

Interest Rate and Economic Growth Nexus in Pakistan: An Investigation using Maximum Entropy Bootstrap Approach

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Abstract:

Internationally, use of interest rate as a policy tool has a long tradition. However, its impact on economic growth is inconclusive. There are two main strands of literature; first Keynesian view, that higher interest rate lowers investment and hence growth, and the second Mackinnon-Shaw hypothesis that postulates that increase in interest rate improves the efficiency of investment and accelerate economic growth. However, despite the nature of relationship, direction of causality is also inconclusive. It could be because of using different data span, countries and most importantly the use of traditional asymptotic theory based econometric approaches like testing for possible unit root and/or cointegration, etc. To overcome these problems, this paper makes use of state of art 'maximum entropy bootstrap (meboot)' approach to investigate the causal link between interest rate and economic growth. This approach doesn't need any data transformation (such as differencing etc.) and thus retains all the characteristics of the data (like trend, structural breaks, etc.), while providing a robust picture of the causal nexus between interest rate and economic growth. The empirical analysis is based on the annual data for Pakistan over the period 1960 to 2017. The study concludes that there exists a unidirectional causal relationship from economic growth to interest rate. Hence state bank of Pakistan should be cautious in using interest rate as a policy tool to accelerate economic growth.

Key Words: Interest Rate; Economic Growth; Maximum Entropy Bootstrap; Non-stationarity; Cointegration; Granger Causality

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1. Introduction

Role of central banks (CB) and monetary policy (MP) has changed over the time especially in the last century. Initially, MP was believed to have little or no effect in stimulating economic growth. However, the role of CB has changed significantly over time. The objectives of CB are to stabilize price level, ensure availability of credit to business, control unemployment, and to stimulate economic activities in a country. Theoretically, it is believed that the CB uses different tools to stabilize economy like monetary base, reserve ratio, policy rate, etc. Before global financial crises (GFC) 2007-08, economist and most of central banks also believed that interest rate can be safely used as a policy tool to control money supply (MS) and accelerate economic growth (EG). All prominent economists either belonging from the Classical, Neoclassical, Keynesian, Monetarist, New-Classical, Neo-Wicksellian, Austrian, some ecological economist and even Post-Keynesian economist believes that lower interest rate stimulate EG (Lee and Werner, 2018). However, after the GFC, use of interest rate as a policy tool becomes ambiguous. Continuous decrease in interest rate could not stimulate economic growth in the most effected countries by the GFC. Hence, GFC has exposed an important puzzle which exists since long time but could not get desired attention in the mainstream ideology.

Ineffectiveness of interest rate to stimulate EG is one of the core issues at the heart of monetary economics. Werner (1997, 2005, 2012) has exposed this puzzles in his several papers but it could not get desirable attention in mainstream literature. He has discussed several examples, Japan is one of them, where continuous reduction in interest rate from 7% in 1991 to 0.001% in almost ten years could not stimulate EG.

Although the relationship between interest rate and EG is highly explored area of monetary economics, but still economist could not reach to concrete conclusion. There are two main strands

of literature; first Keynesian view, that higher interest rate lowers investment and hence growth, and the second Mackinnon-Shaw (M-S) hypothesis that postulates that increase in interest rate improves the efficiency of investment and accelerate EG Owusu and Odhiambo (2014). Many studies, for example, Fry (1988), Gelb (1989), Seck and El Nil (1993), Allen and Ndikumana (2000), Charlier and Oguie (2002) among others, supported M-S hypothesis, while Gul, Mughal, and Rahim (2012), Ali, Saifullah, and Kari (2015), among others supported the Keynesian ideology. Hence, empirical literature on the relationship between interest rate and EG does not lead to a concrete conclusion. It is important to understand that any economic policy not necessarily yields same result if adopted in different country with different macroeconomic environment. It is because, different countries have different set of institutions, levels of financial sector development, fiscal deficit, etc. Hence, for this reason, same policy may yield different result if implemented in other country (Ghatak and Sánchez-Fung, 2007).

