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Sub theme: Increasing Investment in South Asia

*“Future of Growth Perspective through Investment: An Econometric Case Study of Bangladesh”*

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**ABSTRACT**

Since its independence in 1971 with a war-torn economy, Bangladesh has shown tremendous resilience, experiencing a near 7% growth earlier in the 21st century, driven primarily by manufacturing and export-oriented industries. This has resulted in a striking reduction in poverty and a large middle class. But like other developing countries Bangladesh faces many challenges of industrialization such as less employment opportunities, skill mismatch, coupled with technological innovation and stagnant investment scenario. With forty-one years of time series data, this paper will try to find long term relationship in investing in capital formulation to tap into the unskilled-labor intensive manufacturing sector and changes in fundamental institutional policies. Cointegration techniques were applied to find the long-run relationship and it seems that rise in investment is positively related whereas trade openness and increase in standard of living is negatively related to manufacturing share of GDP. The estimated results emphasized the importance of creating a business-friendly environment to maintain the growth and supporting home-grown industries.

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# I. INTRODUCTION

Industrialization driven by manufacturing growth has shaped our modern world. This made the Europe and the United States to reach a post-industrialized era and made it possible for East Asian countries to converge in the later part of the 20th century. Urbanization and dualistic coexistence, market economy based modern states that we see in today’s world are the result of capital investment in manufacturing sector and subsequent industrialization. Developing countries such as Bangladesh is hoping to reach that stage driven primarily by fostering new manufacturing industries. But the business environment is not friendly for investment and recent trends showed that private investment is stagnating for last few years whereas public investment is crowding out the capital necessary for domestic private investment.

In this paper, the primary focus is to find the long-run effect of increase in investment on the manufacturing share of gross domestic product of the country and to see if the looming deindustrialization that Bangladesh faces as its manufacturing shares as a percentage of GDP is shrinking in the first part of this century can be evaded through raising investment. This phenomenon is called premature deindustrialization, (Dasgupta & Singh, 2006) where a country sheds industrial employment below the income level of industrialized economies when they faced it. As the elasticity of substitution between manufacturing and other sectors are less than unity, the differential rates of technology might be responsible for the drop-in employment and rise in industrial output as the sector, specifically unskilled-labor based sector, (something that Bangladesh’s growth depends on) becomes more capital intensive. (Lawrence & Lawrence, 2013) This fall in manufacturing employment can also be explained the trade and globalization; as the developing nations opened up their economy, without a strong comparative advantage might reverse their growth made possible by import substitution industrialization. Economically this might reduce the chances of convergence and politically this might result in a democratic failure due to rising unemployment and instability. (Rodrik, Unconditional Convergence in Manufacturing, 2013)

Bangladesh has shown promising growth in early 2000s and the decade that followed, by enjoying the comparative advantage of the labor-intensive readymade garments sector, converting unskilled agricultural male and informal female labor forces and bringing them into the modern, competitive, productive manufacturing sector. How the increase of domestic investment and injection of foreign capital will affect growth is the main theme of this paper.

In spite of increased focus on the positive impact of the investment on generating new industries and driving growth, there has been a lack of such study examining the long-run relationship for Bangladesh. With this backdrop, this paper has used time series data of forty-one years (1977-2017) to analyze the impact of investment on manufacturing growth as Bangladesh’s economy is still unskilled-labor intensive. There is expectation of a structural break in the growth of manufacturing sector and investment relationship in the early ‘90s when the country’s economy was opened up and financial environment started become friendly.

# II. THEORETICAL BACKGROUND

Developing countries since the end of World War Two has been trying to emulate the growth process that had happened in the West. Many South Asian countries such as Japan in the ‘50s, Taiwan, South Korea in ‘60s, ASEAN countries and specially China in ‘90s were successful to get on the bandwagon of economic growth through a combined policy of Import substitution industrialization (ISI) and export-oriented manufacturing sector. Import substitution industrialization is when a country implements trade and economic policy by increasing domestic production to counter imports. This growth, almost 4 percentage points faster than other advanced economies (McMillan, Rodrik, & Sepulveda, 2017) were experienced by South Asian countries such India and Bangladesh, driven primarily by growth of readymade garments (RMG) industries. This should result in closing the income gap with industrialized economies which is called economic convergence. But what Japan and East Asian Tigers experienced might not happen in case of South Asia. Rise of China as a manufacturing giant and its eventual shedding of manufacturing jobs might lead to other developing nations to face what economists like to call “Pre-mature deindustrialization”, where a country becomes a service economy without experiencing a proper taste of industrialization. Trade openness can transfer efficient technologies to developing countries which might lead to increase in production with decrease in employment share.

