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Productivity Change in Bangladesh Agriculture

Bilkis Raihana

Abstract

In this study, an attempt is made to determine whether productivity growth has increased due to the adoption of irrigation-fertilizer technology in Bangladesh's agriculture sector. The period of the study spans from 1973 to 2008. Using the Tornqvist approximation to the Divisia index, total factor productivity (TFP) was estimated; it was found that TFP increased during the sample period and there was an average annual TFP growth rate of 1.97 percent for the entire study period. The results also show that farmers' terms of trade deteriorated and their economic condition improved slightly over the period.

In recent years, both the concepts of total factor productivity and flexible weight indexing procedures have been used in productivity studies. Following recent developments in the study of productivity measurement, the superiority of total factor productivity (TFP) index is emphasized by several researchers (Hossain, 1973; Brown, 1978; Islam, 1982; Griliches and Lichtenberg, 1984; Wolff, 1985; Gray, 1987; Ali, 1991; Sharma, 2004; Kiani, A. *et.al.* 2008; and Ali, A. *et al.* 2009). In case of agricultural productivity, the works of Lee and Chen (1978), Brown (1978), Lawrence and McKay (1980), Islam (1982), Whittaker (1983), Ball (1985), Bottomley, P. *et al.* (1990), Ali (1991) and Ali,A. *et al.*(2009) are noteworthy for adopting the Divisia indexing method. In the Bangladesh agricultural sector, the simultaneous use of these two concepts is rare in the recent productivity studies. Using the Divisia indexing procedure, the total factor productivity indexes are employed in this study as an improved measure of productivity growth (Christensen, 1975; Diewert, 1976).

Input Use and Output Growth in Bangladesh Agriculture

Since independence, a significant change was witnessed in the use of major agricultural inputs due to adoption of modern technology like fertilizer and irrigation in Bangladesh's agriculture sector. As a core factor of production, total cropped area increased moderately. In 1972-73, the total cropped area was 29,039 thousand acres which increased to 34,845 thousand acres in 2005-06 (BBS, various issues). In 1974, 77.2 percent of the labor force engaged themselves in traditional agriculture while the remaining 22.8 percent were engaged in non-agricultural activities. But in 1991, the occupational dependence on the agriculture sector declined, with 54.6 percent of the labor force engaged in agriculture and 45.4 percent engaged in the non-agricultural sectors. This occurred due to transfer of labor force from the traditional agriculture sector to the non-agriculture sector (BBS, 1994). Consumption of chemical fertilizers also increased markedly. In 1972-73, Urea consumption was only 277 thousand metric tons while it rapidly increased to 2,523 thousand metric tons in 2004-05. As the most modern component, the use of irrigation also significantly increased. The area irrigated by low lift pumps (LLPs) was about 1,165 thousand acres in 1972-73 and in 2004-05 it increased to 1,982 thousand acres (BBS, various issues).

During the post-independence period, agricultural production suffered mostly due to readjustment, reorganization and rehabilitation problems. In the mid-sixties, the seed-water-fertilizer technology was introduced but these technological transformations failed to show satisfactory growth rates. In the mid-seventies, the average rate of growth of food grain output was about 3 percent while in the eighties it declined to about 2.2 percent. This happened due to a significant growth of production in *boro* rice and wheat while the *aman* crop showed a very moderate upward trend and *aus* production exhibited a declining trend (GOB, 1990). Since the contribution of secondary sector to the GDP increased, the direct effect of this situation created the relatively slower growth rate of agriculture and in the 20-year period from 1972-73 to 1991-92, the growth rate of agriculture was found to be 2.16 percent per annum (BBS, 1993).Therefore, dependence on technological change caused marked agricultural growth in Bangladesh.

This study addresses the following objectives: 1) To estimate rates of growth in productivity using total factor productivity approach and applying the flexible weight Divisia indexing method. 2) To analyze the distributional impacts of productivity change using estimates of changes in farmers terms

of trade and returns to cost ratios.

