

Interaction between Monetary and Fiscal Policy: Empirical Evidence from India

Dr. Narayan Sethi

Assistant Professor in Economics,
Dept. of Humanities and Social Sciences,
National Institute of Technology (NIT) Rourkela, Odisha,
email: nsethinarayan@gmail.com

Abstract

Monetary policy and fiscal policy has their own perspective towards maintaining economic stability of the country. So our general idea is that they work individually without the support of other one. But in practically for good functioning one policy it need a cooperation of other policy. In this paper we are empirically examining the interaction between monetary and fiscal policy by using Vector Error Correction Model (VECM) from the period of April 2010 to March 2015. The study also discusses game theoretic approach to know about the strategic interaction between monetary and fiscal policy. The study uses change in gross fiscal deficit and output to represent fiscal policy and inflation and interest rate to represent the monetary policy. As a result, study finds that fiscal policy well respond to any changes in monetary policy but reverse is not taking place.

Keywords: Monetary policy, Fiscal policy, Vector Error Correction Model (VECM)

JEL Codes: C32, E31

1. Introduction

Monetary policy and fiscal policy is two important pillar of an economy to maintain the economic stability of any country. But both the policies have different objectives and different perspectives towards maintaining economic stability. Monetary policy is more inclined towards maintaining price stability while fiscal policy is more incline towards maintaining growth and employment level of the economy. According to Philips curve a high level of employment or output is possible to achieve with a higher level of inflation. But this works only in short run, in long run there is no trade-off between inflation and employment. Monetary policy plays an active role in the long run. With the passage of time policies are changing, many countries declare them as inflation targeting countries. In that case they strictly follow the objective of price stability, which is the main objective of monetary policy. By this we get general idea that role of fiscal policy become minimal but in reality to achieve the price stability in the economy we also need the cooperation from fiscal policy.

We know monetary policy operates with a lag. In that case monetary policy needs a cooperation from fiscal policy to implement its policies. Fiscal policy needs to increase the fiscal tax to satisfy the condition of budget equilibrium. Fiscal policy act as a follower to monetary policy. This is the scenario of Ricardian regime. In this regime monetary policy act as active policy and fiscal policy act as passive policy. An active policy considers the expected future behaviour of economic variables while a passive policy considers the present and past behaviour of economic variables. Any discoordination between these polices leads to adversely affect the overall economic situation of an economy. This loses the credibility of the policies, which ultimately decreases the effectiveness of policies. Perfect coordination between monetary and policy needed not only for a good, efficient, stable economy also for credibility and policy sustainability. Similarly, fiscal policy also needed the cooperation from monetary policy. Central banks often required to finance public sector deficits, including those arising from quasi fiscal activities.

There are some problems in attaining the coordination between monetary and fiscal policy. First problem is the time frame. Both policies act in different time period and operates with different time lags. Second, what will be the main objective if both policies work cooperatively. How economic variables representing fiscal policy response to monetary policy and variables representing monetary policy response to fiscal policy actions. So main focus of our study is to find out how different macroeconomic variable response to different policies adopted by monetary and fiscal authorities. We also theoretic analyse the strategic interaction between monetary and fiscal policy by using game of prisoner's dilemma and battle of sexes.

In this paper we are studying the interaction between monetary and fiscal policy for India. The paper organised into six sections including the introduction one. Second section represent the game theoretic approach and third sections discusses some earlier literature. Section four highlights the data and methodology used in the study. Section five discusses the empirical results. And finally section six draws the conclusion.

2. Game Theoretic Approach

Table 1: Payoff Matrix for Prisoner's Dilemma

		Fiscal Policy	
		Cooperation	Non-cooperation
Monetary Policy	Cooperation	Low Inflation High Employment High Output (a,1)	Low Inflation Low Employment Low output (b,2)
	Non-cooperation	High Inflation High Employment High Output (c,3)	High Inflation Low Employment Low Output (d,4)

Table 2: Payoff Matrix for Battle of Sexes

		Fiscal Policy	
		Active	Passive
Monetary Policy	Passive	High Inflation High Employment High Output (c,3)	High Inflation Low Employment Low Output (d,4)
	Active	Low Inflation High Employment High Output (a,1)	Low Inflation Low Employment Low output (b,2)

The above table 2 represents the payoff matrix between monetary policy and fiscal policy by using 2×2 game theoretic representation of battle of sexes. From given possible outcomes payoff of (c,3) and (b,4) are two possible Nash equilibrium. For fiscal policy payoff (c,3) of high inflation, high employment and high output will be the preferred Nash, while for monetary policy payoff (b,2) of low inflation, low employment and low output will be preferred Nash.