(Schultz, 1953), explained that in a closed economy, the growth is originated by increasing the agricultural productivity. Later, many economists explored and improved the idea. But Sir Arthur Lewis argued that non-agriculture sector employment needs to be expanded and supplemented by progress of technology that does not reduce the agricultural output, and that extra labor absorbed into the productive manufacturing sector (Lewis, 1954). But subsequent works by (Field, 1978) used open-economy model that focuses on international trade in the growth perspective. Subsidizing industry or removing obstacles for business to raise capital investment that can help industrialization far better than broad investment in human capital and institutions; East Asian miracle is a prime example of that (McMillan, Rodrik, & Sepulveda, 2017). But premature deindustrialization is a significant threat, where a country faces deindustrialization without getting rich first. Bangladesh is facing an investment crisis where even though the interest rate is low, there is not a significant rise in investment. This might severely hamper the continuous growth that it has been maintaining in the first decade of 21st century. There have not been any studies regarding this prospect and this study will fill the gap that focuses on the future of growth perspective.

Growths in economies are usually explained by two different types of theories. One is the model developed by (Lewis, 1954) and then formalized and extended by (Fei & Ranis, 1961). In their model, they explained that surplus labor from traditional agricultural sector moves to the more productive, innovative and accumulative manufacturing/industrial sector, driving the growth process and achieving sustainable development. China is a good example, which experienced a growth in manufacturing industries with virtually no drop in agricultural production. In this type of theories, growth is made possible by moving more people from traditional sector to modern manufacturing sector.

The other growth theory is based essentially in neoclassical free-market proposition (Solow, 1956), which asserts that liberalization of markets for foreign investment and stimulating domestic investment and increasing capital accumulation (which is similar to raising the domestic savings rate), will increase capital-labor ratio and per capita income in developing countries. This theory dissolves the differences of different types of economic sectors and assumes that they are structurally analogous and they can be combined into one sector. Growth is assumed to be dependent on the incentive to save, which facilitates into rise in investment. Government can take different policies, such as opening up the economy to trade, financial deregulation, lowering the interest rate through monetary policy to incentivize investment, both foreign and domestic. This increases the capital-labor ratio, facilitating growth (technological change is considered endogenous in this theory) (Grossman & Helpman, 1991). The country needs to diversify its economy to continue this growth prospect. (Aghion & Howitt, 1992). As the capital level is low in developing nations, there should be high return to capital accumulation, that would lead to economic convergence.

These two different theories give us different ideas to explain the economic growth of developing nations, such as Bangladesh. We will combine these ideas and use neoclassical model to focus on the growth of modern sector (manufacturing) and dual-sector model to see the relationship of this growth with flows from other sectors (McMillan, Rodrik, & Sepulveda, 2017). But how we can make sure that this transfer of labor happens to high productive sector in our economy is a challenge. (Acemoglu, Johnson, & Robinson, 2001) argues that it’s the institutional capabilities (in Europe and colonies) that generate sustained growth, with different modern sectors, not just a few but across various ranges and service activities. (Glaeser, La Porta, Lopez-de-Silanes, & Shleifer, 2004) in their research finds a link between different institutions and policies implemented by government and the business environment that expedites growth and increases the long run level of income.

Dani Rodrik gives a typology in his study, where he shows that a country needs both structural transformation and investment in fundamentals (rule of law, good governance, financial atmosphere) to have rapid and sustained growth based on the neoclassical growth theory. Post-industrialized West and recent examples such as Japan, South Korea have all been through that. (McMillan, Rodrik, & Sepulveda, 2017)

|  |  |  |  |
| --- | --- | --- | --- |
| ***Structural transformation*** | | | |
| ***Investment in fundamentals*** |  | *Slow* | *Rapid* |
| *Low* | no growth | episodic growth |
| *High* | slow growth | rapid, sustained growth |