Second important issue which is highly overlooked in the literature is the causal relationship between interest rate and economic growth. Besides nature of relationship, direction of causality is also very important. Few attempts have been made to investigate the causal relationship between these two important variables (interest rate and economic growth). However, researcher provided mixed conclusions. For instance, Jelilov, Waziri, and Isik (2016) and Yien, Abdullah, and Azam (2017) suggested unidirectional causality from interest rate to EG, while Lee and Werner (2018) and Urbanovský (2017) asserted that EG causes interest rate. Moreover, some studies like Jelilov et al. (2016) and Lee and Werner (2018)⁴ found bidirectional causality between interest rate and EG. Surprisingly, we could not find any study for Pakistan which specifically deals with the

⁴ For US, Lee and Werner (2018) found bidirectional causality exist between interest rate and EG.

investigation of causal relationship between interest rate and EG. So it would be interesting to explore this issue further in case of Pakistan.

Pakistan has experienced different shifts in monetary policies over the time. Initially, money was considered as an important policy instrument, however, since 2004 the focus of monetary policy was shifted towards interest rate, and now interest rate corridor system is used from August 2009 (Hanif (2014). It is an important policy question that whether this shift in monetary policy stance is effective in stimulating economic growth? Hence, there is a dire need to investigate the causal relationship between interest rate and economic growth in Pakistan.

To answer the questions raised above, the present study investigates the causal relationship between EG and interest rate in Pakistan, using annual data over the period 1960-2017. In addition to this, instead of using traditional econometric techniques that are based on asymptotic theory such as unit root, cointegration and Granger causality, the present study employs the state of art ‘maximum entropy bootstrap (meboot)’ approach advanced by Ahmed, Riaz, Khan, & Bibi, 2015]. This approach does not need any data transformation (such as differencing, etc.) and thus retains all the characteristics of the data (like trend, structural breaks, etc.) Moreover, it produces robust results for finite samples.

The paper is structured as follows; Section 2 briefly reviews empirical literature. Section 3 deals with methodology and data description. In section 4, empirical results are discussed and we conclude the study in the fifth section.

2. Literature Review

A lot of research has been done on the relationship between interest rate and EG. However, no concrete conclusion could be drawn so far. McKinnon-Shaw (M-S) hypothesis (1973) postulates

that financial repression is one of the main cause of the hindrance of EG. When household face financial repression, they have limited access to credit, as a result, it negatively affect investment. Hence, new technological innovations could not introduce in production processes, which in return negatively affect EG. To handle this situation, financial liberalization such as controls on financial system should be abolished and market forces are allowed to play their role in adjustment of interest rates. Banks offer higher deposit rates to attract more deposits as a result, saving increases, which is considered as the supply of loanable funds. Hence, increase in supply of loanable funds enables businesses to increase investment. According to the M-S hypothesis, increase in interest rate increases saving, which in return increase investment and growth under the assumption of efficient markets and closed capital accounts. On the other hand, Keynes (1936) postulates that increase in interest rate increases cost of borrowing, which exerted negative pressure on investment. Hence, decrease in investment affects economic growth negatively.

It has remained an erroneous but widely believed fact that economic policies yield same results irrespective of the socio economic condition of any county. In general, developing countries are characterized with weak institutions, under-developed financial sector, and higher fiscal deficit. Hence, uniform policy may not necessary yield same results in different countries (Ghatak and Sánchez-Fung, 2007). Kuttner and Mosser (2002) have analyzed the US economy for the period of 1950-2000. They have found positive relationship between real GDP growth and interest rates. Dotsey, Lantz, and Scholl (2003) argued that there exists positive correlation between lagged cyclical output and interest rates.

Some studies have also found no relationship between EG and interest rate. For instance, King and Levine (1993) asserted that better financial system encourage innovations which further accelerate EG. They have developed endogenous growth model with improved financial system for large

group of countries including the most industrialized countries and found no support for the relationship between EG and interest rate. However, they have found that other financial variables does explain EG. Taylor (1999) also found weak relationship between interest rate and macroeconomic variables such as saving and investment.

De-Gregorio and Guidotti (1995) pointed out that the relationship between interest rate and economic growth is non-monotonic. Moreover, volume of investment is not very relevant; rather it is the efficiency of financial sector which can improve growth. On the other hand, Fry (1998) found nonlinear relationship between interest rate and EG in some developing countries. He concluded that initial increase in interest rate stimulates growth but it hinders growth for much higher interest rate. Obamuyi and Olorunfemi (2011) concluded that interest rate played significant role in the development of Nigerian economy. On the other hand, some studies have found that interest rate has no impact on growth. For example, Goldsmith (1969) used data from 1860-1963 of 35 countries and found no correlation between them.

