Impacts of Foreign Direct Investment, Foreign Aid and Export Values on Industrialization and Economic Growth in Bangladesh

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Abstract

The principal purpose of this paper is to identify the impact of foreign direct investment, foreign aid and export values on structural change for industrialization and economic growth in Bangladesh, through use of stylised facts and modern econometric techniques. The Granger causality tests are applied mainly to investigate the causal directions of different macroeconomic variables associated with the change of industrial structure and economic growth. Prior to applying the Granger causality test, the order of integration for all variables is examined by the unit roots tests. The co-integrated tests are also applied to reveal whether or not different pairs of variables share the same stochastic trend. Finally, in order to examine the statistical association of the change of the level of industrialization and economic growth with other selected macroeconomic variables, the regression analysis has also been used.

Keywords: Unit Root Test, Co-integrated Tests, Granger Causality Test, Statistical Association, Regression Analysis

Introduction

Characteristically, foreign direct investment, foreign aid and export values are deemed to be substantial and exogenous factors that contribute to structural change and economic growth of a nation. Foreign direct investment is frequently derived from the belief that it produces externalities in the form of transferring factors of production globally, contrary to the classical theory of international trade. The theory assumes that goods and services can move internationally but the factors of production, i.e. capital, labour, land are relatively immobile. Over the years, this theory of international trade has become increasingly irrelevant to the advanced and highly developed economies. It is commonly argued that capital transformation can ease the transfer of technological and business know-how to poorer countries, which helps exploit unutilized resources more effectively for structural change and development of the economy. Foreign aid functions through a similar framework in providing vital capital that would enhance the long-term prospects of the recipient nation. An important objective of much foreign aid to developing countries is the promotion of economic development and welfare, usually measured by its impact on economic growth and structural change of a nation.[1] Rostow (1956) argued from his well-known historical perspective that the change of industrial structure is induced by the process of take-off [2] into self sustained growth. He emphasised that the take-off requires not only economic, but also political, social and institutional changes to enable it the nation to respond to new opportunities for productive activities. On the other hand Kuznets' (1957) observation on this issue is fundamentally derived from an economic consideration. In his pioneering empirical analysis, Kuznets (1957) shows that a substantial increase of the share of the manufacturing sector both in national output and in the labour force is positively associated with rising per capita income. Moreover, he suggests that economic transformation with rising per capita income is a continuous process from agricultural to manufacturing and then from manufacturing to service, even if less systematically.

The development of industrialization from the agrarian economic system and its association with economic growth, which Kuznets observed, is perfectly consistent with the case study of Japanese economic growth by Chenery and Watanabe (1962) and the cross-country analyses by Chenery (1960), Chenery and Taylor (1968), Chenery and Syrquin (1975), and Chenery and Robinson (1986). In Bangladesh, a several researchers have undertaken studies on economic growth, for example Alam (2005), Chowdhury (2003), Khan (1995), Islam and Saha (1997) etc., but there have been no studies investigating the impacts of foreign direct investment and foreign aid on structural change and economic growth in Bangladesh. That is why in this paper an initial attempt has been made to identify these impacts by using modern econometric techniques. Firstly, I have considered the stylised facts in order to examine the way in which agricultural production may encourage industrialization via technological progress, and to measure the association of different economic variables. In stylised facts, on the basis of the graphical method, I have shown that agricultural production encourages industrialization via technological progress. I have also determined the correlation coefficient in order to measure the association between different pairs of economic variables. Secondly, I have applied econometric techniques in order to find the impacts of some selected macroeconomic variables on structural change and economic growth in Bangladesh. At first, I have applied the unit-root tests in order to investigate the non-stationarity in each of the variables. Then I have applied the Granger causality tests in order to investigate the causal direction associated with industrialization and economic growth in Bangladesh. I have also applied the co-integrated tests in order to examine whether the different pairs of variables share the same stochastic trend or not. Finally, I have measured statistical association between industrialization and some selected macroeconomic variables, and between economic growth and some macroeconomic variables by regression analysis.

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[1] Foreign Direct Investment: Foreign direct investment is defined as investment made by trans-national corporations or by a non-resident in the host countries in which investing units have power to exert some control over decision- making process of the invested unit. The investment may be made in the form of equity participation, or transferring of technology and know-how etc. in order to yield private return according to home and host countries' macro-economic policies.

Foreign Aid: Foreign aid is defined as the monetary value of aid, such as economic, social or military assistance offered by one nation to another.

Industrialization: Ratio of industrial output to agricultural output. In this paper the industrial sector does not indicate only the manufacturing sector but also includes the mining and construction sectors.

[2] Take-Off: Take off is defined as the interval during which the rate of investment increases in such a way that real output per capita rises. This initial increase carries with it radical changes in reduction techniques and the disposition of income flows which perpetuate the new scale of investment and thereby the rising trend in per capita output (Rostow 1956, p.25).

Methodology for Collecting Data

The success of any statistical and econometrical analysis ultimately depends on the availability of the appropriate data. It is therefore essential that we spend some time discussing the nature, sources and limitations of the data that may arise in empirical analysis. The difficulty lies in the availability and nature of the data. A particular problem facing the researcher is that of obtaining appropriate data. In Bangladesh a reliable source of data is a golden deer. It is often difficult to obtain good reliable data with the necessary information required for a particular analysis. Missing value is a great problem in some data. Even in some experimentally collected data, errors of measurement arise from approximation and rounding off. Because of these and many other problems, the researchers should always keep in mind that the result of research may be affected by the quality of the data. Therefore, if in given situations the researchers find that the results of research are unsatisfactory, the explanation may not be that they used the wrong model, but that the quality of the data was poor. Difficulties in finding suitable data are frequently encountered. The empirical analysis in this paper is based on secondary data. Data used in this study are collected from various publications of the government of the People's Republic of Bangladesh such as The Bangladesh Bureau of Statistics, The Bangladesh Board of Investments, Statistical Yearbooks of Bangladesh, Bangladesh Yearbook of Agricultural Statistics etc., as well as World Development Indicators of the Database of the World Bank group and Annual Reports of Bangladesh Bank. This study covers available data from 1972-73 to 2004-05.

The Stylised Facts

Agricultural production still plays a significant role especially in a closed economy, and perhaps even in the modern economic growth system (see Ranis 1988). In order to make primary observations on the relationship between structural change and industrialization and economic growth, firstly the percentage shares of the industrial and agricultural sectors in the total GDP are presented in Figure 1, corresponding to per capita GDP. Figure 2 presents these sectoral shares in log, corresponding to the per capita GDP.

Figure 1: Shares of Agricultural and Industrial Sectors in the Total GDP Corresponding to Per Capita GDP

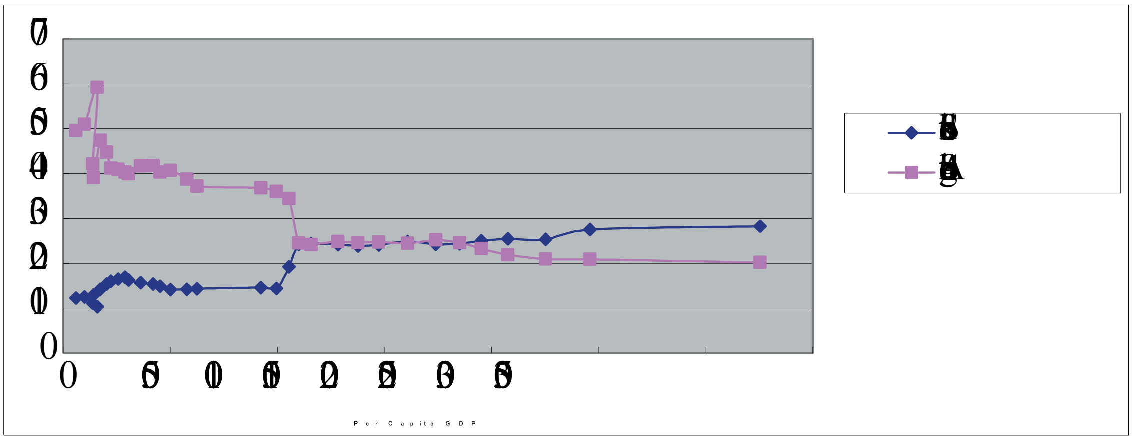


Figure 2 Shares of Agricultural and Industrial Sectors in the Total GDP Corresponding to Per Capita GDP (in Logarithm)