This typology explains that “institutional quality is correlated with income levels” but they are not sufficient to predict the economic growth. The early growth that Bangladesh has experienced since the financial deregulation of 1990s has to be backed up by steady changes in business environment, enhancing domestic and foreign investment. Otherwise, Bangladesh might face a move towards service sector before becoming properly industrialized, like the Dualistic-development theories, a persistent divergence between rich and poor nations; poverty and affluence, modern and traditional sectors, growth and stagnation coexisting in the economy. This is something that India is experiencing as it is riding on the growth of the IT sector and outsourcing services with convergence dynamics but lagging behind in rising employment in highly skill-intensive IT sector as the majority of the labor is skill-intensive in there. And as the rise of technological progress goes on, Bangladesh faces premature deindustrialization as the manufacturing sector becomes more capital and skill intensive and globalization makes the move into service sectors earlier than expected with severe consequence such as lower growth and democratic failure (Rodrik , Premature Deindustrialization, 2015).

# III. RESEARCH OBJECTIVES

Bangladesh aims to increase its’ growth of the economy to 9% by the end of 2030. The growth that it experienced early in the 21st century has been fueled by the manufacturing sector and investment in it but the recent trend showed that private investment is lagging behind in the economy. This paper will try to find out if there is any long-run relationship between manufacturing sector growth and investment (both domestic and foreign) in the context of Bangladesh. It will check how much growth in the modern sector (manufacturing) is affected by changes in financial atmosphere, government policies, and macroeconomic stabilization, paying a close attention to the investment-growth relation in different times, borrowing the ideas of (McMillan & Rodrik, 2011), and seeing the employment share of the manufacturing sector and factors determining its growth. It will try to see if this trend will continue or will improvements in technology evaporate the comparative advantage that Bangladesh has.

# IV. SPECIFICATION OF THE MODEL

Various literature has been done in regarding industrialization/deindustrialization prospect. Some are done based on the manufacturing employment (as a share of total employment) and some are based on manufacturing output (marginal value added as a share of GDP). Consider the equation based on the idea of Dani Rodrik (McMillan & Rodrik, 2011)

**……….… (1)**

**manut**= manufacturing share of GDP (% of GDP) faces a hump-shaped inverted-u curve as a country experiences a rise in manufacturing share of GDP with rise in income and then this share falls as the economy makes a transition into manufacturing to service sector.

**PVIt** = Gross capital formation (% of GDP) (Gross capital formation, formerly gross domestic investment, consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories), measures the changes in capital-output ratio.

**FDIint** = Foreign direct investment, net inflows (% of GDP), which shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP, also complements it and it is in accordance with the neoclassical theories of saving-induced growth (Rahim, 2005).

**FDIoutt** = Foreign direct investment, net outflows (% of GDP) which shows net outflows of investment from the reporting economy to the rest of the world, and is divided by GDP compliments it.

**ln (PCGDP)t** = Natural log of per capita income (at constant prices) explains the curve for Bangladesh and evaluates if it faces the same scenario of East Asian countries and the Western nations.

**ln (PCGDP)t2** = Natural log of per capita income squared (at constant prices) measures the quadratic equation effect of the manufacturing curve over time (Acemoglu, Johnson, & Robinson, 2001).

**Tt** = Trade (% of GDP), (Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product), is added to see the effect of globalization and trade liberalization since the 1990s as the effects of technology and demand shocks depend heavily whether the economy is open to trade or not (Matsuyama, 2009).

Deindustrialization is the eventual outcome of any economy that is industrializing. What this paper will evaluate is if this process is rapid in recent years and how is different types of investment (domestic/foreign) affecting the capital formulation in the manufacturing sector.

In time series, we have to check the stationarity properties first to estimate the relationship among variables. The conventional methods use the Augmented Dickey-Fuller (ADF) test for individual variables to check for stationarity. If an identical conclusion on stationarity is obtained, then the short-run dynamic and long-run co-integration relationship are investigated by using the multivariate Johansen’s co-integration test. If we cannot proceed for co-integration due to the non-identical conclusion from ADF test, we perform OLS procedure to examine the effect of the independent variables on economic growth. If we can proceed for co-integration, then we run the VAR Lag structure test and with appropriate lag length I run the Vector Error Correction Model (VECM) to check the how the long-run relationship is affected by different variables. The equation is expected to have a structural break in 1992, when the country experienced financial deregulation in a newly formed democracy. Interactive dummy technique is used to figure out if there is any structural break, for both intercept and slope coefficient. Serial correlation test in the data and normality check are also performed as post-estimation diagnostics.

