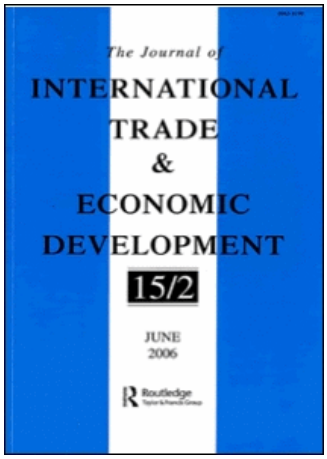

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Trade, Growth and Wage Inequality in Bangladesh

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ABSTRACT *Using model selection techniques based on out-of-sample predictive ability criterion in a Vector Autoregression (VAR) framework, this paper empirically examines the causal relations among growth, trade, and wage inequality in Bangladesh between 1971 and 2000. There is some evidence of bi-directional causality between growth and inequality and between trade and growth. That growth causes trade and that trade causes inequality are robust results. Furthermore, evidence strongly suggests that investment is important for trade, and the terms of trade between agricultural products and manufacturing products is an important causal determinant of both growth and trade.*

KEY WORDS: Bangladesh, trade, trade openness, wage inequality, out-of-sample predictive ability, mean squared forecast errors

Introduction

The development paradigm that many developing countries have embraced in recent years has raised concerns and questions regarding the potential effects of free trade – which has been one of the mainstays of this paradigm – on growth and income distribution in those countries. While its advocates aggressively argue that trade openness enhances growth, they are less vocal about how it affects income inequality. There are theoretical arguments that encompass almost all possible causal relationships among trade, growth, and inequality. However, scrupulous empirical analysis is required to disentangle their mutual causal relations. This paper attempts to examine these relations with special reference to Bangladesh.

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Immediately after its independence in 1971, Bangladesh adopted import-substitution based inward-oriented economic policies. These policies entailed extensive government controls through investment sanctioning, import licensing and exchange controls, arbitrary exemptions, ad hoc concessions and subsidized loans, and allocation of activities to private and public enterprises. By the early 1980s, the failure of such policies was reflected in the disillusionment accompanying the dismal growth performance in the first decade of independence. Enthusiasm for trade liberalization began to build, reinforced by the success of the trade-oriented growth strategies of the Asian Tigers. The Industrial and Trade Policy, announced by the government in the 1980s, targeted greater efficiency and international competitiveness as well as faster growth of export-oriented industries via reduction of regulation and control, tariff rationalization, a liberalized market-based competitive structure, disinvestment of public sector enterprises, and coordination of industrial and export policies.[1] The shift to a more liberal trade policy regime in Bangladesh began gradually, with some acceleration following the industrial policy of 1991.

From a theoretical point of view, free trade is likely to allocate resources to those areas where Bangladesh has comparative advantage, which will promote specialization and growth. Free trade will also accelerate investment by allowing access to bigger markets, permitting scale economies, and encouraging imports of cheaper capital goods and intermediate inputs. Because Bangladesh is relatively abundant in unskilled labor, greater trade can be inequality-reducing by closing the gap between the wages of skilled and unskilled workers. If, however, only one or two industries benefit from trade – which is the case in Bangladesh – then greater trade may be inequality-increasing as the wage gap between traded and non-traded industries grows.

This paper is thought to be the first to examine the causal relations among trade, growth, and wage inequality in Bangladesh using time-series data.[2] Instead of using conventional Granger causality tests, we use predictive ability criterion of model selection to test for causal relations.[3] The use of a Vector Autoregression (VAR) model framework also allows the investigation of interrelations among these variables without a priori commitment to any established theory. The results indicate that there is some evidence of bi-directional causality between growth and inequality and between trade and growth. That growth causes trade and that trade causes inequality are two robust results of our analysis.

The paper is organized as follows. The next section provides a literature review. Data and the variables are described in the third section. The fourth section discusses the empirical methodology. The results of our analysis are presented in the fifth section. Moreover, we present the results of our sensitivity analysis, which includes three different experiments. The summary and conclusion are presented in the sixth section.

Literature Review

There is substantial literature about the relationship between trade and growth. All theoretically plausible relationships between trade and growth have been part of standard textbook discussions, starting from the very basic Ricardian concept of comparative advantage and benefits of free trade, to a neoclassical interpretation in which trade is purported to increase per capita GDP through the more efficient allocation of resources that enhances productivity. More recently, trade has been incorporated within the endogenous growth theory framework as a conduit for technology diffusion (Grossman & Helpman, 1991), or as a tool for learning by doing (Lucas, 1988 and Young, 1991) with its implied effects on long-run growth.

Although earlier literature seems to focus on the effect of trade on growth, it is possible for growth to have an effect on trade. For example, higher income may create better infrastructure and greater demand for traded goods. Growth may also affect trade by putting pressure on the political process for liberalized trade policy. Recent empirical work focuses on cross-country and panel data analyses. Many papers (for example, Barro & Lee, 1994; Easterly & Levine, 2001; Krishna *et al.*, 2003) find evidence of trade openness explaining both the level and growth rate of real GDP per capita.[4] Berg and Krueger (2003) provide a comprehensive survey of theoretical and empirical literature on trade and growth.

The measurement of trade openness is a controversial issue in the empirical literature. Although conceptually trade openness 'is the degree to which nationals and foreigners can transact without artificial (that is, governmentally imposed) costs (including delays and uncertainty) that are not imposed on transactions among domestic citizens' (Berg & Krueger, 2003: 5), finding an appropriate measure is a formidable task. However, Harrison (1996) shows that a positive relationship between free trade and growth is robust to the use of a variety of openness measures.

The literature pertaining to growth and inequality and trade and inequality is also extensive. The inverted U-shaped Kuznets curve, which describes growing inequality in the initial stages of growth and falling inequality in more advanced stages of growth (Kuznets, 1955), has been the cornerstone of most empirical work.[5] However, empirical evidence of all plausible uni-directional and bi-directional causal relations between growth and income inequality has led to the development of a wide range of theories linking growth and inequality.[6] Many of these models use the endogenous growth model framework to examine the dynamic relationship between growth and income distribution. Aghion *et al.* (1999) provides a comprehensive survey of this literature.

The prediction of the theories on the nature of the relationship between trade and income distribution is not clear-cut, and the empirical literature is

even more ambiguous. One major direction of the empirical literature is based on the prediction of the Stolper–Samuelson theorem (SST, hereafter) which states that trade benefits the country's abundant factors of production. Thus, for developing countries, SST implies that free trade increases the relative demand for unskilled workers – which are the abundant factors – and hence narrows the wage gap between skilled and unskilled workers, thus improving income distribution. However, empirical evidence is mixed. For example, Chakrabarti (2000), Edwards (1997), and Wood (1997) do not find evidence of a uniform effect of trade on inequality across countries and over time.

