Trade liberalization, Growth and Inequality in Bangladesh: An Empirical Analysis*

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Abstract: This paper examines time series evidence to establish a link between trade, economic growth and income inequality in Bangladesh. The empirical results from a Vector Autoregression (VAR) model suggest that there is some evidence of trade liberalization accelerating growth in Bangladesh. Trade openness promotes investment. We find little evidence of trade affecting income distribution or of income distribution affecting growth or investment. Given poor quality of the data on inequality measures, there is scope for further investigation. Sensitivity analysis with change in the sample time period suggests that during the post independence period investment has significant positive impact on trade liberalization.

Keywords: Trade liberalization; Income inequality; VAR Analysis; Generalized impulse response

JEL Classification: O1; F1

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1. Introduction

Bangladesh, in its quest for growth, has moved from an import-substituting inward-oriented policy regime towards a more liberalized trade and market oriented regime. In over three decades of its independence, Bangladesh has witnessed growth in per capita real GDP, in volume and value of trade and also an increase in income inequality\(^1\). In the trade literature, there are strong arguments and counter-arguments as to whether trade liberalization promotes growth and leads to a more equitable distribution of income. But how trade liberalization affects growth and income distribution in a country is a purely empirical question.

Bangladesh, immediately after its independence in 1971, adopted import-substitution based inward-oriented economic policies. By the 1980s, the dismal growth performance of the earlier period and a general euphoria about trade liberalization reinforced by disillusionment of most developing countries over import-substitution development strategies they experimented with during the 1950s through the 1970s on one hand, and by the success of the Asian Tigers with trade-oriented development strategies on the other, made a case for policy shift in Bangladesh as in many other developing countries. The statements of Industrial Policy and Trade Policy in the 1980s recognized the need for greater efficiency and international competitiveness, faster growth of export-oriented industries, reduction of regulation and control along with tariff rationalization, a liberalized market-based competitive structure, disinvestment of public sector enterprises and coordination of industrial and export policies.

\(^1\) For a detailed account on the growth of GDP and trade, see Ahmed and Sattar (2004). What has happened to income distribution is controversial. As we will see, the World Bank Deininger and Square Data set indicates a decline in inequality. But two other data sets we use in this study indicate a rise in income inequality. Some recent studies (e.g. Khan and Sen (2001) and Wodon (2000)) have shown that income inequality has risen in the nineties.
From the theoretical point of view, trade liberalization will allocate resources to those areas where Bangladesh has comparative advantage, which in turn will promote specialization and growth. Trade liberalization is also likely to accelerate investment by allowing access to bigger markets, permitting scale economies, and encouraging imports of cheaper capital goods and intermediate inputs. Trade openness rewards a country’s relatively abundant factor of production – unskilled labor in Bangladesh – by augmenting real wages. This will most likely improve the income distribution in Bangladesh.

Despite the fact that Bangladesh has adopted trade liberalization as a policy to achieve higher economic growth there have been few attempts to assess the impact of trade liberalization on macroeconomic performances. Among the earlier studies, Love (1995) made a few observations on the changes in the export sector that followed after Bangladesh had started moving towards a liberalized trade policy regime with emphasis on export growth. He is, however, skeptical about the success of export-oriented policies and suggests that Bangladesh should exercise caution in implementing those policies.

Ahmed and Sattar (2004), however, attribute growth and poverty reduction in recent decades largely to trade liberalization in Bangladesh. They examine both aggregate and disaggregate data to find that the faster pace of trade liberalization in the 1990s has much larger impact on growth while reduction in poverty has slowed down during that period. They ascribe this trend in poverty reduction to slowing down of employment and real wage growth. Accelerating growth in output and slowing down in poverty reduction also indicate that the income distribution has worsened. This accords well with the findings of other empirical research on poverty and inequality in Bangladesh (for example, Khan and Sen (2001)).
Mamun and Nath (2004) examine time series evidence to investigate the link between exports and economic growth in Bangladesh. Using quarterly data for a period from 1976 to 2003 they find that industrial production and exports are cointegrated. The results of an Error Correction Model (ECM) suggest that there is a long-run unidirectional causality from exports to growth in Bangladesh. By focusing only on exports they do not take into account the full effects of trade liberalization.