**IV.1 Sources of Data**

All of these variables are collected from the International Financial Statistics (IFS) and Direction of Trade Statistics (DOTS) of the International Monetary Fund (IMF) and World Development Indicators (WDI) database of World Bank (WB) as time series data from 1977 to 2017.

**IV.2 Integration Order of Variables**

In standard time series analysis, the Augmented Dickey-Fuller (ADF) unit root test method is used to examine the stationarity property of the time series and to determine the integration order of non-stationary time series. Unit root tests are first conducted to establish the stationary properties of the time series variables. Since non-stationary property does incorporate long run mean reversion, inclusion of non-stationary variables results in spurious regressions and offers non-objective policy implications. ADF test in conjunction with the critical values are used for this purpose. The ADF models used in the study are as follows:

**.…………………………………….…..(2)**

**………………………………….….…..(3)**

These two regressions differ in terms of deterministic elements. The first model includes only intercept term and second one includes both the trend (t) and intercepts term. Here, Y variable is used for unit root test and is the white noise series. The null hypothesis for the first model is H0: and the second model is H0: . If the ADF value is bigger than the McKinnon value at 5% significant level, then the H0 is accepted, which means {Yt}has unit root and is non-stationary. If it is less than the McKinnon value then H0 is rejected and {Yt}is stationary and said to be integrated of order zero, I (0). If one variable turns out to be non-stationary, we should test the stationary of its 1st difference. If the 1st difference is stationary, then the series has unit root and it is integration of order I (1). This definition can be extended to integration of k­th order, I (k).

**IV.3 Cointegration Test**

The co-integration theory states that, there may be co-integration relationship between the variables involved, if their 1st difference is stationary. For co-integration test, we will conduct the Johansen’s multi-variate co-integration tests, based on Vector Auto Regression (VAR). The Johansen’s multivariate co-integration test concerns the relationships between the variables. The Vector Auto Regression (VAR) model is as following:

**....….……………………………….…..(4)**

Where, and , Yt represents (n\*1) vector of I (1) variables. and are (n\*n) matrix coefficients to be tested. B denotes (n\*h) matrix and Xt denotes (h\*1) vector of I (0) variables. denotes the rank of the matrix and interrogates the long-run relationships in the variable and is equal to the number of independent co-integrating vectors. If rank of is 0, the variables are not co-integrated.

Johansen developed two test statistics: the trace test and the maximum Eigenvalue test. The λtrace statistic tests the null hypothesis that r=0 (no co-integration). The kmax­ statistic tests the null hypothesis that the number of co-integrating vectors is r against the specific alternative of (r+1) co-integrating vectors. The test statistics obtained from λtrace and kmax­ tests are compared against the asymptotic critical values of the two test statistics.

**IV.4 Error Correction Test**

To test the error correction, vector error correction model (VECM) is used. The error correction model allows us to study the short run dynamics in relationship between Y and X. The model is as follows:

**…….….…..(5)**

Where λ<0; p and q are respectively the number of lags for Y and X. Running OLS regression Y on X and we obtain the estimators. If Yt is greater than the equilibrium Y, then the error correction term (λ) works to push Y back toward the equilibrium. Similarly, if Yt­ is less than the equilibrium Y, then the error correction term induces a positive change in Y back toward the equilibrium.

**IV.5 Structural Break Test**

To test for structural break, the interactive dummy variable method is used, outlined by (Gujarati, 1970), which is an improvement over the Chow test for structural break. Chow test does not tell us the reason behind the structural break; whether it is for slope, intercept or both. Interactive dummy variable technique solves this problem. Suppose:

**…………………………………….……...….…..(6)**

**D** is the dummy variable that is 0 before the structural break and 1 after the structural break.

In (6), α2 is the differential intercept and β2 is the differential slope coefficient (also called the slope drifter). If there is no structural break, then α2 = β2 = 0. If there is a structural break, then α2 or β2 or both could be statistically significant. This method can be applied by running simple OLS method on the variables and checking for coefficient significance.

# V. EMPIRICAL ANALYSIS

**V.1 Stationarity Properties**

Stationarity properties of the variables were explored for the presence of unit roots and to determine the order of integration for each variable using Augmented Dickey-Fuller (ADF) test.