Concerning Bangladesh, while there have been a few studies that assess the impact of trade liberalization on economic growth, to the best of our knowledge there has been no study that examines the relationship between trade and income/wage distribution. Among the macro studies, Ahmed (2003), Begum and Shamsuddin (1998), Hossain and Karunaratne (2004), Mamun and Nath (2005), and Siddiki (2002), find evidence of a positive impact of exports on economic growth. Love and Chandra (2005), on the contrary, find evidence of causality running from growth to exports in short-run as well as in long-run. Using micro level data, Salim (2003) finds little evidence of a positive impact of trade and other economic liberalization measures on productivity growth among manufacturing industries in Bangladesh.

Moreover, Ahmed and Sattar (2004) examine both aggregate and disaggregate level data to find that the faster pace of trade liberalization in the 1990s has a much larger impact on growth while a reduction in poverty has slowed during that period, indicating that inequality has become worse. This accords well with the findings of other empirical research on poverty and inequality in Bangladesh (for example, Khan & Sen, 2001).

There are a few empirical studies that examine poverty and inequality in Bangladesh. Muqtada (1986) examines demographic pressure, land ownership, and the impact of High Yielding Variety (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 study 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. Most of these studies use the Gini index of income inequality.[7]

None of these studies, however, examines the relationship between trade and income inequality. In what follows, we bring together the different strands of the aforementioned literature into a multivariate analysis of trade, growth, and inequality.

Data and the Variables

The data used in this paper have been obtained from various sources. We obtain annual data on real GDP per capita, gross fixed capital formation, exports and imports of goods and services, and government final consumption expenditures from the *Statistical Database* of the United Nations. Data on wage and price indices are obtained from various issues of the *Statistical Yearbook of Bangladesh*. Additionally, the International Monetary Fund's (IMF) *International Financial Statistics* provides data on nominal exchange rate. The sample period for our data set is 1971 to 2000. The choice of the sample period is dictated by the availability of some of the data series. Except for the indices, all variables are in constant Bangladeshi *taka*.

We use first log differences of per capita real GDP (multiplied by 100) as measures of *growth*. This is a common practice in the literature.[8] Real exports *plus* imports as a share of real GDP (in percentage) is used to define the variable – *trade*. This is often used as a measure of trade openness. Like other measures of openness, trade share is not a perfect measure. In particular, trade share may suffer from endogeneity bias when used as an explanatory variable in a regression framework. In the current study, the use of the VAR framework mitigates this potential problem. A lack of time-series data on alternative measures, such as average tariff rates and the difficulty of combining various tariff and non-tariff barriers into a single index prompted us to use trade share. On the positive side, this measure of openness

> combines the effects of 'natural' openness and trade policy .... More fundamentally, natural openness as well as policy openness may matter for growth .... trade policy openness would be of interest where the concern is the influence of distortions on relative prices and the laissez-faire equilibrium, but natural openness would matter to whether trade causes growth through the sharing of ideas and technology that it implies. (Berg & Krueger, 2003: 11)

One limitation for any study of inequality in Bangladesh is the lack of reliable income data. Although most previous studies use the Gini index of income inequality, a cursory look at widely-used World Bank data on income inequality (Deininger & Squire) in Bangladesh makes one suspicious about the quality of the data. In particular, the large swings from one year to the other and discontinuities are worrisome. To overcome these shortcomings, we use a measure of inequality of wages across four major sectors of the economy: agriculture, fishery, construction, and manufacturing. Since free trade has evidently benefited only a few industries (for example, fishery and ready-made garments), faster growth in manufacturing and fishery wages may widen the sectoral wage gaps, causing inequality to

increase. Thus, to define the variable *inequality*, we calculate the coefficient of variation across four different wage indices: manufacturing wage, construction wage, agricultural wage, and fishery wage. Note that we deflate the first two wages by a consumer price index (CPI) for working class and the last two wages by a consumer price index for rural families before calculating the coefficient of variation.[9]

Furthermore, we consider a set of additional variables that may be relevant for *growth*, *trade* and *inequality*. Real gross fixed capital formation as a percentage of GDP is used as the *investment* variable. The percentage growth rate of CPI is used as the *inflation* variable, and the ratio of wholesale price index for agricultural products to that for industrial products is used to define the variable *terms of trade*. The real government consumption expenditure as a percentage of real GDP is used as the fiscal policy variable, *fiscal*. We use US CPI data obtained from the Bureau of Labor Statistics (BLS), US Department of Labor, to calculate *real exchange rate* as follows:

$$e_t = EX_t \times \frac{CPI_t^{US}}{CPI_t^{BD}}$$

where EX_t is the nominal exchange rate (Bangladeshi *Taka* per US$) in period t, and CPI_t^{US} and CPI_t^{BD} are the CPIs in the US and Bangladesh respectively.

Table 1 presents summary statistics of the data series. We include descriptive statistics of the variables in Panel A. Real GDP per capita increased at an annual average growth rate of 0.68 per cent with a median growth rate of 1.86 per cent during 1971–2000. On average, trade accounts for 20 per cent of GDP whereas gross fixed investment accounts for 16 per cent. Bangladesh has experienced an average inflation rate of 9.91 per cent during this period. The terms of trade between agriculture and industry has varied between 77.63 per cent and 121 per cent, turning more in favor of agriculture in recent years. Government consumption expenditure accounts for, on average, about 4 per cent of GDP, and the average real exchange rate has been about 8 *taka* per US dollar.[10]

In panel B of Table 1, we break down the sample period into three sub-periods and present averages of the variables for these periods. As suggested by Hossain and Alauddin (2005), the time until 1982 can be called the pre-liberalization period. The post-liberalization period can be further subdivided into two phases: the transition phase that extends from 1983 to 1991, during which liberalization policies were gradually introduced; and the second phase since 1991, when further liberalization – particularly in trade policies – was rigorously introduced and implemented. Average growth rate, trade ratio and investment are much higher in this phase. Average inequality in the 1990s did not change much from the second sub-period, although it was higher on average than in the pre-liberalization