Review of Selected Agricultural Productivity Studies in Bangladesh

In Bangladesh, several studies have been conducted on agricultural productivity. Most of these studies are not conceptually or methodologically same as our study. An early study of partial factor productivity (PFP) in Bangladesh agriculture was conducted by Hossain (1977). Using farm level data of Phulpur and Thakurgaon, he classified farms as owner I comprising small and medium farms and as owner II comprising large farms. He estimated the difference in land productivity between these two groups of farms and reported an inverse relationship between farm size and productivity. He attempted to improve his tenancy analysis by comparing productivity of owned land with that of rented land with the help of paired t-test. Mandal (1980) attempted to measure and compare resource use and productivity with respect to farm size and tenancy in Bangladesh. By using empirical data collected through a lengthy intensive farm survey in Mymensingh district, he found productivity per acre increased up to a certain level (about 4.0 acres), then declined as farm size increased. Medium farms appeared to be more productive than small and large farms. With the help of paired t-test, share cropping tenancy was found to be inefficient in resource use and production. Abedin and Bose (1988) found a positive relationship between farm size and productivity. Both tabular and production function analysis were employed to estimate the productivities of small, medium and large farms. Using farm level data on irrigated HYV *Aman* rice in Thakurgaon, it was observed that large farms have a higher level of output per hectare than small and medium farms. Matin (1989) observed a very poor inverse relationship between farm size and productivity for rice in Bangladesh. Using farm level data, a log (natural) linear transformation of the Cobb-Douglas production function was estimated by the ordinary least square method to find the effect of size and input use on the productivity of rice. Farm size, agriculture labor, concentration of cultivation, use of pesticides had significant positive effect on the yield of rice. Rahman (2004) applied the sequential malmquist index to calculate multilateral, multifactor productivity (MFP) indexes for agriculture in 16 regions of Bangladesh from 1962 to 1992.He found productivity grew at an average rate of 2.2% per annum; this growth occurred mainly due to technological progress estimated at 2.1 % per year. No one examined the issue of farmers benefit from productivity gain perspectives; by including this issue the present study examines a significant issue and contributes to the existing literature on agricultural productivity growth in Bangladesh.

Concept of Total Factor Productivity

The ratio of output to all productive inputs taken together is known as total factor productivity (TFP). In practice, it is not possible to include all the inputs in the production process. So, the ratio of the single aggregate output to the single aggregate set of the traditional inputs is used to measure total factor productivity. In recent years the TFP approach has gained popularity due to its ability to consider all productive inputs. Thus, to obtain a meaningful perspective on productivity growth, the TFP measure is used in this study.

Growth Rate in TFP

Following Pesek (1961), Griffin (1974), Veeman (1975) and Islam (1978), the following trend cquation (1) has been fitted for the period 1973 to 2008 for computing the annual growth rates.

$$L_n\, g\,(t) = a+bt+u \qquad (1)$$

Where g(t) is the variable for which the rate of growth is estimated and t and u stand for time and stochastic error respectively. Here the compound growth rate was obtained by the antilog of the estimated coefficient on time minus one. Here L_n implies the natural logarithm of the variable.

The Divisia or Flexible Weight Approach

The Divisia indexing procedure was proposed by Divisia (1928). It involves a flexible weighting method. In its continuous version, the Divisia index can be presented as:

$$Q_t/Q_0 = \exp\left\{\int [W_i(t)\,(\dot{q}_i(t)\,/q_i\,(t))]\right\} \qquad (2)$$

W_{it} implies the share of the i-th factor in total cost or the share of the i-th output in total value and a dot (.) over the variable indicates the logarithmic derivative of that variable. Equation (2) shows the continuous version of the Divisia index. But its empirical implementation requires a discrete approximation and the Tornqvist approximation is a discrete approximation to continuous Divisia index. This widely used approximation was proposed by Tornqvist (1936). Following equation (2), the

Tornqvist approximation to the Divisia quantity index can be written as

$$\ln Q_t - \ln Q_{t-1} = \sum \overline{W}_{it} (\ln q_{it} - \ln q_{i,t-1}) \qquad (3)$$

where Q denotes quantity and i refers to sub components.