3. Review of Literature

Leith & Wren-Lewis (2000) states that when monetary policy anchor real interest rate to manage inflation then a self-stabilising fiscal policy is required to ensure model stability. A fiscal policy which does not, by itself, ensure fiscal solvency constraints monetary policy to be relatively passive. According to Friedman (1948) a stable framework of monetary and fiscal policy can eliminate the uncertainty and undesirable political implications of discretionary action by governmental authorities. Woodford (2001) also argues similar thing that to maintain price stability both appropriate monetary and fiscal policy is required.

Aktas, Kaya & Özlale (2010) studies the coordination between monetary and fiscal policy especially for an inflation targeting emerging market. The study takes Turkish economy as laboratory for the study and finds that dynamics in fiscal policies plays a very important role in effective implementation of the monetary policies. Bertella et

al. (2015) examines the interaction between fiscal and monetary policy in a dynamic nonlinear model. The study separately studies the interaction between two policies for inflation targeting and growth targeting economy. As a result, find that stable equilibrium is more restrictive in inflation targeting economy than growth targeting economy. Sufficient conditions of maintain stable equilibrium in growth targeting economy are not sufficient for inflation targeting economy.

Raj, Khundrakpam & Das (2011) also empirically studies the interaction of monetary and fiscal policy for India from the period of 2000Q2 to 2010Q1 by using quarterly data of inflation rate (WPI), change in gross fiscal deficit, policy rate and output gap. As a result, they found that reaction of monetary and fiscal policies to any shocks in inflation and output are opposite. Fiscal policy reacts in a pro-cyclical way while monetary policy reacts in a counter-cyclical way. The study suggests that fiscal policy is effective in increasing the level of output in short run and decreases the level of saving and investment in the medium term. Similarly Kuncoro & Sebayang (2013) try to find out the dynamic interaction between monetary and fiscal policies for Indonesia from the period of 1999-2010. The study finds interest rate and primary balance surplus are the main determinant of interaction between both the policies and monetary policy is more dominant than fiscal policy in case of India. Moreira, Soares, Sachsida, & Loureiro (2011) empirically analyse the interaction between monetary and fiscal policies in case of Brazil from the period of 1995:Q1 to 2008:Q3 and especially focus on whether fiscal policies are active or passive in this time span. The study gets quite confusing result. According to Lepper model fiscal policy was active and monetary policy was active, while in case of Ricardian regime monetary policy was active and fiscal policy was passive but again in case of non-Ricardian regime fiscal policy was active and monetary policy was passive.

Canzoneri, Cumby, & Diba (2010) discusses about different theories related to the optimal policy of the economy. The study focuses to know best combination of monetary and fiscal policies to stabilise the economy by looking to both positive and normative aspects of interaction between monetary and fiscal policy. Goyal (2002) argues about rules related to coordinate monetary and fiscal policies. The study suggests following a fiscal responsibility act, which focus on back loaded reduction of the revenue deficit while protecting capital expenditures, automatic stabilization and incorporating escape clauses. This is also known as fiscal deficit Zone targeting and can make the coordination between monetary and fiscal policies.

Laurens & Piedra (1998) study recent discourses in coordination of monetary and fiscal policies. Now a day the main objective of monetary policy is to ensure price stability and fiscal policy is to manage public debt, in this case managing the coordination between two policies is quite difficult. The study suggests that central banks must have full control over overall liquidity developments in the economy and its ability influence them by means of its discretionary monetary operations. Afonso & Balhote (2014) try to examine the interaction between monetary and fiscal policies for 14 EU countries using panel data from the period of 1970 to 2012 but the study do not get any evidence related to central bank's response to fiscal policy.