Table 1. Summary statistics of the data series

	Growth 1	*Trade* 2	*Inequality* 3	*Investment* 4	*Inflation* 5	*Terms of trade* 6	*Fiscal* 7	*Real exchange rate* 8
Panel A: Descriptive Statistics								
Mean	0.68	20.02	12.34	16.09	9.92	100.15	3.94	7.87
Median	1.86	18.43	12.65	16.43	6.74	102.30	4.30	8.21
Maximum	6.64	36.12	18.32	23.29	58.18	121.04	5.07	12.03
Minimum	−17.58	4.45	3.53	4.81	−16.66	77.63	0.96	2.53
Std. Dev.	4.50	7.41	3.48	4.27	14.26	12.93	1.10	2.25
Observations	30	30	30	30	30	29	30	30
Panel B: Average over three Sub-periods								
1971–82	−1.32	14.55	11.44	12.95	16.10	86.10	3.35	5.70
1983–91	1.47	18.12	12.99	16.98	8.31	106.37	4.23	8.34
1992–2000	2.56	29.21	12.89	19.38	3.28	111.11	4.43	10.29

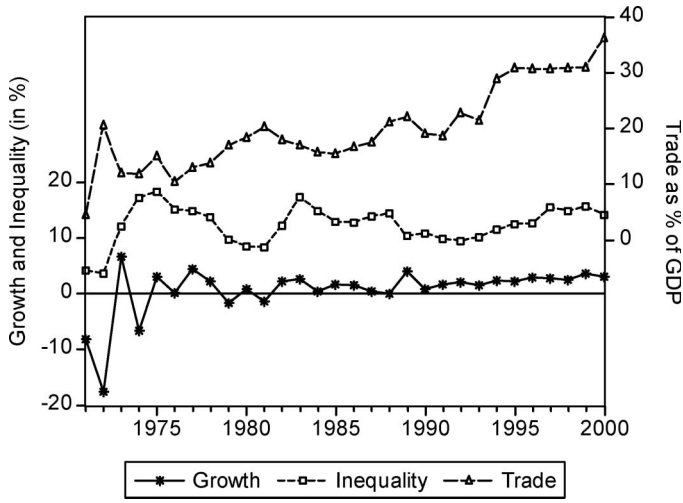

Figure 1. Growth, trade and wage inequality in Bangladesh: 1971 – 2000

period. Inflation came down substantially in the 1990s. On average, agricultural products have been relatively more expensive in the post-liberalization period, and the terms of trade have been continuously improving in favor of agriculture. The real exchange rate has been continuously rising.

Figure 1 plots *growth*, *trade* and *inequality*. All three series were more volatile during the 1970s and part of the 1980s. Bangladesh frequently experienced negative growth rates of real GDP per capita during the 1970s. Since 1981, the growth rate has been positive and more stable in the 1990s. We observe a substantial increase in trade during the last decade. Wage inequality fell steadily during the later half of the 1970s, fluctuated during the 1980s and has been slowly but steadily rising during the 1990s. This pattern is consistent with the findings of some of the previous studies (for example, Wodon, 1999, 2000 and Khan & Sen, 2001) that have shown rising inequality in Bangladesh in recent times.

Empirical Methodology

There has been increased emphasis on the use of out-of-sample forecasting performance of models for testing for Granger causality.[11] Because our objective is to investigate the causal links between *growth*, *trade* and *inequality* in Bangladesh, we use the predictive ability criterion of model selection to determine the directions of causality.[12] The use of the Vector Autoregression (VAR) framework allows us to accommodate a wide range of theoretical possibilities. Furthermore, because the potential misspecification of a model is always an important issue in empirical studies, we start

with a very general specification of the VAR model including all potential variables for which data are available and consider all possible and relevant model combinations of those variables. We then use the out-of-sample predictive ability criterion to select the best model. Thus, we adopt a 'general-to-specific' approach to empirical model building.[13]

It is standard practice in any empirical investigation involving economic time-series to examine the stochastic properties of the variables under consideration by conducting unit root and cointegration tests. We carry out Augmented Dickey–Fuller (ADF) tests to determine the order of integration for each relevant variable. Thus, for each variable we start with a flexible specification of the test equation including an intercept and a trend:

$$\Delta z_t = \alpha_o + \alpha_1 t + \gamma z_{t-1} + \sum_{j=1}^{p} \beta_j \Delta z_{t-j} + \varepsilon_t \tag{1}$$

where z is the variable under consideration, α_0 represents the intercept term, t is the time trend, Δzs are the augmented terms, p is the appropriate lag length of the augmented terms and ε is the white noise error term. The ADF test is essentially the test of significance of the coefficient γ in the above equation. In order to select the lag length p, we start with a maximum lag of 3 and pare it down to the appropriate lag by examining the Schwartz Information Criterion (SIC).[14] If we do not find the intercept and the trend – both or one of them – to be statistically significant at the 10 per cent significance level, we drop the insignificant term(s) and re-estimate the test statistics.

If we find that two or more of our three variables of interest, namely *growth*, *trade* and *inequality*, are of the same order of integration – the order being 1 or above – we also conduct cointegration tests by estimating 'vector error correction' (VEC) models of the following form:

$$\Delta y_t = \delta_o + \lambda t + B(L) y_{t-1} + \sum_{i=1}^{r} \delta_i x_{i,t-1} + v_t \tag{2}$$

where y is an $n \times 1$ vector of variables, z being a typical variable of this vector; δ_0 is an $n \times 1$ vector of constants; λ is an $n \times 1$ vector of coefficients of time t; $B(L)$ is a matrix polynomial in the lag operator L and v_t is a vector of innovations in period t.[15] Furthermore, $x_{i,t-1} = \hat{\alpha}' y_{t-1}$, $i = 1, \ldots, r$, is an $n \times 1$ vector of 'error-correction' terms defined as in Engle & Granger (1987). r is the rank of the cointegrating space, and is estimated using maximum likelihood procedures. The lag length is selected using the SIC.

In order to examine the causal relationships among *growth*, *trade* and *inequality* we form real-time predictions for each of these variables using models that contain variables from the set described above. We then assess the relative predictive ability of alternative model specifications. We begin

with the most general specification that includes all eight variables discussed above and pare it down to models with at least any two of the three variables of interest: *growth*, *trade* and *inequality*. In particular, we estimate models of the form represented by equation (2) with appropriate lag length and cointegrating rank. However, if the variables are I(1) processes but not cointegrated, or are I(0), then the VEC model (2) simply reduces to an unrestricted VAR with variables in their stationary forms. Thus, if the series have unit roots, they will be differenced before estimating the VAR. If, however, they are I(0), then the variables will be included in levels.