In case of both the price and quantity indexes, the weights (w) are the same. A given weight implies the arithmetic mean of the shares in two adjacent periods and the weight can be presented as

$$\overline{W}_{it} = \frac{1}{2}(w_{it} + w_{i,t-1}) \qquad (4)$$

The weights in (4) are flexible over time. The Tornqvist approximation is used in this study to estimate productivity in Bangladesh agriculture.

The Data

In order to derive an index of total factor productivity, it is necessary to construct quantity indexes of total output and all inputs. In our study, the quantity index of aggregate output is constructed by combining all crops together with a total of twenty five crops including cereals, cash crops, pulses, oilseeds, vegetables, fruits and spices. Quantity indexes of aggregate input are constructed by combining all inputs (land, labor, fertilizer and irrigation) together. The quantity of land is the total cropped area, the quantity of labor is persons employed in agriculture, forestry and fishing, fertilizer includes annual use of Urea, Triple Super Phosphate, and Muriate of Potash (in '000 metric tons), and area irrigated by various methods include low lift pumps (LLPs), deep tubewells (DTWs), and shallow tube wells (STWs) in terms of acres.

In order to obtain the index of terms of trade, it is necessary to construct the aggregate price indexes of output and inputs. In case of prices of output, mainly the harvest price of major agricultural crops is used. To construct the price indexes of aggregate inputs, the price of land in taka per acre, daily wages of agricultural labor, prices of fertilizer by type (in Taka per ton) and the operating and maintenance cost paid by farmers for the respective irrigation methods were combined. The data cover the period 1973 to 2008 and the time series data are entirely obtained from the official statistical sources of Bangladesh such as the Bangladesh Bureau of Statistics (BBS, Statistical *Yearbook of Bangladesh, Yearbook of Agricultural Statistics* and *Monthly Statistical Bulletins,* various issues).The estimation was done by using the econometric software *SHAZAM.*

Estimates of Total Factor Productivity

The Divisia quantity indexes of aggregate output and aggregate inputs are reported in column 2 and column 3 of Table 1. The year 1973 is considered as the base year. The index of agricultural output was 1.146 in 1974 and it increased steadily and stood at 3.932 in 2008. During this period, the annual growth rate of output index was 3.08 percent. The quantity index of all inputs gradually increased over time and its annual growth rate was 1.09. The aggregate output index grew at a faster rate while the aggregate input index increased very slowly even though the increased use of fertilizer and irrigation, which enabled technological progress in Bangladesh agriculture, most likely contributed to the increased output. Total factor productivity is the ratio of the index of output and the index of all inputs and it is shown in the last column of Table 1. Though the total factor productivity index fluctuated, an overall rising trend was observed during the sample period. In 1974, the TFP index was 1.113 and it increased to 2.698 in 2008. During this whole period, TFP index increased at an annual growth rate of 1.97 percent. It seems the consumption of fertilizer and irrigation significantly affected productivity growth in Bangladesh agriculture. At the initial stage, prices of inputs were kept low as a part of induced technical change but over time farmers used more fertilizer and irrigation due to gradual awareness of the benefits in spite of the increasing prices of these inputs.

The graphical presentation of TFP indexes are shown in Figure 1 where it is observed that during the study period there was an overall increase in productivity but with some periodic fluctuations. The last few years of the sample period showed gradual increase in TFP and it may be partially attributed to the reduction of price of non-urea fertilizers and cash incentive for diesel. The government took various steps to provide agro-input assistance and favorable impacts of these steps in turn contributed to the increased agricultural output (GOB, 2011).

