Small and Medium Enterprises Financing and Forecasting the Economic Sustainability of Bangladesh: A Bayesian VAR Approach

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Abstract

Small and Medium Enterprises (SMEs) are considered as the major catalyst and a key factor for the development and sustenance of any developing country like Bangladesh. The purpose behind the study is to investigate the role of SME financing in the achievement of economic growth of Bangladesh. This study examined the role of SMEs in the achievement of economic growth in Bangladesh using a Multiple Linear Regression Model which revealed a positive impact of the amount of loans to SMEs on the Gross Domestic Product (GDP) of Bangladesh as well as a negative impact of interest rate has been found on GDP. Stationarity has been checked using Augmented Dickey-Fuller Test and Phillips-Perron Test. Hence, Granger Causality test has been performed to check the Directionality of Loans to SMEs and Real GDP of Bangladesh and a bi-directional causality has been found. Finally, to forecast the economy based on the performance of SMEs, a Bayesian VAR (2) model has been used, which showed an upward trend in the economy of Bangladesh on the upcoming twenty years.

Keywords: SME, Granger Causality Test, GDP, Multiple Regression Model, Bayesian VAR.

1. Introduction

The role of small and medium enterprises (SMEs), achieving the economic growth of a developing country like Bangladesh is beyond imagination. SMEs are the foundation as well as the building block in the realization of any sustainable economic growth..

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The economic contributions made by SMEs are obvious in the mobilization of idle financial resources, exploitation of local raw materials, supplies to large companies, adding varieties for the clients, checking the monopolistic tendency power, providing a source of innovation, creating ground for new industries and most importantly employment creation

A formal definition of SMEs has been provided by the ministry of Industry of Bangladesh and Bangladesh Bank. According to the Industrial policy 2005 of Bangladesh, the definition of SMEs has been set in terms of fixed assets owned by the entrepreneur and number of employees under three major sectors such as, service, manufacturing and trading. [13]

The definition of the SMEs of Bangladesh has been provided by the Ministry of Industry of Bangladesh and has been approved by Bangladesh Bank. According to the Industrial policy 2010, medium enterprises under the manufacturing sector should have either the value or replacement cost of fixed assets (excluding land and building) between TK 100 million to TK 300 million with the number of workers between 100 and 250. Again, under the service sector, the replacement cost should be ranging between TK 10 million to TK 150 million with the number of workers ranging between 50 and 100. In the manufacturing sector, small enterprises should have either the value or

replacement cost of fixed assets (excluding land and building) between Tk 5 million and Tk 100 million with the number of workers ranging between 25 and 99. In the service sector, small enterprises should have either the value or replacement cost of fixed assets (excluding land and building) ranging between Tk 0.5 million and Tk 10 million with the number of workers ranging between 10 and 25. [1]

Gross Domestic Product (GDP) is one of the most widely used indicators of an economy. It is defined as the total value of goods and services produced in a country in a specific time period-monthly, quarterly or annually. GDP gives an overall picture of the state an economy, which enables the policy makers and central banks to judge whether the economy is contracting or growing, whether it needs a boost or restraint, and if a threat such as a recession or inflation looms on the horizon. The GDP of Bangladesh for FY2013-14 was $173.82 billion, which represents 0.28 percent of the world economy. But there was a sharp decrease in the GDP of Bangladesh which slowed down to the growth rate 6.03% in FY2012-13 from 6.32% in the past fiscal year. According to the Word Development Indicators Study Report published by the Word Bank, the contributions of industry and agriculture to GDP were respectively 21.7 % and 30.4 % 1991, 25.9 % and 24.1 % in 2001, 28.5%and 18.6%in 2010. As per recent statistics of Bangladesh Economic Review-2014 the contributions of agriculture and industry to the GDP were 13.09 % and 29 % respectively in the FY 2012-13.[2] [3]