There is an empirical literature that examines poverty and inequality in Bangladesh. Muqtada (1986) studies the trends in poverty and income inequality during sixties and seventies. He also examines demographic pressure, land ownership, and impact of HYV technology as some of the probable determinants of increasing poverty and income inequality. Khan (1990) observes high inequality in agriculture which he attributes to interaction among institutional, technological and demographic factors. He argues that such inequality is a hindrance to poverty alleviation and sustained economic growth. In a paper that explores the connections between environmental damages, inequality and poverty in Bangladesh, Khan (1997) argues that a policy that encompasses environmental quality control may help enhance the poverty reducing effects of growth. None of these studies, however, examines the relationship between trade liberalization and income inequality. One limitation of such an endeavor could the lack of reliable data on inequality in Bangladesh. A cursory look at widely-used World Bank data (Deininger and Square Data set) on income inequality makes one suspicious about the quality of the data.

This paper is an attempt to examine the interrelations among trade liberalization, growth and income distribution in Bangladesh using time series data. We estimate
different specifications of a Vector Autoregression (VAR) model. VAR analysis allows investigation of interrelations among variables without apriori commitment to established theorems. Our results suggest that there is no strong time series evidence of trade liberalization accelerating growth in Bangladesh. However, trade openness promotes investment. We do not find any evidence of trade affecting income distribution or of income distribution affecting growth or investment. Given poor quality of the data on inequality measures, there is scope for further investigation.

The rest of the paper is organized as follows. Section 2 discusses data sources and describes the variables. We present the empirical results from a VAR analysis in the third section. First we discuss the relationship between trade liberalization and growth, and then we explore how income inequality fits into the picture. In Section 4 we present sensitivity analysis. We re-estimate the model with data for post independence period. The next section summarizes and concludes.

2. Data Sources and Description of the Variables

The data used in this paper have been obtained from several sources. The first set of data on real GDP, investment, openness – all in per capita terms – comes from the Penn World Table 6.1 (PWT). These data series cover a period from 1959 to 2000 and the annual values are in 1996 international dollars. We define the following variables to be used in the current study:

\[ gdppc = \text{logarithmic value of Real GDP per capita (Laspeyres) [RGDPL in PWT]} \]

\[ invpc = \text{logarithmic value of per capita real investment [RGDPL \times KI in PWT]} \]
\( t\_ratio = \text{exports plus imports divided by RGDPL [OPENK/100 in PWT], used as a measure of trade liberalization} \)

\( gdp = \text{logarithmic value of real GDP [RGDPL \times POP in PWT]} \)

Data on income inequality come from various sources: the ‘high quality data’ for different years between 1963 and 2000 are obtained from the World Bank Deininger and Square Data Set compiled from various sources; the second set of inequality data comes from the World Income Inequality Database (WIID) compiled by the United Nations University – World Institute of Development Economics Research (UNU-WIDER); and the third set of data on ‘estimated household income inequality (EHII)’ covering a period from 1967 to 1992 is obtained from the University of Texas Inequality Project (UTIP)\(^3\). The third data set alone contains continuous time series data on inequality. These three inequality measures described above are denoted by \( \text{ineq\_ds, ineq\_wider and ineq\_utip} \) respectively.

Table 1 presents summary statistics of the data series: \( gdp, gdppc \) and \( invpc \) in first differences, and of the rest in levels. Furthermore, Figure 1.a plots \( gdppc, invpc \) and \( t\_ratio \) and Figure 1.b plots the three inequality measures. As we can see from the table, real GDP increased at an annual average growth rate of 3.6 percent whereas per capita real GDP and investment increased at 1.1 and 3.2 percent respectively during the period between 1959 and 2000. Moreover, the growth of investment is highly volatile. As one can see from Figure 1.a, per capita real GDP, investment and trade-GDP ratio all declined sharply in early 70s – about the time Bangladesh got independence from Pakistan in 1971. All three variables have been growing steadily since then.

\(^2\) Ahmed and Sattar (2004) also uses trade-GDP ratio as a measure of trade liberalization
\(^3\) See Galbraith and Kum (2003) for methodology used to estimate this inequality measure.
There is no uniform pattern in the inequality measure. The plots of the three measures in Figure 1.b reflect poor quality of data. Although it is difficult to draw any conclusion about trends in income inequality in Bangladesh, other studies (for example, Wodon (1999, 2000) and Khan and Sen (2001)) have shown that inequality has risen in Bangladesh in recent times.