4. Data and Methodology

To study the interaction between monetary and fiscal policy we take monthly data of four variables change in gross fiscal deficit (GFD), output gap inflation and interest rate from the period of April 2010 to March 2015. GFD and output gap will represent the fiscal policy while inflation and interest will represent the monetary policy. These two policies have their own objectives. Monetary policy main objective is to maintain the price stability so to represent that we have taken inflation. While fiscal policy objective is to maintain growth rate and give special preference to lower the unemployment level. To represent this, we take output gap as proxy to represent the unemployment level. Again as monthly data of Gross Domestic Product (GDP) to represent output is not available, we take Index of Industrial Production (IIP) as proxy to GDP, then calculate output gap from IIP by using Hodrick-Prescott Filter.

Generally, the HP filter is used to extract cyclical movements in time series. The function of the HP filter based on the assumption that the non-stationary movements in time series are captured by both smooth and slowly changing trends. Suppose the series (x_t) is composed of the trend component (g_t) and cyclical component (c_t).

$$x_t = g_t + c_t \quad (1)$$

Then HP filter isolates the cyclical component by minimising.

$$\sum_{t=1}^T (x_t - g_t)^2 + \lambda \sum_{t=2}^{T-1} [(g_{t+1} - g_t) - (g_t - g_{t-1})]^2 \quad (2)$$

This cyclical component represents the output gap. We have also taken change in GFD to represent the fiscal policy. Interest also has been taken to represent monetary policy as monetary policy use interest rate as an instrument to manage its objective of maintaining price stability in the economy.

Then we use Vector Error Correction Model (VECM) to empirically study the coordination between monetary and fiscal policy. VECM can be expressed as

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \dots + \Gamma_{k-1} \Delta Y_{t-k} + \Pi Y_{t-k} \varepsilon_t \quad (3)$$

Where Δ is the rank difference operator:

$$\Gamma_i = -I - \Pi_1 - \dots - \Pi_i, \quad i = 1, 2, \dots, k$$

5. Empirical Results

Before any analysis first we tested the stationarity of the variables. GFD, inflation and output gap are stationary at level, while interest rate is stationary at first difference according to Augmented Dickey Fuller (ADF) test. Then we test for co-integrating relationship between variables by using Johansen Jusillius test and according to maximum eigen values there are two co-integrating vector exists between variables. Therefore, we go for VECM model instead of VAR. Then we analyse both variance decomposition and impulse response function (IRF) obtained from a shock of one standard deviation.

Responses of Gross Fiscal Deficit

Figure 1

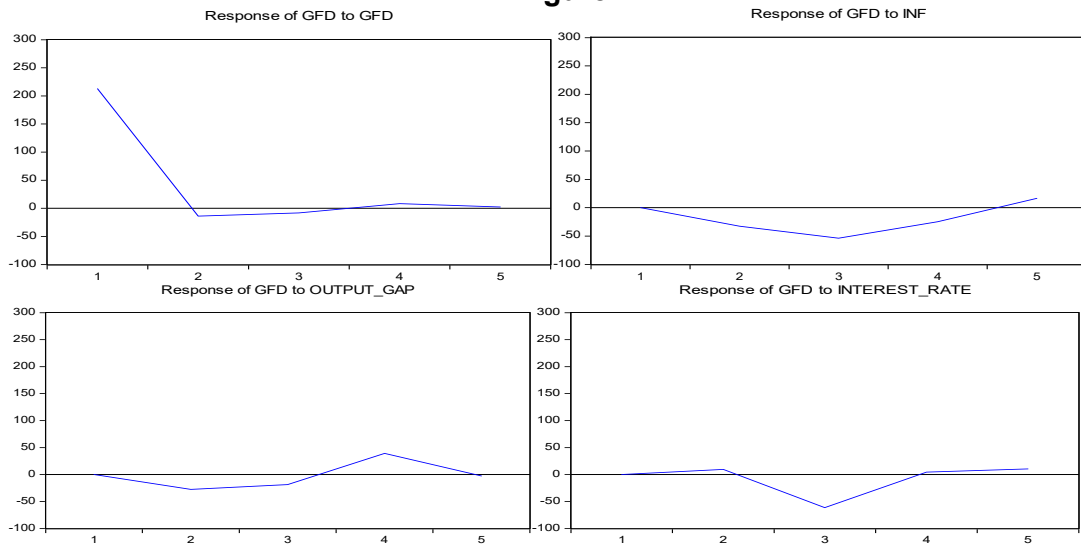


Figure 1 shows the responses of GFD to any shocks to other variables. Any shock to other variables has negative effect on GFD. In case of inflation, output gap and GFD itself has immediate negative impact on GFD but in case of shocks to interest rate GFD takes some lag to response. All the effects become normal by 4th period.