SMEs need financial support to undertake productive investment in order to expand their business, introduce new products, and market those products. Unfortunately they come across great difficulties raising fixed and working capital because of the reluctance of banks to provide loans to SMEs. But this scenario is gradually changing now as there is a significant change in the Government and commercial banks in terms of lending loans and the interest rate associated with them. Total SME loans by banks and non-bank financial institutions increased by Tk. 17823.13 crore or 15.15 percent and stood at Tk. 132406.63

crore at the end of March, 2015 as compared with Tk.114583.50 crore at the end of March, 2014. The increase of institution-wise SME loans at the end of March, 2015 is 44.41 percent in state owned banks, 22.65 percent in private banks and 18.65 per cent in non-bank financial institutions as compared to that of March, 2014. Specialized banks and foreign banks experienced a negative growth of 90.28 percent and 9.90 percent respectively at the end of March, 2015 as compared to March, 2014. SME loans as percentage of total loans increased to 23.51 at the end of March, 2015 compared to 23.23 percent of the same period of the previous year. [7] To keep the interest rate in a tolerable limit Bangladesh Bank is providing refinance facility to banks and financial institutions at bank rate (at present 5%) in SME sector. The fund obtained at bank rate through BB refinance window should be disbursed at bank rate + not more than 5% interest to the client level (in case of women entrepreneurs).[13]

SME sectors are considered as one of the principal driving forces in the development of an economy. So, to convince the policy makers and the bank owners to invest in this sector a forecast is a must. In this study we have used Bayesian VAR model to forecast the contribution of SMEs in the economy of Bangladesh for next 20 years. Bayesian Vector Autoregression (BAVR) uses Bayesian methods to estimate o vector autoregression. Here, model parameters are treated as random variables and prior probabilities are assigned to them. [2]

2. Objectives of the Study

The objectives of the study are:

1. To examine the impact of SME financing in the economic development of Bangladesh.
2. To examine the causality between Real GDP and Loans provided to SMEs.
3. To forecast the Real GDP of Bangladesh up to 2034-2035 using Bayesian VAR model.
4. To put some recommendations for the SME sectors of Bangladesh based on the findings of the study.

3. Data and Variables

Data Sources: The present study is based on the time series data from fiscal year 1993-1994 to 2013-2014 which was obtained from Bangladesh Economic Review-2005 and Bangladesh Economic Review -2014. [3] [4]

Variables: The variables for the present study are Real Gross Domestic Product (real GDP) of Bangladesh, Loans provided to SMEs (LSME), Real Interest Rate (RIntr) and Inflation Rate (Inf).

4.Literature Review

Onokoya *et al.* (2013) showed that loan to small scale industries have significant positive impact on the economic performance while interest rate has a negative impact on economic growth of Nigeria. [9]

Nkwe (2012) found that the contribution of SMEs in Botswana is huge. SMEs contribute by generating employment for rural and urban growing labor force, providing desirable sustainability and innovation in the economy as a whole. [8]

Oreoluwa (2011) assessed specific financing options available to SMEs in Nigeria and contribution with economic growth via investment level using the Spearman's Rho correlation test which indicated that, there is a positive relationship between SMEs financing and economic growth via investment level. [10]

Berger and G.E. Udell (2005) acknowledged that the lack of finance of Bangladesh's SMEs stand in the way of development, with 55% SMEs reporting it. Without enough capital, Bangladesh has little chance of growth or even sustenance in this mobile world. The study has indicated through empirical research, the major problems faced by SMEs and banks of Bangladesh and provided some recommendations based on the findings. [5]

5. Methodology

Multiple Regression Model: To determine the impact of SMEs financing on the economic growth of Bangladesh a multiple regression model using Ordinary Least Square (OLS) have been employed. A multiple linear regression model is of the form:

$$y_i = \beta_0 + \beta_1 x_i + \beta_2 x_i^2 + \varepsilon_i \text{ , } i=1,2,\dots,n.$$

In the present study, Real GDP of Bangladesh has been considered as the response variable. To obtain robust estimates Real Interest Rate, Inflation Rate and Loans to SMEs have been considered as the control variables. The model is specified as follows:

$$\text{LN (Real GDP)} = \alpha_0 + \beta_0 \text{LSME} + \beta_1 \text{ RIntr} + \beta_2 \text{ Inf} + \varepsilon_t \qquad [1]$$

