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Dynamics of Income Inequality, Economic Growth, Globalization and Democracy: Empirical Evidence from Bangladesh

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Abstract

Income inequality has become a key issue in international development agenda in the recent years. In Bangladesh, rising income inequality is a major impediment to sustainable and inclusive economic development in spite of its achievement in several socio-economic indicators during last decades. The purpose of this paper is to examine the dynamics among income inequality, economic growth, globalization and democracy in Bangladesh using annual data from 1972-2016 applying innovation accounting approach without any prior restriction of theoretical imposition: generalized impulse response functions (GIRF) and generalized forecast error decomposition (GFEVD) methods. The empirical results show that democratization process in Bangladesh has positive effect in reducing income inequality and improving globalization. Evidence also suggests that globalization in Bangladesh not only accelerate economic growth but also promotes democracy. In brief, the study proposed that focusing on only market based economic liberalization even in presence of liberal democracy can results in economic growth but will sacrifice equity. Only transparent and accountable democracy is capable of tackling income inequality problem through egalitarian redistributive policies.

Keywords: Income Inequality, Economic Growth, Globalization, Democracy, Vector Autoregression (VAR), Generalized Impulse Responses Function (GIRF), Generalized Forecast Error Variance Decomposition (GFEVD), Bangladesh.

1. Introduction

Bangladesh has emerged as one of the most sustained growth economy in the world with exceptional social development progress over the last four and half decades since its independence in 1971. Despite political instability and

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problems in governance and institutions, it has fulfilled several targets in Millennium Development Goals (MDGs) regarding human development, food security, reducing poverty, and promoting gender equality (Chowdhury et al., 2013). Along with this progress in health and social sectors, the economy also grew at an average rate of 6.20 percent over the last decade (FY2005-06 to FY2014-15) and reached 7.28 percent GDP growth in FY2016-17 amidst persistent global economic uncertainties (BBS, 2017). Because of this phenomenal success the country is expecting to become a middle income nation by year 2021 and consequently a developed nation in 2041 (GED, 2012). However, despite these remarkable progress in socio-economic development indicators (see Table 1), widening income inequality is still a major impediment for Bangladesh to achieve sustainable and inclusive economic development (Asadullah, Savoia, & Mahmud, 2014; Chowdhury et al., 2013). From Table 1 we can observe that contrary to other socio-economic indicators, income inequality, measured by Gini index, has risen from 39.0 in 1990 to 43.2 in 2015, a substantial increase in any standard over the last 15 years. Zhuang, Kanbur, & Maligalig (2014) found that, during last decades inequality has increased steadily for many developing countries as poverty started to decline. Recent studies (Cornia & Court, 2001; Ravallion, 2006) show that rising inequalities can hinder poverty reduction agenda and in the long run will reduce investment in human capital and make prospects of economic growth unsustainable for developing nations.

Mainstream literatures (Ahmed, 2006) suggest that the socio-economic success in Bangladesh like South Asia region, pertains to the "Neo-liberal" development paradigm. After 1975, over the period of 1980s, abandoning the so called "socialist" experimentation of state controlled closed economy, Bangladesh embraced the development strategy of economic deregulation and trade liberalization (Ahmed & Sattar, 2004). In addition, as Bangladesh enters into the electoral democracy in 1991, the process accelerated by introducing more liberalized version of industrial policy attracting on private investment (Saidjada & Jahan, 2016). According to Ahmed (2006) these first-generation policy reforms, including global integration, macroeconomic stabilization, and economic deregulation have enhanced the role of the private sector as the engine of growth, makes business environment competitive, adaptive and creates opportunity of cultural, technological, and knowledge diffusion in society.

Table 1: Some selected social and economic development indicators

Year	1990					2015				
	GINI	*HDI*	*IMR*	*TFR*	*GDPPC*	*GINI*	*HDI*	*IMR*	*TFR*	*GDPPC*
Bangladesh	39.0	38.6	99.7	4.5	399.5	43.2	57.9	29.7	2.1	971.6
South Asia	43.1	43.8	91.7	4.3	548.8	44.0	62.1	40.3	2.5	1602.6
World	72.1	59.7	64.8	3.3	7163.5	64.6	71.7	31.4	2.5	10263.1

Notes: GINI denotes Gini index; *HDI* denotes Human Development Index; *IMR* denotes Infant mortality rate; *TFR* denotes Total fertility rate; *GDPPC* denotes real GDP per capita (constant 2010 US$);

Source: *GINI* (Lahoti, Jayadev, & Reddy, 2016); *HDI* (UNDP, 2016); *IMR*, *TFR*, and *GDPPC* (World Bank, 2017)

While it has been criticized that advocates of "Neo-liberal" development paradigm avoids the discussion of the effects of its economic policy on income inequality or accepts inequality as long as there is equality of opportunity in the society (Pieterse, 2002). According to Muhammad (2015) rising inequalities and poverty amidst of the "quantitative" economic success is the output of neoliberal reforms programs which helps primitive capital accumulation by appropriating common public resources and turning them into private property like other periphery countries of the world.

This study intends to examine the dynamics among income inequality, economic growth, globalization and democracy using econometric techniques which allows the investigation of interrelations among these variables without a priori commitment to any deterministic established theory. This paper differs from the existing studies in several ways; First, the study uses a long time series data set covering the period 1972-2016; Second, it does not aim to supplement the studies on the factors which may have contributed to income inequality in Bangladesh; Overall, this paper is an attempt of improvement over the early literatures in terms of the data used and techniques employed and I feel that such an effort is necessary and overdue given the gap that exists in the empirical literature pertaining to Bangladesh.

The rest of the paper is organized as follows: Section 2 provides a brief literature review, Section 3 describes the econometric methods and findings of the study, Section 4 presents discussion and conclusion.

2. Literature Review

Most of the scholars have studied the effects income inequality along with economic growth, globalization and democracy in separate literatures across several disciplines and mostly as deterministic process. But recently it has been found that income inequality does not follow a deterministic process (Piketty & Saez, 2014) and studying factors such as economic growth, globalization and democracy with income inequality separately will fail to capture the dynamics of the relation among these factors.