To investigate causal relationship between interest rate and EG, very few attempts have been made. For instance, Lee and Werner (2018), Davcev, Hourvouliades, and Komic (2018), Urbanovský (2017), and Anaripour (2011) have reported that EG causes interest rate. Anaripour (2011) has investigated the causal relationship for the panel of 22⁵ countries using data from 2004-2010. On the other hand, Davcev et al. (2018) has used quarterly data from 2000 to 2014 and concluded that EG causes interest rate in Bulgaria and FYROM. However, in Romania, interest rate causes EG. Urbanovský (2017) has used traditional VAR models and found that EG causes interest rate in Czech Republic. Similarly, Lee and Werner (2018) has analysed four advanced industrial

⁵ Panel of 22 countries include Hong Kong, Indonesia, Iran, India, Japan, Korea, Malaysia, Brazil, Mexico, South Africa, Thailand, The Philippines, Singapore, Argentina, Chile, Colombia, Peru , Venezuela, Egypt, Israeli , Czech Republic, and Russia.

economies (US, UK, Germany and Japan) and concluded that EG causes interest rate in UK, Germany and Japan, but in the US found bidirectional causality.

In contrast, Yien et al. (2017) used VAR-based Granger causality test and found that interest rate causes EG in Malaysian economy. Moreover, Jelilov et al. (2016) used traditional methods such as cointegration, error correction model (ECM) and Granger causality test to investigate the causal relationship between interest rate EG. They concluded bidirectional causality between interest rate and EG for Nigerian economy. However, for Pakistan, we do not find any study that analyzed the causal relationship between EG and interest rate. Some studies have been conducted to investigate the impact of monetary measures to stimulate growth. But no specific study has been so far conducted on the causal relationship between interest rate and EG. Hameed and Ume (2011) used traditional regression analysis to investigate the impact of MP on growth using data from 1980 to 2009. They found that MS, inflation and interest rate significantly affected EG in Pakistan. Similarly, Waliullah and Rabbi (2011) used Johansen Cointegration (JC) approach and Vector Error Correction Model (VECM) to investigate the role of MP in stimulating EG. They concluded that MP plays important role in stimulating EG in Pakistan. Gul et al. (2012) used unstructured OLS methods to find link between MP and EG using data from 1950 to 2010 and found that tight MP effect EG. Ahmad, Afzal, and Ghani (2016) found that interest rate negatively affected EG using the data from 1973 to 2014.

Based on the review of above cited literature, we may deduce that inconclusive findings with regards to the causal the relationship between interest rate and EG. The present study fills the gap by investigating causal relationship between interest and EG for Pakistan using relatively new methodology developed by Vinod (2009) [see Ahmed et al. (2015) for details].

3. Methodology and Data Description

Most of the economic and social science variables are non-stationary, vigorous and adoptive in nature, which lead to the risk of rejecting the true null hypothesis. To tackle this problem, traditional econometrics devised several tests for causality, stationarity, and cointegration, grounded on “asymptotic theory”. Ahmed et al., 2015; Yalta, 2011). Researcher are often converting non-stationary series in to stationary by “detrending or differencing approach” (Khan, Ahmed, & Bibi, 2018). However, this leads to reduction in the efficiency of OLS, misspecification of model, it is inappropriate to deal with structural changes (Hamilton, 1994) and may lead to loss of true data (Vinod, 2006). Moreover, to investigate the causal relationship, Granger causality test is commonly used. The Granger causality test proposed by Granger (1969) provides useful information about the time structure between two variables, but unfortunately results could be misleading if variables are either integrated or cointegrated. Actually, Granger causality test possess “asymptotic properties”, which may lead to highly biased results in case of small sample (Toda & Phillips, 1993). To handle these issues, meboot approach introduced by Vinod (2006) provide reliable and robust results with respect to the causal relationship between the variables (Vinod, 2006; Vinod & López-de-Lacalle, 2009).

Following Khan et al. (2018); Ahmed et al. (2015) and Yalta (2011) simulation-based Maximum Entropy Bootstrap Approach (Meboot) is employed to investigate the causal between EG and interest rate. Meboot does not required stationarity of different variables, which make the task simpler. Hence, the present study employs bivariate causal analysis between short term interest rate and EG. In this study short term interest rate is measured by money market rate and economic growth is measured by real GDP growth for the period 1960-2017. Data has been collected from

the World Bank's World Development Indicators (WDI), State Bank of Pakistan and the International Monetary Fund's International Financial Statistics (IFS).