Here,

Real GDP = Real Gross Domestic Product (which is a proxy for economic growth)

LSME = Loans to SMEs

RIntr = Real Interest Rate

Inf = Inflation Rate

α_0 = Intercept

β_0- β_2 = Coefficient of each explanatory variables

Granger Causality Test: Granger causality measures whether one phenomenon happens before another phenomenon and helps predict it. [14] In the present study, to determine the direction of causality between SME financing and economic growth of Bangladesh, Granger causality test have been used. The equation is defined as:

$$Real\ GDP_t = \sum_{i=a}^{n} \alpha_i\, LSME_{t-i} + \sum_{j=1}^{n} \beta_j\, Real\ GDP_{t-j} + \varepsilon_{1t} \qquad [2]$$

$$LSME_t = \sum_{i=1}^{n} \partial_i LSME_{t-i} + \sum_{j=1}^{n} \delta_i\, Real\ GDP_{t-j} + \varepsilon_{2t} \qquad [3]$$

In equation [2], the null hypothesis that Real GDP does not granger cause Loans to SMEs and in equation [3], the null hypothesis that Loans to SMEs do not granger cause Real GDP of Bangladesh have been tested.

Bayesian VAR model: Bayesian vector autoregressive (BVAR) model uses Bayesian

methods to estimate a vector auto regression (VAR). In that respect, the difference with standard VAR models lies in the fact that the model parameters are treated as random variables, and prior probabilities are assigned to them.

To conduct a BVAR model, we need to check the stationarity of the data and then select an optimal lag. To check the stationarity of the data of the present study, we have used Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) Test. [6] [11].

Estimation of BVAR (p) model: Let, $Y_t = (y_{1,t}, y_{2,t}, \ldots, y_{n,t})'$ be a vector of random variables. Then, the VAR (p) model is of the form:

$$Y_t = c + A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + u_t \quad [4]$$

Where, u_t is an n-dimensional white noise with covariance matrix $\mathbb{E}u_t u_t' = \Psi$, $c = (c_1, c_2, \cdots, c_n)'$ is an n dimensional vector of constants and $A_1, A_2, \cdots, A_p$ are $n \times n$ autoregressive matrices.

Now, to estimate the model using Bayesian VAR approach Minnesota Prior (Litterman, 1996) has been used. The basic assumption behind it is that all the equations are "centered" around the random walk with drift. That means, the prior can be associated with the following representation for Y_t.

$$Y_t = c + Y_{t-1} + u_t \quad [5]$$

The prior specification of [5] dictates that, the more recent lags should provide more reliable information than the more distant ones and that own lags should explain more of the variation of a given variable than the lags of other variables in the equation.[2]

6. Analysis & Interpretations

6.1 Multiple Regression Model
The result from table-1 showed that, the independent variables Loans to SMEs, Real Interest Rate and Inflation Rate jointly explained about 81% variations or changes in economic growth. More specifically, the result revealed that SMEs

financing has a positive impact on Real GDP. Holding all other variables constant, on the average the Real GDP of Bangladesh will increase by 0.373842 for every 1 unit increase in Loans to SMEs. Again, Real Interest Rate and Inflation Rate have negative impact on Real GDP. Holding all other variables constant, the Real GDP of Bangladesh will decrease by 0.000069 for every 1 unit change in Real Interest Rate. That is, the result indicates that Loans to SMES are statistically significant in explaining the economy of Bangladesh. That is, SMEs is fundamental in achieving economic growth in Bangladesh.

6.2 Granger Causality
Since both the probability values in table-2 are less than the critical value 0.05, it reveals that, Loans to SMEs granger cause Real GDP, which means, economic growth in Bangladesh as well as, Real GDP also granger causes Loans to SMEs. Hence, there exists a bi-directional causal relationship between Real GDP and Loans to SMEs of Bangladesh.

