	37.34	30.18
1995-96	1999-00	20.17	17.80
1984-85	1999-00	76.36	56.23

6.2.4 Import of Capital Goods and Materials for Capital Goods

The percentage of new machinery may reflect directly technology embodied in installed equipment, which in turn can play an important role in enhancing productivity of the system. This section considers import volumes of capital goods and materials for capital goods (including equipment but not including intermediate goods) as an indication of the level of technology, since many developing countries are heavily dependent on imports of capital and intermediate goods as inputs into production (Bardhan and Lewis, 1979). Volume of import of capital goods and materials for capital goods in Bangladesh for the years considered as reference points

in this study are presented in Table 6.13. The table also shows import to GDP ratio for these years. Growth in import volume in the sub-periods considered in this study is shown in Table 6.14. It can be observed from these tables that, although the import to GDP ratio did not increase significantly in the sub-periods still the volume of import, particularly import of capital goods and materials for capital goods increased substantially during the whole period. Hence, it can be inferred that growth of such import has been a potential source of productivity growth for the country during the period.

Table 6.13

Import of capital goods and materials for capital goods in Bangladesh

Year	Capital Goods		Material for Cap.Good		Import Vol.	Import/GDP
	(mill.tk.)	(% of total)	(mill.tk.)	(% of total)	(mil.tk.)	ratio
1984-85	8544	12.50	11368	16.60	68263	0.168
1989-90	12989	11.50	22495	19.90	113305	0.113
1995-96	35867	14.09	46329	18.19	254646	0.153
1999-00	44206	11.90	73993	19.90	372022	0.157

Source: Foreign Trade Section of BBS

Table 6.14

Growth in import volume

Year		Avg. Growth/annum (%)		
From	to	Captial Goods	Materials	Total Import
1984-85	1989-90	10.40	19.58	13.20
1989-90	1995-96	29.36	17.66	20.79
1995-96	1999-00	5.81	14.93	11.52
1984-85	1999-00	27.83	36.73	29.67

6.2.5 Trade Liberalization

The policy reform and trade liberalization in Bangladesh started in 1976 with deregulation measures under a new government, which increasingly distanced itself from the earlier socialist approach. Four notable features of policy during this period of greater market orientation were – reduction of restrictions on investment, gathering momentum of denationalization of public sector enterprises, limited reduction of tariffs and non-tariff barriers, and incentive packages for the emerging ready-made garments sector. During the latter half of the 1980s, a more comprehensive reform program started under structural adjustment policies. In the area of tariff reforms, these policies emphasized rationalization of the import regime, simplification and reduction of effective protection, elimination of negative and restricted lists of industrial imports, and facilitation of imports of raw materials and intermediate and capital goods including the imports needed for direct and indirect exporters.

The policy reform process gained substantial momentum following the restoration of democracy in 1991. The main political parties embraced a liberal economic agenda, which augured well for genuine and sustained political commitment to reform and liberalization. Since then, wide-ranging reforms and liberalization measures have been initiated and implemented, which have virtually transformed the policy landscape. These measures included tariff reductions, the elimination of a large number of quantitative restrictions, a flexible exchange rate regime, and the provision of a range of fiscal and financial incentives for export promotion. Therefore, it is quite possible that policy reforms towards trade liberalization after nineties had a significant positive influence on productivity growth in the major sectors of Bangladesh economy.

The exposure to foreign markets should have an effect on the economy of scale and exposure to foreign competition should create pressure to improve productivity. In this study, ratio of total of import and export volume to GDP is considered as indicator of degree of openness for Bangladesh economy. This measure is shown in Table 6.15. It can be observed that, openness increased in the late nineties.

Table 6.15

Degree of openness for the Bangladesh economy

Year	Import (mil.tk.)	Export (mil.tk.)	GDP (mil.tk.)	Degree of Openness [a]
1984-85	68263	26225	405410	0.233
1989-90	113305	51415	1003290	0.164
1995-96	254646	144521	1663240	0.240
1999-00	372022	247415	2370860	0.261

Note:

a Degree of Openness = (Import + Export) / GDP

Sources: Various issues of Statistical Yearbook of Bangladesh (by BBS)

6.2.6 Financial Sector Development

During the eighties and nineties, the financial sector in Bangladesh was opened up for private sector participation, operational procedures were partly deregulated and a number of important steps were undertaken. For instance, several government-owned banks were denationalized and a number of new private commercial banks were given licenses in the eighties. Financial sector reform, however, started in an intensive way in the beginning of the nineties under the Financial Sector Adjustment Credit (FSAC) which Bangladesh contracted with the World Bank. Though the Financial Sector Reform Programme (FSRP) ended in mid-1990s, yet the reform measures were continued to be pursued. After the expiry of FSRP in 1996, the Government of Bangladesh formed a Bank Reform Committee (BRC), which submitted its recommendations in 1999. Since the financial sector reform started extensively in early nineties, this can have some positive impact on the production system through incorporation of efficiency in financing the projects and can be considered as a potential source of productivity growth after nineties.