Because we are using time series data it is imperative that we test for stationarity of each variable. We conduct Augmented Dickey Fuller Test (ADF) for unit root on each of the five variables. The test statistics along with MacKinnon’s p-values are reported in Table 2. As we see from the table, *gdppc, invpc, t_ratio* and *ineq_utip* are I (1) processes while *gdp* is an I (2) process. Multivariate time series modeling technique suggests that if the variables are non stationary and they are of same order of integration one should test for cointegration. However Johansen’s cointegration test on *gdppc, invpc, t_ratio* and *ineq_utip* rejects any cointegrating relationship among these variables. We, however, do not report the results.

3. Empirical Results from VAR Analysis

We use a Vector Autoregression (VAR) model to investigate the interrelations among trade, growth and income inequality. In particular, we estimate different specifications of a VAR model of the following form:

\[
Y_t = A_0 + \sum_{i=1}^{p} A_i Y_{t-i} + \varepsilon_t,
\]

where \(Y_t\) is an \(n \times 1\) vector of variables in time \(t\), \(A_0\) is an \(n \times 1\) vector of constant terms, \(A_i\) is an \(n \times n\) matrix of the coefficients associated with lag \(i\) of the variables in \(Y\) and \(p\) is
the maximum lag included in the VAR model. \( \boldsymbol{\epsilon} \) is an \( n \times 1 \) vector of white noise disturbances. \( n \) is the number of variables in vector \( Y \).

### 3.1. Trade Liberalization and Growth

#### 3.1.1 A ‘parsimonious’ specification

In order to investigate the relationship between trade liberalization and growth without getting mired in a lot of detail, we first estimate a bivariate VAR which is parsimonious in terms of the number of variables. We estimate three alternative versions of the model with the vector \( Y \) including the following variables:\(^4\):

- Model 1: \( Y = (gdppc, t\_ratio) \)
- Model 2: \( Y = (\Delta gdppc, t\_ratio) \)
- Model 3: \( Y = (\Delta gdp, t\_ratio) \)

We include two lag of each variable in the estimation of Model 1 and one lag in the estimation of Model 2 and 3. The lags are selected on the basis of AIC.

The estimated generalized impulse responses\(^5\) (along with two standard error bands) are shown in Figure 2. The first row of graphs shows the responses of each variable to a one standard deviation innovation in the other variable in Model 1. An innovation in Trade-GDP ratio leads to a permanent increase in per capita real GDP. Per capita real GDP has a positive permanent effect on trade liberalization and it gets stronger over time. One has to be careful in interpreting these results. First, as ADF test results indicate all these variables are unit root processes. Therefore, a disturbance is more likely

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\(^4\) Whether the variables in a VAR need to be stationary is controversial. Sims (1980) and others (e.g. Doan (1992)), argue that the goal of VAR analysis is to determine the interrelationships among the variables, not the parameter estimates. Also see Enders (1995)

\(^5\) Generalized impulses are derived from an orthogonal set of innovations that do not depend on the VAR ordering. For details, see Pesaran and Shin (1997)
to cause a permanent drift in the variable. Second, as time passes the estimated standard errors become more imprecise.

The middle row shows the generalized impulse responses derived from the estimation of Model 2. An innovation in Trade-GDP ratio leads to a permanent increase in the growth rate of per capita real GDP but this effect is not strong in terms of statistical significance. The effects of GDP growth on trade liberalization are weak. However, the responses of the growth in real GDP to a one standard deviation innovation in Trade-GDP ratio – shown in the third row of Figure 3 - are a bit weaker than those of per capita GDP growth. Again, trade-GDP ratio does not seem to respond to shock to per capita GDP growth rate.

3.1.2 An augmented VAR

At the theoretical level, one would expect that investment – change in the capital stock – and the change in the labor input will affect the growth rate of real GDP. In per capita terms, per capita real investment will affect the growth rate of per capita real GDP. We, therefore, add investment to the system so that we can control for the effects of investment while looking at the impact of trade liberalization. We estimate two alternative specifications of the model with the vector $Y$ including the following variables:

Model 4: $Y = (\Delta gdppc, invpc, t_{ratio})$

Model 5: $Y = (gdppc, invpc, t_{ratio})$

We include two lags of each variables selected by the AIC.
Figure 3 presents the estimated generalized impulse responses (along with two standard error bands) obtained from Model 4. The first row shows the responses of per capita real GDP growth and per capita real investment to a one standard deviation innovation in Trade-GDP ratio. While the responses of per capita real GDP growth do not seem to be statistically significant, trade liberalization has significant positive permanent effects on investment. The responses of per capita real GDP growth and of trade liberalization to a one standard deviation innovation in investment are shown in the middle row. Although there is positive and significant response of per capita GDP growth in first two periods after the shock, it turns significantly negative in the third period and then quickly dies off. Trade liberalization does not seem to respond to a shock to investment. Investment and trade liberalization do not respond to a shock to the growth of per capita real GDP.