6.3 Stationarity Test

From table 3(a) and 3(b) it can be concluded that, the variables Real GDP and Loans to SMES have become stationary after 2nd difference and the variables Inflation rate and Real Interest Rate have become stationary after taking 1st difference. Since the ADF test statistic and adjusted t-statistic are less than the critical values at 5% level of significance, the null hypothesis of having unit roots in the data set have been rejected. Thus, the variables Real GDP and Loans to SMEs are integrated at order I(2) and the variables Real Interest Rate and Inflation rate are integrated at order I(1). This leads us to consider an Autoregressive Model for further study as the variables are integrated at different levels including order 2.

6.4 Optimal lag selection

From table-4 it can be seen that, the AIC value, SC value and HQIC value is minimum for lag-4, so, it

can be concluded that lag-4 is optimal for the present study.

6.5 Bayesian VAR Model

For the present study, to do the analysis of BVAR the variables Real GDP, Inflation rate, Real interest rate and Loans to SMEs have been considered to do the structural models. Since we have only 20 observations, the number of lags could not be large as it will result into loss of information. Hence, we have chosen the lag number to be, p=2. Here, the prior type is Litterman/Minnesota, which was automatically chosen by the computer program EVIEWS.

Table-5 reveals that, the values of the variables at a near past are more efficient in explaining the variables at a current period than the distant ones. The values 0.848 and 0.193 of real GDP, 0.041 and 0.005 of loans to SMEs, 0.103 and 0.021 of Real Interest rate reveals that the variables at lag-1 positively and more effectively affect the respective variables at current period. Again, the value -0.025 of real interest rate indicate that, at lag-1 inflation rate has a negative impact on real GDP of Bangladesh.

6.6 Forecasting Using Bayesian VAR (2) model

To forecast the variables of the present study, the Bayesian VAR (2) model has been used.
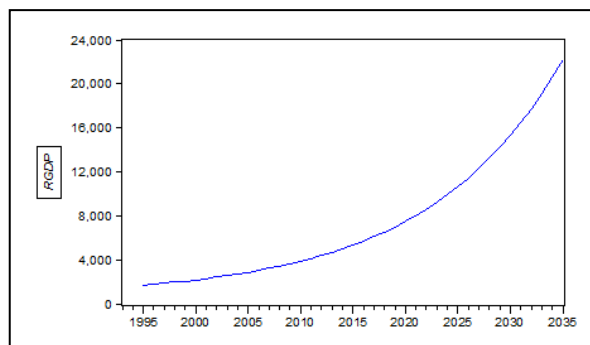

Figure 1: Forecast of Real GDP

Figure-1 shows the future values of Real GDP of Bangladesh up to 2034-2035. These values are the indication of the increase of real GDP using a one-step forecast. The figure-1 also shows the actual data from 1993-94 to 2013-14. Again, from table-6,

we can see that loans to SMEs and Real GDP of Bangladesh have an upward trend with 5% level of significance. That means, over the years with increasing amount of loans, the real GDP of Bangladesh also increases. Thus, with the advancement in the SME sectors of Bangladesh, the economy also flourishes.

But, from table-6, we can also see that, the real interest rate associated with the provided loans also increases, which may have a negative role in the economy of Bangladesh. As from table-1, it is clear that; real interest rate is negatively associated with real GDP of Bangladesh. Finally, from table-6, we can see that, the inflation rate remains almost same as before. It does not show any significant pattern over the years.

7. Conclusions and Recommendations

The main objective of the study was to determine whether or not SMEs are requisite in achieving sustainable economic growth of Bangladesh. The result from multiple regression model revealed that, there exist a positive relationship between the amount of loans provided to SMEs and real GDP of Bangladesh. So, the role of SMEs in the economic development of Bangladesh can be explained in such a way that the Real GDP increases. That is, if the amount of loans provided to Small and Medium entrepreneurs increases, Real GDP also Increases. Also, since the real interest rate showed a negative relationship with real GDP, an adequate and coordinated financing with relatively low interest rate should be introduced to SME sectors of Bangladesh.