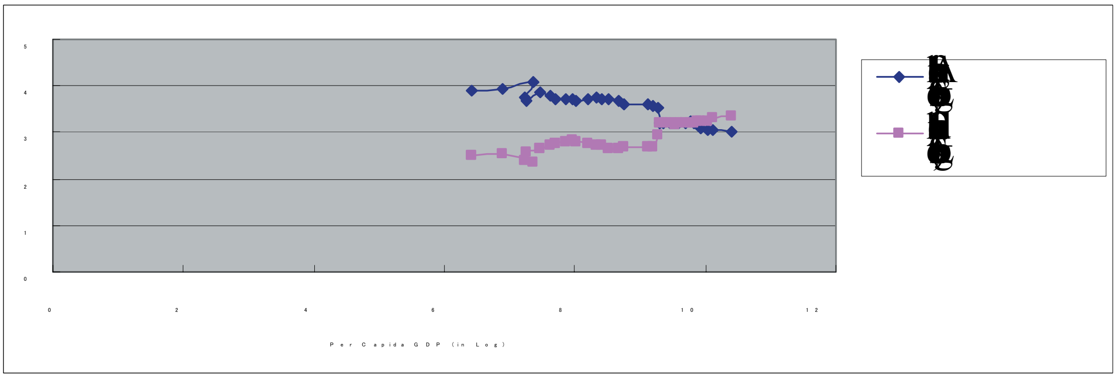
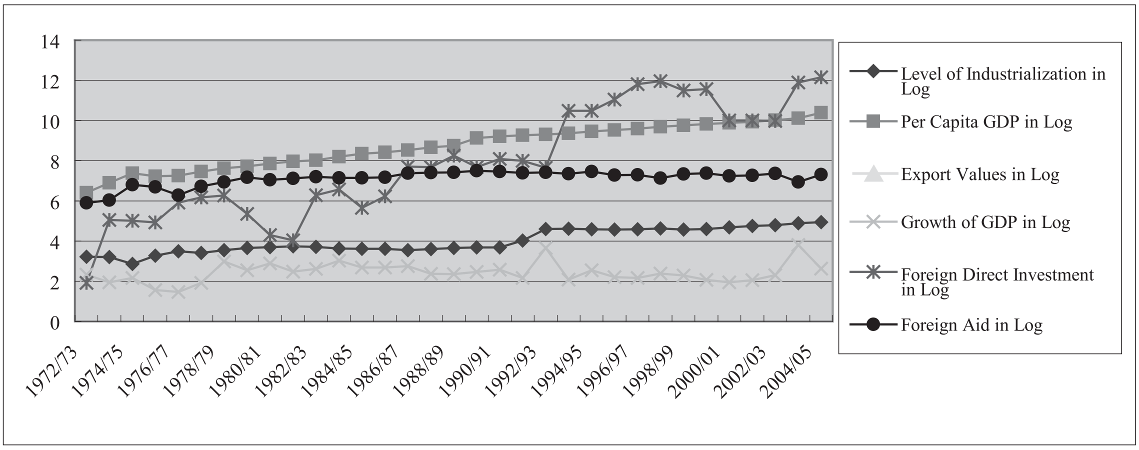


Figure 3 Level of Industrialization, Foreign Direct Investment, Foreign Aid, Export Values, Per Capita GDP, and Growth of GDP in Logarithms



From Figures 1, and 2, it is clear that the agricultural sector's share is declining while that of the industrial sector is increasing. These figures also indicate that the declining rate of the agricultural sector is higher than the increasing rate of the industrial sector. Moreover, the declining share of the agricultural sector is substantially offset by the increasing share of the industrial sector. This indicates that the source of major contribution to the economic development of Bangladesh is shifting from the agricultural sector to the industrial sector. Thus, in this paper, I have focused more on structural change in terms of industrialization, i.e. from agricultural sector to industrial sector, and economic growth. The levels of industrialization, foreign direct investment, foreign aid, export values, growth of GDP and per capita GDP in logarithms are presented in Figure 3. From this Figure it can be said that these variables display an unmistakable upward trend. The question is whether the trend arises from the positive drift term or not, of a random walk. To explore this, an empirical investigation has been conducted in this paper. For empirical verification, three cases have been considered. In case one, constant and trend terms are included in the model; in case two only constant term is included in the model; and in case three, no constant and trend terms are included in the model. In addition, in order to measure the degree of association of different pairs of macroeconomic variables, the correlation coefficients have been estimated. These estimated values are reported in Table 1.

Table 1 The Correlation Matrix of Different Pairs of Variables[3]

Variables	LPGDP	LINDUS	LFAID	LFDIN	LEXPO	LGGDP
Correlation of LPGDP Test Statistic p-value		0.9084 12.0981 0.00000	0.7487 6.2876 0.00000	0.9187 12.9533 0.00000	0.9916 42.5659 0.00000	0.2086 1.1873 0.24415
Correlation of LINDUS Test Statistic p-value	0.9084 12.0981 0.00000	1.00	0.5311 3.4901 0.00147	0.8778 10.2032 0.00000	0.9318 14.2881 0.00000	0.1858 1.0525 0.30069
Correlation of LFAID Test Statistic p-value	0.7487 6.2876 0.0000	0.5311 3.4901 0.00147	1.00	0.5853 4.0195 0.00035	0.7052 5.5371 0.0000046	0.2945 1.7159 0.096168
Correlation of LFDIN Test Statistic p-value	0.9187 12.9533 0.00000	0.8778 10.2032 0.00000	0.5853 4.0195 0.00035	1.00	0.9325 14.370829 0.00000000	0.0561 0.313046 0.756342
Correlation of LEXPO Test Statistic p-value	0.9916 42.5659 0.00000	0.9318 14.2881 0.00000	0.7052 5.5371 0.0000046	0.9325 14.370829 0.00000000	1.00	0.2055 1.168904 0.2513525
Correlation of LGGDP Test Statistic p-value	0.2086 1.1873 0.244115	0.1858 1.0525 0.30069	0.2945 1.7159 0.096168	0.0561 0.313046 0.756342	0.2055 1.168904 0.2513525	1.00

Discussion of Results：From the estimated values of correlation coefficients which are reported in Table 1, it has been found that all the pairs of variables are positively associated. It has also been found that relationships of growth of GDP with different variables are not statistically significant. Apart from this, the relationships between different pairs of variables are statistically significant.

Econometric Methodology

The principal econometric analysis involves testing whether the macroeconomic variables such as the level of industrialization, foreign direct investment, foreign aid, export values, growth of GDP and also the per capita GDP individually contain a unit root or not, and whether an underlying co-integration relation exists. If a variable does not contain a unit root, then any innovations to the series are temporary and have short-run consequences. Otherwise, any shocks to it will be permanent and thus have a long-term effect. To test for the stationarity of a variable, a number of econometric techniques have been developed which are called unit root tests. Also, in order to find the casual direction associated with the change of industrial structure and with economic growth, here the Granger Causality tests are applied. Nest unit root tests are discussed.

