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Determining the Ideological Approach of Finance-Growth Nexus in Bangladesh: New Evidence from Dynamic Factor Based Causality Approach

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Abstract

Applying an alternative econometric approach, this paper evaluates the long-run causal relationship between the Quantum Index of Manufacturing (QIM) and financial development. We use monthly data of Bangladesh for the period from 2004 to 2017 and apply dynamic factor model (DFM) and vector auto-regression (VAR) based Granger causality approach. Following the results of DFM, two factors, named as 'Stock Market' and 'Banking Sector' are formed with their respective variables or indicators. Results of factors-and-VAR based Granger causality exhibit a bidirectional relationship between QIM and 'Banking Sector' significantly causing each other. There are strong evidences that Bangladesh government has long been employing huge policy efforts (under neoliberal structural adjustment) on fostering supply leading approach, to increase industrial production by developing its stock market. But result shows a unidirectional and demand following relationship; the stock market is being developed in response to the demand of industrial production only. Since the existing relationship does not support government's policy, its efforts might be missing due to the market's deregulation-led inefficient and instable deepening. So, Bangladesh government should leave the ideology of fostering supply leading approach to economic growth and adopt policy efforts to let the demand following relationship function.

Keywords: Banking Sector, Stock Market, Industrial Production, Bangladesh Economy, Dynamic Factor Based Causality, Demand-following, and Supply-leading Approach.

1. Introduction

Finance-growth nexus is an evergreen research issue across the countries, and talking about this issue the economists are intensely divided among themselves. Debate on the issue has long been continuing due to disproportionate or unverified use of different statistical methods, time period and country

differences, specialization of financial sectors, availability of numerous financial measurements and their different integrations or combinations. Enormous researches have already been done on the relationship between financial sector development and economic growth. The research issue is now in a kind of 'sleeping mode'. But policy changes like the 1980 financial liberalization and the historical event or crisis like the 1929 great depression or the 2008 great recession, rejuvenate the debate or the research issue by bringing new dimensions into it.

The relationship between the development of financial sector and economic growth follows two ideological approaches—either fostering supply-leading or promoting demand-following or both. Whatever the existing relationship, promoting the supply leading or demand following approach has been an ideological matter as it is now the matter of supports and beliefs with regardless of real historical evidences. Schumpeter (1911) first focused on the supply-leading relationship which refers to accelerating economic growth by developing financial sector. Conversely, Robinson (1952), Friedman and Schwartz (1963), and Stiglitz (1994) promoted the demand-following relationship—developing financial sector in response to the demand of a country's economic growth or activities. Other scholars Adams (1819) and Hicks (1969) are also convinced that financial development follows economic growth.

The empirical researches that evidence the supply leading relationship are, for examples, McKinnon (1973), Levine (1997, 2005), Ngugi and Kabub (1998), Wachtel (2001), Ndebbio (2004), Abaid et al. (2004), FitzGerald (2006), Loayza and Ranciere (2006), Ang (2008), Feyzioglu et al. (2009),and Ray (2013). The findings of these researches usually conclude that the financial development, along with its efficiency and stability, accelerates economic growth. Of them, McKinnon (1973), Kabub (1998), Ndebbio (2004), and Abaid et al. (2004) directly support the policy changes like the financial liberalization. They were intended to demonstrating that the strength of the positive effect of financial deepening on economic growth increases further due to financial liberalizations and market deregulation. So, it is revealed that there is a clear association between the promotion of the supply-leading approach to economic growth and the implementation of the financial liberalization and market deregulations program. But we are not driven by any kind of beliefs that the financial sector will be efficient and stable. Based on evidences, this paper will be convinced to propose an appropriate ideological approach of finance-growth nexus for Bangladesh.

Because, the most motivated supply-leading approach is heavily vulnerable/prone to the sectors' volatilities, policy changes and economic/financial crisis. There are some historical evidences which suggest that such kind of policy changes and financial crisis make the supply-leading approach failed by fostering a big sized financial sector and excessive finance. For examples, Tobin (1984), Rajan (2005), Johnson (2009), Arcand et al. (2012), Rachdi (2014), and Hossain (2016) showed that policy changes, like financial liberalization, adopted in the 1980s pose the potential danger of large financial sector. As a result, excessive finance causes negative effects on economic growth in both developed and developing countries.

On the contrary, some historical country-specific evidences, for examples, Guryay et al. (2007), Güryay, Safakli and Tuzel (2007), Ndlovn (2013), and Sami (2013) illustrated the demand-following relationship, i.e. finance follows growth. Some other researches, for examples, Lewis (1955), Patrick (1966), and Saad (2014) disclosed bidirectional (both supply-leading and demand-following) relationship between the development of financial sector and economic growth. During the period of 1976-2012, Shahbaz et al. (2015) used quarterly data and found that the relationship is two-way in Bangladesh but capitalization impedes the economic growth. For the same country, Hossain et al. (2015) found a two-way relationship of economic growth with bank credit deepening but no relationship with stock market capitalization during the period of 1990 – 2013.