Figure 4 presents the estimated generalized impulse responses obtained from Model 5. The first row shows the responses of per capita real GDP and per capita real investment to a one standard deviation innovation in Trade-GDP ratio. Trade liberalization has significant positive permanent effects on per capita real GDP and investment. The responses of per capita real GDP and of trade liberalization to a one standard deviation innovation in investment are shown in the middle row. Per capita GDP increases reaching a peak in period 2 and then the increase dies off gradually. Trade liberalization does not seem to respond to a shock to investment. The third row of graphs presents the responses of per capita real investment and trade liberalization to a one standard deviation innovation in the per capita real GDP. Investment increases first,
declines in period 2 to where it was before, and increases again. Trade-GDP ratio permanently increases as a result of the shock to per capita real GDP.

The key result of this subsection is that an innovation in trade liberalization leads to a positive and permanent increase in investment. Furthermore, there is some weak evidence of trade liberalization accelerating the growth rate of per capita real GDP.

3.2 Trade Liberalization, Growth and Income Inequality

Now we expand our set of variables to include measures of income inequality so that we can examine interrelations among trade liberalization, growth and income inequality. Because we have continuous time series data only on ineq_utip we use that series only. However, this data series is available only for the period from 1967 to 1992 and, therefore, we use data on each variable for that sub-period. We estimate the following specifications:

Model 6: \( Y = (\Delta gdppc, ineq\_utip, t\_ratio) \)

Model 7: \( Y = (\Delta gdppc, ineq\_utip, invpc, t\_ratio) \)

Figure 5 presents the estimated generalized impulse responses (along with two standard error bands) obtained from Model 6. The first row shows the responses of per capita real GDP growth and inequality to a one standard deviation innovation in Trade-GDP ratio. Although the responses of per capita real GDP growth and inequality are positive they are not statistically significant. As we can see from the second and the third row one standard deviation innovation in inequality and real per capita growth seems to have no statistically significant effects on the other variables.
The estimated generalized impulse responses from Model 7 are presented in Figure 6. A one standard deviation innovation in trade-GDP ratio leads to an increase in inequality in period 1 and 2. But these effects are rather weak. None of the variables seem to respond significantly to a one standard deviation innovation in inequality. Responses of per capita real GDP, investment and trade liberalization to other shocks are qualitatively similar to those we have found in the previous section under various specifications of the model.

Given that the data on income inequality are of poor quality there is scope for further investigation. It is important to examine how trade has differential effects on different sectors of the economy. In Bangladesh manufacturing goods constitute the major share of total trade. Also, within manufacturing sector only a few industry groups such as ready made garments benefit from trade. Against this backdrop it would be interesting to see if trade liberalization has significantly skewed the distribution of income in Bangladesh.

4. Sensitivity Analysis

We next examine the sensitivity of our results to changes in time period. We have noticed that all the data series have break points around the time of independence. We, therefore, take the period after independence: 1973 – 2000 and re-estimate the impulse responses from two specifications of the augmented VAR: Model 4 and Model 7. The impulse response functions are presented in Figure 7 and 8. When we re-estimate Model 4, we notice two important differences: in response to a one standard deviation innovation in investment, growth of real GDP per capita falls in the first period, it
increases in the second period and then the change dies off. A shock to the growth of per capita real GDP has significant negative effects on investment for first three periods after the shock. It is intuitively not clear why shock to per capita real GDP leads to a decline in investment or why an innovation in investment negatively affect the growth rate of per capita real GDP.

Re-estimation of Model 7 with a shorter sample produces impulse responses very similar to the one we estimate with the full sample. However, a one percent standard deviation innovation in investment leads to a significant positive effect on the trade-GDP ratio for at least four periods after the shock.