Responses of Inflation

Figure 2

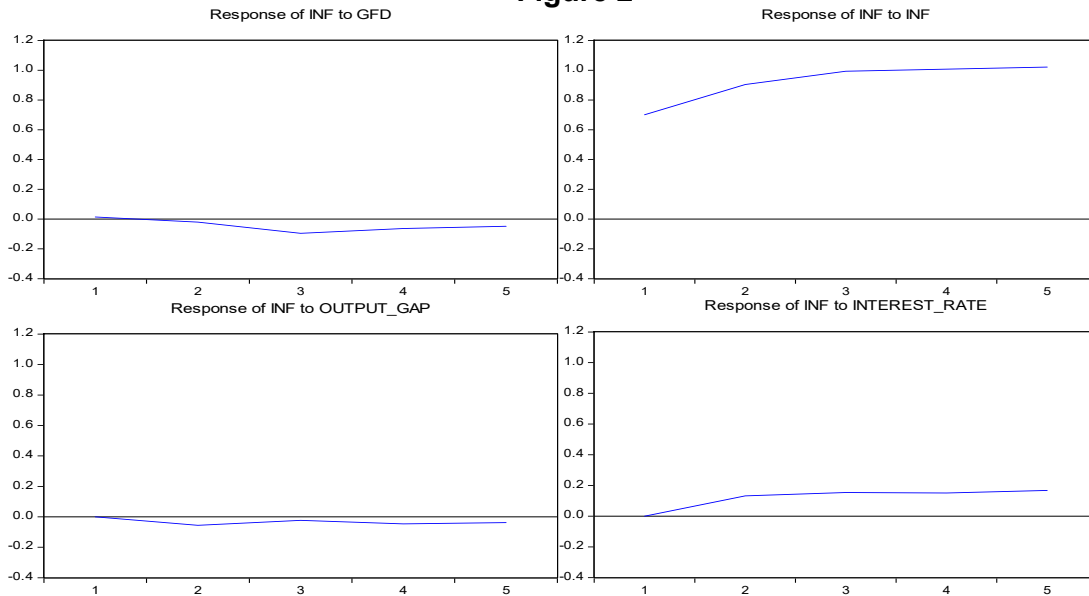


Figure 2 represents the response of inflation to, shocks to other variables. From the above figure we can clearly see that inflation highly react to any shocks to inflation

itself and interest rate. It does not significantly respond to any shocks to GFD or output gap.