Conceptually income inequality is at the intersection of social sciences and philosophical inquiry. Discussion of unequal income distribution of a nation always invokes various economic, political, social and moral issues. Every discipline in social sciences has its own stylized understanding, assumptions and also different reasons to study distributional issues of income or wealth in a society. It will be futile to make sense of these vast amount of literatures in a small attempt like this. Here we will selectively discuss the general views of income inequality in the literatures within the realm of economics and sociology discipline to construct a conceptual framework for this study. There are two reasons for this approach: (1) before 1970s issues regarding distribution of income or wealth were the exclusive research agenda of sociology. Economists considered distributional problems as the secondary issues after undertaking the maximization of total output of an economy aka economic growth (Anderson, 2015; Grusky & Kanbur, 2006). So, any discussion regarding "non-monetary" causes of income inequality such as, social and political variables (i.e. educational qualifications of individuals or democracy) always lends to the stratification theory of sociology discipline (Collins, 2004); (2) after mid 1980s greater availability of both monetary and non-monetary data for developing countries (i.e. high quality household survey data sets) has extended the scope of application to the theories of sociological tradition (Grusky & Kanbur, 2006). Encompassing both economic and sociological theory Simpson (1990) synthesized three general genre of theories on the determinants of income inequality: (i) Modernization theory; (ii) Stratification theory; (iii) Dependency/World System theory.

Modernization theory, the most orthodox theoretical paradigm in social sciences till current time, explains the trajectory of prosperity of a nation typically in two ways: focusing on internal factors of a nation or society (i.e.

economic growth or sectoral development) or explaining changes caused by factors of globalization (i.e. diffusion of technology, culture or commercial trade and foreign direct investment etc.) (Chase-Dunn, 1975). In 1950s and 1960s with several subsequent literature economists Simon Kuznets empirically established the curvilinear relationship of between income inequality and economic growth, famously known as "Kuznets Curve" and popularize the notion of modernization theory as economic theory in neo-classical economic tradition. Kuznets (1963) showed that income inequality increases in the early stages of economic growth, reaches its peak, and then declines. That are the dynamics of inequality of a poor nation faces two stages. In first stage relatively, few individuals from the wealthier classes of the society accumulate wealth through entrepreneurship agenda attracting both local and foreign investments and by using these economic resources efficiently create severe spatial inequality in the society. In the second stage, inequality plunges due to the diffusion of "modern" knowledge and technology throughout the economy created in the first stage (Ahluwalia, 1976; Beer & Boswell, 2001).

In case of "non-economic" theories, the hypothesis dominating the current research (Burkhart, 2007) agenda that the nature of political system or institutions influence the income inequality situation of a country is rooted back in the work of Lenski's (1966) grand "stratification theory" proposed in his famous book *"Power and Privilege: A Theory of Social Stratification"*. Following the Marxian tradition of stratification theory, he categorized almost the entire range of human societies that have existed throughout world history according to the degree of economic inequality in them. According to him as societies moved from hunter-gatherer tribes to advanced industrialized nation-states, more *surplus* goods were produced after satisfying *basic needs* of its population. Subsequently, distribution of this surplus wealth of a society is determined by the political system and the balance of power within the society, not the economic system. In aristocracy, which monopolize power to small group of elites, irrespective of their technological base or affluence, creates opportunity for the elites to accumulate more wealth than the rest of the population. Whereas democracy, with political participation of middle class, and poor, allows for competition between social classes, thereby creating pressures and policies geared toward income equalization. That is the concentration of power determines the concentration of wealth. Thus Lenski's argument is to decrease wealth inequality the economic shift of a society from agrarian to industrial societies also have to be accompanied by a political shift

from aristocracy to democracy (Collins, 2004; Crenshaw, 1992; Milner, 1987; Simpson, 1990).

From 1970s until recent times, different studies (Bergesen & Bata, 2002; Chase-Dunn, 1975; Evans & Timberlake, 1980) attempted to explore the relationship of inequality within and between income countries with the forces of economic globalization.

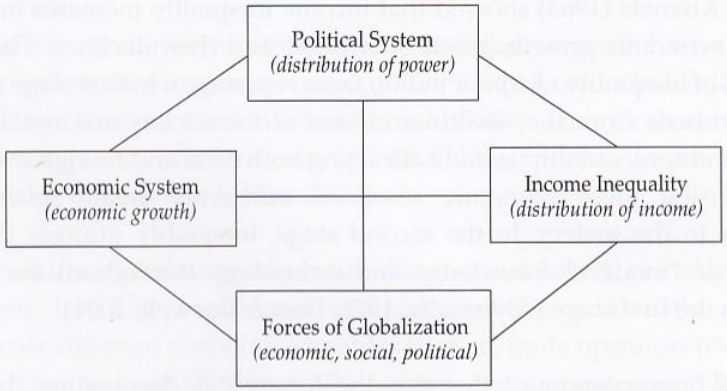

Figure 1: Nexus of income inequality, economic growth, globalization, and democracy

While most of the studies on globalization focus only on international trade, economic dualism, or domestic technological base following the tradition of modernization theory. But globalization has multiple economic, political, and cultural facets, important factors in the of free market economy such as FDI or state of foreign investment restrictions etc. must not be ignored in globalization-inequality studies. Criticizing this dominant theoretical paradigm, Wallerstein (1974a, 1974b) proposed world-system theory during 1970s, to explain the dynamics of development and inequality in the "capitalist world economy" in consequence of globalization. According to world-system theory there are two important categories of country: core regions (industrially advanced capitalist states) and peripheral regions (industrially undeveloped countries) (Martínez-Vela, 2001). The core regions have exclusive control over international trade and investment in peripheral regions and extract capital surpluses through unequal exchanges. On the other hand, peripheral regions' excessive reliance on foreign capital penetration such as, multinational corporations (MNCs) investments or foreign direct investment (FDI) with coercive labor policies creates uneven economic and social development which result in both global and domestic income inequality (Chase-Dunn, 1975; Evans & Timberlake, 1980).

Empirical literatures pertaining to Bangladesh regarding income inequality, and its relationship with macro-factors such as economic growth, globalization and democracy are sparse. Most of the studies (Ferdousi & Dehai, 2014; Islam & Khan, 1986; Uz Zaman & Akita, 2012) considered income inequality as deterministic output of some social or economic factors. However, Nath & Mamun (2007) examines the interrelationships wage inequality economic factors such as, economic growth and trade in a VAR framework without considering non-economic factors such as, political variables. Considering these methodological deficiencies in existing body of literatures I have designed this study to be more comprehensive in terms of theoretical underpinning by including both economic and noneconomic variables. Also, I have employed dynamic econometric techniques-innovation accounting approaches (IAA) through VAR models to capture the nexus of income inequality, economic growth, globalization and democracy in Bangladesh.

3. Econometric Methods and Results

3.1 Overview of the Data

This section describes the nature and broad characteristics of the data. The time period under study is 1972-2016. We begin our analysis by describing the measurement of variables (see Appendix A, Table A1 for a concise summary of variable definations and sources).