5. Concluding Remarks

This paper examines time series evidence to establish a link between trade, economic growth and income inequality in Bangladesh. The empirical results from a Vector Autoregression (VAR) model suggest that there is some evidence of trade liberalization accelerating growth in Bangladesh. Trade openness promotes investment. We find little evidence of trade affecting income distribution or of income distribution affecting growth or investment. Given the poor quality of the data on inequality measures, there is scope for further investigation. Re-estimation of the model with post independence data suggests that investment could be important for trade liberalization.
Table 1: Summary Statistics of the Data Series

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sample period</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>No. of observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>∆gdp</td>
<td>1960 - 2000</td>
<td>0.036</td>
<td>0.042</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-0.094,0.152)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>∆gdppc</td>
<td>1960 - 2000</td>
<td>0.011</td>
<td>0.043</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-0.121,0.125)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>∆invpc</td>
<td>1960 - 2000</td>
<td>0.032</td>
<td>0.222</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(-0.843,0.644)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>t_ratio</td>
<td>1959 - 2000</td>
<td>0.164</td>
<td>0.065</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.092,0.309)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ineq_ds</td>
<td>1963 - 2000</td>
<td>0.336</td>
<td>0.039</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.259,0.390)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ineq_wider</td>
<td>1963 - 1999</td>
<td>0.377</td>
<td>0.036</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.290,0.450)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ineq_utip</td>
<td>1967 - 1992</td>
<td>0.412</td>
<td>0.024</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.361,0.456)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: In column 2, the numbers in parentheses are the minimum and maximum values of the variables.
Table 2: Augmented Dickey Fuller Test Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF test statistic (1)</th>
<th>MacKinnon p-value (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>gdp</td>
<td>5.473</td>
<td>1.000</td>
</tr>
<tr>
<td>gdppc</td>
<td>-1.086</td>
<td>0.919</td>
</tr>
<tr>
<td>invpc</td>
<td>-2.342</td>
<td>0.164</td>
</tr>
<tr>
<td>ineq_utip</td>
<td>-4.946</td>
<td>0.003</td>
</tr>
<tr>
<td>t_ratio</td>
<td>2.346</td>
<td>0.995</td>
</tr>
<tr>
<td>Δgdp</td>
<td>0.277</td>
<td>0.760</td>
</tr>
<tr>
<td>Δgdppc</td>
<td>-5.122</td>
<td>0.001</td>
</tr>
<tr>
<td>Δinvpc</td>
<td>-7.256</td>
<td>0.000</td>
</tr>
<tr>
<td>Δt_ratio</td>
<td>-8.594</td>
<td>0.000</td>
</tr>
<tr>
<td>Δ²gdp</td>
<td>-5.096</td>
<td>0.000</td>
</tr>
</tbody>
</table>
Per Capita Real GDP, Investment and Trade-GDP Ratio in Bangladesh: 1959 - 2000

Figure 1.a

Income Inequality in Bangladesh: 1963 - 2000

Figure 1.b
Figure 2: Generalized Impulse Responses: Model 1, 2 and 3

- Response of gdppc to t_ratio
- Response of t_ratio to gdppc
- Response of D(gdppc) to t_ratio
- Response of t_ratio to D(gdppc)
- Response of D(gdp) to t_ratio
- Response of t_ratio to D(gdp)
Figure 3: Generalized Impulse Responses: Model 4
Figure 4: Generalized Impulse Responses: Model 5
Figure 5: Generalized Impulse Responses: Model 6

- Response of $D(\text{gdppc})$ to $t_{ratio}$
- Response of $\text{ineq}_{utip}$ to $t_{ratio}$
- Response of $D(\text{gdppc})$ to $\text{ineq}_{utip}$
- Response of $t_{ratio}$ to $\text{ineq}_{utip}$
- Response of $\text{ineq}_{utip}$ to $D(\text{gdppc})$
- Response of $t_{ratio}$ to $D(\text{gdppc})$
Figure 6: Generalized Impulse Responses: Model 7

- Response of $D(gdppc)$ to $t\_ratio$
- Response of ineq\_utip to $t\_ratio$
- Response of invpc to $t\_ratio$
- Response of $D(gdppc)$ to invpc
- Response of ineq\_utip to invpc
- Response of $t\_ratio$ to invpc
- Response of $D(gdppc)$ to ineq\_utip
- Response of invpc to ineq\_utip
- Response of $t\_ratio$ to ineq\_utip
- Response of ineq\_utip to $D(gdppc)$
- Response of invpc to $D(gdppc)$
- Response of $t\_ratio$ to $D(gdppc)$
Figure 7: Generalized Impulse Responses: Model 4 (1973 – 2000)
Figure 8: Generalized Impulse Responses: Model 7 (1973 – 1992)
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