Under the capitalist ideology (led by World Bank and IMF), huge policy efforts have already been implemented to increase economic growth and prosperity by fostering the development of

financial sector.[1]In the broader context, Bangladesh has been implementing neoliberal structural adjustment policies (NSAP) since the early 1980s (Nuruzzaman, 2004). Being a part of the NSAP, Financial Sector Reform Program (FSR) took place to support the supply leading approach during the same period (Bhattacharya and Chowdhury, 2003); and it is being continued and advanced by the all consecutive government in Bangladesh. See Quadir (2000), Bhattacharya and Chowdhury (2003), and Nuruzzaman (2004) for more details about NSAP and FSR, and their social, economic and political negative consequences in Bangladesh. There are strong recent evidences[2] that, under NSAP, the supply leading approach coupled with default loans and market crisis is still being promoted at the cost of public (taxpayers') money by the present government, lasting more than 10 (ten) years. Therefore, checking whether its policy efforts are working or not, are vital to recognise the existing finance-growth nexus in Bangladesh.

To measure the development of financial sector, the World Bank's Global Development Indicators Database developed a framework with four sets of proxy variables characterizing a well-functioning financial system under two subsectors- financial institution and financial market. Depth, access, efficiency and stability are those four dimensions used to measure the development of a financial system. Under each dimension, there are many proxy variables or indicators. To keep the study simple, most of the existing studies, especially for Bangladesh, have considered only one or two indicators separately into their models to explain the development of financial sector. Regrettably, it is not enough to consider one or two indicators to represent the whole financial sectors.

Since the late 1970s, successive waves of financial innovations have made the measurement of the development of financial sector very difficult by using a fewer number of indicators separately. Thus, we should consider more indicators or dimensions to measure the financial sectors and keep them together in the nexus model. Targeting the objective, Hossain et al. (2017) applied an ordinary Factor Model by considering the interaction and joint effects of those. But this ordinary factor model might not appropriate for time series data as the factor process also varies in time (Geweke, 1977). There is a dynamic part, the auto-regressive process of the factors, should be added to the usual factor model and the resulted model is called a dynamic factor model (Coppi and Zannella, 1978).

By using the dynamic factor based causality approach, this study is intended to finding the existing nature of finance-growth nexus in Bangladesh during the period from 2004 to 2017. The development of financial sector is proxied by eight indicators—one from each dimension of both banking sector and stock market. The economic growth of Bangladesh is proxied by Quantum Index of Manufacturing (QIM). Using monthly data, this study specifically applies dynamic factor model to derive a fewer number of dynamic (financial) factors from those eight financial indicators; that is, the model is used to address the unaddressed issue of multidimensionality problem in measuring the financial development. With QIM and relevant control variables, the estimated dynamic factors are then put into the VAR based causality approach for identifying the existing nature of the finance-growth nexus. Finally, a rigorous discussion and conclusion are drawn to propose an appropriate ideological approach of the finance-growth nexus to be followed in Bangladesh.

[1]Following the supply-leading approach, as results, the financial sector of Bangladesh has already formed an empire over its economy; where the economic activities are controlled by the financial world. Bangladesh has long been following and practicing this capitalist ideology.

[2]The Daily Star, March 13, 2018: Assistant Editor, Syed Mansur Hashim questioned, "Why the endless bailouts of state-owned banks." The same daily newspaper on June 5, 2018 reported that government might inject BD TK 2000 crore in the next FY to help them tackle capital deficit. The Daily Sun (June 2, 2018) reported, "For making the country's capital market vibrant, Finance Minister is likely to propose reducing corporate tax for listed companies and reducing turnover tax for transaction in the next budget."

2. Alternative Econometric Approaches

The alternative approach is used to identify and quantify a smaller number of financial factors which explain the development of financial sector proxied by indicators of the banking and stock market. The approach finally explores the directional relationships among these underlying financial factors and economic grow, proxied by QIM, in Bangladesh for the time period of 2003-2016. The approach includes the dynamic factor model, VAR model and Granger Causality.

Factor analysis uses mathematical procedures for the simplification of interrelated measures to discover patterns in a set of variables (Child, 2006). Attempting to discover the simplest method of interpretation of observed data is known as parsimony, and this is essentially the aim of factor analysis (Harman, 1976). Factor analysis is useful for studies that involve a few or hundreds of variables which can be reduced to a smaller set, to get at an underlying concept, and to facilitate interpretations (Rummel, 1970). Factor coefficients are used to obtain factor scores for selected factors. The factors with eigenvalues greater than one are employed in multiple regression analysis (Eyduran*et al.,* 2009).Though it is easier to focus on some key factors rather than having to consider too many variables by replacing variables into meaningful categories by the factor analysis, this ordinary version of factor analysis is assumed to apply to cross sectional and multivariate normal data. But our problem considers or forms a multiple time series. Again, the static model proposed by Chamberlain and Rotschild (1983) requires orthogonality of the idiosyncratic components, but it allows infinite cross-section dimension. The dynamic model proposed by Forni *et al.* (2000) is more general, as it allows non-orthogonal idiosyncratic components and has the possibility to handle the dynamics of large cross-section units. The dynamic factor model can be applied to weakly stationary[3] (covariance-stationary) multivariate time series.