Responses of Output Gap

Figure 3

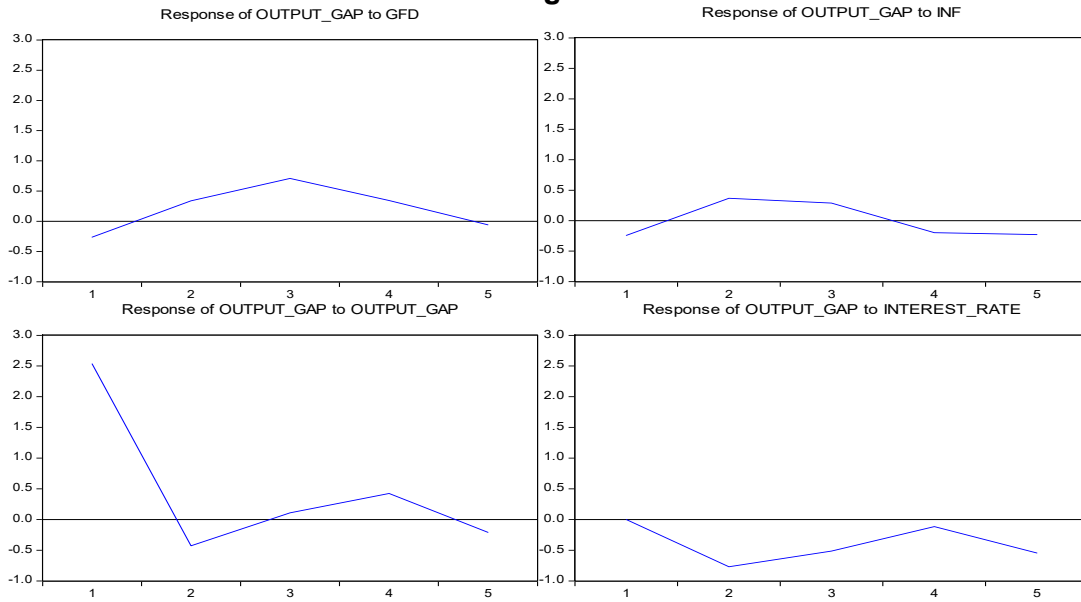
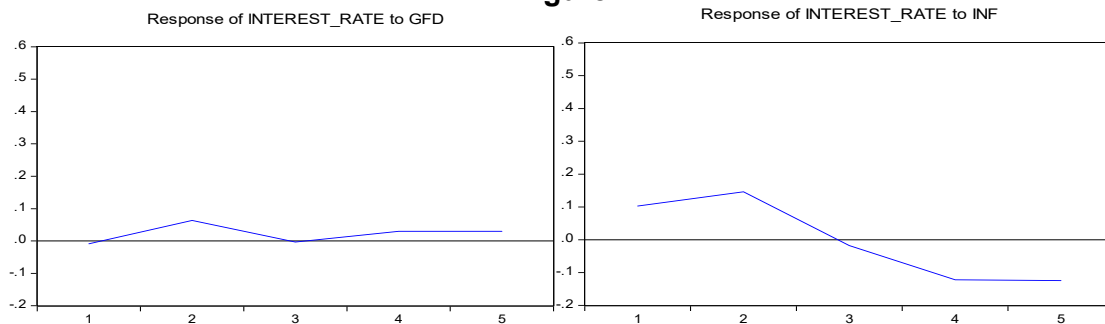


Figure 3 shows the response of output gap in case of any shocks to other variables. Output gap responds positively to the shocks to GFD while it responds negatively to the interest rate. In case any shock to inflation output gap takes some time lag to response negatively. May be on initial stages inflation affects output positively, when inflation increases beyond threshold level it affects output negatively.

Responses of Interest Rate

Figure 4



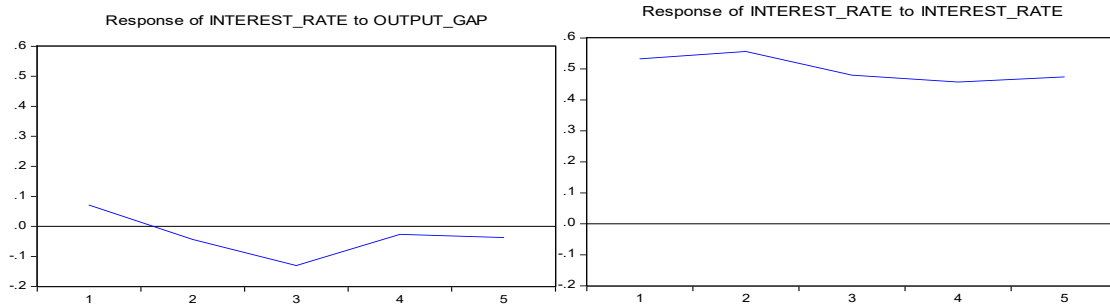
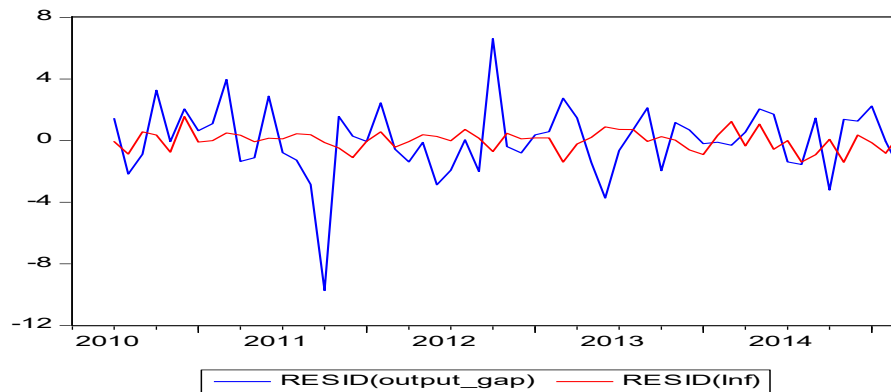


Figure 4 represents the response of interest rate to the shocks of other variables. Any shock to GFD does not affect much to interest rate but when any shock given to output gap Interest rate response negatively and after some time it start to recover but still remains negative. Interest rate takes some time in reacting to any shock to inflation but after that it shows a sudden fall.