Distribution of Productivity Gains

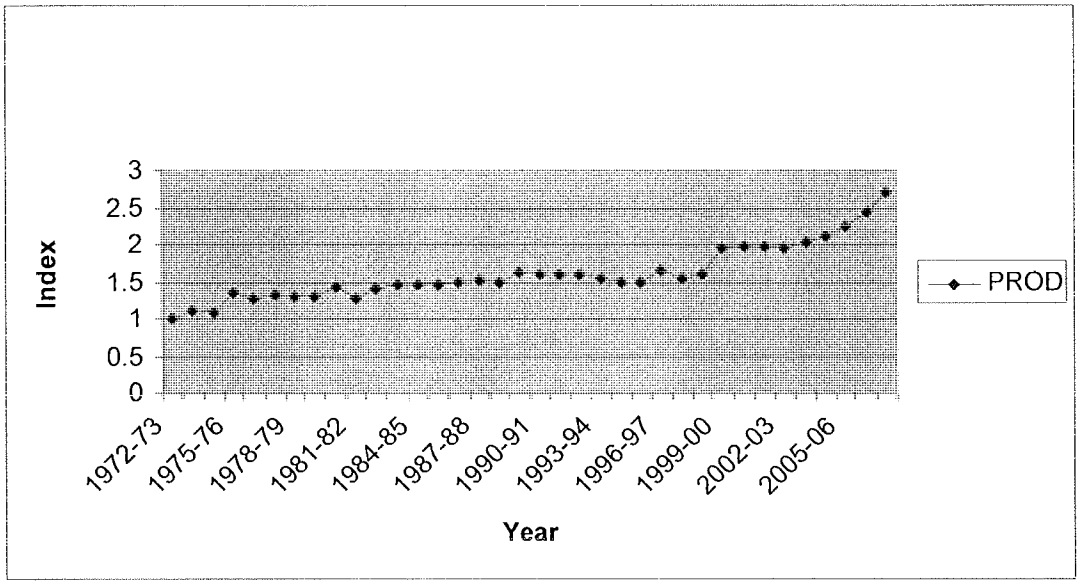
In the study of productivity, it would be reasonable to explore the benefits of productivity growth and this will enable us to know how much the farmers benefited from the distributional impacts of productivity changes in Bangladesh agriculture.

Table 1: Indexes of Agricultural Output, Inputs and Total Factor Productivity in Bangladesh, 1973-2008 (1973=1.000)

Year	Output	Inputs	Productivity
1973	1.000	1.000	1.000
1974	1.146	1.029	1.113
1975	1.091	1.014	1.076
1976	1.377	1.024	1.345
1977	1.299	1.024	1.268
1978	1.382	1.045	1.322
1979	1.391	1.073	1.296
1980	1.384	1.078	1.284
1981	1.516	1.061	1.429
1982	1.409	1.105	1.274
1983	1.564	1.123	1.393
1984	1.636	1.124	1.455
1985	1.651	1.139	1.449
1986	1.714	1.173	1.461
1987	1.736	1.167	1.486
1988	1.778	1.167	1.522
1989	1.766	1.188	1.486
1990	1.971	1.212	1.626
1991	1.947	1.226	1.587
1992	1.970	1.236	1.593
1993	1.991	1.243	1.601
1994	1.916	1.250	1.533
1995	1.869	1.264	1.479
1996	1.916	1.277	1.499
1997	2.125	1.291	1.645
1998	2.024	1.3o6	1.549
1999	2.094	1.320	1.585
2000	2.584	1.335	1.936
2001	2.666	1.349	1.975
2002	2.688	1.364	1.970
2003	2.701	1.379	1.958
2004	2.845	1.394	2.040
2005	2.980	1.410	2.113
2006	3.216	1.425	2.256
2007	3.513	1.441	2.437
2008	3.932	1.457	2.698
Annual Growth Rates (in percent)			
(1973-08)	3.08	1.09	1.97

Source: Own estimation.