2.1. Dynamic Factor Model (DFM)

Dynamic factor models were originally proposed by Geweke (1977) as a time-series extension of factor models previously developed for cross-sectional data. The DFM framework has been introduced and developed by Coppi and Zannella (1978), and the re-examined by Coppi et al. (1986) and Corazziari (1997). The principle of a dynamic factor model is that a few latent dynamic factors, f_t, drive the co-movements of a high-dimensional vector of time-series variables, X_t, which is also affected by a vector of mean-zero idiosyncratic disturbances, e_t. These idiosyncratic disturbances arise from measurement error and from special features that are specific to an individual series. The latent factors follow a time series process, which is commonly taken to be a vector autoregression (VAR).
In equations, the dynamic factor model is,

$$X_t = \lambda(L) f_t + e_t ... \tag{1}$$

$$f_t = \Psi(L) f_{t-1} + \eta_t .. \tag{2}$$

where there are N series, so X_t and e_t are $N \times 1$, there are q dynamic factors so f_t and η_t are $q \times 1$, L is the lag operator, and the lag polynomial matrices $\lambda(L)$ and $\Psi(L)$ are $N \times q$ and $q \times q$, respectively. The i^{th} lag polynomial $\lambda_i(L)$ is called the dynamic factor loading for the i^{th} series, X_{it}, and $\lambda_i(L) f_t$ is called the common component of the i^{th} series. It is assumed that all the processes in (i) *and* (ii) are stationary. The idiosyncratic disturbances are assumed to be uncorrelated with the factor innovations at

[3] The stationary properties of the considered variables or financial indicators will be examined by using Augmented Dickey-Fuller (ADF), (Dickey & Fuller, 1979 &1981) and Phillips-Perron (PP), (Perron, 1989 & 1990) Unit root tests. As we compiled the monthly data, the process of seasonality identification and remedial will be completed by using dummy variable model. But these tests are not theoretically discussed here; for more details, interested readers can follow Gujarati *et al.* (2009).

all leads and lags, that is, $Ee_t\eta'_{t-k}=0$ for all k. In the so-called exact dynamic factor model, the idiosyncratic disturbances are assumed to be mutually uncorrelated at all leads and lags, that is, $Ee_{it}e_{js}=0$ for all s if $i\neq j$.

The first step [4]in implementing this approach is to write the DFM as a linear state space model as follows. Let p be the degree of the lag polynomial matrix $\lambda(L)$, let $F_t=\left(f_t', f_{t-1}',\ldots,f_{t-p}'\right)$ denote an $r\times 1$ vector, and let $\Lambda=\left(\lambda_0,\lambda_1,\ldots,\lambda_p\right)$, where λ_i is the $N\times q$ matrix of coefficients on the i^{th} lag in $\lambda(L)$. Similarly, let $\Phi(L)$ be the matrix consisting of 1's, 0's, and the elements of $\psi(L)$ such that the vector autoregression in (ii) is rewritten in terms of F_t.With this notation the DFM (i) and (ii) can be rewritten,

$$X_t=\Lambda f_t+e_t. \tag{3}$$

$$\Phi(L)F_t=G\eta_t.. \tag{4}$$

where G is a matrix of 1's and 0's chosen so that (iv) and (ii) are equivalent. Equations (iii) and (iv) are referred to as the "static form" of the DFM because the factors appear to enter only contemporaneously, although this is just a notational artifact since the static factors F_t contain current and past values of the dynamic factors f_t. The linear state space model is completed by specifying a process for e_t and for the errors η_t. Typically the errors e_t are assumed to follow univariate autoregressions,

$$d_i(L)e_t=\zeta_{it}, i=1,...,N.. \tag{5}$$

With the further assumptions that ξ_{it} is i.i.d. $N\left(0,\sigma_{\xi_i}^2\right), i=1,\ldots,N$, $i=1,\ldots,N$, η_{jt} is i.i.d. $N\left(0,\sigma_{\eta_j}^2\right), j=1,\ldots,q$ and $\{\xi_t\}$ and $\{\eta_t\}$ are independent, equations $(iii)-(v)$ constitute a complete linear state space model. Given the parameters, the Kalman filter can be used to compute the likelihood and to estimate filtered values of F_t and thus of f_t.

An advantage of this parametric state space formulation is that it can handle data irregularities. For example, if some series are observed weekly and some are observed monthly, the latent process for the factor (iv) can be formulated as evolving on a weekly time scale, but the dimension of the measurement equation (iii) depends on which series are actually observed, that is, the row dimension of Λ would change depending on the variables actually observed at a given date; see Harvey (1989, p. 325) for a general discussion. The EM algorithm can be used to compute the MLEs[5] of the parameters.

Three methods have been proposed for formal estimation of the number of dynamic factors. Hallin and Liska (2007) propose a frequency-domain procedure based on the observation that the rank of the spectrum of the common component of X_t is q. Bai and Ng (2007) propose an estimator based on the observation that the innovation variance matrix in the population VAR has rank q. Their procedure entails first estimating the sample VAR by regressing the principal components estimator on

[4]Early time-domain estimation of dynamic factor models used the Kalman filter to compute the Gaussian likelihood, estimated the parameters by maximum likelihood, and then used the Kalman filter and smoother to obtain efficient estimates of the factors (Engle and Watson, 1981 & 1983; Stock and Watson, 2009; Sargent, 1989; and Quah and Sargent, 1993).

[5] Nevertheless, the number of parameters is proportional to N, so direct estimation of the coefficients by MLE is cumbersome and historically was prohibitive for large systems. The second and third generations of estimators are not discussed here.

its lags, then comparing the eigenvalues of the residual variance matrix from this VAR to a shrinking bound that depends on (N,T). Amenguel and Watson's (2007) estimator is based on noting that, in a regression of X_t on past values of F_t, the residuals have a factor structure with rank q; they show that the Bai-Ng (2002) information criterion, applied to the sample variance matrix of these residuals, yields a consistent estimate of the number of dynamic factors. Once one has reliable estimates of the factors in hand, there are a number of things one can do with them such as vector auto-regressions with the estimated factors.