The standard bivariate vector autoregressive (VAR) model is used for empirical analysis:

$$y_t = c_1 + \sum_{i=1}^p \alpha_{1i} y_{t-i} + \sum_{i=1}^p \beta_{1i} STIR_{t-i} + \varepsilon_{1t} \dots \dots \dots \quad (1)$$

$$STIR_t = c_2 + \sum_{i=1}^p \alpha_{2i} y_{t-i} + \sum_{i=1}^p \beta_{2i} STIR_{t-i} + \varepsilon_{2t} \dots \dots \dots \quad (2)$$

Where c_1 and c_2 are constants, ε_{1t} and ε_{2t} are white noise error term and α_{ji}, β_{ji} are the respective coefficients, where $p=2$ is the maximum lag length used in bivariate setting. The meboot approach adopts a special procedure by creating an ensemble of both STIR and GDP growth for fixed number of times (say $m=999$). Each series embodies the "population" of the original data and it provides different bands. The important feature of this approach is that each band possesses same properties as the original data series possess. Hence, 999 coefficients estimates for each parameters $(\alpha_{ji}, \beta_{ji})$ are obtained that are later used to construct conf. Intervals for α_{ji}, β_{ji} . With "High-density region (HDR) approach is used to compute these intervals.⁶ In this approach sampling distribution does not matter, whether it is bimodal or multimodel, HDR provide consistent confident intervals. Hence, the null hypothesis the STIR does not cause GDP growth (or GDP growth does not cause STIR) is rejected if zero lies outside the range of $(1 - \alpha)100\%$ confidence interval for α_{1i}, β_{2i} ⁷.

⁶ The HDR means that each point within this region has at least as high probability as for every point lying outside the method (Hyndman, 1996).

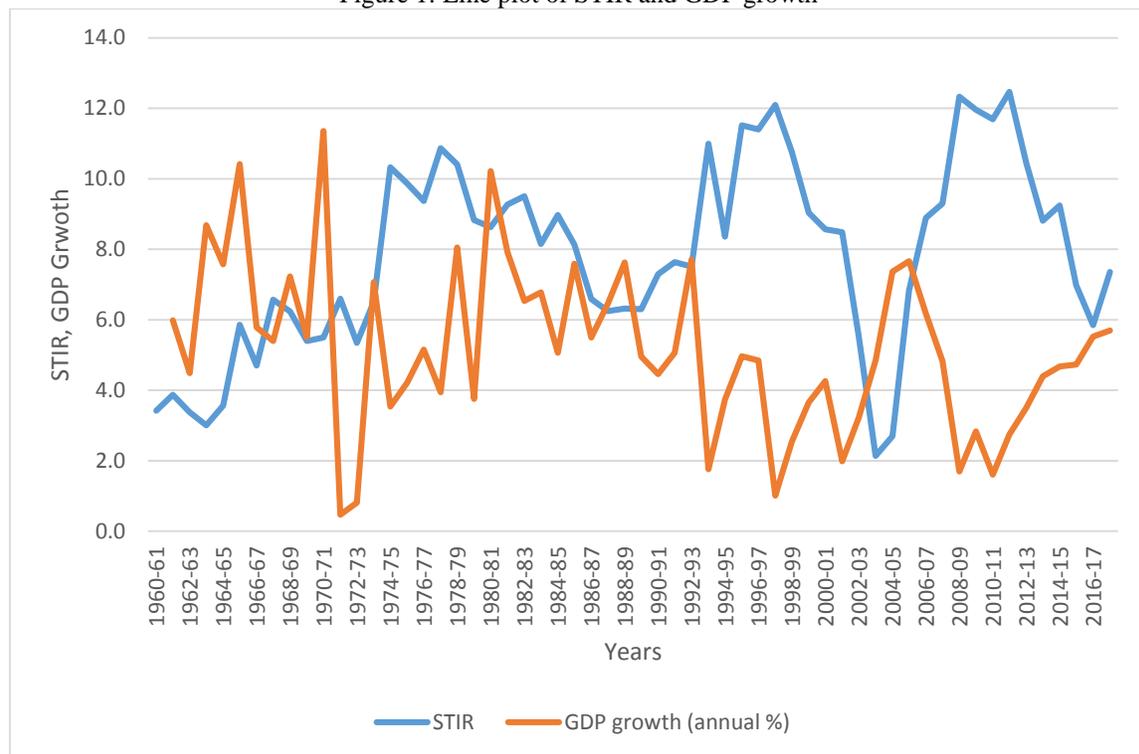
⁷ More discussion can be found in Khan et al. (2018); Ahmed et al. (2015); Yalta (2011) and Vinod (2013).