Figure 1: Total Factor Productivity in Bangladesh, 1973-2008 (1973 = 1.000)



Following Lawrence and McKay (1980), Islam (1982) studied Canadian agricultural productivity and Ali (1991) examined this issue for the UK agriculture. Both studies adopted the concepts of terms of trade and returns to costs ratio.

Terms of trade is defined as the ratio of the index of output price to the index of inputs prices. The price index of aggregate output and price index of aggregate input and terms of trade are presented in columns 2, 3 and 4 respectively of Table 2. From 1973 to 2008, the terms of trade declined over time. In the early years of the sample period, the terms of trade were improving because during this period output prices were higher than input prices. But from 1976, the terms of trade tended to deteriorate and this situation continued over the latter period. This occurred due to increases of input prices. During the sample period (1973-2008), the terms of trade had a negative annual growth rate of –0.95 percent.

A graphical representation of terms of trade is presented in Figure 2, which shows from 1976 it tended to fall which continued over the latter period.

To know farmers' economic position, both the growth rate of terms of trade and the growth rate of productivity have to be examined. Improved welfare position of the farmers can be achieved if growth of productivity is higher than the decline in the terms of trade. As given by Lawrence and McKay (1980), the relationship between returns to costs ratio, terms of trade and productivity can be presented as:

$$\begin{bmatrix}\text{Growth rate of}\\ \text{Returns to costs}\end{bmatrix}=\begin{bmatrix}\text{Growth rate}\\ \text{of productivity}\end{bmatrix}+\begin{bmatrix}\text{Growth rate of}\\ \text{Terms of trade}\end{bmatrix} \quad (5)$$

Corresponding to equation (5), the derived growth rate of the returns to costs is +1.02 (since growth rate of productivity is 1.97, and growth rate of terms of trade is - 0.95,). Since the negative growth rate of terms of trade is obtained, the growth rate of returns to costs is found positive and it occurs due to the higher positive contribution of productivity growth rates which seems to be attained by the technological progress. Though the annual growth rate of returns to cost was very low, the positive growth rate of returns to costs may indicate that the farmers' welfare position in Bangladesh, based on farm income, slightly improved during the sample period. If the growth rates of returns to costs, productivity and terms of trade are all positive, the farmer's welfare position, based on their farm income would seem to be improve. It should be mentioned that the measurement of farmers overall welfare is a much more complicated issue, because it needs consideration of many other related determinants such as off-farm income, capital gains and losses from off-farm investments, etc.(Ali, 1991).

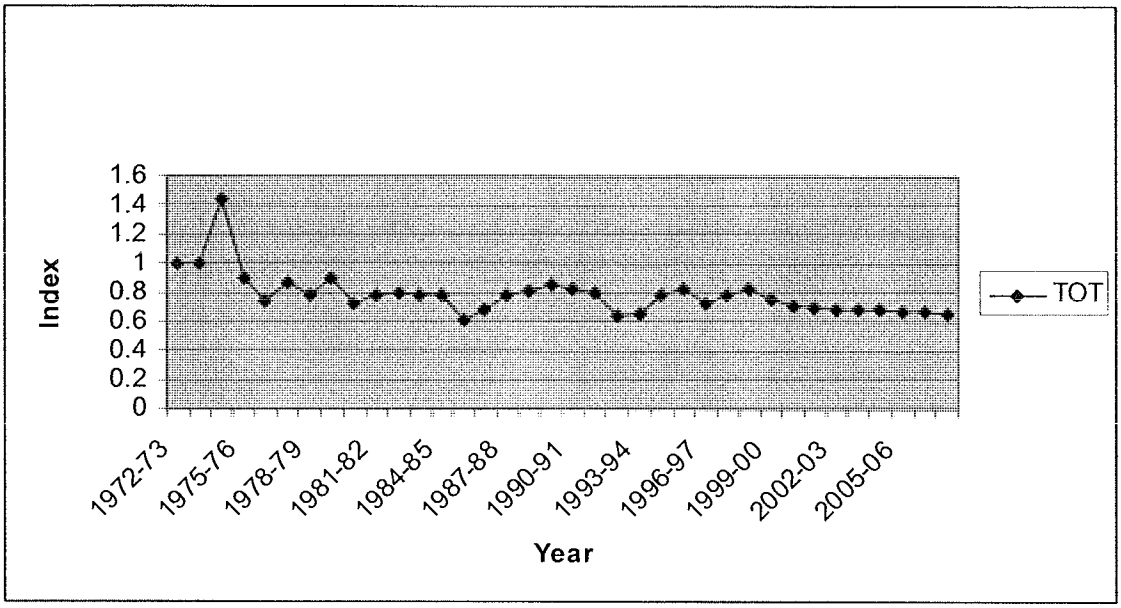
Despite some differences in methodology, estimation procedure and data, it may be worthwhile to compare the findings of this study with other countries'