The null hypothesis is considered as non-stationary or unit-root series. From the sample probability value (p-value), we take our decision. If p-value>0.05, we do not reject the null hypothesis of non-stationary series. If p-value ≤ 0.05, we reject the null hypothesis; the series is stationary. The ADF test has been performed with intercept and with trend and intercept both. The results from ADF tests suggest that our dependent variable, and independent variables are all integrated of order 1, I (1).

ADF tests revealed that variables are non-stationary at level but they become stationary after first differencing. Therefore, I concluded that all the variables are co-integrated of order one I (1), which satisfies the first condition for running the co-integration tests. We can now proceed with the Johansen co-integration test. The results of ADF tests are summarized in the table 1.

|  |  |  |  |  |  |  |
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| **Table 1**  **Augmented Dickey-Fuller Test [ I (1) ]** | | | | | | |
|  | **With intercept** | | | **With trend and intercept** | | |
| **variable** | **t-Statistic** | | **Prob.** | **t-Statistic** | | **Prob.** |
| **manu** | -6.552\*\*\* | | 0.000 | -6.531\*\*\* | | 0.000 |
| **PVI** | -4.307\*\*\* | | 0.002 | -4.257\*\*\* | | 0.009 |
| **FDIin** | -3.126\*\* | | 0.034 | -3.470 \* | | 0.059 |
| **FDIout** | -6.425\*\*\* | | 0.000 | -3.468 \* | | 0.061 |
| **ln(PCGDP)** | -2.966 \*\* | | 0.047 | -7.868\*\*\* | | 0.000 |
| **ln(PCGDP)2** | -2.966 \*\* | | 0.047 | -7.868 \*\*\* | | 0.000 |
| **T** | -5.752\*\*\* | | 0.000 | -5.674 \*\*\* | | 0.000 |
| \*\*\*= significant at 1% level of significance | | \*\*=significant at 5% level of significance | | | \*=significant at 10% level of significance | |
| Notes | | Tests were done using EViews 7 | | | | |
| **Statistic** | | **Without trend** | | | **With trend** | |
| 95% critical values for ADF statistic | | -3.05 | | | -3.69 | |
| 99% critical values for ADF statistic | | -3.89 | | | - 4.57 | |

**V.2 Cointegration Analysis**

Since all the variables are found to be cointegrated of order 1, I(1), we can find a cointegrating relationship among the variables. If we want to check the presence of the long-run relationship, we use the most popular Johansen Cointegration test. We need to check the lag structure of the variables before conducting Johansen Cointegration test. In order to find the appropriate lag length, I have estimated the unrestricted VAR model and then used the Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC), developed by Gideon E. Schwarz (Schwarz, 1978), also known as Schwarz Information Criterion to select the lag length. The results of both of the criterion shows that lag length of 1 would suffice, which is shown below in table 2.

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| **Table 2**  **VAR Lag Structure Selection** | | |
| **Endogenous variables: manut, PVIt, FDIint, FDIoutt, ln(PCGDP)t, ln(PCGDP)t2, Tt** | | |
| **Lag** | **AIC** | **BIC** |
| 0 | 9.458 | 9.714 |
| 1 | 0.535\* | 2.327\* |
| 2 | 0.724 | 4.051 |

Note: \*Indicates Lag Order selected by the respective criterion

Next, I tried to identify the number of cointegrating vectors using the Johansen cointegration test. In Johansen – Juselius co-integration test (Johansen & Juselius, 1990), I allowed for linear deterministic trend in data, and calculated intercept with no trend in cointegrating equation and tested for VAR with a lag selection criterion of 1 which I got from the VAR lag structure selection beforehand.

Both trace and maximum eigenvalue tests assumes no co-integrating relationship in their respective null hypothesis and after running the tests, they showed us that there exists co-integration among the variables (at most 3 co-integrating equations) and so we will be able to find the long-run association by using vector error correction model. The results of the trace and maximum eigenvalue tests from Johansen co-integration tests are given in Table 3 and 4.