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[3] LPGDP : per capita GDP in logarithm, LINDUS : Level of industrialization means ratio of industrial output to agricultural output in logarithm, LFAID : foreign aid in logarithm, LFDIN : Foreign direct investment in log, LEXPO : export values in logarithm , LGGDP : growth of GDP in Logarithm, Growth of GDP is defined as $\frac{GDP(t)-GDP(t-1)}{GDP(t-1)} \times 100$

Unit Root Tests without Structural Breaks

Initially the Granger Causality tests are applied, in order to investigate the causal direction associated with the change of industrial structure and economic growth. Prior to the Granger causality tests, it is necessary to examine the order of integration for all variables by the unit root test. It is well known that the usual techniques of regression analysis can result in highly misleading conclusions when variables contains stochastic trends (Stock and Watson 1988); Granger and Newbold 1974). In particular, if the dependent variable and at least one independent variable contain stochastic trend, and if they are not co-integrated, the regression results are spurious (Phillips 1986; Granger and Newbold 1974). To identify the correct specification of the model, an investigation of the presence of stochastic trend in the variables is needed. The Dickey-Fuller, Augmented Dickey-Fuller and Phillips-Perron tests are applied in order to investigate whether or not each of the variables contain stochastic trend. The variables which are applied here are the level of industrialization in log (LINDUS), foreign direct investment in log (LFDIN), foreign aid in log (LFAID), export values in log (LEXPO), per capita GDP in log (LPGDP), and growth of GDP in log (LGGDP).
The following three cases have been considered for the Dickey-Fuller test

Case One: Constant and trend terms are included in the equation

$$\Delta X_t = \alpha_0 + \alpha_1 t + \theta X_{t-1} + u_t \quad (1)$$

Case Two: Only constant term is included in the equation

$$\Delta X_t = \alpha_0 + \theta X_{t-1} + u_t \quad (2)$$

Case Three: Neither constant nor trend terms are included in the equation

$$\Delta X_t = \theta X_{t-1} + u_t \quad (3)$$

For the Augmented Dickey-Fuller Test, the following equations have been considered

Case One: Constant and trend terms are included in the equation

$$\Delta X_t = \alpha_0 + \alpha_1 t + \theta X_{t-1} + \sum_{i=1}^{m} \varphi \Delta X_{t-i} + u_t \quad (4)$$

Case Two: Only constant term is included in the equation

$$\Delta X_t = \alpha_0 + \theta X_{t-1} + \sum_{i=1}^{m} \varphi_i \Delta X_{t-i} + u_t \quad (5)$$

Case Three: Neither trend nor constant terms are included in the equation

$$\Delta X_t = \theta X_{t-1} + \sum_{i=1}^{m} \varphi_i \Delta X_{t-i} + u_t \quad (6)$$

X_1 is the series under investigation and Δ stands for first difference. If $\theta = 0$ then the series X_1 contains a unit root and therefore an I(1) process governed by a stochastic trend. Since the estimated θ does not have the usual asymptotic distribution, the values tabulated by MacKinnon (1991) are used; these values are more accurate than the ones originally tabulated by Fuller (1976) and Dickey-Fuller (1987). We can also use the Phillips-Perron test. Phillips and Perron (1987) generalized the following results to the case when the random error term u_t is serially correlated and possibly heteroscedastic as well. The Phillips-Perron test for the null hypothesis $H_0: \rho=1 \Longrightarrow H_0: \theta=0$ is given by:

$$Z_{\rho}=T[\hat{\rho}-1]-\frac{1}{2}\left[T^2 \frac{\hat{\sigma}_{\rho}^2}{s^2}\right][\hat{\lambda}^2-\hat{\gamma}_0] \tag{7}$$

where the estimated autocovariances of the OLS residuals $\hat{u}$'s are given as:

$$\hat{\gamma}_0=\frac{1}{T}\sum_{t=1}^{T}\hat{u}_t^2\ ; \qquad \hat{\gamma}_j=\frac{1}{T}\sum_{t=j+1}^{T}\hat{u}_t\hat{u}_{t-j}\ ; \qquad \hat{\lambda}^2=\hat{\gamma}_0+2\sum_{j=1}^{q}q\left[1-\frac{j}{q+1}\right]\hat{\gamma}_j\ ;$$

The usual OLS formula for the variance of the residuals from their regression is given by:

$$s^2=\frac{1}{T-2}\sum_{t=1}^{T}\hat{u}_t^2$$

To examine the order of integration for all variables by the unit root tests, the Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests results are reported in the following Table.

Table 2:Dickey-Fuller, Augmented Dickey-Fuller and Phillips-Perron Tests Results[4]

Variables	DF Test			ADF Test			PP Test		
	Case 1	Case 2	Case 3	Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
LINDUS	-2.4840	-0.5982	-1.6766	-2.1950	-1.202	-1.5174	-12.389	-1.0580	-2.0396
LFDIN	-3.3314	-1.7249	1.05194	-2.8462	-0.6906	1.07623	-17.847	-3.9175	0.8209
LFAID	-3.2901	-2.5712	0.93489	-1.3640	-2.8563	1.20569	-10.959	-8.9744	0.1779
LPGDP	-3.2966	-2.1258	5.03177	-2.9950	-1.0592	3.32707	-16.419	-1.4645	0.4470
LGGDP	-3.6912	-2.1772	-1.1320	-1.9195	0.12726	6.55740	-14.5470	0.3301	0.0785
LEXPO	-3.046	-2.0250	5.16802	-2.844	-1.1842	5.41204	-15.7373	-1.2441	0.7077

Discussion of results: From these test results, it can be concluded that all the variables are integrated of order 1 that is I(1). Thus from our analytical results it can be concluded that all the variables are non-stationary and have long-run consequences. Recent studies have been found that the standard ADF and PP tests have low power against stationary alternatives in small samples (see e.g. Campbell and Perron 1991, and DeJong et al. 1992). Therefore failure to reject the null hypothesis of a unit root may not give one much information regarding whether the series is indeed stationary. Perron (1989) points out that these tests perform especially poorly when there is a break in the deterministic trend, and drives the asymptotic distribution of the test statistic which incorporates such a break trend. However, Perron's method has received some criticisms because his breaking point is chosen based on pre-test examination of the data, leading his procedure to overstate the likelihood of the trend breaking alternative hypothesis. Thus in the next section, unit root test is discussed with break points.

[4] At 5% level of significance the critical values of DF and ADF Tests for case 1, 2 and 3 are -3.568, -2.98 and -1.95 respectively, and for Philips-Perron test the critical values for cases 1, 2 and 3 are -18.508, -12.756 and -7.428 respectively.

Unit Root Tests with Structural Breaks

Zivot and Andrew (1992), among others, introduced methods to endogenously search for a break point and test for the presence of a unit root when the time series process has a breaking trend. In this paper the Zivot-Andrews technique is applied to test for the stationarity of these variables. In the Zivot-Andrews test the null hypothesis is:

$$\chi_t = \alpha_0 + \chi_{t-1} + u_t \quad (8)$$

The selection of the possible break point is viewed as the outcome of an estimation procedure designed to fit $\{\chi_t\}$ by a trend-stationary process with a one time break in the trend occurring at an unknown point in time. This procedure searches for the break that gives the most weight to the trend stationary alternative. The possible break point in the sample is T_b, which lies between 1 and T, i.e.< T_b< T, the regression equations are specified as follows:

Model(A): $$\Delta\chi_t = \alpha_0 + \alpha_1 t + \alpha_2 \chi_{t-1} + \alpha_3 d^i_{t-} t + \sum_{j=1}^{k} \varphi_j \Delta\chi_{t-j} + u_t \quad (9)$$

Model(B): $$\Delta\chi_t = \alpha_0 + \alpha_1 t + \alpha_2 \chi_{t-1} + \alpha_3 d^i_t t + \sum_{j=1}^{k} \varphi_j \Delta\chi_{t-j} + u_t \quad (10)$$

Model(C): $$\Delta\chi_t = \alpha_0 + \alpha_1 t + \alpha_2 \chi_{t-1} + \alpha_3 d^i_{t-} t + \alpha_4 d^i_{t-} t + \sum_{j=1}^{k} \varphi_j \Delta\chi_{t-j} + u_t \quad (11)$$

where χ_t is the series under investigation of unit root and Δ stands for the first difference and the lagged difference terms on the right hand side of the equations (9), (10), and (11).

Here; d^i_t = 0; for, t = 1, 2, …………(i-1)

= 1 for t = i, i+1, i+2, T. (12)

Model (A) allows for a breakpoint in the intercept; model (B) allows for a breakpoint in the trend function; and model (C) includes a hybrid of the two. In each model, the k extra regressors are included to eliminate possible nuisance-parameter dependencies in the asymptotic distributions of the test statistic caused by serial correlation in the error terms. As for the procedure of determining the break and computing the test statistic, here an OLS is applied to each model with a break point at T_b where T_b ranges from 1 to T-2 for model (C) and 1 to T-1 for Model (A) and (B). For each value of T_b, the number of extra regressors, k is determined using the procedure suggested by Campbell and Perron (1991).F_i denotes the F-statistic for testing the null hypothesis $H_0 : \alpha_3 = 0$, for model (A) that is there is no break at intercept, and $H_0 : \alpha_3 = 0$ for model (B) that there is no trend break in period t, and $H_0 : \alpha_3 = \alpha_4 = 0$ for model (C) that there is no time trend break in the period t = i. For each model, for i = 3, 4, 5,………,(T-1), I have estimated F_2, F_3,………., F_{T-1} The estimated values of F-test statistic corresponding to their break points for Model (A), (B) and (C) are reported in Table 3.