4. Empirical Results and Discussion

4.1.Descriptive Analysis

Before performing meboot techniques, we have plotted the data to get the glimpse of data. The line plot of STIR and GDP growth is shown in Figure 1.

Figure 1: Line plot of STIR and GDP growth



Note: Both variables are in their natural logarithmic forms

Overall, there is high fluctuation in growth and interest rate. The fluctuations in interest rate is much higher as compared to EG.

The basic summary statistics of chosen variables are provided in Table 1 below suggest that STIR series ranges from 2.1 to 12.5 while the number varies from 0.5 to 11.4 for GDP growth. The mean and median are almost close to each other, implying that the variables show symmetric behavior.

Table 1: Summary Statistics of STIR and GDP growth

Summary Statistics	STIR	GDP growth
Mean	7.8	5.2
Standard Deviation	2.67	2.37
Standard Error	0.3	0.3
Median	8.1	5.0
Minimum	2.1	0.5
Maximum	12.5	11.4
Count	57	57

4.2. Maximum Entropy Bootstrap Approach (Meboot)

Empirical results based on VAR (1) and VAR (2) are shown in Table 2

Table 2: Bivariate Analysis using 90% and 95% confidence levels

Variable	VAR(1) meboot 95% confidence intervals				VAR(2) meboot 90% confidence intervals			
	GDP growth		MMRate		GDP growth		MMRate	
	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
Constant	-0.246	1.103	0.450	1.529	-0.168	1.105	0.950	2.995
GDPGrowth(-1)	0.964	1.010	0.596	0.753	0.691	1.205	0.672	0.969
MMRate(-1)	-0.048	0.038	-0.030	0.009	-0.056	0.040	-1.337	1.170
GDPGrowth(-2)					-0.217	0.292	-0.403	-0.079
MMRate(-2)					-0.043	0.052	-1.209	1.304

Note: Bold figures show null hypothesis of no causal relationship is rejected.

It is evident from Table 2 that the null hypothesis that EG does not cause short term interest rate is rejected in both the VAR(1) and VAR(2) models. The same is evident from the plots of high density regions (see Figure 2 & 3).

Figure 2: Plots of High Density Regions for the estimates of GDP growth (GDP growth) (Bivariate case)