Overall we can clearly see that variables representing to fiscal policy is reacting to any shock to variables representing monetary policy but reverse is not happening. Variables representing to monetary policy are not much responsive to if any shock takes place in variables representing fiscal policy. As we have already discussed to maintain the objective of price stability by monetary policy it need cooperation of fiscal policy which is taking place but vice versa is not taking place. Variance decomposition represented in table 1 also shows the same thing. Any way the final objective of both the policy is to have stable economy although they have different objectives. Sometimes they deviate from achieving their final objective. This can be seen from below figure 5. Residual of output gap represent the deviation from the side of fiscal policy while residual from inflation represents the deviation from the side of monetary policy.

Deviation of Monetary and Fiscal Policy

Figure 5



Above figure 5 shows that fiscal policy need more time lag than monetary policy. Monetary policy actions are quicker than fiscal policies. It has been always a problem between monetary and fiscal policy is that, if any deviation takes place in the economy who the first one will be to takes initiatives. They both decide different combinations of their nominal anchors to mane the economic instability. But sometimes it works sometimes it won't.

6. Conclusion

This study analyse the interaction between monetary and fiscal policy for India. The coordination between monetary and fiscal policy is a sufficient condition to achieve the financial stability in the economy. Whether it is the objective of monetary policy or fiscal policy. We find that a good response from fiscal policy leads to changes take place in the action of monetary policy. However, monetary policy less responsive to changes in action of fiscal policy.

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APPENDIX

Table 3
Result of Unit Root Test without Trend

Variables	Augmented Dickey Fuller	
	t-statistics	P Value
At Level		
Gross Fiscal Deficit	-7.80	0.00
Output Gap	-7.80	0.00
Inflation	-1.37	0.99
Interest Rate	-1.69	0.42
1st Difference		
Gross Fiscal Deficit	-9.73	0.00
Output Gap	-10.65	0.00
Inflation	-5.59	0.00
Interest Rate	-7.25	0.00

*The tabulated value at 5% level of significance is -3.42.

Table 4
Result of Johansen Co integration Test

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None*	0.46	70.38	47.85	0.00
At most 1	0.39	34.07	29.79	0.01
At most 2	0.07	4.54	15.49	0.85
At most 3	0.00	0.18	3.84	0.66

Null hypothesis indicates no co integration at the 0.05 level.

*denotes rejection of the hypothesis at the 0.05 level.

Table 5: Variance Decomposition of Variables

Variance Decomposition of GFD				
Period	GFD	Output Gap	Inflation	Interest rate
1	100.0000	0.000000	0.000000	0.000000
2	95.97694	1.235904	2.586949	0.200203
3	83.65930	1.408625	7.864722	7.067350
4	80.49315	4.373087	8.309818	6.823946
5	79.94385	4.371161	8.715840	6.969151
Variance Decomposition of Output Gap				
1	1.059099	98.94090	0.000000	0.000000
2	2.414919	88.39265	1.393187	7.799239
3	8.113093	79.46451	2.293439	10.12895
4	9.136892	78.51089	2.480332	9.871882
5	8.780041	75.50246	3.037751	12.67974
Variance Decomposition of Inflation				
1	0.043849	0.900442	99.05571	0.000000
2	0.048211	1.835922	96.80632	1.309545
3	0.410806	1.624371	96.21347	1.751353
4	0.405327	1.719565	95.98948	1.885629
5	0.358517	1.709843	95.87402	2.057619
Variance Decomposition of Interest Rate				
1	0.023721	1.240407	3.972774	94.76310
2	0.648364	1.099544	5.000583	93.25151
3	0.467762	2.645401	3.700819	93.18602
4	0.453149	2.126647	4.330616	93.08959
5	0.437349	1.791027	4.755255	93.01637

Cholesky Ordering: GFD, Output Gap, Inflation, Interest Rate