The income Gini index (*GINI*) for Bangladesh was obtained from the Global Consumption and Income Project (GCIP) (Lahoti et al., 2016). GCIP, a new dataset, released in 2016, consists of two related datasets: The Global Consumption Dataset (GCD) and The Global Income Dataset (GID). It uses existing secondary data sources such as, national statistical offices, UN agencies, academic studies and private sector databases to estimate the mean and distribution of income and consumption and also a Lorenz curve from this income/consumption profiles for any given year and country. Using the estimated Lorenz curve, inequality measures (also poverty measures) such as, Gini coefficient, ratio of mean to median, Palma ratio, Theil index, etc. are computed by constructing synthetic populations that consists of 100 "persons" of a "model population" of 10,000 persons from a certain country, each representing a percentile in that country's income distribution [see Lahoti, Jayadev, & Reddy (2016) for detail discussion on methodology]. Income Gini

coefficient of Bangladesh used in this study comes from the GID files of GCIP data sets.

Annual real GDP per capita (*GDPPC*), as a proxy for economic growth of Bangladesh, is obtained from World Development Indicators (WDI) database (World Bank, 2017). In this study *GDPPC* will be log transformed for ease of interpretation.

To capture the dynamics of globalization and democracy I have used two composite indices as proxy respectively, KOF Globalization Index (*GLOBAL*) developed by Dreher, Gaston, & Martens (2008) and Democracy Index (*DEMOC*) computed from the average of Political Rights Index and Civil Liberties Index of Freedom House (2017).

Phenomenon like globalization is a multidimensional aspect, not only in terms of economic but also social and political dimensions. Usually economic literatures use different economic variables such as, trade openness (export and import as percentage of GDP or GNI), foreign direct investment (FDI), MNC activities and investments, foreign aids or inflow and outflow of remittance separately and quantifiable social and political variables though scarcely to measure globalization. Gaston & Rajaguru (2009) identified two problems in using variables separately as globalization proxies in econometric model; First, the problem of mismeasurement and interpretation; Second, the issue of omitting important variables from the model. Composite indices, such as KOF Globalization Index used in this study can be an ideal way to avoid these methodological problem as well as to capture the dynamic nature of globalization which encompasses multitude of aspect in a single statistic without the fear of confounding effects of variation at lower levels of aggregation. The KOF Globalization Index (*GLOBAL*), used in this study, measures the three dimensions of globalization: economic, social, and political (see Appendix A, Table A2 for a summary each of the components).

In choosing proxies for democracy we have followed the norms of the existing literature in economics and used Freedom House data. Freedom House's project "Freedom in the World" methodology is based on the Universal Declaration of Human Rights of United Nation. It provides two sets of ratings, one on the level of political rights, and the other on civil liberties (see Appendix A, Table A2 for a summary each of the components). Conventionally, the

political rights ratings better approximate standard definitions of democracy than the civil liberties ratings. But civil liberties such as freedom of speech, association, and assembly are integral part of electoral democracy (USAID, 1998). In a country like Bangladesh both of these concepts are crucial to measure the status of democracy. So, as per relevant literatures (Burkhart & Lewis-Beck, 1994; Knack, 2004) I have used the average of these two ratings namely, Political Rights (PR) and Civil Liberties (CL) to compute Democracy Index (*DEMOC*). Originally, countries are rated on a 1 to 7 scale in both ratings, with higher values indicating less freedom. In the study, the scales are reversed before computation so that a higher value indicates a country is more democratic.

Inspection of the graphical presentation of the data should be the first step in any time series econometric analysis in order to understand the features of the data such as forms of trend, direction of trend, structural breaks and stationarity. The graphical presentation of the data is presented in Figure 2.

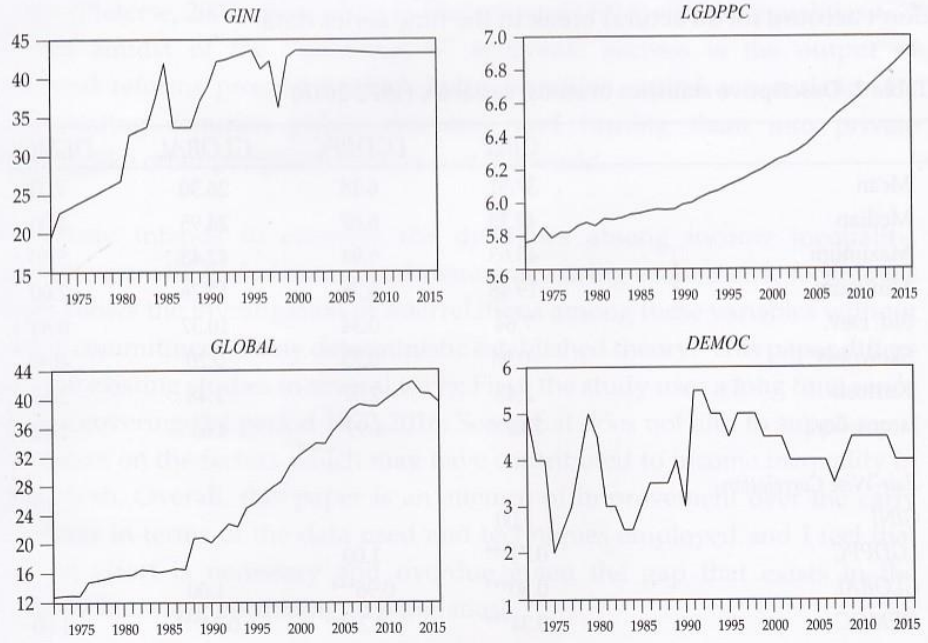

Figure 2. Trends of study variables: income Gini coefficient (*GINI*), log of real GDP per capita (*LGDPPC*), globalization index (*GLOBAL*), and democracy index (*DEMOC*) from 1972 to 2016.

LGDPPC and *GLOBAL* exhibit a linear distinct upward and deterministic trend in pattern; while *GINI* shows a volatile but slightly upward trend. The visual inspections show that the *GINI*, *LGDPPC*, and *GLOBAL* seems to have unit root problem. Overall the variables likely to have structural breaks.

Table 2 provides the descriptive statistics and pair-wise correlations results. The statistics of Jarque–Bera provide clear evidence that *LGDPPC*, *GLOBAL*, and *DEMOC* are having zero mean and finite covariance. This means that the variable *LGDPPC*, *GLOBAL*, and *DEMOC* are normally distributed. The findings of a pair-wise correlation shows that *LGDPPC*, *GLOBAL*, and *DEMOC* have statistically significant positive correlation with *GINI*. The correlation of *LGDPPC* with *GLOBAL* is also positive and statistically significant and the same is true for *GLOBAL* and *DEMOC*.

3.2 Integration Analysis

To determine the order of integration of variables, the analysis begins through applying unit root tests. At first, I have applied standard unit root tests which don't account for structural break in the time series data.