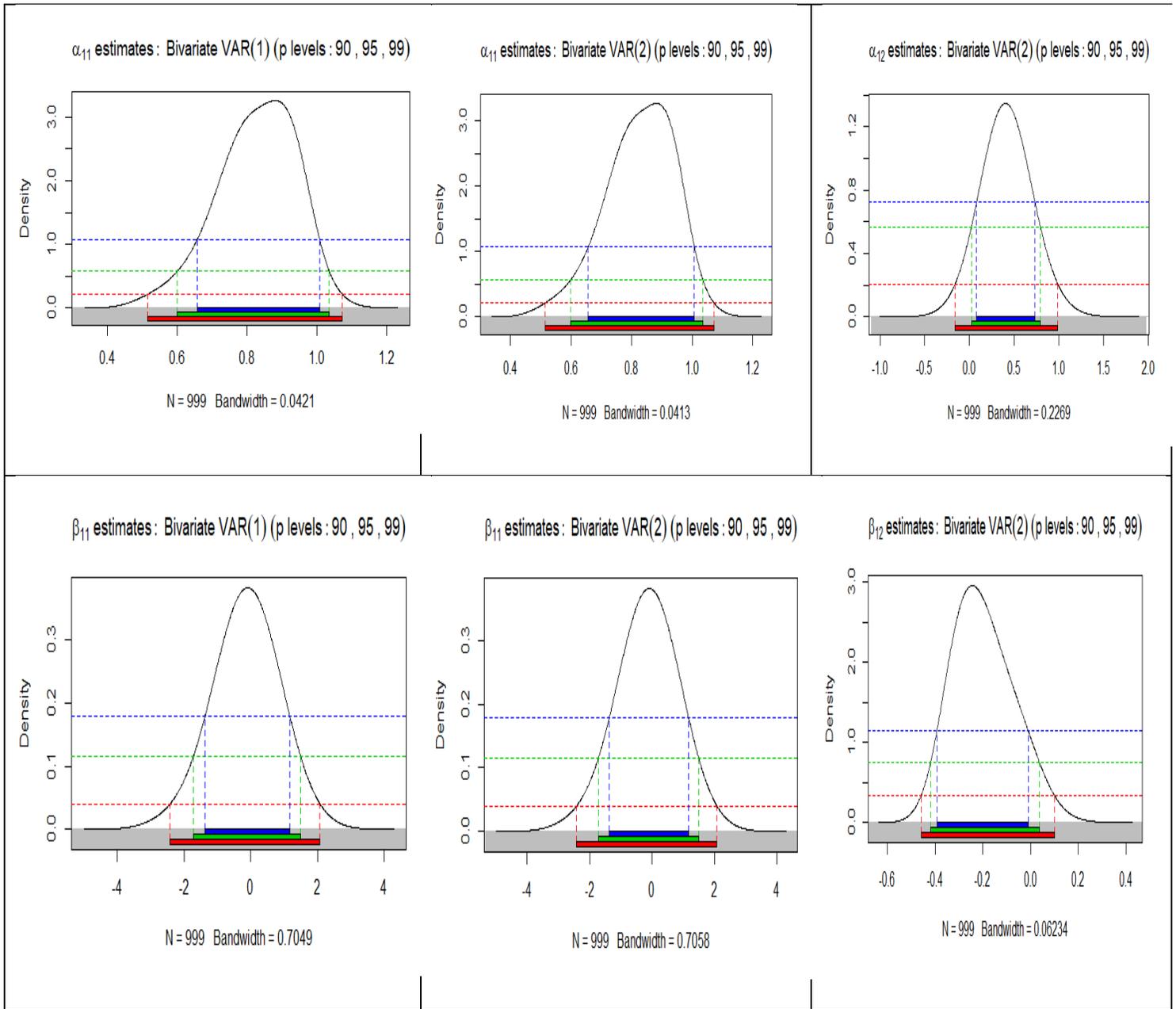
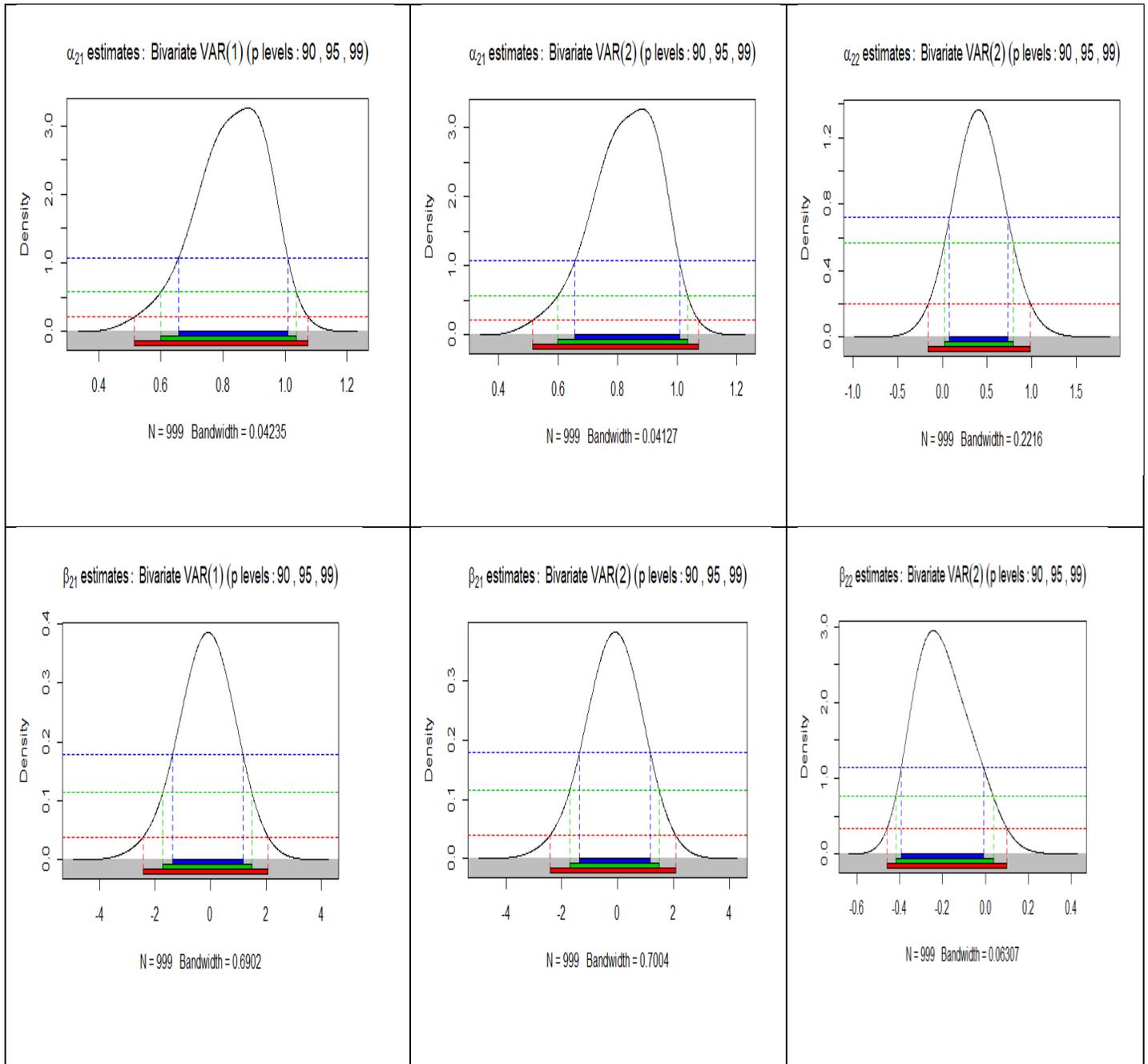