The sample is split into two periods with length S and P respectively such that $T = S + P$ where T is the size of the full sample. We first estimate the model with the first S observations. A one-step ahead forecast of Δy (or, of y if y is I(0)) for period $S+1$ is then constructed. Note that we calculate the forecasts only for *growth*, *trade* and *inequality*, although the VAR system will include equations for other variables as well. We then augment our sample with one new observation, re-estimate the model, and form a second real-time one-step ahead forecast for each of the three variables for period $S+2$. This process is continued until the entire sample of T observations is exhausted, and we are left with a sequence of P one-step-ahead forecasts. We then construct a sequence of real-time forecast errors as follows

$$FE_t = Actual_t - Forecast_t \tag{3}$$

where $Actual_t$ is the actual value of the variable in period t and $Forecast_t$ is the one-step ahead forecast of the variable in period t. These forecast errors are used to construct the Mean Squared Forecast Error ($MSFE$) as follows:

$$MSFE = \frac{\sum_{t=S+1}^{T} FE_t^2}{P} \tag{4}$$

A comparison of $MSFE$s across model specifications for each of the variables (that is, for each of *growth*, *trade* and *inequality*) will allow us to choose the best model: the model with the lowest $MSFE$ will be the best model for a variable of interest. Once we choose the best models for each of *growth*, *trade* and *inequality*, we can determine the directions of causality among them by looking at the variables included in the best models.

Results

Stochastic Trending Properties of the Variables

We conduct Augmented Dickey–Fuller (ADF) Tests for unit roots on each of the eight variables. The test statistics along with MacKinnon's p-values, lag length, and information about the specification of the test equations are reported in Table 2. As we see from the table, we reject the null hypothesis of

Table 2. Augmented Dickey – Fuller test results

Variables	*Intercept in the test equation 1*	*Trend in the test equation 2*	*Lag length 3*	*ADF test statistic 4*	*MacKinnon's p-value 5*
Growth	yes	yes	0	−6.32	0.00
Trade	yes	yes	0	−3.82	0.03
Inequality	yes	no	1	−5.63	0.00
Investment	yes	yes	0	−2.57	0.30
Inflation	yes	yes	3	−14.12	0.00
Terms of trade	yes	yes	0	−2.40	0.37
Fiscal	yes	no	1	−3.79	0.01
Real exchange rate	yes	yes	1	−4.61	0.01
First difference of *investment*	yes	no	0	−7.76	0.00
First difference of *terms of trade*	no	no	0	4.77	0.00

Note: The appropriate lag length for augmented terms in the test equation is determined by using a step-down method. We start with a maximum lag length of 3 $\left(\cong 3.1 = \sqrt[3]{30}\right)$ and pare it down using the Schwartz Information Criterion (SIC). Whether an intercept term or both intercept and time trend are included in the test equation is determined by looking at the t-statistics of these terms in the estimated test equation.

a unit root for all but *investment* and *terms of trade*. Since most variables – the three variables of interest, in particular – are (unit root) stationary we do not conduct the cointegration test. Also, model (2) simply reduces to an unrestricted VAR with all but two (*investment* and *terms of trade*) variables in levels.

Model Selection and Direction of Causality Based on Out-of-Sample Predictive Ability

In this section, we present the results of our empirical analysis on how we select the best models to predict *growth*, *trade* and *inequality*. We also use these results to determine the directions of causality between these variables.

Table 3 presents the Mean Squared Forecast Errors (MSFE) for each of the three variables of interest, calculated from a sequence of one-step ahead forecasts constructed by using VAR models. Columns (2) through (4) present the MSFEs based on a 10-year forecast horizon between 1991 and 2000. The results indicate that the best model for *growth* in Bangladesh includes lags of *growth*, *inequality*, *inflation*, *terms of trade* and *real exchange rate* (**Model 63**). For *trade*, the preferred model includes lags of *trade*, *growth*, *investment*, *inflation*, *terms of trade* and *real exchange rate* (**Model 22**).[16] *Inequality* is best explained by lags of *growth*, *trade*, *inequality* and *real exchange rate* (**Model 79**).[17]

Thus, our results indicate that *growth* 'causes' (in the temporal sense) both *trade* and *inequality* in Bangladesh whereas *inequality* causes *growth*, and *trade* causes *inequality*. Thus, we find evidence of bi-directional causality

Table 3. Model selection and direction of causality results based on a predictive ability approach: 10-year forecasting horizon

		Mean Squared Forecast Errors		
Model No.	*Models* 1	*Growth* 2	*Trade* 3	*Inequality* 4
1	*Growth, Trade, Inequality, ΔInvestment, Inflation, Fiscal, ΔTerms of Trade, Real Exchange Rate*	1.26	13.86	5.69
2	*Growth, Trade, Inequality, ΔInvestment, Inflation, Fiscal, ΔTerms of Trade*	1.37	14.26	3.59
3	*Growth, Trade, Inequality, ΔInvestment, Inflation, Fiscal, Real Exchange Rate*	3.95	18.52	1.79
4	*Growth, Trade, Inequality, ΔInvestment, Inflation, ΔTerms of Trade, Real Exchange Rate*	0.50	13.32	6.31
5	*Growth, Trade, Inequality, ΔInvestment, Fiscal, ΔTerms of Trade, Real Exchange Rate*	0.76	13.28	5.42
6	*Growth, Trade, Inequality, Inflation, Fiscal, ΔTerms of Trade, Real Exchange Rate*	0.82	14.40	3.75
7	*Growth, Trade, ΔInvestment, Inflation, Fiscal, ΔTerms of Trade, Real Exchange Rate*	1.15	12.67	
8	*Growth, Inequality, ΔInvestment, Inflation, Fiscal, ΔTerms of Trade, Real Exchange Rate*	1.20		2.52
9	*Trade, Inequality, ΔInvestment, Inflation, Fiscal, ΔTerms of Trade, Real Exchange Rate*		14.43	5.55
10	*Growth, Trade, Inequality, ΔInvestment, Inflation, Fiscal*	4.14	26.46	1.86
11	*Growth, Trade, Inequality, ΔInvestment, Inflation, ΔTerms of Trade*	0.41	13.39	5.07
12	*Growth, Trade, Inequality, ΔInvestment, Inflation, Real Exchange Rate*	19.45	23.02	1.82
13	*Growth, Trade, Inequality, ΔInvestment, Fiscal, ΔTerms of Trade*	0.71	13.67	3.56
14	*Growth, Trade, Inequality, ΔInvestment, Fiscal, Real Exchange Rate*	7.59	19.42	2.05
15	*Growth, Trade, Inequality, ΔInvestment, ΔTerms of Trade, Real Exchange Rate*	0.49	14.35	6.83
16	*Growth, Trade, Inequality, Inflation, Fiscal, ΔTerms of Trade*	1.06	14.45	2.22
17	*Growth, Trade, Inequality, Inflation, Fiscal, Real Exchange Rate*	3.55	18.27	1.78
18	*Growth, Trade, Inequality, Inflation, ΔTerms of Trade, Real Exchange Rate*	0.43	13.89	2.96
19	*Growth, Trade, Inequality, Fiscal, ΔTerms of Trade, Real Exchange Rate*	0.54	14.25	3.11
20	*Growth, Trade, ΔInvestment, Inflation, Fiscal, ΔTerms of Trade*	0.89	13.50	
21	*Growth, Trade, ΔInvestment, Inflation, Fiscal, Real Exchange Rate*	1.65	16.33	
22	*Growth, Trade, ΔInvestment, Inflation, ΔTerms of Trade, Real Exchange Rate*	0.88	**12.16**	
23	*Growth, Trade, ΔInvestment, Fiscal, ΔTerms of Trade, Real Exchange Rate*	1.17	12.16	
24	*Growth, Trade, Inflation, Fiscal, ΔTerms of Trade, Real Exchange Rate*	1.13	12.93	