Table 3: Results of F-Test Statistic with Break Points and Zivot-Andrews Test for a Unit Root[5]

Break Point, T_B	F-Test	Zivot Test of	Break Point, T_B	F-Test	Zivot Test of	Break Point, T_B	F-Test	Zivot Test of
Foreign Aid			**Per Capita GDP**			**Level of Industrialization**		
Model A			Model A			**Model A**		
1975-76	4.33823	-1.76540	1975-76	10.2015	-1.53581	1975-76	7.02400	-2.55662
1977-78	6.78189	-4.59368	1983-84	4.81718	-3.86382	1982-83	2.9891	-3.17245
1978-79	8.92127	-4.79883	1984-85	3.88972	-3.71745	1983-84	3.1379	-3.24874
1979-80	7.75675	-4.57950	1986-87	4.14319	-3.76078	1990-91	4.5591	-3.14710
1981-82	3.68158	-3.92950	1987-88	4.23797	-3.77451	1991-92	14.3596	-4.51357
1982-83	3.1227	-3.82356	1995-96	6.42036	-4.14036	1992-93	11.5435	-4.58828
1985-86	2.8969	-3.93560	1996-97	7.57791	-4.32814	**Model B**		
1986-87	3.0122	-3.93605	1997-98	8.01506	-4.38767	1975-76	7.0240	-2.55662
1995-96	5.5454	-4.36096	1998-99	8.20752	-4.41153	1982-83	3.3034	-3.23149
1996-97	3.5424	-3.91539	1999-00	6.82621	-4.18497	1990-91	5.37598	-3.47102
1997-98	3.1889	-3.82509	2000-01	4.30570	-3.72753	1991-92	12.7212	-4.24331
Model B			2003-04	6.73529	-0.02431	1992-93	7.8463	-4.06722
1975-76	4.33823	-1.76540	**Model B**			**Model C**		
1977-78	13.9008	-5.38424*	1975-76	10.20152	-1.53581	1975-76	7.02400	-2.55662
1978-79	13.0302	-5.46072*	1992-93	4.16723	-3.71010	1976-77	10.2631	-2.64438
1879-80	4.99978	-4.25893	1993-94	5.65635	-4.01494	1977-78	2.9235	-2.32259
1992-93	3.6541	-3.96965	1994-95	7.08102	-4.25037	1991-92	7.06647	-4.29720
1993-94	5.29221	-4.25639	1995-96	10.37542	-4.7388*	1992-93	5.5742	-4.37116
1994-95	4.91037	-4.14974	1996-97	10.78998	-4.7892*	**Growth of GDP**		
1995-96	8.11570	-4.72765*	1997-98	10.00741	-4.6644*	**Model A**		
1996-97	4.76491	-4.09654	1998-99	8.95557	-4.5063*	1977-78	5.76373	-3.32425
1997-98	3.7912	-3.91368	1999-00	6.74251	-4.15301	1978-79	8.53605	-3.98024
Model C			2003-04	6.73529	-0.02431	1993-94	5.33858	-3.22307
1975-76	4.33823	-1.76540	**Model C**			2002-03	3.2647	-2.36982
1977-78	18.5741	-3.25970	1976-77	11.38754	-2.03274	2003-04	5.29304	-2.83813
1878-79	6.71428	-4.27580	1977-78	6.31228	-2.06580	**Model B**		
1979-80	3.8295	-4.32171	1986-87	4.68734	-4.54245	1977-78	6.83209	-3.45513
1980-81	2.6142	-3.85852	1987-88	7.12073	-5.20512	1978-79	8.1880	-3.96950
1981-82	3.9443	-4.32247	1988-89	11.31276	-6.1935*	1987-88	2.9569	-3.05840
1982-83	4.6070	-4.51844	1989-90	48.42823	-11.6977*	1993-94	3.9717	-3.18766
1983-84	5.16413	-4.72012	1992-93	15.41470	-6.7483*	2002-03	3.2704	-2.39197
1984-85	6.23694	-4.99130	1993-94	15.70815	-6.8859*	2003-04	5.09097	-2.83745
1985-86	7.7460	-5.35580	1994-95	14.38698	-6.66576	**Model C**		
1986-87	10.3423	-5.9979*	1995-96	12.41119	-6.21159	1977-78	3.3535	-3.39972
1987-88	11.5022	-6.4082*	1996-97	8.79723	-5.40893	1978-79	4.2301	-3.89352
1988-89	12.2440	-6.5848*	1997-98	6.07205	-4.70707	1993-94	2.8084	-2.66401
1990-91	12.1483	-6.5555*	1998-99	4.46354	-4.18852	2003-04	5.70811	-2.25570
1991-92	11.1177	-6.3323*	**Export Values**					
1992-93	8.80967	-5.8166*						
1993-94	7.34556*	-5.45800	1975-76	9.17593	5.16418			
1994-95	5.0868*	-4.85084	1999-00	3.4567	-4.41894			
1995-96	5.16312*	-4.88701	2003-04	6.4435	-3.16375			
1996-97	2.8626*	-4.17162	**Model B**					
2002-03	3.42687*	-3.64517	1975-76	9.17593	-4.32849			
Foreign Direct Investment			1999-00	2.7834	-4.27960			
Model A			2003-04	6.40616	-3.18375			
1993-94	6.35869	-3.88917	**Model C**					
2000-01	3.3639	-3.40458	1975-76	9.17593	-4.32849			
Model B			1976-77	4.62774	-3.73562			
1993-94	3.0935	-3.39166	1999-00	3.74695	-3.91373			
2000-01	3.0222	-3.36873	2001-02	5.13568	-4.25997			
Model C			2002-03	3.60234	-3.90804			
1993-94	5.1478	-4.29461	2003-04	3.1560	-2.87575			

[5] For each choice of the breaking point T_b , the optimum lag length k is selected as suggested by Campbell and Perron (1991). For each model specification, the 5% critical value is obtained from Zivot and Andrews (1992). At 5% level of significance the critical value for Model (A) is -4.80 for Model (B) is -4.42 and for Model (C) is -5.80. * : indicates significant at 5% level of significance or less.

Results Discussion with Break Points: I have confined the analysis to a scenario in which structural breaks which are either a one-time parallel shift or a shift in the trend or a combination of the two, are ruled out. This presumption is problematic on different fronts. Actually, foreign aid, foreign direct investment, export values, the level of industrialization, per capita GDP and growth of GDP are affected by different factors, such as floods, cyclones, political and ideological conflicts, policy change of the government, change in policies and views of different foreign aid institutions such as ADB, IMF, World Bank, and EU etc., and policy changes in different aid countries. That is why in this section an attempt has been made to investigate whether or not our non-stationary result is sensitive to structural breaks. Instead of choosing a breakpoint arbitrarily on pre-test examination of the data, here the Zivot-Andrews (1992) procedure has been applied to search endogenously for a break point and test for a unit root in each of the variables. Since it is unknown a *priori* whether the break is in the intercept, in the time trend, or in both the intercept and trend, I run all three equations (9), (10) and (11). The breaks points for each series and the estimated values of tests are reported in Table 3. From estimated results it has been found that the non-stationary results are sensitive for the variables foreign aid and per capita GDP with the structural breaks. In each model specification, the Zivot test statistics are much smaller in absolute value that the associated 5% critical values for the variables foreign direct investment, export values, level of industrialization and growth of GDP. Thus the estimated results indicate that the variables foreign direct investment, export values, level of industrialization and growth of GDP individually contain a unit root still obtained even when a break point is appropriately taken into account. It is apparent that our conclusion is invariant to structural breaks. Finally, from both test's results it can be concluded that the variables foreign direct investment, export values, level of industrialization and growth of GDP contain unit root, i.e. these series are non-stationary without and with structural breaks. Thus it can be said that these variables have a long-run effect for economic development in Bangladesh. From the estimated results also it can be concluded that the variables foreign aid and per capita GDP do not contain unit root with structural breaks. It is also essential to enquire into the second order unit root in each series. The test results for the second order unit root are reported in Table 4.