Figure 3: Plot of High Density Regions for the estimates of Money Market Rate (MMRate)



Hence, both model shows that there exist unidirectional causality and it runs from economic growth (GDPgrowth) to short term interest rate (MMRate). Our results are consistent with Lee and Werner (2018) for UK, Germany and Japan , Davcev et al. (2018) for Bulgaria and FYROM,

Urbanovský (2017) for Czech Republic and Anaripour (2011) for the panel of 22 countries. This implies that interest rate is not a significant factor that cause EG, but it is the EG that causes interest rate.

Hence, the State Bank of Pakistan should be cautious in using interest rate as monetary policy tool to stabilize the economy. One possible channel could be that an increase in EG leads to increase in the demand for money with given supply of money, as now households and businesses need more money for transactions which puts upward pressure on interest rate. The second possible channel could be; given the supply side bottlenecks, an increase in growth lead to increase in inflation. In order to control inflation, the State Bank of Pakistan may increase interest rate. Future studies can investigate which channel actually works behind the unidirectional causal relationship from EG to interest rate.

Our results partially support the argument of Ali and Ahmed (2014) who believe that interest rate does not perform better as compare to money in order to stabilize the economy. Hayat, Balli, Obben, and Shakur (2016) also argued that CB should not be completely emphasized on interest rate as a policy tool, instead MS is still important factor that help in stabilizing economic growth. Lee and Werner (2018) emphasized that it is not the interest rate that cause economic growth but it is endogenous MS created by the commercial banks in the form of credit creation, which matters for growth. Hence, future research can investigate this aspect of monetary policy.

5. Conclusions and Recommendations

Literature on causality shows that there is a trade-off between traditional bivariate models which usually suffer from omitted variable bias, and the multivariate models, which face the problem of over parameterization in single country case (Smyth & Narayan, 2015). This is a sombre constraint

when one wants to draw policy implication for certain countries with short data series. The maximum entropy bootstrap approach has excellent features that it does not rely on asymptotic theory and provide robust results even with short data span. In addition to that, this approach can be safely applied in the presence of nonstationary and, structural breaks, and it does not require any further transformation to make data stationary. Hence, we have employed meboot approach to examine the causal relationship between interest rate and EG for Pakistan using annual data over the period 1960-2017. The present study contributed to the literature by providing the empirical support in analysing whether the State Bank of Pakistan use interest rate as policy variable to stimulate growth. The results indicate that causality moves from EG to interest rate. This implies that interest is not the main cause of EG, but it is in fact the EG which cause interest rate. Present study has laid the first brick in the foundation of MP. But to understand the true mechanics, there is need for more comprehensive analysis which future studies can do on the lines we have provided in this study. Hence, this study is a good starting point for future research, which help us in understanding the possible monetary factors that cause economic growth.

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