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| --- | --- | --- | --- | --- |
| **Table 3**  **Johansen Tests for Co-integration (λ Trace Test)**  **Unrestricted Cointegration Rank Test (Trace)** | | | | |
| **Hypothesized** |  | **Trace** | **0.05** |  |
| **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.\*\*** |
| **None \*** | 0.949 | 206.850 | 95.753 | 0.000 |
| **At most 1 \*** | 0.697 | 94.029 | 69.819 | 0.000 |
| **At most 2 \*** | 0.546 | 48.624 | 47.856 | 0.042 |
| **At most 3** | 0.269 | 18.644 | 29.797 | 0.518 |
| **At most 4** | 0.157 | 6.741 | 15.495 | 0.608 |
| **At most 5** | 0.006 | 0.241 | 3.841 | 0.623 |
| Trace test indicates 3 cointegrating eqn(s) at the 0.05 level | | | | |
| \* denotes rejection of the hypothesis at the 0.05 level | | | | |
| \*\*MacKinnon-Haug-Michelis (1999) p-values | | | | |
| **Table 4**  **Johansen Tests for Co-integration (Maximum Eigenvalue Test)**  **Unrestricted Cointegration Rank Test (Maximum Eigenvalue)** | | | | |
| **Hypothesized** |  | **Max-Eigen** | **0.05** |  |
| **No. of CE(s)** | **Eigenvalue** | **Statistic** | **Critical Value** | **Prob.\*\*** |
| **None \*** | 0.949 | 112.821 | 40.078 | 0.000 |
| **At most 1 \*** | 0.697 | 45.404 | 33.877 | 0.001 |
| **At most 2 \*** | 0.546 | 29.980 | 27.584 | 0.024 |
| **At most 3** | 0.269 | 11.903 | 21.132 | 0.557 |
| **At most 4** | 0.157 | 6.450 | 14.265 | 0.550 |
| **At most 5** | 0.006 | 0.241 | 3.841 | 0.623 |
| Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level | | | | |
| \* denotes rejection of the hypothesis at the 0.05 level | | | | |

**V.3 Long Term Relationship**

I get the coefficients of the cointegrating equation from the Johansen tests done earlier with appropriate lag selection. These coefficients are significant at 1% level of significance for each of the variables when normalized and significant at 1% level of significance for PVI, ln (PCGDP) and ln (PCGDP)2 when adjusted for first differencing. From these coefficients, I can calculate the cointegrating equation and use that to calculate the residuals for error correction in the VECM model. It shows that there exists a long-run relationship among the dependent variables and the independent variable (manut) and the signs are as predicted. Foreign investment seems to be more important in raising the manufacturing share of the GDP and generating growth. The results for the cointegrating equation are summarized below in Table 5.

After calculating the cointegrating equation, I found that the long-run coefficient is -0.398448 and it is significant at 1% level of significance with expected sign. This coefficient shows us the speed of adjustment towards the long-run equilibrium. After running simple OLS procedure with the residuals from the cointegrating equation, we can see that there exists a strong long-run co-integrating relationship among the variables, meaning that there exists a long-run causality from the independent variables to manufacturing share of GDP.

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| **Table 5**  ***Cointegrating Equation(s)*** | | |
| ***Vector of Long Run Coefficients*** | | |
| **Variables** | **Coefficients** | **(Std. error)** |
| **PVI** | 0.907 \*\*\* | 0.082 |
| **FDIin** | 4.790 \*\*\* | 0.901 |
| **FDIout** | 19.091 \*\*\* | 3.921 |
| **ln(PCGDP)** | -7.958\*\*\* | 2.030 |
| **ln(PCGDP)2** | -3.979 \*\*\* | 1.015 |
| **T** | -0.503 \*\*\* | 0.068 |
| ***Vector of Error Correction Coefficients*** | | |
| **Variables** | **Coefficients** | **(Std. error)** |
| **D(PVI)** | -0.295 \*\*\* | 0.048 |
| **D(FDIin)** | -0.002 \*\*\* | 0.024 |
| **D(FDIout)** | 0.001 | 0.006 |
| **D(ln(PCGDP))** | 0.005 \*\*\* | 0.001 |
| **D(ln(PCGDP)2)** | 0.010 \*\*\* | 0.002 |
| **D(T)** | -0.025 | 0.328 |

To find the short-run causality, we use the Wald test to check if the lagged values of the independent variables have any combined impact on the dependent variable. I found that except for Foreign direct investment, net outflows (% of GDP), all the other independent variables have short-run impact on the dependent variable at 1% level of significances. The results of the Wald test are given in table I in the appendix.