Table 4 Dickey-Fuller, Augmented Dickey-Fuller and Phillips-Perron Tests Results for Second Order Unit Root[6]

Variables	DF Test			ADF Test			PP Test		
	Case 1	Case 2	Case 3	Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
ΔLINDUS	-5.4521 **	-5.5449 **	-5.1298**	-4.8681 **	-4.966 **	-4.031 **	-32.418 **	-32.304 **	-29.942 **
ΔLFAID	-7.0132 **	-6.4400 **	-6.2993 **	-6.2825 **	-7.391 **	-7.2205 **	-40.784 **	-36.807 **	-35.593 **
ΔLFDIN	-6.3279 **	-6.4901 **	-6.2738 **	-4.4950 **	-4.607 **	-4.2290 **	-33.438 **	-33.676 **	-31.695 **
ΔLEXPO	-9.4339 **	-9.54912 **	-4.72874 **	-3.7948 *	-3.9476 **	-3.88382 **	-40.787 **	-39.731 **	-18.652 **
ΔLPGDP	-5.1948 **	-5.4558 **	-3.5376 **	-8.5260 **	-8.895 **	-3.8023 **	-24.892 **	-24.397 **	-12.851 **
ΔLGGDP	-7.2153 **	-7.42880 **	-2.27647 *	-4.0951 *	-4.1579 *	-2.06086 *	-35.563 **	-35.235 **	-8.152 **

[6] *indicates significant at 5% level of significance, ** : indicates significant at 1% level of significance.

Discussion of results: From all the test results it has been found that the null hypothesis of second order unit root for all the variables will be rejected at any significance level. Thus it has been found that none of the variables contain second unit root. Thus, from the test results it can be concluded that all the variables are integrated of order one that is I(1).

Co-integration Test for Granger Causality Investigation

The notion of co-integration among variables has introduced a new flexibility into the modeling of economic time series. As defined by Engle and Granger (1987), two variables are said to be co-integrated of order (1, 1), if each variable individually is stationary in first differences (integrated of order 1), but linear combination of the variables is stationary in level (integrated of order 0). Many economic variables might plausibly be co-integrated when correctly measured, sometimes in natural or sometimes in log units.[7] The concept of co-integration and error-correction are closely related. An error correction model for two variables relates the change in the variables to lagged changes and a lagged linear combination of levels.[8] This type of model was introduced by Phillip (1954) and Sargan (1964) and has been promoted by Hendry Davidson and others in a series of papers (Hendry Davidson 1987; Davidson and Hendry 1981; Hendry and Richard 1983; Hendry 1986, 1986). Engle and Granger (1987), following the work of Granger (1981, 1983) has shown that two variables which are co-integrated of order (1, 1) have an error-correction representation. The linear combination of levels which enters the error-correction model is just that combination which is stationary in levels. There is also a less formal link between co-integration and error-correction. The same kind of story is often used to motivate both these concepts. In the words of Granger (1986), for example, "at the least sophisticated level of economic theory lies the belief that certain pairs of economic variables should not diverge from each other by too great an extent, at least in the long-run". Thus, such variables may drift apart in the short-run or according to seasonal factors, but if they continue to be too far apart in the long-run, then economic forces, such as a market mechanism or government intervention, will begin to bring them together again. There is a suggestion here that "economic forces", at least those that we understand, are better at explaining long-run tendencies than short-run tendencies in the series. Economic theory, Granger seems to say, is valid for describing the long-run equilibrium, but random shocks knock the economy away from the equilibrium and its moves back only slowly. Why is the adjustment back to equilibrium not instantaneous? Granger does not say. We suppose that he may intend such things as sticky prices, long-term contracts, costs of adjustment and other factors that may be difficult to model. Engle and Granger (1987) introduced some terminology which fits naturally with this account. They describe co-integration variables as being in equilibrium when the stationary linear combination of their levels is at its unconditional mean (assumed equal to zero for simplicity). Most of the time, this combination of

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[7] More generally, a set of variables is co-integrated of order (d, b) if each variable individually is integrated of order d, but at least one linear combination exists which is of order (d-b). Most of the literature focuses on the case d=1 and b=1, and I will do the same here.

[8] This definition follows Engle and Granger (1987). Much of the literature uses a single equation relating the change in one variable to the contemporary change in the other, lagged changes in both variables and a lagged linear combination of levels.

levels is not zero and the system is out of equilibrium, but because the combination of levels is stationary, there is a tendency for the system to return to equilibrium. Engle and Granger call the stationary combination of levels the "equilibrium error". An error correction model can then be thought of as a description of the stochastic process by which the economy eliminates or corrects the equilibrium error. This motivation for error-correction models suggests a word in which economic theory describes the long run rather than the short run, and in which unspecified factors cause the economy to respond slowly to random shocks.[9] The terminology makes it natural to think that the equilibrium error appears in the equation describing changes of economic variables because these variables respond to the error in order to eliminate it. As Davidson and Hendry (1981) put it, there is a servo-mechanism which returns the economy to equilibrium. Engle and Granger's findings that co-integrated variables have an error-correction representation can be thought of as a statement about Granger Causality: the stationary linear combination of levels must Granger Cause the change in at least one of the co-integrated variables. Now, it is well known that Granger causality from a variable Z_1 to a variable Z_2 can arise for two reasons. The variable Z_1 may cause Z_2 in the common-language sense or instead the variable Z_1 may anticipate to forecast Z_2 . In the former case, an intervention which changes the stochastic process for Z_1 will change the behaviour of Z_2, while in the latter case an intervention which changes the stochastic process for Z_2 will change the behaviour of Z_1. In Sims (1977) terminology, while both show causal ordering from Z_1 to Z_2, in the former case there is a structural ordering from Z_1 to Z_2 latter case a structural ordering from Z_2 to Z_1 . The motivation for co-integration given above stresses the idea that the equilibrium error causes changes in the variables of the model. I wish to emphasize instead the possibility that the equilibrium error results from agents "forecast" of these changes.

In order to do the Granger causality test, it is necessary to examine the co-integrating relationships between the pairs of series. To facilitate the exposition, we specify the following co-integrating regression in levels:

Case 1: Constant and trend terms are included in the model

$$X_t = \alpha_0 + \alpha_1 t + \alpha_2 Y_t + u_t \tag{13}$$

and

$$Y_t = \beta_0 + \beta_1 t + \beta_2 X_t + u_t \tag{14}$$

Case 2: Only constant term is included in the model;

$$X_t = \alpha_0 + \alpha_1 Y_t + u_t \tag{15}$$

and

$$Y_t = \beta_0 + \beta_1 X_t + u_t \tag{16}$$

where X and Y are the variables under investigation.

To test for co-integration, the Augmented Engle-Granger (1987) and Phillips and Ouliaris test (1990) methods are applied. The co-integrated tests results of variable X on the variable Y and also the co-integrated tests results of the variable Y on X are given below.

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[9] Engle and Granger say that their notion of equilibrium is just "a stationary point characterized by forces which tend to push the economy back toward equilibrium whenever it moves away". Their notion of equilibrium is specific to the error correction model they define and has no clear relation to other concepts of equilibrium in economics.

Table 5 The Augmented Engle-Granger and Phillips-Ouliaris Tests Results for Co-integration Between Different Pairs of Variables[10]