Table 2: Price Indexes of Aggregate Output and Aggregate Input, and Terms of Trade in Bangladesh, 1973-2008 (1973=1.000)

Year	Price Index of Aggregate Output	Price Index of Aggregate Input	Terms of Trade
1973	1.000	1.000	1.000
1974	1.366	1.371	0.996
1975	2.681	1.864	1.438
1976	1.721	1.900	0.905
1977	1.540	2.062	0.746
1978	1.992	2.270	0.877
1979	2.106	2.657	0.792
1980	2.751	3.052	0.901
1981	2.525	3.495	0.722
1982	3.030	3.871	0.782
1983	3.286	4.135	0.794
1984	3.685	4.674	0.788
1985	4.354	5.523	0.788
1986	4.076	6.572	0.620
1987	4.762	6.963	0.683
1988	5.101	6.509	0.783
1989	5.510	6.735	0.818
1990	5.984	6.940	0.862
1991	6.082	7.320	0.830
1992	6.251	7.800	0.801
1993	6.345	8.284	0.765
1994	6.739	8.679	0.776
1995	7.124	9.029	0.789
1996	7.507	9.039	0.830
1997	7.069	9.768	0.723
1998	7.968	10.159	0.785
1999	8.816	10.565	0.834
2000	8.258	10.988	0.751
2001	8.118	11.427	0.710
2002	8.258	11.884	0.695
2003	4.538	12.360	0.690
2004	8.828	12.854	0.686
2005	9.093	13.368	0.680
2006	9.365	13.903	0.673
2007	9.646	14.459	0.667
2008	9.936	15.038	0.660
Annual Growth Rates (in percent)			
(1973-08)	5.89	6.90	- 0.95

Source: Own estimation

Figure 2: Terms of Trade in Bangladesh, 1973-2008 (1973 = 1.000)



experience. Islam (1982) and Ali (1991) studied TFP and distribution of productivity gain for Canadian agriculture and U.K agriculture respectively. Islam (1982) used the Tornqvist approximations to the Divisia index and obtained a TFP growth rate of 1.31 percent in 1962-78 period for Canada and for western Canada the TFP growth rate was 1.70 percent in the same period. The growth rate of terms of trade and the growth of returns to cost, both were found to be negative. Ali (1991) estimated the TFP indexes by using the Tornqvist-Theil approximation to the Divisia index for the period 1967-87. The TFP in U.K agriculture increased at an annual growth rate of 1.16 percent. The growth rate of terms of trade was 0.46 percent in the pre-EEC 1968-73 and it was 0.80 percent in the post-EEC 1974-87. In the pre-EEC period the growth rate of returns to cost was negative while it was positive in the post-EEC period.