(*continued*)

Table 3. (*Continued*)

Model No.	*Models* 1	*Mean Squared Forecast Errors*		
		Growth 2	*Trade* 3	*Inequality* 4
25	*Growth, Inequality, ΔInvestment, Inflation, Fiscal, ΔTerms of Trade*	2.90		2.71
26	*Growth, Inequality, ΔInvestment, Inflation, Fiscal, Real Exchange Rate*	3.63		2.31
27	*Growth, Inequality, ΔInvestment, Inflation, ΔTerms of Trade, Real Exchange Rate*	0.33		3.87
28	*Growth, Inequality, ΔInvestment, Fiscal, ΔTerms of Trade, Real Exchange Rate*	0.66		2.63
29	*Growth, Inequality, Inflation, Fiscal, ΔTerms of Trade, Real Exchange Rate*	0.79		2.04
30	*Trade, Inequality, ΔInvestment, Inflation, Fiscal, ΔTerms of Trade*		14.58	3.24
31	*Trade, Inequality, ΔInvestment, Inflation, Fiscal, Real Exchange Rate*		18.32	1.82
32	*Trade, Inequality, ΔInvestment, Inflation, ΔTerms of Trade, Real Exchange Rate*		13.38	5.68
33	*Trade, Inequality, ΔInvestment, Fiscal, ΔTerms of Trade, Real Exchange Rate*		14.19	5.10
34	*Trade, Inequality, Inflation, Fiscal, ΔTerms of Trade, Real Exchange Rate*		13.22	3.51
35	*Growth, Trade, Inequality, ΔInvestment, Inflation*	19.68	30.39	1.83
36	*Growth, Trade, Inequality, ΔInvestment, Fiscal*	12.25	37.36	2.95
37	*Growth, Trade, Inequality, ΔInvestment, ΔTerms of Trade*	1.02	13.42	7.17
38	*Growth, Trade, Inequality, ΔInvestment, Real Exchange Rate*	19.50	22.93	1.54
39	*Growth, Trade, Inequality, Inflation, Fiscal*	3.65	24.94	1.84
40	*Growth, Trade, Inequality, Inflation, ΔTerms of Trade*	0.40	14.03	2.65
41	*Growth, Trade, Inequality, Inflation, Real Exchange Rate*	17.64	22.83	1.69
42	*Growth, Trade, Inequality, Fiscal, ΔTerms of Trade*	0.61	14.31	2.01
43	*Growth, Trade, Inequality, Fiscal, Real Exchange Rate*	6.68	19.15	2.07
44	*Growth, Trade, Inequality, ΔTerms of Trade, Real Exchange Rate*	0.42	15.02	3.29
45	*Growth, Trade, ΔInvestment, Inflation, Fiscal*	1.74	22.71	
46	*Growth, Trade, ΔInvestment, Inflation, ΔTerms of Trade*	0.45	12.57	
47	*Growth, Trade, ΔInvestment, Inflation, Real Exchange Rate*	11.00	21.22	
48	*Growth, Trade, ΔInvestment, Fiscal, ΔTerms of Trade*	0.88	12.98	
49	*Growth, Trade, ΔInvestment, Fiscal, Real Exchange Rate*	3.03	17.28	
50	*Growth, Trade, ΔInvestment, ΔTerms of Trade, Real Exchange Rate*	0.73	12.97	
51	*Growth, Trade, Inflation, Fiscal, ΔTerms of Trade*	0.89	13.51	
52	*Growth, Trade, Inflation, Fiscal, Real Exchange Rate*	1.63	16.41	
53	*Growth, Trade, Inflation, ΔTerms of Trade, Real Exchange Rate*	0.94	12.53	
54	*Growth, Trade, Fiscal, ΔTerms of Trade, Real Exchange Rate*	1.13	12.62	

(*continued*)

Table 3. (*Continued*)

Model No.	*Models* 1	*Mean Squared Forecast Errors*		
		Growth 2	*Trade* 3	*Inequality* 4
55	*Growth, Inequality, ΔInvestment, Inflation, Fiscal*	4.36		2.43
56	*Growth, Inequality, ΔInvestment, Inflation, ΔTerms of Trade*	2.52		3.63
57	*Growth, Inequality, ΔInvestment, Inflation, Real Exchange Rate*	3.90		2.44
58	*Growth, Inequality, ΔInvestment, Fiscal, ΔTerms of Trade*	2.33		2.77
59	*Growth, Inequality, ΔInvestment, Fiscal, Real Exchange Rate*	6.43		2.89
60	*Growth, Inequality, ΔInvestment, ΔTerms of Trade, Real Exchange Rate*	0.37		3.93
61	*Growth, Inequality, Inflation, Fiscal, ΔTerms of Trade*	2.54		2.18
62	*Growth, Inequality, Inflation, Fiscal, Real Exchange Rate*	3.57		2.11
63	*Growth, Inequality, Inflation, ΔTerms of Trade, Real Exchange Rate*	**0.32**		2.52
64	*Growth, Inequality, Fiscal, ΔTerms of Trade, Real Exchange Rate*	0.54		2.03
65	*Trade, Inequality, ΔInvestment, Inflation, Fiscal*		26.12	1.88
66	*Trade, Inequality, ΔInvestment, Inflation, ΔTerms of Trade*		13.29	4.46
67	*Trade, Inequality, ΔInvestment, Inflation, Real Exchange Rate*		23.03	1.62
68	*Trade, Inequality, ΔInvestment, Fiscal, ΔTerms of Trade*		14.05	2.99
69	*Trade, Inequality, ΔInvestment, Fiscal, Real Exchange Rate*		19.30	2.06
70	*Trade, Inequality, ΔInvestment, ΔTerms of Trade, Real Exchange Rate*		15.00	6.35
71	*Trade, Inequality, Inflation, Fiscal, ΔTerms of Trade*		13.87	2.27
72	*Trade, Inequality, Inflation, Fiscal, Real Exchange Rate*		18.33	1.78
73	*Trade, Inequality, Inflation, ΔTerms of Trade, Real Exchange Rate*		12.31	3.39
74	*Trade, Inequality, Fiscal, ΔTerms of Trade, Real Exchange Rate*		12.78	3.22
75	*Growth, Trade, Inequality, ΔInvestment*	20.85	34.54	1.76
76	*Growth, Trade, Inequality, Inflation*	17.85	29.16	1.72
77	*Growth, Trade, Inequality, Fiscal*	10.58	35.28	2.90
78	*Growth, Trade, Inequality, ΔTerms of Trade*	0.90	14.04	3.96
79	*Growth, Trade, Inequality, Real Exchange Rate*	17.68	22.74	**1.42**
80	*Growth, Trade, ΔInvestment, Inflation*	11.77	28.05	
81	*Growth, Trade, ΔInvestment, Fiscal*	6.91	33.44	
82	*Growth, Trade, ΔInvestment, ΔTerms of Trade*	0.57	12.64	
83	*Growth, Trade, ΔInvestment, Real Exchange Rate*	11.11	21.14	
84	*Growth, Trade, Inflation, Fiscal*	1.66	21.81	
85	*Growth, Trade, Inflation, ΔTerms of Trade*	0.48	12.73	
86	*Growth, Trade, Inflation, Real Exchange Rate*	10.24	21.23	
87	*Growth, Trade, Fiscal, ΔTerms of Trade*	0.88	13.14	
88	*Growth, Trade, Fiscal, Real Exchange Rate*	2.86	17.31	