6.2.7 Infrastructure

Economic development and economic growth are not only a result of a proper combination of private production factors such as labor and capital but also of infrastructure in general and publicly provided infrastructure in particular. Such infrastructure improvement leads to a higher productivity of private production factors, since public capital or infrastructure is the foundation on which the factors of production interact to produce output. Infrastructure includes kind of services, without which primary, secondary and tertiary production activities cannot function. In its wider sense it includes all public services from law and order through education and public health to transportation, communications, power and water supply as well as such agricultural overhead capital as irrigation and drainage systems (Emmanuel, 1995). Aschauer (1989) argued that much of decline of U.S. productivity that occurred in the 1970s was precipitated by declining rates of public capital investment. Before that, Ratner (1983) found government capital to be productive with an output elasticity of about 0.06.

The present study considers the several types of infrastructure in Bangladesh. The types of infrastructure considered are listed below. Data is presented for the years considered as reference points in this study.

a) Transport infrastructure in terms of total length in kilometer of road network as shown in Table 6.16,
b) Communication infrastructure in terms of total number of telephone lines and telephones per 1000 persons as shown in Table 6.17,
c) Energy infrastructure in terms of installed capacity in megawatt of the power stations to produce electricity as shown in Table 6.18,
d) Education infrastructure in terms of number of schools, general colleges and government universities including student-teacher ratio for each category as shown in Table 6.19,
e) Health infrastructure in terms of number of government and private hospitals and government dispensaries and in terms of total number of beds per 1000 person and number of registered doctors and nurses per 1000 person as shown in Table 6.20.

Table 6.16

Transport infrastructure in Bangladesh

Year [a]	High type [b] (km)	Low type [c] (km)	**Total (km)** [d]
1985	6215	4159	**10374**
1990	7914	5713	**13627**
1996	11663	5891	**17554**

Note:

a A consistent definition of roads is available up to 1996, a different series is available for periods afterwards

b 'High type' refers to roads having cement, concrete or bituminous surface

c 'Low type' refers to roads generally of stones, bricks, gravel or ordinary earth roads aligned with drainage structure provided

d Road kilometer covers only roads constructed and maintained by the Roads and Highways Department. Roads constructed by municipalities, district councils and other local bodies are not included here

Source: Roads and Highways Department

Table 6.17

Communication infrastructure in Bangladesh

Year	Total Telephones	Telephone / 1000 persons
1984-85	151356	1.63
1989-90	205500	1.98
1995-96	387769	3.26
1999-00	579794	4.50

Source: Bangladesh Telegraph and Telephone Board

Table 6.18

Energy infrastructure in Bangladesh

Year	Installed Capacity (MW)	Generation (MKWH)	Number of Villages with Electricity
1984-85	1141	4545	6507
1989-90	2353	7732	12573
1995-96	2908	11474	22260
1999-00	3291	13204	25078

Note:

MKWH Million kilowatt hours

MW Mega watt

Source: Bangladesh Power Development Board

Table 6.19

Education infrastructure in Bangladesh

Year	Primary School		Secondary School		General College		Govt. University	
	(nos.)	(student/ teacher)	(nos.)	(student/ teacher)	(nos.)	(student/ teacher)	(nos.)	(student/ teacher)
1984-85	43588	54	8649	27	687	30	6	13
1989-90	45783	62	9822	37	893	34	7	10
1995-96	61583	68	12858	36	3032	33	11	30
1999-00	63658	67	14640	40	2437	28	13	n.a.

Note:

n.a. Data not available

Sources: (i) Thana Education Offices

(ii) District Education Offices, Ministry of Education

(iii) Directorate of Primary Education

(iv) Bangladesh Educational Statistics, BANBEIS, 2003

Table 6.20

Health infrastructure in Bangladesh

Year	Total Facilities			Facility Per 1000 Person [a]		
	Govt. Hospital	Private Hospital	Government Dispensary	Hospital Beds	Registered Doctors	Registered Nurses
1985	596	164	1559	0.30	0.16	0.07
1990	608	267	1310	n.a.	0.19	0.09
1996	645	288	1397	0.32	0.23	0.12
2000	670	712	1397	0.35	0.25	0.14

Note:

n.a. data not available

a Figures are calculated by dividing number of reported facilities by population, population data is obtained from IFS CD-ROM

Source: Director-General of Health Services (Health Information Unit), Ministry of Health and Family Welfare

Since all types of infrastructure listed above show steady rate of increase in the period under study, each of them can be considered as a potential source of productivity growth in the mentioned period.