Augmented Engle Granger Test Results					
Cases	DE(LINDUS) EX(LFDIN)	DE(LINDUS) EX(LFAID)	DE(LINDUS) EX(LEXPO)	DE(LINDUS) EX(LGGDP)	DE(LINDUS) EX(LPGDP)
Case 1	-2.61937	-2.35454	-2.56675	-1.95858	-2.32912
Case 2	-3.09180	-1.45688	-2.86912	-1.15187	-2.96692
	DE(LGGDP) EX(LINDUS)	DE(LGGDP) EX(LFAID)	DE(LGGDP) EX(LFDIN)	DE(LGGDP) EX(LEXPO)	DE(LGGDP) EX(LPGDP)
Case 1	-5.35743*	-5.76518*	-6.25318*	-5.40584*	-4.66633*
Case 2	-5.25027*	-4.61451*	-6.07859*	-5.29083*	-4.56293*
	DE(LFDIN) EX(LINDUS)	DE(LFDIN) EX(LFAID)	DE(LFDIN) EX(LEXPO)	DE(LFDIN) EX(LGGDP)	DE(LFDIN) EX(LPGDP)
Case 1	-3.47096	-3.54090	-2.93684	-3.41600	-3.23417
Case 2	-2.67380	-1.66162	-3.00321	-1.54968	-3.04772
	DE(LFAID) EX(LINDUS)	DE(LFAID) EX(LFDIN)	DE(LFAID) EX(LEXPO)	DE(LFAID) EX(LGGDP)	DE(LFAID) EX(LGGDP)
Case 1	-3.10280	-3.47454	-3.68533	-3.01142	-3.47096
Case 2	-1.42501	-3.07142	-3.13408	-3.20182	-2.99130
	DE(LEXPO) EX(LINDUS)	DE(LEXPO) EX(LFAID)	DE(LEXPO) EX(LFDIN)	DE(LEXPO) EX(LGGDP)	DE(LEXPO) EX(LPGDP)
Case 1	-2.93525	-3.00702	-3.15039	-3.79298	-5.26508*
Case 2	-2.80796	-1.30489	-2.67783	-0.64185	-3.73607*
	DE(LPGDP) EX(LINDUS)	DE(LPGDP) EX(LFAID)	DE(LPGDP) EX(LFDIN)	DE(LPGDP) EX(LGGDP)	DE(LPGDP) EX(LEXPO)
Case 1	-3.98211	-3.10903	-3.90541	-3.31452	-3.49881
Case 2	-3.08968	-1.10054	-2.74456	-1.61993	-2.74990
Phillips and Ouliaris Test Results					
	DE(LINDUS) EX(LFDIN)	DE(LINDUS) EX(LFAID)	DE(LINDUS) EX(LGGDP)	DE(LINDUS) EX(LEXPO)	DE(LINDUS) EX(LPGDP)
Case 1	-12.8890	-11.2120	-11.5037	-12.2604	-9.0697
Case 2	-17.8116	-5.0372	-1.4091	-13.1835	-12.8475
	DE(LGGDP) EX(LINDUS)	DE(LGGDP) EX (LFAID)	DE(LGGDP) EX(LFDIN)	DE(LGGDP) EX(LEXPO)	DE(LGGDP) EX(LPGDP)
Case 1	-27.8670*	-27.5354*	-29.8127*	-27.8016*	-28.0578*
Case 2	-25.9014*	-24.8167*	-26.0433*	-25.8935*	-25.2981*
	DE(LFDIN) EX(LINDUS)	DE(LFDIN) EXP(LFAID)	DE(LFDIN) EXP(LGGDP)	DE(LFDIN) EXP(LEXPO)	DE(LFDIN) EXP(LPGDP)
Case 1	-18.5484	-18.7015	-17.1885	-14.2434	-16.9871
Case 2	-19.7874	-5.3220	-1.9005	-15.2053	-15.5231
	DE(LFAID) EX(LINDUS)	DE(LFAID) EX(LFDIN)	DE(LFAID) EX(LGGDP)	DE(LFAID) EX(LEXPO)	DE(LFAID) EXP(LPGDP)
Case 1	-10.7216	-12.5053	-14.9509	-18.3114	-18.0542
Case 2	-12.7370	-10.6370	-11.2115	-9.6968	-11.0833
	DE(LEXPO) EX(LINDUS)	DE(LEXPO) EX(LFAID)	DE(LEXPO) EX(LFDIN)	DE(LEXPO) EX(LGGDP)	DE(LEXPO) EX(LPGDP)
Case 1	-23.1681	-21.2148	-19.8161-	-20.7730	-25.5584
Case 2	-13.3621	-3.5148	12.4492	-0.6997	-19.7070
	DE(LPGDP) EX(LINDUS)	DE(LPGDP) EX(LFAID)	DE(LPGDP) EX(LFDIN)	DE(LPGDP) EX(LEXPO)	DE(LPGDP) EX(LGGDP)
Case 1	-15.0063	-22.7740	-15.5895	-17.4382	-17.4276
Case 2	-13.2087	-2.6598	-12.7638	-19.6345	-2.5201

[10] At 5% level of significance the critical values for Augmented Engle-Granger Test for case 1 and 2 are -4.0802 and -3.5268 respectively. For the Phillips- Ouliaris test the critical values at 5% level of significance for case 1 and 2 are -27.1 and -20.5 respectively. DE : indicates dependent variable, EX : indicates independent variable, * : indicates statistically significant at 5% level of significance or less.

Discussion of results: In the preceding analysis, it has been found that all the variables contain a unit root. It is very important to know that the different pairs of variables may still share a common trend; thus I have conducted an alternative analysis by using the con-integration techniques. Here I have applied the Augmented Engle Granger and Phillips–Ouliaris test statistics in order to find co-integrated relationships between different pairs of variables. From both tests' results it has been found that the growth of GDP is co-integrated with all the variables. Thus it can be said that the growth of GDP shares the same stochastic trend with these variables. Also, from test results, it has been found that the export value is co-integrated with only per capita GDP. Thus it can be said that this pair of variables has a long-run consequence. Next I will move to the Granger Causality test in order to find the causal relationship between variables.

The Granger Causality Test

In order to investigate the causal directions of different macroeconomic variables associated with the change of industrial structure – i.e. the level of industrialization, and with economic growth – i.e. growth of GDP and per capita GDP, in this paper initially I have used the Granger causality tests. Prior to the Granger causality test, I have examined the order of integration for all variables by the unit roots tests. From the Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF) and the Philips-Perron tests results, it has been found that all the variables are integrated of order 1, i.e. I(1). I have also examined the co-integration relationship between different pairs of series which are used for the Granger causality test. The estimated co-integrated results for different pairs of variables are presented in Table (5). From these estimated results, I have found that some pairs of variables indicate the co-integration relationship. The Granger Causality test takes the following form for the variables which are co-integrated:

$$X_t = \alpha_0 + \sum_{i=1}^{m} a_i X_{t-i} + \beta_j \sum_{j=1}^{n} Y_{t-j} + u_t \qquad (17)$$

On the other hand, if the pairs of series do not appear to be co-integrated, the Granger causality test takes a different form, below, in order to avoid producing potentially spurious results:

$$\Delta X_t = \alpha_0 + \sum_{j=1}^{m} a_i \Delta X_{t-i} + \beta_j \sum_{j=1}^{n} \Delta Y_{t-j} + u_t \qquad (18)$$

In this paper, moreover, I have taken 2 different lags in equations (17) and (18), i.e. n=m= 1, 2. Taking 2 continuous lags is somewhat conventional. I have also investigated the casual direction for higher lag values, but there is no causal relationship between the variables for higher lag values and the AIC and SBIC are greater for higher lags: that is why the test results for higher lag values are not reported. The estimated values are reported in the following Table:

Table 6: Granger Causality Test Results of Different Pairs of Variab1es[11]