Table 2. Descriptive statistics of study variables (1972-2016)

	GINI	*LGDPPC*	*GLOBAL*	*DEMOC*
Mean	37.51	6.18	26.30	4.03
Median	42.25	6.07	24.95	4.00
Maximum	43.63	6.94	42.43	5.50
Minimum	19.48	5.76	12.76	2.00
Std. Dev.	7.64	0.34	10.37	0.84
Skewness	-0.98	0.75	0.20	-0.46
Kurtosis	2.48	2.37	1.48	2.65
Jarque-Bera	7.67**	4.99*	4.65*	1.82
Pair-Wise Correlations				
GINI	1.00			
LGDPPC	0.71***	1.00		
GLOBAL	0.80***	0.96***	1.00	
DEMOC	0.34***	0.26*	0.34***	1.00
N	45	45	45	45

***, **, and * denote 1, 5 and 10 percent significance levels, respectively.
Descriptive analysis has been carried out in EViews 10.

Three different unit root tests namely, augmented Dickey–Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests are applied to examine the integration level of the variables. What distinguishes these tests is the fact that the null hypothesis for the ADF and PP is the alternative hypothesis for the KPSS. The ADF and PP tests are tests for the null hypothesis of a unit root against the alternative hypothesis of a stationary process. The KPSS test considers instead the null hypothesis of stationarity versus the alternative hypothesis of a unit root (see Appendix A, Table A3 for a summary of the ADF, PP, and KPSS unit root tests result). Only *DEMOC* is stationary at their levels in both ADF and PP tests except *GINI* which is only stationary at level according to PP test. *LGDPPC* and *GLOBAL* is non-stationary at level but stationary at first difference in both ADF and PP tests. According to KPSS test, *GINI*, *LGDPPC*, and *DEMOC* support result with ADF test. But only in case of GINI the KPSS test result contradicts with PP test.

However, one of the main concerns in this study is to account for structural breaks in the econometric modelling. But standard ADF, PP, and KPSS unit root test described above cannot capture the impact of structural breaks in integration analysis. So, in addition to these standard unit root test, this study also performed three alternative unit root test to account for one structural breaks namely, Zivot-Andrews (ZA) (Zivot & Andrews, 1992), Lee-Strazicich (LS) (Lee & Strazicich, 2003, 2013), and Clemente-Montañés-Reyes (CMR) (Clemente, Montañés, & Reyes, 1998) tests (see Appendix A, Table A4 for a summary of these three test ZA, LS, and CMR unit root tests with one break result). Out of other three variables, only *DEMOC* is stationary at levels and *LGDPPC* and *GLOBAL* are stationary in first difference (non-stationary at levels) in ZA, LS and CMR tests. *GINI* is stationary at level in ZA but stationary at first difference in both LS and CMR test. In other words, it can be summarized that DEMOC is *I(0)* that is integrated at levels and *GINI*, *LGDPPC*, *GLOBAL* are *I(1)* which denotes that the time series are integrated at the first difference level.

3.3 Innovation Accounting Approach (IAA)

In order to examine dynamic relationship among income inequality, economic growth, globalization, and democracy without imposing any priori restriction on the econometric model we adopted Vector Autoregressive (VAR) model. VAR is a dynamic simultaneous equation model for analyzing interactions

among variables. In a VAR model all the variables are treated as endogenous and each endogenous variable is explained by its lagged or past values and the lagged values of all other endogenous variables included in the model.

The general mathematical form of an unrestricted VAR can be expressed as:

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + Bx_t + \varepsilon_t \quad (1)$$

where y_t is a k vector of endogenous variables, x_t is d vector of exogenous variables, $A_1, \ldots A_p$, and are matrices of coefficients to be estimated, and ε_t is a vector of innovations that may be contemporaneously correlated with each other but are uncorrelated with their own lagged values and uncorrelated with all of the right hand side variables.

However, directly interpreting the estimated coefficients of the VAR models may not be a proper strategy for its complicacy and uselessness. Hence, in this study I have used innovation accounting approach (IAA) which includes generalized impulse response functions (GIRF) and generalized forecast error variance decomposition (GFEVD) method proposed by Pesaran & Shin (1998) to interpret the dynamics of VAR model. Unlike standard "orthogonalized" approach, generalized approach is insensitive to the ordering of variables in the VAR system and thought to be superior method for conducting impulse response and forecast error decomposition analysis (Hurley, 2010).

But, before conducting GIRF and GFEVD analysis at first, I have estimated a VAR model. To estimate VAR model, I have to decide on several issues; First, I will use stationary data series in VAR model to explain GIRF. Second, as I want to incorporate structural break in the VAR model a formal structural break test needs to be done to locate the break year in VAR model; Third, I need to determine the optimal lag length of the VAR model.

3.3.1 Structural Break in VAR Model

I have employed the recent technique proposed by Qu & Perron (2007) (QP break test) which is designed to find endogenously determined unknown structural breaks in a system of equations. I use this test to determine whether there are any breaks in the dynamic structure of the VAR. Because I have relatively small sample of 45 years only one break has been allowed in estimation. The general unrestricted model considered by Qu and Perron is as follows:

$$y_t = \left(I \otimes y'_{t-1}\right) S\beta_j + u_t \tag{2}$$

where y_t is an n-vector of variables and y_{t-1} is a q-vector that includes the lagged variables from all equations, and $u_t \sim (0, \Sigma_j)$. S is an identity matrix of $nq \times p$ dimension with full column rank.

I have differenced the nonstationary variables *GINI, LGDPPC,* and *GLOBAL* consider the following VAR (1) model for QP test can be formulated as follows:

$$\begin{bmatrix} DGINI_t \\ DLGDPPC_t \\ DGLOBAL_t \\ DEMOC_t \end{bmatrix} = \left(I_4 \otimes (1\ DGINI_{t-1}\ DLGDPPC_{t-1}\ DGLOBAL_{t-1}\ DEMOC_{t-1})\right) S \begin{bmatrix} \beta_{1j} \\ \beta_{2j} \\ \vdots \\ \beta_{16j} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \\ u_{4t} \end{bmatrix} \tag{3}$$

(see Appendix A, Table A5 for the results which suggests the presence of a structural break in 1999).

Although, In the year 1999 Bangladesh experienced a sharp increase in income inequality (see Figure 3) which may be the effect of the aftermath of 1998 flood in Bangladesh. But the structural break in 1999 signifies the onset of economic growth revival and stabilization in income inequality after 1999 and most importantly after 1999 changes in all the data series become less volatile.

3.3.2 Lag Selection for VAR Model

After deciding upon modelling strategy, I have determined the optimal lag length of the models. In this context, the likelihood ratio, final prediction error, Akaike information criteria, Schwarz information criterion and Hannan-Quinn tests were used to determine the optimal (appropriate) lag length. According to the results of Table A6 in Appendix A, the optimal lag length was determined to be "1" for the model.