Policy implications and Conclusions

This study outlines and illustrates improved theoretical and empirical approaches to study productivity growth in Bangladesh agriculture. Given these improvements, it is recommended that particular attention be paid in future to further improvement of the basic data series, especially input series which underlies this work. Studies of productivity change in Bangladesh agriculture will be greatly facilitated if Bangladesh Bureau of statistics provides more complete data of price and quantity on various agricultural inputs on a yearly basis.

In the study of productivity, total factor productivity (TFP) of Bangladesh was estimated by using the flexible weight Divisia indexing procedure and annual TFP growth rate was found 1.97 percent. Turning to the policy implications of the TFP results, it may be noted that if the desired level of productivity growth is to be maintained, it is important to increase research and development expenditures both in the public and private sector simultaneously. In addition, development of new cropping patterns by selecting crops on the basis of their suitability to soil conditions and cost effectiveness to farmers in each area would also be very useful to the farmers.

Though total factor productivity (TFP) increased, at the same time, a great deal of this gain was consumed by the adverse movement of terms of trade (the price of inputs grew at a much higher rate that the price of outputs) so that farmers' economic condition did not appreciably improve. Terms of trade deteriorated largely because of continuous upward increases in input prices. If a better level of returns to cost growth is to be attained, the terms of trade have to be improved. It is necessary that the government adopt proper policy measures to ensure the supply of agricultural inputs at reasonable prices. An important policy implication of this is that input subsidy policy should be not abruptly abandoned.

Finally, in estimating productivity growth rates, different sub periods can be considered to take into

account floods, cyclones, droughts, excessive rainfalls etc. This is likely to generate a more accurate measure of productivity change. It is hoped that this study will stimulate additional research on productivity.

References

Abedin J. and Bose, G. K. (1988). Farm Size and Productivity Difference: A Decomposition analysis, *Bangladesh Development Studies,* 16(3), 71-79.

Ali, A., Mushtaq, K., Ashfaq, M. and Raza, M. A. (2009). An analysis of productivity growth of Agriculture in Pakistan:1971-2006, *Journal of Agricultural Research,* 47(4), 439-450.

Ali, M. (1991). Factor Substitution and Productivity Change in United Kingdom Agriculture, unpublished Ph.D. thesis, University of Manchester, UK.

Ball, V. E. (1985). Output, Input and Productivity measurement in U.S. Agriculture, 1948-79, *American Journal of Agricultural Economics,* Vol. 67, 475-486.

Bangladesh Bureau of Statistics, Statistical *Bulletin of Bangladesh,* (Various issues), Dhaka. Monthly.

Bangladesh Bureau of Statistics, *Statistical Yearbook of Bangladesh* (Various issues), Dhaka: Ministry of Planning, Government of Bangladesh.

Bangladesh Bureau of Statistics, *Yearbook of Agricultural Statistics of Bangladesh* (Various issues), Dhaka: Ministry of Planning.

BBS. (1993). *Twenty Years of National Accounting of Bangladesh 1972-73 to 1991-92*, Dhaka: Bangladesh Bureau of Statistics.

BBS. (1994). *Bangladesh Population Census 1991*, Vol. I: Analytical report, Dhaka: Bangladesh Bureau of Statistics.

Bottomley, P., Ozanne, A. and Thirtle, C. (1990). A Total Factor Productivity Index for U.K. Agriculture 1967-87, Discussion Paper No. 90/012, Dept. of Agricultural Economics and Management, University of Reading.

Brown, R. S. (1978). Productivity, Returns and the Structure of Production in the US Agriculture, 1947-74 unpublished Ph.D. dissertation, University of Wisconsin, Madison, WI.

Christensen, L. R. (1975). Concepts and Measurement of Agricultural Productivity, *American Journal of Agricultural Economics,* 57, 910-915.

Diewert, W. E. (1976). Exact and Superlative Index Numbers, *Journal of Econometrics,* 4, 115-145.

Divisia, F. (1928). *Economique Rationalle,* Paris, 1928.