Lags	R^2	Granger F-Test		Lagrange Multiplier Test		AIC	SBIC
		Test Value	p-value	Test Value	p-value		
				$\Delta LFDIN \rightarrow \Delta LINDUS$			
1	0.142355	4.30404*	0.04732875	4.130285*	0.04212226	-6.95176	-2.64980
2	0.149079	0.85052	0.43918435	1.911210	0.38457940	-9.82825	-2.82226
Lag				$\Delta LFAIN \rightarrow \Delta LINDUS$			
1	0.119257	3.45686**	0.07352847	3.406652**	0.0649340	-6.12793	-1.82597
2	0.240847	2.46436**	0.0954745	4.940460**	0.08456541	-13.25173	-6.24574
Lag				$\Delta LEXPO \rightarrow \Delta LINDUS$			
1	0.104913	2.95276**	0.09677153	2.957268**	0.08549230	-5.62713	-1.32517
2	0.181679	1.38238	0.2695109	2.987339**	0.2245471	-11.00019	-3.99420
				$\Delta LGGDP \rightarrow \Delta LINDUS$			
1	0.011271	0.02124	0.8851676	0.023499	0.87816562	-2.54265	1.75931
2	0.097737	0.09084	0.9134652	0.216439	0.897430	-8.07066	-1.06468
Lag				$\Delta LPGDP \rightarrow \Delta LINDUS$			
1	0.016706	0.17611	0.6779363	0.193765	0.65980102	-2.71351	1.58845
2	0.377083	1.22061	0.31203878	2.668848	0.2633098	-19.18545	-12.17946
3	0.324609	0.60942	0.6144873	2.225083	0.52702480	-18.26944	-8.69837
Lag				$LINDUS \rightarrow LGGDP$			
1	0.067286	0.44066	0.51204749	0.478968	0.48889036	69.24545	73.64266
2	0.089219	0.12077	0.8867277	0.285351	0.86703555	69.57119	76.74113
				$LFDIN \rightarrow LGGDP$			
1	0.054830	0.05267	0.82009949	0.058008	0.80967226	69.66998	74.06719
2	0.081112	0.00501	0.9950005	0.011949	0.9940430	69.84591	77.01585
Lag				$LFAID \rightarrow LGGDP$			
1	0.119230	2.17696	0.1508666	2.234430	0.1349663	67.41177	71.80897
2	0.105079	0.35330	0.705683	0.820204	0.66358250	69.02662	76.19655
				$LEXPO \rightarrow LGGDP$			
1	0.078035	0.78390	0.3832350	0.842222	0.35876195	68.87454	73.27174
2	0.100429	0.28428	0.7548660	0.663389	0.71770671	69.18728	76.35721
Lag				$LPGDP \rightarrow LGGDP$			
1	0.076978	0.74979	0.39364993	0.806503	0.36915603	68.91120	73.30841
2	0.089536	0.12534	0.88272929	0.296027	0.86241965	69.56042	76.73035
Lag				$\Delta LINDUS \rightarrow \Delta LPGDP$			
1	0.038418	1.09101	0.3051816	1.162605	0.2809260	-26.81954	-22.51758
2	0.268957	0.22380	0.8010599	0.527671	0.76809985	-44.14986	-37.14388
Lag				$\Delta LFDIN \rightarrow \Delta LPGDP$			
1	0.319890	12.31694*	0.0015377	9.470588*	0.00208792	-37.55563	-33.2536
2	0.346739	1.73878	0.19632004	3.663478	0.16013487	-47.52472	-40.51873
Lag				$\Delta LFAID \rightarrow \Delta LPGDP$			
1	0.214151	6.89216*	0.0138701	6.123352*	0.01334076	-33.07584	28.77388
2	0.287767	0.55983	0.57830255	1.286002	0.52571235	-44.93188	-37.92589
Lag				$\Delta LEXPO \rightarrow \Delta LPGDP$			
1	0.988201	4.85201*	0.03571417	4.586565*	0.0322235	-25.68003	-21.28282
2	0.991970	6.98527*	6.98527	10.835149*	0.00443790	-36.41111	29.24118

[11] $A \rightarrow B$: indicates the causal direction from A to B, AIC : Akaike Information Criterion, SBIC : Schwarz Baysian Information Criterion, R^2 : indicates goodness of fit, p value : indicates the lowest significance level at which a null hypothesis can be rejected, Δ: means first difference, * : indicates the statistically significant at 5% level of significance or less, ** : indicates statistically significant at 10% level of significance.

Discussion of the Granger Causality Test results: The results of the Granger Causality tests for different pairs of variables are reported in Table 6. From both the tests' results it has been found that the foreign direct investment, foreign aid and export values cause the structural change that leads to industrialization in Bangladesh. From the both tests results it has been found that the level of industrialization, foreign direct investment, foreign aid, export values do not cause the growth of GDP in Bangladesh. It has also been found that the variables foreign direct investment, foreign aid and export values cause the development of per capita income in Bangladesh Finally, from both the Granger causality tests' results, it can be concluded that the variables foreign direct investment, foreign aid and export values have impacts for structural change, i.e. for industrialization in Bangladesh. But it has not been found that any variable is a significant cause of growth of GDP in the case of Bangladesh. Also it has been found that foreign direct investment, foreign aid and export values have significant impacts for development of per capita income in Bangladesh.

In order to show the statistical association of level of industrialization, growth of GDP and per capita GDP with other selected macroeconomic variables, I have done a regression analysis. The next section discusses the regression analysis for time series data.

Regression Analysis for Time Series Data

The time series data sets in economics provide an important source of information. In this section, regression analysis has been conducted to investigate the economic association of the change in industrial structure and economic growth with other macroeconomic variables. In this paper I have presumed the level of industrialization as the ratio of industrial output to agricultural output as a proxy for structural change in the economy. In this section I have estimated the parameter values for determining the economic association between industrialization and other macroeconomic variables.

Here, the following regression equation has been considered.

$$\Delta LINDUS_t = \alpha_0 + \alpha_1 \Delta LFDIN_t + \alpha_2 \Delta LFAID_t + \alpha_3 \Delta LEXPO_t + \alpha_4 \Delta LPGDP_t + \alpha_5 \Delta LINDUS_t + u_t \quad (21)$$

In this section I have also regressed the growth of GDP on different macroeconomic variables in order the find their impacts on economic growth in Bangladesh. From the co-integrated tests results it has been found that the variable LGGDP is co-integrated with the variables, LINDUS, LFDIN, LFAID, LEXPO, LPGDP. This implies that there is a long-run equilibrium relationship between LGGDP and these macroeconomic variables. In the short term, however, they should be in disequilibrium. Therefore, I have used the error correction mechanism in the regression equation as the equilibrium error. I have to use this error term to tie the short-run behaviour of LGGDP to its long-run value. The error term can be defined as:

$$Z_t = LGGDP_t - 1.9363 - \beta_1 LFDIN_t - \beta_2 LFAID_t - \beta_3 LEXPO_t - \beta_4 LPGDP_t - \beta_5 LINDUS_t + u_t \quad (20)$$

Here the following regression equation has been used:

$$\Delta LGGDP_t = \alpha_0 + \alpha_1 \Delta LFAIN_t + \alpha_2 \Delta LFAID_t + \alpha_3 \Delta LEXPO_t + \alpha_4 \Delta LPGDP_t + \alpha_5 \Delta LINDUS_t + Z_t + u_t \quad (21)$$

I have also considered another regression equation to measure the impacts of several variables on economic growth. The equation is given by:

$$\Delta LPGDP_t = \alpha_0 + \alpha_1 \Delta LFDIN_t + \alpha_2 \Delta LFAID_t + \alpha_3 \Delta LEXPO_t + \alpha_4 \Delta LGGDP_t + \alpha_5 \Delta LINDUS_t + u_t \quad (22)$$

where
$LINDUS_t$: the level of industrialization means the ratio of industrial output to agricultural output in log at time t
$LEDIN_t$: foreign direct investment in log at time, $LEDIN_t$: foreign aid in log at time t, $LEXPO_t$: export values in log at time t, $LPGDP_t$: per capita output GDP) (in log) at time , and it is hypothesised as domestic demand per capita.
$LPGDP_t$: growth of GDP in log at time t, Δ : stands for the first difference of the variables, u is the random error term.
The estimated values for the equations (19), (21) and (22) are given below.

Table 7 Parameter Estimates of the Regression Equations

Variables	Dependent Variable (ΔLINDUS)			
	Parameters Values	S.E. of the Coefficients	t-Test Values	p-Values
Constant	0.079854656	0.038107771	2.09550	0.04563882
ΔLFDIN	0.043204632	0.024042606	1.79700	0.08353094
ΔLFAID	0.102710310	0.130388707	0.78772	0.43771933
ΔLEXPO	0.343583743	0.144234604	2.38212	0.02451974
ΔLPGDP	-0.600164989	0.230449317	-2.60433	0.01478453
ΔLGGDP	0.011101648	0.032067939	0.34619	0.73209546
R^2		0.455984		
F-Test		5.6577		0.00192938
DW Test		1.346463		
Variables	Dependent Variable (ΔLGGDP)			
	Parameters Values	S.E. of the Coefficients	t-Test Values	p-Values
Constant	0.112397811	0.295204487	0.38075	0.70674139
ΔLFDIN	0.074547413	0.136381793	0.54661	0.58969424
ΔLFAID	-1.202242898	0.665211145	-1.80731	0.08326649
ΔLEXPO	1.441251531	0.966520421	1.49118	0.14894319
ΔLPGDP	1.457991579	1.593987376	0.91468	0.36945744
ΔLGGDP	0.374897401	0.974337228	0.38477	0.70379517
Z	0.931168693	0.228609291	4.07319	0.00043787
R^2		0.481683		
F-Test		3.7173		0.00935308
DW Test		1.810143		
Variables	Dependent Variable (ΔLPGDP)			
	Parameters Values	S.E. of the Coefficients	t-Test Values	p-Values
Constant	0.122185241	0.024552089	4.97657	0.00003960
ΔLFDIN	0.017144713	0.016296084	1.05208	0.30282823
ΔLFAID	0.206731284	0.073379574	2.81729	0.00932340
ΔLEXPO	0.014505601	0.116324647	0.12470	0.90175891
ΔLGGDP	0.031578802	0.018405933	1.71569	0.09858928
ΔLINDUS	-0.272315432	0.108132222	-2.51836	0.01856101
R^2		0.584291		
F-Test		7.0276		0.00031788
DW Test		2.043366		