2.2. Vector Autoregression (VAR)

To capture the linear interdependencies among multiple time series, VAR is a stochastic process model popularly used due to several decent reasons. First, the model is relatively easy to estimate. A VAR (*p*) model can be estimated by the least square (LS) or maximum likelihood (ML) method or Bayesian method. All three estimation methods have closed-form solutions. For a VAR model, the least-squares estimates are asymptotically equivalent to the ML estimates and the ordinary least-squares (OLS) estimates are the same as the generalized least-squares (GLS) estimates (see Zellner, 1962). In this study the maximum likelihood method has been used for estimating the VAR model which is not discussed in details here. In the same way, all the variables are entered into the VAR model, where each variable has an equation explaining its evolution based on its own lagged values, and an error term. The following intuitive notion of a variable's forecasting ability is due to Granger (1969). VAR models in economics were made popular by Sims (1980). For example, Qin (2011) and Enders (2010) include the definite and up-to-dated technical references for VAR and its post estimations like Granger Causality tests. The multivariate time series z_t follows a VAR model of order p, VAR (*p*), if

$$z_t = \phi_0 + \sum_{i=1}^{p} \phi_i z_{t-i} + a_t .. \tag{6}$$

where ϕ_0 is a *k*-dimensional constant vector and ϕ_i are $k \times k$ matrices for $i > 0, \phi_p \neq 0,$ and a_t is a sequence of independent and identically distributed (i.i.d) random vectors with mean zero and covariance matrix Σ_a which is positive-definite. Prior to estimating the VAR model, it must be ensured the weak stationarity-sufficient and necessary condition- of the model. Furthermore, the iterated procedure of Box and Jenkins consisting of model specification, estimation, and diagnostic checking has been followed (see Box, Jenkins and Reinsel, 2008) earlier estimating the model. For VAR models, model specification is to select the order *p*. e.g. Schwarz's Bayesian information criterion (SBIC) proposed, the Akaike's information criterion (AIC), and the Hannan and Quinn information criterion (HQIC) are commonly used techniques to select the order. In the context of VAR models, AIC tends to be more accurate with monthly data, HQIC works better for quarterly data on samples over 120 and SBIC works fine with any sample size for quarterly data (see Ivanov and Kilian, 2001).

2.3 Dynamic Factor Based Causality

The general VAR model suffers from explaining many parameters due to complex interactions and feedback between the variables in the model. To get rid of the suffering and explain the VAR model more precisely, the post estimation method called Granger causality test has been used in testing for causality. Specifically, the traditional Granger test for testing causality between Quantum index of manufacturing (QIM), estimated factors (F_t) and the control variables for our study can be represented as follows:

$$QIM_t = \sum_{i=1}^{n} \beta_i F_{t-1} + \sum_{i=1}^{n} \lambda_i QIM_{t-1} + \delta_t \ . \tag{7}$$

$$F_t = \sum_{i=1}^{n} \mu_i F_{t-1} + \sum_{i=1}^{n} \theta_i QIM_{t-1} + \varepsilon_t \quad (8)$$

where δ_t and ε_t are uncorrelated. The test involves testing the null hypothesis that there is no Granger causality and any of the following conditions may prevail: (a) If estimated coefficients on lagged are statistically different from zero, i.e $\sum \beta_i \neq 0$ and set of coefficients on lagged QIM is not statistically different form zero, i.e. $\sum \theta_i = 0$, then there is unidirectional causality from, $F_t \rightarrow$ QIM. (b) If lagged QIM coefficients are statistically different from zero, i.e. $\sum \theta_i \neq 0$ and set of lagged F_t coefficients are not statistically different from zero, i.e. $\sum \beta_i = 0$. This implies unidirectional causality from QIM $\rightarrow F_t$. (c) If both estimated coefficients on lagged F_t and lagged QIM coefficients are statistically different from zero, i.e. $\sum \beta_i \neq 0$ and $\sum \theta_i \neq 0$, then there is bilateral causality or Feedback, QIM$\leftrightarrow F_t$. (d) Finally independence is implied when sets of QIM and F_t coefficients are not statistically significant in both equations, i.e. $\sum \theta_i = 0$ and $\sum \beta_i = 0$ .To test the hypothesis, the Granger causality uses the simple F-test statistic, namely;

$$F = \frac{(RSS_R - RSS_{UR}) / m}{RSS_{UR} / (n-k)} \quad (9)$$

which follows the F Distribution with m and (n-k) degrees of freedom, where m is the number of lagged F_t terms and k is estimated parameters in the unrestricted regression (number). Therefore, the null hypothesis is rejected if computed F value exceeds critical F value at a certain level of confidence; i.e. F_t causes QIM.

3. Data, Results and Discussion

3.1. Data Sources and Variable Descriptions

Monthly data on the following variables for the period of 2004 to 2017 of Bangladesh have been compiled from different national and international sources. Most of the data are collected from the national sources such as the publications of Bangladesh Bank[6] Quarterly and Monthly Economic Trend and Bangladesh Bureau of Statistics[7]. The data have also been composed from the international source, which is CEIC[8]. A total of thirteen variables or indicators have been used in this study – one variable is used as a proxy of economic growth, eight indicators for measuring the development of banking and stock market, and the remaining four as the relevant control variables.

Economic growth is narrowly and specifically proxied by the Quantum Index of Manufacturing (QIM), which measures the changes in production of Medium and Large Scale Manufacturing Industries over time on monthly as well as cumulative basis. The weights presently used for the QIM[9] were derived from the Census of Manufacturing Industries (CMI) 1988-89. Though QIM explains a small part of economic growth, we have considered it as a proxy indicator of economic growth due to data insufficiency for financial sector development and economic growth on yearly basis.