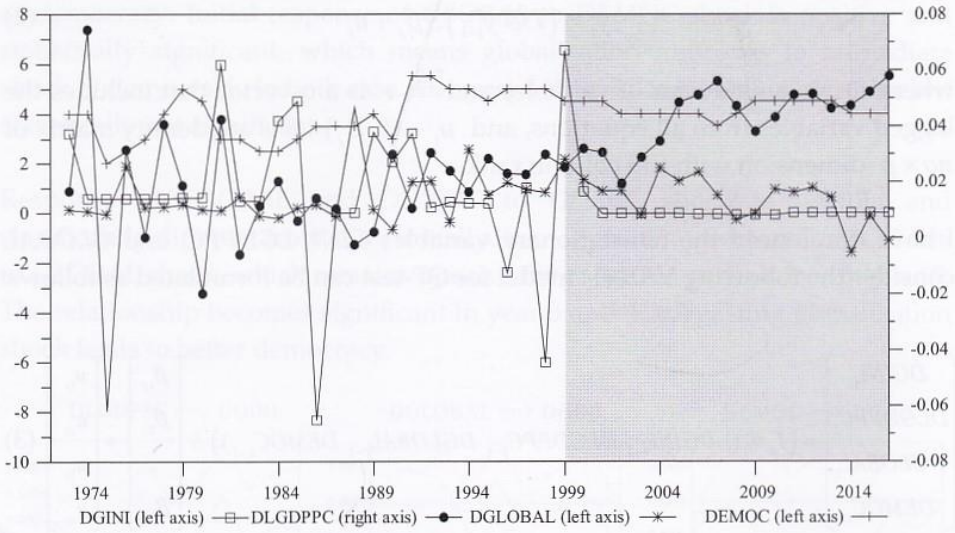

Figure 3: Time trends of endogenous variables of VAR (1) model (formulated for QP test)

Notes: The shaded area refers to the period after the year 1999 when the dummy variables are found from QP test (see Appendix A, Table A5).

3.3.3 VAR Estimation

After locating the structural break, the VAR model with one lag and structural break at 1999 as exogenous variable can be written as following:

$$\begin{bmatrix} DGINI(t) \\ DLGDPPC(t) \\ DGLOBAL(t) \\ DEMOC(t) \end{bmatrix} = \begin{bmatrix} \beta_{11,1} & \beta_{12,1} & \beta_{13,1} & \beta_{14,1} \\ \beta_{21,1} & \beta_{22,1} & \beta_{23,1} & \beta_{24,1} \\ \beta_{31,1} & \beta_{32,1} & \beta_{33,1} & \beta_{34,1} \\ \beta_{41,1} & \beta_{42,1} & \beta_{43,1} & \beta_{44,1} \end{bmatrix} \begin{bmatrix} DGINI(t-1) \\ DLGDPPC(t-1) \\ DGLOBAL(t-1) \\ DEMOC(t-1) \end{bmatrix} + \begin{bmatrix} \omega_1 \\ \omega_2 \\ \omega_3 \\ \omega_4 \end{bmatrix} DUM\_1999(t) + \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{bmatrix} C + \begin{bmatrix} u1(t) \\ u2(t) \\ u3(t) \\ u4(t) \end{bmatrix} \quad (4)$$

Estimated VAR coefficient can be expressed in following equation:

$$\begin{bmatrix} DGINI(t) \\ DLGDPPC(t) \\ DGLOBAL(t) \\ DEMOC(t) \end{bmatrix} = \begin{bmatrix} -0.215 & -7.464 & 0.059 & -0.221 \\ -0.000 & -0.422 & -0.002 & 0.006 \\ -0.013 & -9.628 & -0.041 & 0.192 \\ 0.013 & 1.422 & 0.008 & 0.661 \end{bmatrix} \begin{bmatrix} DGINI(t-1) \\ DLGDPPC(t-1) \\ DGLOBAL(t-1) \\ DEMOC(t-1) \end{bmatrix} + \begin{bmatrix} -0.545 \\ 0.036 \\ 0.010 \\ 0.026 \end{bmatrix} DUM\_1999(t) + \begin{bmatrix} 1.852 \\ 0.002 \\ 0.131 \\ 1.300 \end{bmatrix} C + \begin{bmatrix} u1(t) \\ u2(t) \\ u3(t) \\ u4(t) \end{bmatrix} \quad (5)$$

(see Appendix B, Figure B1 for reports that the inverse roots of AR characteristic polynomials lie within the unit circle). These findings indicate that there is no issue in terms of stability of the one-lag VAR model.

3.4 Generalized Impulse Responses Function (GIRF) Analysis

Impulse response functions are used to trace out the dynamic interaction among variables. It measures the dynamic reaction of the system to a shock or innovation of interest and focuses more on the increase or decrease in trend rather than the actual value of the variable. But, when the underlying data generating process (DGP) cannot be well approximated by a VAR process, IRFs derived from the model will be biased and misleading. Moreover, IRFs of the VAR model in levels are consistent estimators of their true impulse response functions both in the short- and medium-run, except in the longer run standard impulse responses do not converge to their true values (Phillips, 1998). To overcome these problems Jordà (2005) proposed an alternative method for computing IRFs based on local projections that do not require specification and estimation of the unknown true multivariate dynamic system itself and it also likely to adequately capture the cyclical response of a variable to an unexpected structural shock (Basher, Haug & Sadorsky, 2012). In this study we used this method local projection method to estimate GIRFs of VAR system. To construct error bands around GIRFs we used "conditional bands" approach proposed by Jordà (2009).

Figure 3 shows that initial impact (in year 0) of *DEMOC* shock on *GINI* is negative and statistically significant, which means income inequality tends to decrease after initial democracy shock. But after year 1 *GINI* shows positive response for one period and again drops and remain negative. Initial impact of *GDPGR* shock on *GINI* is also negative but statistically not significant. Overall response of *GINI* to *GDPPC* and *GLOBAL* shows small and volatile effect and most importantly not significantly different from zero.

Immediate response of *GDPPC* to *GLOBAL* shock is negative and statistically significant suggesting economic growth tends to decrease after initial shock of globalization. But just after the impact period (year 0) the response of *GDPPC* becomes positive and remains positive though statistically not significant. Whereas, the response of *GDPPC* to *DEMOC* shock in year 0 is positive and statistically significant which means economic growth benefits on initial shock

of democracy. Initial response of *GLOBAL* to *DEMOC* shock is positive and statistically significant, which means globalization improves to immediate shock of democracy. In both case after year 1 the response remains positive but statistically not significant.

Response of *GLOBAL* and *DEMOC* to *GDPPC* shock is volatile and significantly different from zero. Initially there is positive effect on *DEMOC* due to *GLOBAL* shock, which remains positive for entire ten periods except year 9. The relationship becomes significant in year 3 and 4, suggesting globalization shock leads to better democracy.