Discussion of results of Regression Analysis : From the estimated results in Table 7 it has been found that the variables foreign direct investment, foreign aid, export values and growth of GDP have positive impact on structural change, i.e. for industrialization in Bangladesh, and the variable per capita GDP has negative impact for structural change in Bangladesh. The impacts of foreign direct investment and foreign aid and growth of GDP are not statistically significant, but the impacts of export values and per capita GDP are statistically significant. From the F-test statistic, it has been found that the impact of the variables simultaneously on level of industrialization is statistically significant. The Durbin-Watson test result indicates that there is inconclusive evidence regarding the presence or absence of positive first-order auto correlation.
From the estimated results it has also been found that the variable foreign aid has negative impacts on growth of GDP in Bangladesh, and the variables foreign direct investment, export values, per capita GDP and level of industrialization have positive impacts on economic growth in Bangladesh. From the error correction term it has been found that 93.12% of the discrepancy between the actual and the long-run or equilibrium value of LGGDP is added or corrected to the equation. Also, it has been found that this corrected value is statistically significant at any level. From the test results it has been found that the impacts of these variables individually on economic growth are not statistically significant. From the F-test result it has been found that the effect of these variables simultaneously on economic growth is statistically significant at any level of significance. The Durbin-Watson test result indicates that there is inconclusive evidence regarding the presence or absence of positive first-order auto correlation. From the estimated results it has also been found that the variable level of industrialization has negative effect on per capita GDP and the variables foreign direct investment, foreign aid, export values, and growth of GDP have positive effects on per capita GDP. The impacts of foreign aid and level of industrialization are statistically significant. From the F-test result it has been found that the effect of the variables simultaneously is statistically significant. The Durbin-Watson test result indicates the presence of negative first order auto-correlation. Since the variable foreign aid has negative impact on economic growth in Bangladesh, the government and politicians should make proper decisions regarding foreign aid in Bangladesh.

An Overall Discussion and Conclusion

The principle objective of this paper is to find the impacts of some macroeconomic variables on structural change, i.e. on level of industrialization and economic growth in Bangladesh, on the basis of the stylised facts and econometric analysis. From Figures 1 and 2, it can be said that declining rate of the share of the agricultural sector in total GDP is higher than the increasing rate of the share of the industrial sector. This indicates that the contribution to the economic development of Bangladesh is shifting from agricultural sector to industrial sector. From Figure 3, it can be seen that the variables demonstrate an upward trend. The question is whether the trend arises from the positive drift term, or a random walk. An empirical investigation has been undertaken in this paper to explore this. Firstly, in order to measure the association between different pairs of variables, the correlation coefficients have been estimated. From the estimated results it has been found that all the pairs of variables are positively associated. It has also been found that relationships of growth of GDP with different variables are not statistically significant. Apart from this, the relationships of different pairs of variables are statistically significant. An empirical investigation has been done in order to determine whether or not each of the variables contain stochastic trends. The Dickey-Fuller, Augmented Dickey-Fuller and Phillips-Perron tests are applied in order to investigate this. From the test results it has been found that all the variables contain stochastic trend and they are integrated of order 1 i.e. I(1). We know that foreign aid, foreign direct investment, export values, the level of industrialization, per capita GDP and growth of GDP are affected by different random factors, such as floods, cyclones, political and ideological conflicts, governmental policy changes, changes in policies and views of different foreign aid institutes such as ADB, IMF, World Bank, and EU etc., and also policy changes in different aid countries. Thus the break can occur in these series. That is why in this paper an attempt has been made to investigate whether or not our non-stationary result is sensitive to structural breaks. The Zivot-Andrews (1992) procedure has been applied to search endogenously for a break point and test for a unit root in each of the variables. From estimated results it has been found that the non-stationary results are sensitive to the variables of foreign aid, and per capita GDP with break points. It has also been found that the variables foreign direct investment, export values, level of industrialization and growth of GDP individually contain a unit root which is still obtained even when a break point is appropriately taken into account. It is apparent that our conclusion is invariant to structural breaks. Finally, from the both tests' results it can be concluded that the variables foreign direct investment, export values, level of industrialization and growth of GDP contain unit root, i.e. these series are non-stationary both with and without structural breaks. Thus it can be said that these variables have long-run effects on economic development in Bangladesh. To determine whether or not the different pairs of variables share the same stochastic trend, two co-integrated tests were applied: the Augmented Engle Granger and Phillips–Ouliaris tests. From these co-integrated test results, it has been found that the growth of GDP is co-integrated with all the variables. Thus it can be said that the growth of GDP shares the same stochastic trend with these variables. It has also been found that the export values are co-integrated only with per capita GDP. Thus it can be said that this pair of variables has a long-run consequence. The remaining pairs of variables are not co-integrated to each other.

In this paper, the Granger causality tests are applied in order to investigate the causal direction of different macroeconomic variables associated with the change of industrial structure – i.e. with the level of industrialization, and with economic growth – i.e. growth of GDP, and with per capita GDP. From both the tests' results it has been found that foreign direct investment, foreign aid and export values cause the structural change that drives industrialization in Bangladesh. From both tests it has been found that the level of industrialization, foreign direct investment, foreign aid and export values are not causes of growth in GDP in Bangladesh. It has also been found that the variables foreign direct investment, foreign aid and export values cause the development of per capita income in Bangladesh Finally, from both the Granger causality test results, it can be concluded that the variables foreign direct investment, foreign aid and export values have large impacts on structural change i.e. for industrialization in Bangladesh. However, the results do not identify any variable that is a significant cause of GDP growth in the case of Bangladesh. It has also been found that foreign direct investment, foreign aid and export values have the significant impacts for development of per capita income in Bangladesh. A regression analysis has been undertaken in order to investigate the statistical association of level of industrialization, growth of GDP and per capita GDP with some selected macroeconomic variables. From the estimated results it has been found that the variables foreign direct investment, foreign aid, export values and growth of GDP have positive impacts on structural change – i.e. for industrialization in Bangladesh, and the variable per capita GDP has negative impacts for structural change in Bangladesh. The impacts of foreign direct investment, foreign aid and growth of GDP are not statistically significant but the impacts of export values and per capita GDP are statistically significant. From the F-test statistic, it has been found that the impact of all variables on levels of industrialization is statistically significant. The Durbin-Watson test result indicates that there is inconclusive evidence regarding the presence or absence of first-order auto correlation. From the estimated results it has also been found that the variable foreign aid has negative impacts on growth of GDP in Bangladesh, and the variables foreign direct investment, export values, per capita GDP and level of industrialization have positive impacts on economic growth in Bangladesh. From the error correction term it has been found that 93.12% of the discrepancy between the actual and the long-run or equilibrium value of LGGDP is added or corrected to the equation. It has also been found that this corrected value is statistically significant at any level of significance. From the test results it has been found that the impact of these variables individually on economic growth is not statistically significant, and from the F-test result it has been found that the effect of these variables simultaneously on economic growth is statistically significant at any level of significance. The Durbin-Watson test result indicates that there is inconclusive evidence regarding the presence or absence of positive first-order auto correlation. From the estimated results it has also been found that the variable level of industrialization has a negative effect on per capita GDP, while the variables foreign direct investment, foreign aid, export values and growth of GDP have positive effects on per capita GDP. The impacts of foreign aid and level of industrialization are statistically significant. From the F-test result it has been found that the effect of the variables simultaneously is statistically significant. The Durbin-Watson test result indicates the presence of negative first order auto-correlation. Since the variable foreign aid has negative impacts on economic growth in Bangladesh, the government and politicians should endeavour to make more appropriate decisions regarding foreign aid in Bangladesh.

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