Market capitalization (MC), number of listed companies (NLC), Turnover ratio (TR), and **price-to-earnings ratio (P/E) are considered to measure the** depth, access, efficiency and

[6] www.bb.org.bd
[7] www.bbs.gov.bd
[8] www.ceicdata.com
[9] This makes industrial production an important tool for forecasting future GDP and economic performance. It is a short-term indicator plays an important role on comparison of economic performance over time.

stability of the stock market, **respectively**. Similarly, domestic credit to private sector (DCPB), number of branches of scheduled banks (NBSB), interest rate spread (IRS), and Bank nonperforming loans (NPL) are respectively used to measure the depth, access, efficiency and stability of the banking sector. There are some much talked important and relevant economic variables; of them, the following three – consumer price index (CPI), export (EXP), imports (IMP) and Electricity Consumption (EC) are used as the control variables with QIM in VAR model.

3.2. Results and Discussion

Data measured in different units are standardized to make them unit free and hence are re-denoted by ZMC, ZPE, ZTO, ZNLC, ZDCPB, ZIRS, ZNBSB, and ZNPL. These variables are now used to conduct the factor analysis. Factor analysis requires the data to be seasonally adjusted. As our data are monthly, we check seasonality by using the dummy variable approach and find no seasonality in data. Stationarity of the variables is also checked applying ADF and PP test and found that the variables are integrated of order one. [10]Thus the further analysis is conducted on the first differenced data. We first use an approximate factor model on the stationary data. First two factors are chosen based on both AIC and BIC for the maximum likelihood estimation of the factor model. We use different combinations of $n_f, p \text{ and } q$ (where n_f is the number of factors, p is the number of lags in the factor which represents the dynamic factor and q is the lags of the error terms). On the basis of Bai and Ng (2002) model selection criteria, the dynamic factor model is chosen at the combination of $n_f = 2, p = 1 \text{ and } q = 1$.

Results of the dynamic factor model are shown in **Table 1**.Results of **Table 1** reveal that the variables DZMC, DZPE, DZTO and DZNLC are consistent with the Factor 1. The significance of the coefficients of these variables ensures that they form the "Stock Market" dimension which is similar to the results of approximate factor model. Results also confirm that the variables DZDCPB, DZNBSB, DZIRS and DZNPL form the Factor 2 which forms "Banking Sector" which is also similar to the results of approximate factor model. Based on the results**,** we may conclude that indicators which come from the stock market form the "Stock Market" factor and indicators which come from banking sector form the "Banking Sector" factor. [11]The results of this dynamic factor analysis are different to the application of ordinary factor analysis by Hossain et al. (2017). Hossain et al. (2017) also found two factors but the first factor was formed with depth and stability, and the second factor with accessibility and efficiency of the financial sector; that is, factors were not categorized as 'Stock Market' and 'Banking Sector' like the current study. These differences might be due to the differences in used data frequencies and study period. They considered yearly data from 1988 – 2013; where economic growth was directly proxied by GDP growth.

We proceed for vector autoregression (VAR) analysis with the chosen first two estimated dynamic factors denoted as dyf1 and dyf2. The procedure of the VAR analysis with QIM, dyf1, dyf2 and control variables are discussed as follows. The standardized version of variables QIM, EC, EXP, IMP and CPI re-denoted by ZQIM, ZEC, ZEXP, ZIMP and ZCPI are used along with the estimated dynamic factors dyf1 and dyf2. We apply ADF and PP test to check the stationarity of the variables. After first differencing the variables become stationary at 1 percent level of significance. Thus, the further analysis is conducted on the first differenced data. After choosing the lag order[12] we estimate

[10] Results of seasonality test and stationarity are not reported due to space constraint.

[11]In addition, we obtain the AIC and BIC information criterion of the estimated dynamic factor model and find that the dynamic factor model fits well for the data set than approximate factor model and dynamic factor model in static form.

[12]The VAR order has been selected based on Likelihood ratio and information criteria. Schwarz- Bayesian and Hannan-Quinn information criteria select the lag order of 3, and LR test FPE test and Akaike information criteria select the 4 order the VAR model. Ivanov (2001) suggests that, in the context of VAR models, AIC tends to be more accurate with monthly data, HQIC works better for quarterly data on samples over 120 and SBIC works fine with any sample size for quarterly data. Since we have used monthly data with 168 observations, AIC is used to determine the appropriate lag order of 4.

the VAR (4) model and obtain the results. **Table 2** represents the coefficients of VAR (4) model when DZQIM works as dependent variable.

Results of the **Table 2** show that $DZQIM$ is highly dependent on its lag values and the coefficients are statistically significant at 5 percent level of significance. This shows the linear dependence of $DZQIM_t$ on $DZQIM_{t-1}, DZQIM_{t-2}, DZQIM_{t-3}$ *and* $DZQIM_{t-4}$ .Also, the linear dependence of $DZQIM_t$ on Stock Market factor at second lag $Ddyf1_{t-2}$ is statistically significant. Similarly, the coefficient values of $Ddyf2_{t-2}, Ddyf2_{t-3}$, $DeEC_{t-3}$, $DZEXP_{t-1}$, $DZEXP_{t-3}, DZEXP_{t-4}, DZIMP_{t-1}, DZIMP_{t-3}, DZIMP_{t-4}$ and $DZCPI_{t-1}$ are statistically significant at 10 percent level of significance. That means that $DZQIM_t$ is statistically and linearly dependent on these variables. In a similar manner, the dependence of each variable on its different lags is also found. The better and easier way to deal with a VAR model is the Granger causality test. The VAR based Granger causality test is used to clearly identify the significant causal relationships among the underlying variables.