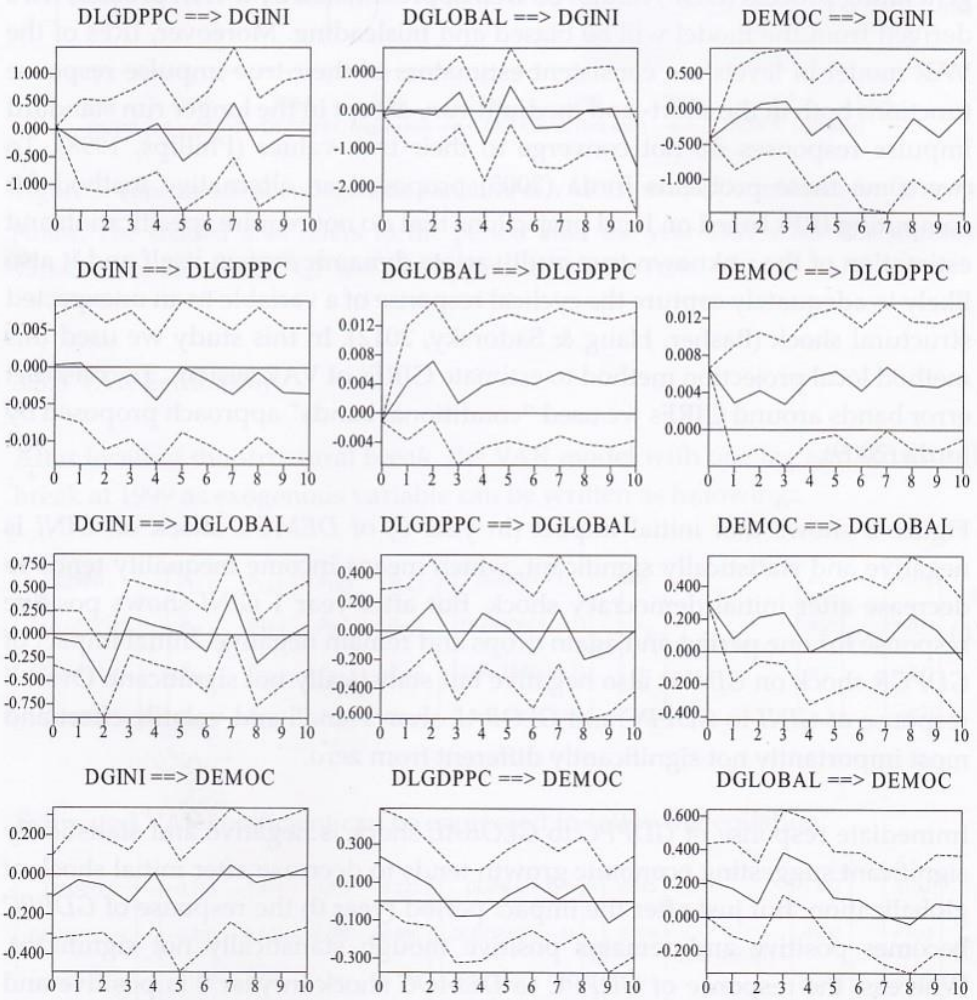

Figure 3. Generalized Impulse Responses Function (GIRF) result

Notes: The figure plots generalized impulse responses (solid line) and one standard deviation 95.0% confidence intervals (dotted lines). Impulse ==> Response; *D* before *GINI, LGDPPC,* and *GLOBAL* denotes first difference operator. IRFs are estimated by local projection method proposed by Jordà (2005) using EViews Add-ins LOCALIRFS developed by Ocakverdi (2016).

3.5 Generalized Forecast Error Variance Decomposition (GFEVD) Analysis

The generalized forecast variance decomposition (GFEVD) approach estimates the simultaneous shock effects using a VAR system to test the strength of causal relationship among the variables. It shows the extent to which a variable is explained by the innovations or shocks in all the variables in the system. Now turn to the results for the GFEVD analysis to observe the intensity of impulse responses findings in the previous section.

From Figure 4 and Table 3 it appears that, Except *DEMOC* other variable shocks have very negligible amount of contribution in explaining variations of *GINI*.

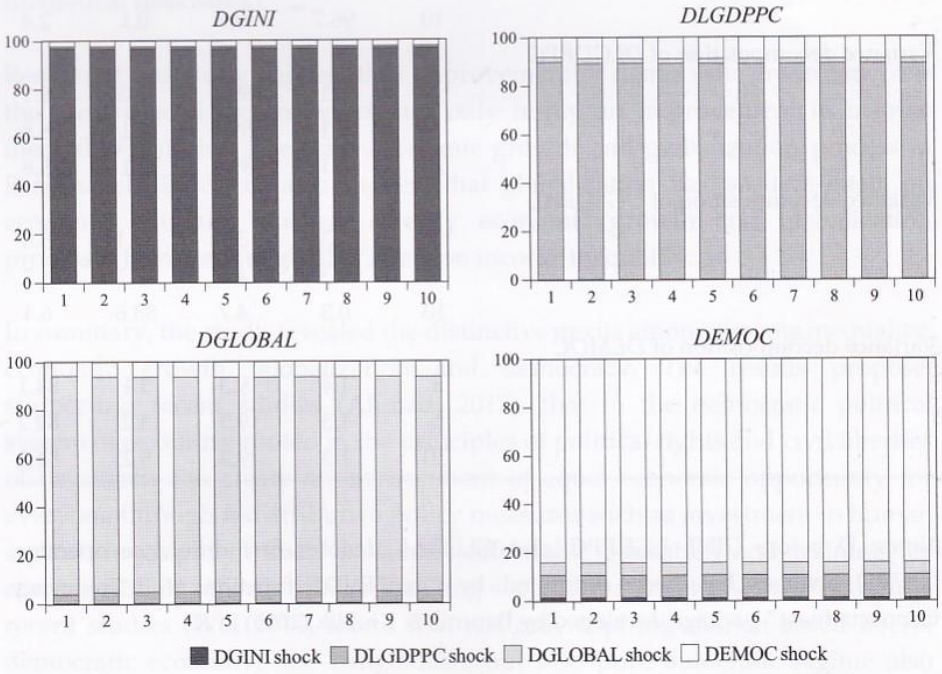

Figure 4. Generalized forecast error variance decomposition (GFEVD) results for 10 years horizon

Shock in *DEMOC* consistently explains variation in *GINI* which was about 2.2% in the first year-1 and increased to 2.4% in year-10. Whereas, shock in *DEMOC* explains more than 8% and shock in *GLOBAL* explains more than 2% variations in *GDPPC* over the 10-year period. Variations of *GLOBAL* explained by *DEMOC* shock and *GDPPC* shock increases from 5.8% in year-1 to 6.4% and 3.8% in year-1 to 4.7% in year-10, respectively. Although *GINI* shock has a negligible contribution in *GDPPC* and *GLOBAL* variations, but in it has consistently explains more than 1% variants in *DEMOC*. Other than *GINI*, shock in *GDPPC* and *GLOBAL* steadily explained the variations in *DEMOC* over the entire 10-year period more that 9% and about 5%, respectively.