**V.4 Diagnostic Results**

I used interactive dummy technique by (Gujarati, 1970) to run for structural break test and found out that with known break year of 1992, when the financial deregulation happened, there is evidence of structural break in the data. With manut as the dependent variable and PVIt as the independent variable with interactive dummy, the differential intercept coefficient (α2) and the differential slope coefficient (β2) are both statistically significant, meaning that both intercept and slope changes after the deregulation. Intercept gets higher by 8 units whereas the slope gets flatter by 0.5 units. Financial deregulation increased the effects investment have on manufacturing.

I ran the Breusch – Godfrey serial correlation test to check for any statistical error in residuals in the specification of the model. The data appears to be serially correlated. The variables ln(GDPPC) and ln(GDPPC)2 are usually correlated with each other as one is generated from the other. The result of the structural break and serial correlation test are given below in table 6.

Another post estimation diagnostic which can be done is to check for normality of the data. I tried to see the Jarque – Bera statistics to check for normality, which has the null hypothesis of normal distribution. The residuals are seen to be not normally distributed as the probability value is 0.000 and the null hypothesis of normal distribution is rejected. The results of the normality test is given in the table II of the appendix.

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| --- | --- | --- |
| **Table 6**  ***Interactive Dummy Test for Structural Break*** | | |
| **Variable** | **Coefficient** | **Std. Error** |
| C (α1) | 2.839 | 1.698 |
| Dt (α2) | 8.366\*\*\* | 2.151 |
| Xt (β1) | 0.685\*\*\* | 0.109 |
| Dt Xt (β2) | -0.515\*\*\* | 0.121 |

|  |  |  |
| --- | --- | --- |
| ***Breusch-Godfrey Serial Correlation LM Test*** | | |
| **Statistics** | **Value** | **Prob.** |
| F – statistics (2,22) | 0.632 | 0.541 |
| Obs\*R-squared, Chi-Square(2) | 2.063 | 0.356 |

# VI. CONCLUSION

Based on our analysis, using Vector Error Correction Model (VECM), after checking for stationarity and cointegration, we can see that there exists a stable long-run relationship among manufacturing employment share of % of GDP and investment (both domestic and foreign), trade openness, and per-capita GDP.

Increase (decrease) in domestic investment, foreign investment in and out of the country are found to have a positive (negative) impact in the manufacturing share of the country and increase (decrease) in per-capita GDP and trade are found to have a negative (positive) impact in the manufacturing share of the country. The long-run dynamic model appears to be stable for the country and the disequilibrium appears to correct itself. The short-run dynamic model tells us that the Foreign direct investment, net outflows (% of GDP) does not have any short-run impact in correcting the equilibrium, as expected, since the economy of the country is relatively small. There exists a structural break in the year of 1992, when the economy was opened up and the trade openness started to make an impact; investment since then had larger impact on manufacturing growth. The limitation of the model is that the data appears to be serially correlated with non-normal distribution.

With better institutions, property rights and less distortionary policies, Bangladesh will be able to invest in human and physical capital, raising employment and income, which will be consistent with the findings of (Acemoglu, Johnson, & Robinson, 2001). Weak infrastructure and poor business environment make doing business in Bangladesh hard. Restructuring of the trade policies to expand and diversify the economy and attract foreign investment, and reform of the ailing banking sector to increase domestic investment is needed. With all of these policies in place, Bangladesh can hope to maintain the growth and achieve the economic convergence with the developed world.

# REFERENCES

Acemoglu, D., Johnson, D., & Robinson, J. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review, 91*(5), 1369–1401.

Aghion, P., & Howitt, P. (1992). A Model of Growth through Creative Destruction. *Econometrica, 60*(2), 323–351.

Dasgupta, S., & Singh, A. (2006). Manufacturing, Services and Premature Deindustrialization in Developing Countries: A Kaldorian Analysis. *United Nations University Research Paper*.

Fei, J., & Ranis, G. (1961). A Theory of Economic Development. *51*(4), 533–558.

Field, A. (1978). Sectoral Shift in Antebellum Massachusetts: A Reconsideration. *Explorations in Economic History, 15*(2), 146–171.

Glaeser, E., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2004). Do Institutions Cause Growth? *Journal of Economic Growth, 9*(3), 271–303.

Grossman, G., & Helpman, E. (1991). *Innovation and Growth in the Global Economy.* Cambridge, MA: MIT Press.