Granger causality test results are given in **Table 3**. The results exhibit that the second dynamic factor, "Banking Sector", significantly causes the QIM and QIM causes the factor "Banking Sector". Therefore, it can be predicted that the relationship between QIM and 'Banking Sector' is the supply-leading as well as demand-following in Bangladesh. We can therefore highlight that the second factor, "Banking Sector", significantly causes the QIM perhaps through exports and consumer price index. This finding is consistent with the results of Shahbaz et al. (2015). The result of the current study is also supportive to the studies done by Lewis (1955), Patrick (1966) and Saad (2014). Results also illustrate that the second factor, "Banking Sector", significantly causes the first factor "Stock Market" whereas the reverse is not true. Again, QIM significantly causes the first factor, "Stock Market" but the Stock Market does not cause the QIM. Thus, there is a unidirectional demand-following relationship that the development of stock market follows industrial production (QIM).Conclusion on the relationship between 'Stock Market' and QIM is consistent with the research works done by Guryay et al. (2007), Güryay, Safakli and Tuzel (2007), Ndlovn (2013) and Sami (2013). The conclusion is also consistent (almost) with Hossain et al. (2017).

Whereas, there has been a long term government (led by World Bank and IMF) policy effort like Financial Sector Reform, started in the early 1980s to promote the supply leading approach, the relationship between 'Stock Market' and QIM is only the demand following in Bangladesh. Despite having such a huge policy effort to increase industrial production (QIM) directly through the development of stock market if the existing relationship is only the demand following, the effort might be missing due to the market's efficiency and instable deepening. However, QIM was assumed to be directly accelerated by the development of stock market; that is why, the stock market was mainly and specially established. In this circumstance, if 'Banking Sector' causes 'Stock Market', the strength of the missing efforts will be higher as the force of causation. That is, a part of the effort behind the development of banking sector has also been missing through the malfunction of stock market.

3.3. From Historical Perspective

Under the neoliberal structural adjustment program (NSAP), the supply leading approach to economic growth in Bangladesh has been encountering by the policy change of financial sector liberalization and market deregulation program (FSLMDP) since the early 1980s. In the one hand FSLMD program promotes the supply leading approach to economic growth. On the other hand, FSLMD program brings economic/financial crisis and market failure to lessen or lose the effects of the supply leading efforts on economic growth in Bangladesh. In this regard, Zakaria et al. (2015) argued that Banking Deregulations have decreased the youth unemployment rate, while bank crisis and high wage rate have increased the unemployment in South Asia region. If we accept the argument that Banking

Deregulations itself create bank crisis, it is not wise to claim that deregulations finally reduce the unemployment in the region.

The Structural Adjustment Participatory Review Initiative (SAPRI) study, conducted by the World Bank in 2000 argued that the Financial Sector Adjustment Credit (FSAC) implemented in the beginning of the 1990s was failed to address the issue of efficient resource allocation in terms of access to credit by productive sectors (Bhattacharya and Chowdhury, 2003). Quadir (2000) claimed that the Financial Reforms had failed to bring about improved performance in the financial sector, further worsening the crisis of debt default of commercial bank loans. The debt default started in the late 1970s and it has been reached a magnitude of unmanageable proportion by now-a-days. Instead of rationalizing the private sector, the privatization program under the NSAP had consistently benefited a small group of so called entrepreneurs. Subsidized credits from public funds (mostly the Development Finance Institutions) were made readily available to them. This small group of families effectively controls the total industrial and financial assets of the nation (Nuruzzaman, 2004). Specially, the development of stock market in Bangladesh mostly ignores the demand of the productive sector. The stock market is illegally boomed and bust in the secondary market without making any relation to the productive sector. However, the capital market gets huge incentives through the national budget at the cost of taxpayer's (public) money. For example, corporate tax for the listed companies is also reduced to make the country's capital market vibrant (The Daily Sun, Jun 2, 2018). Power and money sharing illegal relation between the consecutive governments and business elites reduces the regimes' ability to develop and activate a legal and regulatory framework to control the economic/ financial crises, to which the supply leading approach to economic growth is vulnerable/prone.

In an overall assessment on the pro-market policy reforms of NSAP, Quadir (2000) claimed that the policies were adopted in Bangladesh neither to stabilize the economy nor to meet broader development challenges. To consolidate the power of the ruling elites, successive regimes, both military and civilian, allowed business elites to use economic restructuring as the primary tool to attain their financial gains. Again, Nuruzzaman (2004) found that the share of agriculture in GDP decreased by the end of the 1980s, but the industrial sector did not register any noticeable growth. Rather, an unproductive one, the service sector boomed to some extent and that compensated for the decline in the agriculture sector. Thus, there was a clear indication of missing efforts of the NSAP to its objective of making the country industrialized as a whole.