(*continued*)

Table 3. (*Continued*)

Model No.	*Models*	*Mean Squared Forecast Errors*		
		Growth	*Trade*	*Inequality*
	1	*2*	*3*	*4*
89	*Growth, Trade, ΔTerms of Trade, Real Exchange Rate*	0.81	13.30	
90	*Growth, Inequality, ΔInvestment, Inflation*	8.22		2.43
91	*Growth, Inequality, ΔInvestment, Fiscal*	2.70		1.95
92	*Growth, Inequality, ΔInvestment, ΔTerms of Trade*	3.62		3.47
93	*Growth, Inequality, ΔInvestment, Real Exchange Rate*	4.37		3.78
94	*Growth, Inequality, Inflation, Fiscal*	4.38		2.34
95	*Growth, Inequality, Inflation, ΔTerms of Trade*	2.51		2.42
96	*Growth, Inequality, Inflation, Real Exchange Rate*	3.86		2.24
97	*Growth, Inequality, Fiscal, ΔTerms of Trade*	2.26		2.14
98	*Growth, Inequality, Fiscal, Real Exchange Rate*	6.22		2.59
99	*Growth, Inequality, ΔTerms of Trade, Real Exchange Rate*	0.34		2.79
100	*Trade, Inequality, ΔInvestment, Inflation*		30.06	1.65
101	*Trade, Inequality, ΔInvestment, Fiscal*		38.43	2.85
102	*Trade, Inequality, ΔInvestment, ΔTerms of Trade*		13.79	6.35
103	*Trade, Inequality, ΔInvestment, Real Exchange Rate*		22.90	1.52
104	*Trade, Inequality, Inflation, Fiscal*		24.96	1.84
105	*Trade, Inequality, Inflation, ΔTerms of Trade*		12.91	2.97
106	*Trade, Inequality, Inflation, Real Exchange Rate*		22.82	1.62
107	*Trade, Inequality, Fiscal, ΔTerms of Trade*		13.20	2.12
108	*Trade, Inequality, Fiscal, Real Exchange Rate*		19.51	1.97
109	*Trade, Inequality, ΔTerms of Trade, Real Exchange Rate*		13.47	3.49
110	*Growth, Trade, Inequality*	18.77	32.69	1.75
111	*Growth, Trade, ΔInvestment*	13.31	32.29	
112	*Growth, Trade, Inflation*	10.64	27.08	
113	*Growth, Trade, Fiscal*	5.90	31.81	
114	*Growth, Trade, ΔTerms of Trade*	0.44	12.83	
115	*Growth, Trade, Real Exchange Rate*	10.34	21.16	
116	*Growth, Inequality, ΔInvestment*	6.85		1.89
117	*Growth, Inequality, Inflation*	8.34		2.34
118	*Growth, Inequality, Fiscal*	2.68		1.89
119	*Growth, Inequality, ΔTerms of Trade*	3.65		2.34
120	*Growth, Inequality, Real Exchange Rate*	4.28		3.42
121	*Trade, Inequality, ΔInvestment*		33.13	1.97
122	*Trade, Inequality, Inflation*		29.17	1.66
123	*Trade, Inequality, Fiscal*		37.11	2.68
124	*Trade, Inequality, ΔTerms of Trade*		13.12	4.01
125	*Trade, Inequality, Real Exchange Rate*		22.72	1.43
126	*Growth, Trade*	11.93	30.75	
127	*Growth, Inequality*	6.98		1.85
128	*Trade, Inequality*		32.89	1.97

Note: The Mean Squared Forecast Errors (MSFE) based on per capita GDP growth equations, trade equations and inequality equations from VAR models as specified in the first column are reported in columns (2) through (4). These MSFEs are calculated from a sequence of one-step ahead forecasts constructed from the relevant VAR models for last 10 years of the sample period, that is, from 1991 to 2000. In each column, the bold entry denotes the model which has the lowest MSFE among the candidate models, and hence indicates the model with the 'best' predictive ability.

between *growth* and *inequality*. It is difficult to speculate on one particular explanation for this relationship. Growth may have affected inequality through trade. However, it is not clear how wage inequality may have affected *growth*. A glance over the data reveals that there are substantial fluctuations in growth of per capita real GDP during the first few years of our sample period. Our results may have picked some of this noise, thus making interpretation difficult.

The results further demonstrate that *inflation* and *terms of trade* between agricultural products and manufacturing products are important determinants of *growth* and *trade*. Given that inflation was high during the 1970s and the 1980s, it is not surprising that it affected *growth* and *trade*. It may be noted that although agriculture has been the largest contributor of GDP, the relative importance of manufacturing has increased over the years. Furthermore, as we have seen before, agricultural products have been relatively more expensive since the mid-1980s. These trends may reflect the structural change that has taken place in Bangladesh over the years.

Investment growth appears to be important for *trade*. Trade policies aimed at promoting exports and reducing import barriers may have encouraged increased investment, which in turn contributed to increased volume of trade. Since trade is concentrated in only a few items in Bangladesh, an exploration of the relationship between *investment* and *trade* requires study at a more disaggregated level.[18] Interestingly, *real exchange rate* appears to be an important explanatory variable for all three variables of interest.