Gujarati, D. (1970, February). Use of Dummy Variables in Testing for Equality between Sets of Coefficients in Two Linear Regressions: A Note. *The American Statistician, 24*(1), 50-52. doi:10.2307/2682300

Johansen, S., & Juselius, K. (1990, May). Maximum likelihood estimation and inference on cointegration — with applications to the demand for money. *Oxford Bulletin Of Economics And Statistics, 52*(2).

Lawrence, R., & Lawrence, E. (2013). *US Employment Deindustrialization: Insights from History and the International Experience.* Peterson Institute for International Economics.

Lewis, W. A. (1954). Economic Development with Unlimited Supplies of Labor. *22*(2), 139–191.

Matsuyama, K. (2009, April–May). Structural Change in an Interdependent World: A Global View of Manufacturing Decline. *Journal of the European Economic Association, 7* (2-3), 478–486.

McMillan, M., & Rodrik, D. (2011). Globalization, Structural Change, and Productivity Growth. In *In Making Globalization Socially Sustainable.* Geneva: International Labour Organization and World Trade Organization.

McMillan, M., Rodrik, D., & Sepulveda, C. (2017). *Structural Change, Fundamentals and Growth: A Framework and Case Studies.* NBER Working Paper.

Rahim, M. (2005). Effects of Foreign Aid on GDP Growh and Fiscal Behavior: An Econometric Case Study of Bangladesh. *The Journal of Developing Areas, 38*(2), 95-117.

Rodrik , D. (2015). *Premature Deindustrialization.* NBER Working Paper.

Rodrik, D. (2013, February). Unconditional Convergence in Manufacturing. *Quarterly Journal of Economics, 128*(1), 165‐204.

Schultz, T. (1953). *Economic Organization of Agriculture.* New York: McGraw-Hill.

Schwarz, G. E. (1978). Estimating the dimension of a model. *Annals of Statistics, 6*(2), 461–464. doi:10.1214/aos/1176344136

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics, 70*(1), 65–94.

# APPENDIX

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| --- | --- | --- | --- |
| **Table I**  ***Wald Test for Short Run Coefficients*** | | | |
| ***Variables*** | **Statistics** | **Value** | **Prob.** |
| ΔPVI | F – statistics | 5.123\*\* | 0.014 |
| Chi – square | 10.247\*\*\* | 0.006 |
| ΔFDIin | F – statistics | 7.410\*\*\* | 0.003 |
| Chi – square | 14.821\*\*\* | 0.001 |
| ΔFDIout | F – statistics | 1.420 | 0.261 |
| Chi – square | 2.840 | 0.242 |
| ΔT | F – statistics | 5.198\*\* | 0.013 |
| Chi – square | 10.396\*\*\* | 0.006 |
| Δln(GDPPC) | F – statistics | 10.713\*\*\* | 0.001 |
| Chi – square | 21.427\*\*\* | 0.000 |
| Δln(GDPPC)2 | F – statistics | 10.713\*\*\* | 0.001 |
| Chi – square | 21.427\*\*\* | 0.000 |

Note(s): degrees of freedom are (2,24) and 2 for F – statistics and Chi – square for each of the variables

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| **Table II**  ***Normality Test*** |
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| --- | --- | --- | --- | --- |
| **Table III**  ***Long-Run and Short-Run Coefficients Using VECM Model*** | | | | |
|  | **Coefficient** | | **Std. Error** | |
| δ1 | -0.398\*\*\* | | 0.057 | |
| δ2 | 0.180 | | 0.124 | |
| δ3 | -0.122 | | 0.133 | |
| δ4 | -0.410\*\* | | 0.156 | |
| δ5 | 0.382\*\* | | 0.146 | |
| δ6 | 2.085\*\*\* | | 0.553 | |
| δ7 | 1.317\*\* | | 0.534 | |
| δ8 | 2.520 | | 1.752 | |
| δ9 | -0.185 | | 1.731 | |
| δ10 | -0.142\*\*\* | | 0.044 | |
| δ11 | -0.041 | | 0.045 | |
| δ12 | 21.628\*\* | | 8.193 | |
| δ13 | 13.577\* | | 7.513 | |
| δ14 | -0.142\*\*\* | | 0.044 | |
| δ15 | -0.041 | | 0.045 | |
| δ16 | -0.803\*\*\* | | 0.240 | |
| \*\*\*= significant at 1% level of significance | | \*\*=significant at 5% level of significance | | \*=significant at 10% level of significance |