Table 3: Generalized forecast error variance decomposition (GFEVD) results (in percentage) for 1, 5, and 10 year

Variance decomposition of *DGINI*					
	1	97.0	0.6	0.1	2.2
	5	96.8	0.7	0.1	2.4
	10	96.7	0.7	0.1	2.4
Variance decomposition of *DLGDPPC*					
	1	0.1	89.8	2.0	8.1
	5	0.1	89.0	2.1	8.8
	10	0.1	89.0	2.1	8.8
Variance decomposition of *DGLOBAL*					
	1	0.3	3.8	90.1	5.8
	5	0.3	4.7	88.7	6.3
	10	0.3	4.7	88.6	6.4
Variance decomposition of *DEMOC*					
	1	1.4	9.3	5.1	84.1
	5	1.3	9.3	5.2	84.2
	10	1.3	9.3	5.2	84.2

Notes: D before GINI, LGDPPC, and GLOBAL denotes first difference operator. GFEVD analysis has been computed by "genFEVD" function of "frequency Connectedness" package developed by Barunik & Krehlik (2015) in R.

The package can be found at https://github.com/tomaskrehlik/frequency Connectedness.

4. Discussions and Conclusion

Globally issues regarding income inequality emerged as the center of political and economic debate both in academia and popular media after the publication of the English version of "Capital in the 21st Century" by Thomas Piketty in 2014. Consequently, after decades of negligence in Millennium Development Goals (MDGs), international development also committed to reduce inequality, though vaguely, in the post-2015 development agenda—Sustainable Development Goals (SDGs).

Recognizing the problems of the rising income inequality in Bangladesh in the context of global development agenda in post-2015 era I have carried out a dynamic analysis of the interactions of income inequality, economic growth, globalization and democracy using the most up-to-date annual data available. My effort can be characterized in several ways; First, incorporation of structural break in the multivariate settings of a VAR model. Second, I have implemented IAA approach: GIRF and GFEVD techniques, without any prior restriction of theoretical imposition.

Results of this study suggest that improvement in democratic environment is the most crucial factors which not only imply an improvement in income inequality but also accelerate economic growth and globalization process in Bangladesh. Evidence also suggest that globalization has positive effect on economic growth. Whereas directly economic growth and globalization processes have very negligible effect on income inequality.

In summary, the study revealed the distinctive nexus among income inequality, economic growth, globalization and democracy. The results propose, supporting recent studies (Ahmad, 2017), that in the democratic political system of a country rooted in the principles of political rights and civil liberties of its citizen can create an environment of equal economic opportunity for everyone through redistributive policy measures such as investment in human capital development such as quality affordable education and training for earning skill or other income-equalizing social transfers etc. Notwithstanding, recent studies (Wu, 2014) found that not only aspiring market-based liberal democratic economy, like Bangladesh, but also pure autocratic regime also impact globalization process positively. Because market-based reforms such as economic deregulation and trade liberalization to create a favorable

environment for business and commerce benefit only economic growth prospects but these benefits fail transcend to the poorer segment of population. Democratization process needs to be transparent and accountable in its implementation of these economic liberalization to eliminate corruption and the rent-seeking behaviors to distribute the fruits of globalization through inclusive economic growth.

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Appendix A
Data description & preliminary analysis

Table A1: Data sources and notes

Label	Definition/Notes	Sources
GINI	Income Gini coefficient	Global Consumption and Income Project (Lahoti et al., 2016)
GDPPC	GDP per capita (constant 2010 US$)	World Development Indicators (World Bank, 2017)
GLOBAL	Globalization index	KOF Index of Globalization (Dreher et al., 2008)
DEMOC	Annual Democracy index (average of Political Rights and Civil Liberties (CL) ratings)	Freedom House Index (Freedom House, 2017a)

Notes: Globalization index data are available for the period 1970 – 2014 and Gini index are available for 1960 – 2015. Globalization index data for 2015 and 1016 and Gini index for 2016 have been linearly extrapolated using Microsoft Excel 2016's TREND function from last 3 years' index value. Globalization index data are retrieved from www.globalization.kof.ethz.ch (accessed at September 10, 2017)

Table A2: Components of Globalization Index (GLOBAL) and Democracy Index (DEMOC)

KOF Globalization Index (*GLOBAL*)	Freedom House Democracy Index (*DEMOC*)
(I) Economic dimension	(I) Political Rights
Actual economic flow (% GDP)	Electoral process
Trade	Political pluralism & participation
FDI & portfolio investment	Functioning of government
Income payments to foreign nationals	(II) Civil liberties
Economic restrictions	Freedom of expression and belief
Hidden import barriers	Associational and organizational rights
Mean tariff rate	Rule of law
Taxes on international trade (% current revenue) Capital account restrictions	Personal autonomy and individual rights
(II)Social dimension	
Personal contact	
Telephone Traffic	

Inflows and outflows of transfers (% GDP)
International tourism
Foreign population (% population)
International letters (per capita)

Information flow

Television and internet Users (per 100 people)
Trade in Newspapers (% GDP)

Cultural proximity

McDonald's & Ikea (per 100'000 people)
Trade in books (% GDP)

(III) Political dimension

Embassies in country
Membership in international organizations
Participation in U.N. Security Council Missions
International treaties

Source: Dreher et al. (2008); Freedom House (2017b)

Table A3: Unit root tests (without break) results of the study variables

Statistics (Levels)				
	GINI	*LGDPPC*	*GLOBAL*	*DEMOC*
τ_T (ADF)	-2.30	1.68	-1.58	-3.49
τ_μ (ADF)	-2.38	6.08	-0.37	-3.06*
τ (ADF)	0.99	1.77	3.48	-0.79
τ_T (PP)	-2.15	1.89	-1.65	-3.49
τ_μ (PP)	-3.28*	8.08	-0.37	-3.13*
τ (PP)	1.34	5.97	3.16	-0.73
η_t (KPSS)	0.21*	0.22**	0.14	0.10
η_u (KPSS)	0.73*	0.82**	0.83**	0.31
Statistics (First difference)				
	DGINI	*DLGDPPC*	*DGLOBAL*	*DDEMOC*
τ_T (ADF)	-8.12**	-9.71**	-6.05**	-5.65**
τ_μ (ADF)	-7.89**	-1.17	-6.15**	-5.68**
τ (ADF)	-7.61**	0.47	-1.75	-5.72**
τ_T (PP)	-13.85**	-9.88**	-6.05**	-8.18**
τ_μ (PP)	-8.06**	-6.39**	-6.15**	-8.34**
τ (PP)	-7.62**	-3.11**	-4.96**	-8.49**
η_t (KPSS)	0.22*	0.11	0.20*	0.11
η_u (KPSS)	0.47*	0.12	0.20	0.12

Notes: and represents the most general model with a drift and trend; and is the model with a drift and without trend; is the most restricted model without a drift and trend; The lags for the ADF test are determined by AIC set to maximum 3. In PP test bandwidths are automatically selected by Newey-West bandwidth method determined by Bartlett-Kernel spectral estimation method. ** and * denote rejection of the null hypothesis at the 1 and 5 percent levels, respectively. Tests for unit roots have been carried out in EViews 10.