The study also examined the causality between Real GDP of Bangladesh and the amount of loans provided to small and medium entrepreneurs. The granger Causality test has been used for this purpose and the test revealed that, there exist a bi-directional causality between Loans to SMEs and Real GDP of Bangladesh. Thus, with an increase in the amount of loans, the real GDP also increases.

Finally, a forecast has been performed using Bayesian VAR (2) model. From the forecasted values it is clear that, the economy of Bangladesh

will flourish significantly due to the contribution of the SME sectors.

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Appendix

Table 1: Result of multiple regression model

Dependent Variable	Independent Variables	Coefficients	t-statistic	p-value
LN(Real GDP)	Constant	2.220497	108.8929	0.0000*
	LN(Loans to SMEs)	0.373482	22.38026	0.0001*
	LN(Real Interest Rate)	-0.000069	4.184892	0.0006*
	LN(Inflation Rate)	-0.014469	-1.21797	0.0037*
R^2	0.815452			
F-statistic	345.219			

Table 2: Result of Granger Causality between Real GDP and Loans to SMEs

Null Hypothesis	F-statistic	p-value
Real GDP does not Granger cause Loans to SME	3.9390	0.0439*
Loans to SME does not Granger cause Real GDP	0.07067	0.0321*

Table 3(a): Results of unit root test using ADF test

Series	Considering Constant			Considering Constant and Linear Trend		
	ADF Test Statistic	Critical Values (0.05)	Order of Integration	ADF Test Statistic	Critical Values (0.05)	Order of Integration
LN (Real GDP)	4.4277	-3.0207	I(0)	-0.9394	-3.0207	I(0)
	-2.3779	-3.0298	I(1)	-4.2956	-3.0298	I(1)
	-5.2402	-3.8867	I(2)	-5.0071	-3.8867	I(2)
LN (Loans to SMEs)	0.94474	-3.0521	I(0)	-1.7294	-3.0521	I(0)
	-1.7674	-3.0521	I(1)	-2.1637	-3.0521	I(1)
	-8.5288	-3.0404	I(2)	-8.9876	-3.0404	I(2)
LN (Real Interest Rate)	-1.1293	-3.0207	I(0)	-1.3785	-3.0207	I(0)
	-4.2951	-3.0299	I(1)	-4.3674	-3.0299	I(1)
LN (Inflation Rate)	-2.5657	-3.0206	I(0)	-3.0258	-3.0206	I(0)
	-4.2951	-3.0404	I(1)	-4.7104	-3.0404	I(1)

Table 3(b): Results of unit root test using P-P test

Series	Considering Constant			Considering Constant and Linear Trend		
	Adjusted t-statistic	Critical Values (0.05)	Order of Integration	Adjusted t-statistic	Critical Values (0.05)	Order of Integration
LN (Real GDP)	5.5563	-3.0207	I(0)	-0.8572	-3.0207	I(0)
	-2.2376	-3.0298	I(1)	-4.3117	-3.0298	I(1)
	-16.1016	-3.8867	I(2)	-15.8455	-3.8867	I(2)
LN (Loans to SMEs)	2.3391	-3.0521	I(0)	-2.0317	-3.0521	I(0)
	-2.7655	-3.0521	I(1)	-3.2803	-3.0521	I(1)
	-8.0829	-3.0404	I(2)	-8.9876	-3.0404	I(2)
LN (Real Interest Rate)	-1.1729	-3.0207	I(0)	-1.3785	-3.0207	I(0)
	-4.3065	-3.0299	I(1)	-4.6115	-3.0299	I(1)
LN (Inflation Rate)	-2.6751	-3.0206	I(0)	-2.7056	-3.0206	I(0)
	-5.6453	-3.0404	I(1)	-6.0659	-3.0404	I(1)

Table 4: Result of optimal lag selection

Lag	Akaike Information Criterion (AIC)	Schwarz Information Criterion (sc)	Hannan-Quinn Information Criterion (HQ)
0	42.7662	42.9622	42.7856
1	32.7133	33.6936	32.8108
2	32.0336	33.7981	32.2090
3	28.5089	31.0576	28.7623
4	-156.3239*	-152.9912*	-155.9926*