Sensitivity Analysis

In this section, we conduct three different experiments to examine the robustness of our results. The first experiment involves using a shorter forecast horizon of 5 years to estimate the *MSFE*s. Second, we use export share (the variable *export*, defined as exports as a share of GDP) and import share (the variable *import*, defined as imports as a share of GDP) separately instead of trade ratio. Finally, we estimate VAR models using all observations in our sample and conduct conventional Granger causality tests to examine pairwise causal relationships among the variables of interest.

A. *Model selection and direction of causality based on out-of-sample predictive ability using 5-year forecast horizon*

Since 1991 – particularly after the announcement of the Industrial Policy – Bangladesh has achieved strong and stable growth relative to historical experience. By excluding observations from that period in our estimation of forecast errors, at least for the initial years of our forecast horizon, our empirical model may be omitting the effects of the 1991 policy change. In

Table 4. Model selection and direction of causality results based on a predictive ability approach: 5-year forecasting horizon

Dependent variable	*Best models* 1	*Mean Squared Forecast Errors* 2
Growth	*Growth, Trade, ΔInvestment, ΔTerms of Trade*	0.12
Trade	*Growth, Trade, ΔInvestment, Fiscal, ΔTerms of Trade, Real Exchange Rate*	5.11
Inequality	*Trade, Inequality, ΔInvestment*	1.91

Note: The mean squared forecast errors (MSFE) reported in column 2 are the ones associated with the models in column 1. Each represents the lowest value MSFEs among those calculated from 96 possible models for each of *growth*, *trade* and *inequality*.

this experiment, therefore, we accord somewhat higher emphasis on what may have been the first evidence of a persistent growth pattern that may have significant causal relations with either *trade* or *inequality* or both. We extend the sample of observations from 1971 to 1995 to estimate our first model to generate forecasts for 1996 and thereafter. We re-estimate the *MSFE*s by using the remaining five forecast errors. Our objective is to see if the above results are robust to the selection of our forecast horizon.

The results from this experiment are summarized in Table 4. The best model for explaining *growth* selected by the lowest *MSFE* includes lags of *growth*, *trade*, *investment* and *terms of trade*. *Growth*, *investment*, *terms of trade* and *real exchange rate* continue to be important determinants of *trade*. In addition, the *fiscal* variable now becomes important. *Growth* is no longer important for *inequality*, but *trade* and *investment* are.

Using the shorter forecast horizon produces evidence of bi-directional causality between *growth* and *trade*. As the longer horizon produced evidence of *growth* causing *trade*, new evidence of causality running in the opposite direction may be a reflection of the fact that the volume of trade grew substantially enough to have a significant effect on growth only in the 1990s.[19] Otherwise, the main findings of our original model are robust to the change in horizon.

B. *Export and import estimated separately*

Bangladesh is a net importer, although the gap has narrowed in recent years. Since one of the mainstays of trade policies in Bangladesh has been to promote exports and special measures have been adopted for providing incentives, most previous studies (for example, Begum & Shamsuddin, 1998; Mamun & Nath, 2005; Love & Chandra, 2005) focus on the relationship between exports and growth, with mixed results. There are several channels through which exports may affect growth: facilitating production of those items in which the country has comparative advantage; enhancing efficiency through scale economies; facilitating imports of state-of-the-art capital

goods; and removing foreign exchange constraints. Specialization and trade may also affect the income distribution in the country.

In order to examine how increased exports in Bangladesh have interacted not only with *growth* and *inequality* but also with imports, we now replace the variable *trade* with *export* and *import* and, thus, the set of potentially relevant variables is now expanded to include nine variables in total.[20] With these variables we can have a maximum of 320 possible models that include at least two and at most nine variables. As in our original model, we calculate the *MSFE*s for *growth*, *export*, *import* and *inequality* using 10 years of forecast errors. The summary results that show the best models for each of these four variables based on minimum *MSFE*s are reported in Table 5.

Table 5. Model selection and direction of causality results based on a predictive ability approach: 10-year forecasting horizon

Dependent variable	*Best models* *1*	*Mean Squared Forecast Errors* *2*
Growth	*Growth, ΔExport, Inequality, Inflation, Real Exchange Rate*	0.24
ΔExport	*Growth, ΔExport, Import, Inflation, ΔTerms of Trade*	0.82
Import	*Growth, ΔExport, Import, Inequality, ΔInvestment, Inflation, Real Exchange Rate*	6.14
Inequality	*Growth, Import, Inequality, Inflation, Fiscal*	1.53

Note: The mean squared forecast errors (MSFE) reported in column 2 are the ones associated with the models in column 1. Each represents the lowest value MSFEs among those calculated from all possible models for each of *growth*, *export*, *import* and *inequality*.

The main findings of this experiment are as follows. First, bi-directional causality between *growth* and *inequality* still holds. Second, there is bi-directional causality between *growth* and *export* as well. This is interesting because most previous studies find uni-directional causality either from *export* to *growth* or from *growth* to *export*. However, the sample period, the data frequency and the empirical methods of those studies are different from ours. Furthermore, *export* and *import* cause each other. This may be interpreted as evidence in support of the foreign exchange constraint argument for export promotion. Third, *inflation* is important not only for *growth* and two components of trade (i.e. *export* and *import*) but also for *inequality*. Finally, while the real exchange rate appears to be an important determinant of *growth* and *import*, *investment* is important only for *import*. Also, interestingly, *import* and the *fiscal* variable seem to play a role in determining *inequality*.

C. *Conventional Granger Causality test results*

We also conduct conventional Granger causality tests based on in-sample estimation of relevant VAR models to further investigate the relationships among *growth*, *trade* and *inequality* and to examine the robustness of our

Table 6. Summary results of pairwise granger causality tests

Number of models in which	*Growth equation 1*	*Trade equation 2*	*Inequality equation 3*
Lagged '*growth*' is included as explanatory variable	96	64	64
Lagged '*trade*' is included as explanatory variable	64	96	64
Lagged '*inequality*' is included as explanatory variable	64	64	96
Growth Granger causes	–	11 (17.19%)	9 (14.06%)
Trade Granger causes	36 (56.25%)	–	11 (17.19%)
Inequality Granger causes	31 (48.44%)	1 (1.56%)	–

Note: In last three rows, the numbers in parentheses represent percentage of total number of models in which the relevant variable on the left column 'Granger causes' the variable in the top row. Thus, for example, in the fourth row '17.19%' implies that in 17.19 per cent of 64 models – in which lags of growth appear as explanatory variables of trade – there is evidence that growth Granger-causes trade.

findings in the previous sections. The multivariate generalization of the conventional Granger Causality Test is also called a 'block causality' test.[21] A likelihood ratio test is used to test the cross equation restrictions on the lags of the variables of interest. We conduct a pairwise Granger Causality Test by estimating each of the 128 possible VAR models, choosing the appropriate lag length based on the SIC. Note that each of the three variables of interest appears in 96 out of 128 models. In turn, with each variable in these 96 models, each of the other two variables appears only 64 times.