GOB. (1990). *Fourth Five Year Plan of Bangladesh, 1990-95*, Dhaka: Planning Commission, Ministry of Planning, Government of Bangladesh.

GOB. (2011). *Bangladesh Economic Review 2010*, Dhaka: Ministry of Finance, Government of Bangladesh.

Gray, W. B. (1987). Cost of Regulation: OSHA, EPA and the Productivity Slowdown, *American Economic Review,* 77(5), 998-1006.

Griffin, K. (1974). *The Political Economy of Agrarian Change: An Essay on the Green Revolution.* London: Macmillan.

Griliches, Z. and Lichtenberg (1984). Inter-industry Technology Flows and Productivity Growth: A Re-examination, *Review of Economics and Statistics,* 66(2), 324-329.

Hossain, M. (1973). *Farm-Size and Productivity in Bangladesh Agriculture: A Case Study of Phulpur Farms,* New Series No: 14, Dhaka: Bangladesh Institute of Development Economics.

Hossain, M. (1977). Farm-Size, Tenancy and Land Productivity: An analysis of Farm Level Data in Bangladesh Agriculture, *Bangladesh Development Studies,* 5(3), 285-348.

Islam, T. S. (1982). Input Substitution and Productivity Change in Canadian Agriculture, unpublished Ph.D. dissertation, University of Alberta, Canada.

Kiani, A. K., Iqbal, M. and Zaved, T., (2008). Total Factor Productivity and Agriculture Research Relationship: Evidence from crops subsector of Pakistan's Punjab, *European Journal of scientific research,* 66(1), 87-97.

Lawrence, D. and McKay, L. (1980). Inputs, Outputs and Productivity Changes in the Australian Sheep

Industry, *Australian Journal of Agricultural Economics,* 24, 46-59.

Lee, T. and Chen, Y. (1978). Agricultural Growth in Taiwan, 1911-1978, in Hayami, Y., V.W. Ruttan and H.M. Southwarth (eds.), *Agricultural Growth in Japan, Taiwan, Korea and the Philippines,* Honolulu: The University Press of Hawaii.

Mandal, M. A. S. (1980). Farm size, Tenure and Productivity in an Area of Bangladesh, *Bangladesh Journal of Agricultural Economics,* 3(2), 21-42.

Matin, K. A. (1989). Farm-Size, Input Use and Land Productivity o Rice in Bangladesh, *Dhaka University Studies,* Part C, 10 (1), 37-49.

Pesek, B. (1961). Economic growth and the Measurement, *Economic Development and Cultural Change,* 9(April):295 -315.

Rahman, S. (2004). Regional Productivity differences and prospect for convergence Bangladesh Agriculture, 1962-1992, Paper presented at the annual meeting of the American Agricultural Economics Association, Denver, Colorado, August 1- 4.

Dr. Bilkis Raihana
Assistant Professor of Economics
Asian University of Bangladesh, Uttara
Dhaka-1230, Bangladesh
E-mail: bilkisraihana@yahoo.com

Sharma, S. (2004). A study on Productivity performance of Indian Automobile industry: Growth accounting analysis. Paper presented in conference, Centre for efficiency and productivity analysis, University of Queensland, Brisbane, Australia, July 14- 16.

Tornqvist, L. (1936). Bank of Finland Consumption Price Index, *Bank of Finland Monthly Bulletin,* 10, 1-8.

Veeman, T. S. (1975). Economic Consequences and Policy Implications of the "Green Revolution" in India with Particular Emphasis on Water Resources Policy in Punjab, unpublished Ph.D dissertation, University of California, Berkeley.

Whittaker, J. M. (1983). An Economic Analysis of Productivity Growth in U.K. Agriculture, unpublished M. Phil. Thesis, University of Nottingham.

Wolff, E. N. (1985). Industrial Composition, Interindustry Effects, and the US Productivity Slowdown, *Review of Economics and Statistics,* 67(2), 268-277.