Table 5: Output of the Bayesian VAR (2) Model

	Real GDP$_t$	Loans to SMEs$_t$	Real Interest Rate$_t$	Inflation Rate$_t$
Real GDP$_{t-1}$	0.848044 (0.04555) [18.6175]	0.207976 (0.04523) [2.40540]	0.108802 (0.07951) [2.61569]	0.001742 (0.00479) [0.36397]
Real GDP$_{t-2}$	0.193076 (0.04529) [4.26307]	0.026723 (0.04489) [0.59534]	0.054360 (0.07892) [0.68884]	-0.000672 (0.00475) [-0.14138]
Loans to SMEs$_{t-1}$	0.040618 (0.84716) [1.34468]	-0.072537 (0.03024) [-2.39904]	0.688938 (0.05946) [12.8873]	0.000628 (0.00320) [0.19639]
Loans to SMEs$_{t-2}$	0.005172 (0.02561) [0.20196]	-0.023206 (0.02563) [-0.90530]	0.164208 (0.04549) [3.60993]	-0.000927 (0.00271) [-0.34161]
Real Interest Rate$_{t-1}$	0.103055 (0.04685) [1.18665]	0.079607 (0.03759) [0.87905]	0.076993 (0.02281) [0.52094	0.003497 (0.00920) [0.38012]
Real Interest Rate$_{t-2}$	0.020761 (0.04764) [0.43582]	0.033867 (0.00382) [0.40404]	-0.006811 (0.04812) [-0.14154	0.002919 (0.00505) [0.57836]
Inflation Rate$_{t-1}$	-0.025948 (0.84716) [-0.03063]	2.202070 (1.49063) [1.47727]	0.282171 (0.04716) [0.33280]	0.064434 (0.03049) [0.71205]
Inflation Rate$_{t-2}$	0.059778 (0.45628) [0.13100]	0.216860 (0.80286) [0.27011]	0.190310 (0.45667) [0.41674]	-0.006780 (0.04880) [-0.13893]

	Real GDP$_t$	Loans to SMEs$_t$	Real Interest Rate$_t$	Inflation Rate$_t$
Constant	23.57080 (37.5293) [0.62806]	-425.3556 (66.0892) [-6.43608]	-178.6726 (37.6024) [-4.75162]	2.659967 (3.97501) [0.66917]
R^2	0.919715	0.881970	0.846734	0.572314

Table 6: Predicted values of Real GDP using the lagged variables Loans to SMEs, Real Interest Rate and Inflation Rate

Year	Real GDP (Billion Tk.)	Loans to SMEs (Billion Tk.))	Real Interest Rate (Billion Tk.))	Inflation Rate (Percentage)
2014-15	4960.23	4420.94	112.08	7.12
2015-16	5287.94	4957.52	112.12	6.75
2016-17	5639.85	5555.53	112.23	6.69
2017-18	6017.74	6222.00	112.01	6.72
2018-19	6423.54	6964.77	112.68	6.24
2019-20	6859.29	7792.58	113.20	6.13
2020-21	7327.22	8715.15	113.58	5.57
2021-22	7829.70	9743.34	114.32	5.49
2022-23	8369.27	10889.25	114.69	5.34
2023-24	8948.69	12166.33	114.98	5.78
2024-25	9570.89	13589.61	115.32	6.01
2025-26	10239.04	15175.84	115.96	6.45
2026-27	10956.51	16943.66	116.34	6.71
2027-28	11726.96	18913.86	116.52	6.79
2028-29	12554.30	21109.61	117.23	7.14
2029-30	13442.72	23556.73	118.50	7.47
2030-31	14396.74	26284.01	118.72	8.14
2031-32	15421.20	29323.51	119.02	7.78

Year	Real GDP (Billion Tk.)	Loans to SMEs (Billion Tk.))	Real Interest Rate (Billion Tk.))	Inflation Rate (Percentage)
2032-33	16521.30	32710.97	119.42	6.75
2033-34	17702.63	36486.23	119.65	6.72
2034-35	20333.40	40693.70	119.84	6.69