We report the summary results for how many times out of 64 a variable of interest 'Granger causes' the other. The results are presented in Table 6. Among all possible cases, we find the strongest evidence in favor of '*trade* Granger causes *growth*' (more than half of the time), followed by '*inequality* Granger causes *growth*' (almost half of the time). There is some evidence to support '*growth* Granger causes *trade*' and '*trade* Granger causes *inequality*' (one sixth of the time in each case). However, there is little evidence of *inequality* causing *trade*.

Conclusion

This paper examines the directions of causality among *trade*, *growth* and *inequality* in Bangladesh between 1971 and 2000. Models based on out-of-sample predictive ability criterion in a VAR framework find some evidence of bi-directional causality between *growth* and *inequality* and between *trade* and *growth*. That *growth* causes *trade* and that *trade* causes *inequality* are robust results. Evidence also suggests that *investment* growth is an important determinant of *trade*, and the *terms of trade* between agricultural products and manufacturing products is an important causal determinant of both *growth* and *trade*.

From the policy perspective, the results seem to suggest that while policies aimed at increasing trade openness may affect growth, policymakers should pay attention to the effects of greater trade on income distribution. Furthermore, the policymakers should also recognize the link between investment growth and trade, and of the structural change with growth and trade. However, to derive more concrete and precise policy implications we need to focus on the specific nature of the relationship between *trade* and *growth*, and between *trade* and income distribution. More specific policy suggestions will also require investigation of disaggregated level industries. Our future research intends to address those issues.

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Notes

[1] The New Industrial Policy (NIP) announced by the government in 1982 outlined reform measures that were aimed at promoting private sector-led industrialization. The Revised Industrial Policy (RIP) of 1986 re-emphasized the role of the private sector by further strengthening the incentives for private acquisition of public enterprises. Special incentives to attract foreign direct investment (FDI) and significant liberalization of import licensing were other measures that were intended to help the reform measures. The Industrial Policy of 1991 and trade policies of mid-1990s placed further emphasis on trade liberalization.

[2] We use the term 'causal relation' in the sense of 'Granger causality' as defined in Granger (1969, 1980). By using the percentage share of exports and imports in GDP as the trade variable in our empirical analysis, we are examining the relations among trade openness, growth, and wage inequality. As we will discuss in the third section, this measure of trade openness captures the effect of trade liberalization policy. Although the fact that the average tariff rate in Bangladesh decreased from 100 per cent in early 1980s to about 26 per cent in the late 1990s (see Berg & Krueger, 2003) may indicate that trade liberalization has contributed to increased trade openness, a formal validation of such a link is outside the scope of this paper.

[3] This method has recently been used by Krishna *et al.* (2003).

[4] Other notable examples include Dollar and Kraay (2003, 2004), Edwards (1998), Frankel and Romer (1999), Harrison (1996) and Islam (1995).

[5] Examples of recent works based on Kuznets' hypothesis include Chambers (2007), Lin *et al.* (2006), and Lopez (2006).

[6] Some prominent empirical and theoretical studies include Aghion and Bolton (1997), Alesina and Rodrik (1994), Bandyopadhyay and Basu (2005), Banerjee and Duflo (2000), Banerjee and Newman (1993), Barro (2000), Bertola (1993), Castello and Domeneh (2002), Forbes (2000), Galor and Zeira (1993), Persson and Tabellini (1994).

[7] Khan (1990) is an exception. He uses income elasticity of demand for food items to study income distribution.

[8] Some studies also use log of per capita real GDP. Since our objective is to focus on the interaction among trade, growth, and inequality, we use growth.

[9] The implicit assumption is that CPI for the working class reflects costs of living for workers engaged in manufacturing and construction, and CPI for rural families reflects the costs of living for workers engaged in agriculture and fishery, which are predominantly rural industries.

[10] This is to say that, on average, during the sample period the real value of a US dollar is equivalent to the real value of 8 Bangladeshi *taka*: what a dollar can buy in the US is equivalent to what 8 *taka* can buy in Bangladesh. In other words, \$1 can buy eight times more than what 1 *taka* can buy.

[11] See Granger (1980), Ashley *et al*. (1980) for early advocates; and Chao *et al*. (2001) and the references therein for more recent advocates.

[12] Our approach is very similar to Krishna *et al*. (2003)

[13] For a discussion on the usefulness of 'general-to-specific' approach, see Hendry (1995).

[14] There is no general rule as to how one chooses the maximum lag length to start with. Enders (2004: 192) suggests that one should 'start with a relatively long lag length…'. Some researchers use the following rule of thumb: start with a maximum lag length equal to the cube root of the number of observation which is 3. ($\cong \sqrt[3]{30}$) in our case. We also use other information criteria, such as the Akaike Information Criterion (AIC) or Hannan–Quinn Criterion (HQC). Most times these criteria choose the same lag length. Even for cases with different lag lengths selected by different criteria the ADF test results are qualitatively similar.

[15] In this form we are assuming that each element of y is an I(1) process and thus Δy is a vector of I(0) variables. In application, after determining the order of integration of each of *growth*, *trade*, *inequality*, *investment*, *inflation*, *fiscal*, *terms of trade* and *real exchange rate*, we will include the stationary forms of the respective variables in the vector Δy.

[16] As we can see from the table, the *MSFE* for Model 23 is the same. However, this is because of rounding of the value to the two decimal places. At five decimal places, MSFE for Model 22 is 12.15921 and MSFE for Model 23 is 12.15928.

[17] We also compare these best models with simple AR(1) models for *growth*, *trade* and *inequality* using a Diebold–Mariano (see Diebold & Mariano, 1995) type test. We use forecast errors from both models to construct the test statistics as follows (see Amato & Swanson, 2001; and MacCracken, 1999):

$$\mathrm{d}m = \frac{\sum_{t=1}^{P}\left(FE^2_{AR,t} - FE^2_{Best,t}\right)}{\sqrt{P} \times SE\left(FE^2_{AR,t} - FE^2_{Best,t}\right)}$$

Following a suggestion from Amato & Swanson (2001), we use unity as the 5 per cent critical value. We find that the best models outperform the simple AR model in all three cases.

[18] For a study using disaggregate level data, see Salim (2003).

[19] In fact, the trade ratio jumped from less than 20 per cent in 1991 to more than 30 per-cent in 1995.

[20] We find that *export* is an I(1) process and *import* is an I(0) process.

[21] For a discussion, see Enders (2004: 283–284).

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