Despite the efforts of the NSAP are still missing to improve the economic performance, Bangladesh economy has been booming for more than last one decade but in other ways. The United Nations recently published a report that Bangladesh will be the third fastest growing economy in the world in terms of GDP growth in 2019. The Bangladesh economy is progressing by narrowing the current account deficit due to increased remittance inflows and garment exports.[13] The GDP growth is expected to be supported by private consumption and, in some cases, investment demand. Although more than half of GDP is generated through the service sector, almost half of Bangladeshis are employed in the agriculture sector and garments exports accounted for more than 80% of total exports in 2016.[14]The present government is credited to let them happened with its long lasting progressive tenure and political stability. The World Bank's former chief economist, Kaushik Basu[15] explained that Bangladesh's economic transition was driven in large part by social changes, starting with the empowerment of women. He also explained, as a result of progressive social policies and a bit of historical luck, Bangladesh has gone from being one of the poorest countries in the South Asia to an aspiring "tiger" economy. But financial sectors, both banking and stock markets have been failed to accumulating and channelling the huge remittance inflows into the productive sector. Here there is no

[13] On March 19, 2019, *FocusEconomics* published Bangladesh Economic Outlook at www.focus-economics.com/countries/bangladesh;

[14] *Indexmundi* published Bangladesh Economic Profile 2018 at https://www.indexmundi.com/bangladesh/economy_profile.html

[15] On April 23, 2018, the World Bank's former chief economist, Kaushik Basu wrote in *Project Syndicate*.

remarkable contribution from the NSAP, financial sector reform program and their supportive supply leading approach to the current economic progression of Bangladesh.

4. Conclusion and Recommendation

This study is intended to propose an appropriate ideological approach to the finance-growth nexus for Bangladesh. Using monthly data from 2004 to 2017, the results of the dynamic factor analysis indicate that we can estimate two factors, categorized as 'Stock Market' and 'Banking Sector'. Results of the Granger causality test illustrate that there is bidirectional causality between 'Banking Sector' and industrial production (QIM). But the relationship between 'Stock Market' and QIM is only the demand following; the development of stock market follows industrial production. Results also display that Banking Sector significantly causes Stock Market, although the reverse is not true.

Despite having such a huge policy effort to increase QIM directly through the development of stock market, the existing relationship is only the demand following. In this circumstance, it is a big concern that why stock market of Bangladesh has been missing the supply-leading policy efforts to increase the industrial production! Since the development of banking sector accelerates the development of stock market, a part of the policy effort behind banking sector has also been missing through the stock market.

As we have discussed, the supply leading approach of finance-growth nexus is still being promoted and accelerated with the blessings of the Financial Sector Reform Programs (FSRP)of financial liberalization and market deregulation under the neoliberal structural adjustment program in Bangladesh. The NSAP was started with the prescription and design of the World Bank and IMF in the early 1980s. The NSAF has been failed to improve the performance of Bangladesh economy according to its industrialization objective. Following the path of NSAP, the FSRP also failed to increase the industrial production by promoting the supply leading approach, especially through the development of stock market. In other words, government-business or power-finance illegal nexus has caused the finance-growth nexus of stock market failed in the supply leading approach to industrialization. On the one hand FSLMD program promotes the supply leading approach to economic growth and, on the other, it brings economic/financial crisis and market failure to lessen or lose the effects of the supply leading efforts or the development of financial sector on economic growth in Bangladesh.

Whatever the existing relationship, promoting the supply leading or demand following approach is an ideological matter as it has been the matter of supports and beliefs with regardless of real historical evidences. But the supply leading approach to economic growth has been proved to be vulnerable/prone to economic/financial crises and market failures. Our ideology never supports to comply with these power-finance illegal nexus, financial crises and market failures through the path of the supply leading approach. In Bangladesh, we should leave the ideology of fostering supply leading approach to economic growth and adopt policy efforts to let the demand following relationship function; which refers to allowing the development of stock market in response to the demand of industrial production. Moreover, the demand following approach is less likely to be prone to the power-finance illegal nexus, financial crisis and market failure.

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Tables:

Table 1: Dynamic-factor model (DFM)[16]

Variable		Coefficient on Factor		Coefficient on Lag of Factor	
		Estimate	**P-Value**	**Estimate**	**P-Value**
Factor1				0.0307169	0.747
Factor2				1.010183	0.000
DZMC	dyf1	0.1058748	0.000	-0.4081131	0.000
	dyf2	0.0007328	0.191		
DZPE	dyf1	0.2168772	0.000	0.1468487	0.201
	dyf2	-0.0002859	0.805		
DZTO	dyf1	0.2600907	0.000	-0.3101386	0.000
	dyf2	0.0004614	0.776		
DZNLC	dyf1	-0.0594825	0.008	-0.3420523	0.000
	dyf2	0.0009258	0.310		
DZDCPB	dyf1	0.0013908	0.296	-0.1798708	0.045
	dyf2	0.0011468	0.037		
DZIRS	dyf1	-0.0165633	0.592	-0.1104523	0.150
	dyf2	-0.002322	0.085		
DZNBSB	dyf1	0.0024582	0.292	0.0392197	0.617
	dyf2	0.0010038	0.040		
DZNPL	dyf1	0.0011408	0.926	-0.0042712	0.956
	dyf2	-0.0047525	0.042		
Sample: 2004m2 - 2017m12 **Log likelihood = 846.26563**				**Number of observation = 167** **Wald chi2(26) = 54251.68** **Prob> chi2 = 0.0000**	