Table A4: Unit root tests results with break of the study variables

Statistics (Levels)					
		GINI	*LGDPPC*	*GLOBAL*	*DEMOC*
τ_A (ZA)	t- statistic	-4.44	-0.19	-2.68	-5.27*
	$\hat{T}_B$	(1980)	(2004)	(1993)	(1990)
τ_B (ZA)	t-statistic	-4.50*	-1.84	-2.05	-4.12
	$\hat{T}_B$	(1992)	(1997)	(2010)	(1994)
τ_C (ZA)	t-statistic	-4.54	-1.71	-2.17	-5.33*
	$\hat{T}_B$	(1990)	(1996)	(2010)	(1990)
τ_A (LS)	t-statistic	-2.56	-0.49	-1.24	-4.46**
	$\hat{T}_B$	(1980)	(1981)	(1998)	(1990)
τ_C (LS)	t-statistic	-4.16	-2.14	-2.20	-4.69*
	$\hat{T}_B$	(1995)	(1997)	(1997)	(1990)
AO (CMR)	t-statistic	-3.33	-1.90	-2.57	-5.18**
	$\hat{T}_B$	(1986)	(2009)	(1996)	(1988)
IO (CMR)	t-statistic	-3.93	1.97	-2.92	-5.77**
	$\hat{T}_B$	(1979)	(2003)	(1986)	(1989)
Statistics (First difference)					
		DGINI	*DLGDPPC*	*DGLOBAL*	*DDEMOC*
τ_A (ZA)	t-statistic	-8.61**	-10.88**	-7.77**	-6.07**
	$\hat{T}_B$	(1985)	(2004)	(1987)	(1996)
τ_B (ZA)	t-statistic	-8.08**	-11.23**	-7.69**	-5.67**
	$\hat{T}_B$	(1981)	(1987)	(2005)	(1991)
τ_C (ZA)	t-statistic	-8.95**	-11.41**	-7.69**	-6.22**
	$\hat{T}_B$	(1985)	(1989)	(1987)	(1985)
τ_A (LS)	t-statistic	-7.59**	-8.73**	-6.18**	-5.78**
	$\hat{T}_B$	(1987)	(2004)	(1990)	(1992)

τ_C (LS)	t-statistic	-7.72**	-8.78**	-7.61**	-5.96**
	$\hat{T}_B$	(1991)	(2004)	(1997)	(1981)
AO (CMR)	t-statistic	-4.49**	-10.15**	-7.11**	-8.09**
	$\hat{T}_B$	(1983)	(2002)	(2011)	(1976)
IO (CMR)	t-statistic	-9.06**	-9.98**	-6.44**	-5.68**
	$\hat{T}_B$	(1984)	(2003)	(1986)	(1975)

Notes: ZA stands for Zivot & Andrews (1992) unit root test; LS stands for Lee & Strazicich (2013) LM unit root test with one break; CMR stands for modified Clemente, Montañés, & Reyes (1998) unit root test with one break (Baum, 2005); τA represents model with change in the intercept; τB is model with change in the trend; τC is the model with change in both the intercept and the trend; AO means additive outlier model and IO means innovational outlier model; denotes break year; The critical values for the LS unit-root test with one break are tabulated in Lee & Strazicich (2013, Table 1); The critical values for the modified CMR unit-root test with one break are taken from Perron & Vogelsang (1992, Table 3 and 4 from T=50); ** and * denote rejection of the null hypothesis at the 1 and 5 percent levels, respectively. ZA and LS unit root tests have been carried out in WinRATS Pro (v.8.00) using RATS procedure developed by Doan (2003) and (2008), respectively; Modified CMR unit root test has been conducted in Stata 15 using Stata routine developed by Baum (2004).

Table A5: QP test for structural breaks in VAR model

VAR Model	$\hat{T}_B$	95% CI		SupLR	WDmax
		Low	*High*		
DGINI, DLGDPPC, DGLOBAL, DEMOC	1999	1997	2000	44.658***	44.658***

Note: (1) Time series model: unrestricted VAR (1) without constant; (2) M (number of break) =1; (3) Sample trimming = 0.20; (4) The covariance matrix of the errors is not allowed to change. (6) The error is serially uncorrelated; (7) The distribution of the regressors is allowed to change; (8) Pre-whitening with VAR (1) when constructing confidence intervals; denotes estimated break year; The test has been conducted in Gauss 10 using the code written by Qu & Perron (2007). The programs can be found at http://people.bu.edu/perron/code.html. *, ** and *** denote significance at the 10, 5 and 1% levels, respectively.

Table A6: Test results of the lag length selection for the VAR model

VAR model	Lag	LR	AIC	SC	HQ
DGINI, DLGDPPC, DGLOBAL, DEMOC, DUM_1999	1	38.70*	3.95*	4.95	4.32*

Notes: LR: sequential modified LR test statistic (each test at 5% level); AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion; * indicates lag order selected by the criterion; The test has been carried out in Eviews 10.

Appendix B
Stability analysis of the VAR model

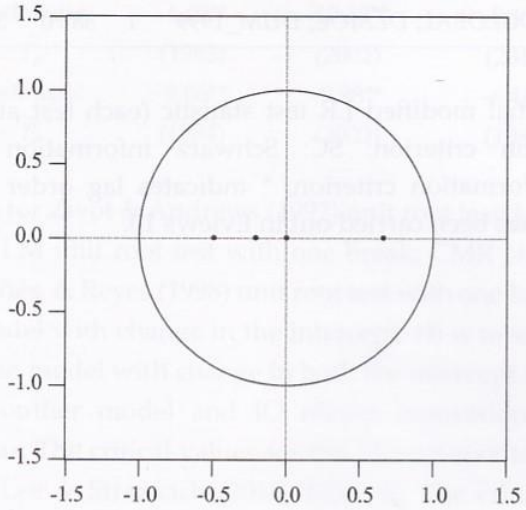

Figure B1: Inverse Roots of AR Characteristic Polynomial