Table 2: Vector Autoregression

Dependent Variable: *DZQIM* **Parameters: 29; RMSE: 0.166614**				R^2 **: 0.6494;** $\chi^2 - value$ **: 298.2103** $\Pr ob > \chi^2$ **: 0.0000**		
	Coefficient	**Std. Err.**	**Z**	**P>|z|**	**[95% Conf. Interval]**	
DZQIM						
L1.	-0.67581	0.084415	-8.01	0.000	-0.84126	-0.51036
L2.	-0.39691	0.09786	-4.06	0.000	-0.58871	-0.20511
L3.	-0.36918	0.099401	-3.71	0.000	-0.564	-0.17435
L4.	-0.20356	0.088212	-2.31	0.021	-0.37645	-0.03066
Ddyf 1						
L1.	-0.65881	0.404009	-1.63	0.103	-1.45066	0.133031
L2.	-0.88505	0.488489	-1.81	0.070	-1.84247	0.072375
L3.	-0.28387	0.490196	-0.58	0.563	-1.24463	0.676898
L4.	-0.2481	0.405264	-0.61	0.540	-1.0424	0.546201
Ddyf 2						
L1.	0.007246	0.014962	0.48	0.628	-0.02208	0.03657
L2.	0.028762	0.013673	2.1	0.035	0.001963	0.055562
L3.	-0.04054	0.012576	-3.22	0.001	-0.06519	-0.01589
L4.	-0.01998	0.012256	-1.63	0.103	-0.044	0.004039
DeEC						
L1.	0.019976	0.071904	0.28	0.781	-0.12095	0.160905
L2.	-0.10221	0.068305	-1.5	0.135	-0.23608	0.03167
L3.	-0.14457	0.071428	-2.02	0.043	-0.28456	-0.00457

[16]First we use the dynamic factor model in static form. But results show none of the variables form factors significantly, this model might not be appropriate model for analyzing the data.

Dependent Variable: *DZQIM* **Parameters: 29; RMSE: 0.166614**				R^2 **: 0.6494;** $\chi^2 - value$ **: 298.2103** $\Pr ob > \chi^2$ **: 0.0000**		
	Coefficient	**Std. Err.**	**Z**	**P>|z|**	**[95% Conf. Interval]**	
L4.	**-0.01421**	**0.072279**	**-0.2**	**0.844**	**-0.15587**	**0.127458**
DZEXP						
L1.	-0.21221	0.067441	-3.15	0.002	-0.34439	-0.08002
L2.	0.089809	0.062838	1.43	0.153	-0.03335	0.212968
L3.	-0.14769	0.062335	-2.37	0.018	-0.26987	-0.02552
L4.	-0.20513	0.071189	-2.88	0.004	-0.34465	-0.0656
DZIMP						
L1.	0.299562	0.080451	3.72	0.000	0.141881	0.457242
L2.	-0.02899	0.078669	-0.37	0.712	-0.18318	0.125196
L3.	0.242292	0.078379	3.09	0.002	0.088673	0.395911
L4.	0.15412	0.078349	1.97	0.049	0.000558	0.307682
DZCPI						
L1.	-1.81815	0.515216	-3.53	0.000	-2.82795	-0.80834
L2.	-0.68204	0.576277	-1.18	0.237	-1.81152	0.447442
L3.	0.055333	0.595542	0.09	0.926	-1.11191	1.222573
L4.	0.808289	0.558843	1.45	0.148	-0.28702	1.9036
Constant	0.092774	0.021775	4.26	0.000	0.050097	0.135452

Table 3: Granger Causality Wald Tests

Equation	***Excluded***	χ^2	$\Pr ob > \chi^2$	***Equation***	***Excluded***	χ^2	$\Pr ob > \chi^2$
DZQIM	Ddyf1	4.7838	0.310	**DeEC**	**DZEXP**	**14**	**0.008**
DZQIM	**Ddyf2**	**20.789**	**0.000**	**DeEC**	**DZIMP**	**14**	**0.007**
DZQIM	DeEC	6.468	0.167	**DeEC**	**DZCPI**	**25**	**0.000**
DZQIM	**DZEXP**	**23.337**	**0.000**	DZEXP	DZQIM	6.7	0.155
DZQIM	**DZIMP**	**26.798**	**0.000**	DZEXP	Ddyf1	4.6	0.332
DZQIM	**DZCPI**	**23.065**	**0.000**	**DZEXP**	**Ddyf2**	**8.3**	**0.080**
Ddyf1	**DZQIM**	**10.077**	**0.039**	DZEXP	DeEC	5.9	0.203
Ddyf1	**Ddyf2**	**13.545**	**0.009**	**DZEXP**	**DZIMP**	**13**	**0.010**
Ddyf1	DeEC	4.0753	0.396	DZEXP	DZCPI	1.1	0.894
Ddyf1	DZEXP	7.7459	0.101	DZIMP	DZQIM	7	0.135
Ddyf1	DZIMP	2.6074	0.626	DZIMP	Ddyf1	4	0.406
Ddyf1	DZCPI	4.0865	0.394	DZIMP	Ddyf2	5.9	0.208
Ddyf2	**DZQIM**	**28.928**	**0.000**	**DZIMP**	**DeEC**	**9.6**	**0.047**
Ddyf2	Ddyf1	3.9039	0.419	DZIMP	DZEXP	5.5	0.241
Ddyf2	DeEC	0.65127	0.957	DZIMP	DZCPI	2.1	0.716
Ddyf2	DZEXP	4.6387	0.326	DZCPI	**DZQIM**	**9**	**0.061**
Ddyf2	**DZIMP**	**8.5399**	**0.074**	DZCPI	Ddyf1	2	0.734
Ddyf2	**DZCPI**	**14.663**	**0.005**	DZCPI	**Ddyf2**	**24**	**0.000**
DeEC	**DZQIM**	**8.8735**	**0.064**	DZCPI	**DeEC**	**8.2**	**0.084**
DeEC	Ddyf1	5.4014	0.249	DZCPI	DZEXP	2.4	0.666
DeEC	Ddyf2	0.27462	0.991	DZCPI	DZIMP	1.8	0.775