# Simulation Analysis of Short and Long Run Shocks on the Macroeconomy of Pakistan

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## Abstract

*This paper traces the effects of temporary and permanent changes in price level, GDP, money supply, interest rate, exchange rate and foreign exchange reserves by using a six-variable VAR model. The main findings are that; GDP growth in the long run pressurizes prices due to which inflation keeps on increasing along with GDP. An exogenous increase in prices results an increase in GDP in short run but in long run it depresses the output. Therefore, there is an evidence of optimum rate of inflation with respect to output growth and targeted inflation rate is not necessary to become zero.*

## I.     Introduction

The economists, sociologists and politicians condemn the inflation because it takes away purchasing power from the individuals, reduces real cash balances, increases the nominal interest rate and creates unwarranted effects on the distribution of economic well-being. Inflation is usually considered or treated as a single macro variable but it is a natural response to a variety of disturbances in the economy. According to the framework of aggregate demand and supply, inflation is a result of excess demand or deficient supply in goods market. Therefore, any particular level of prices during a specific time period is the result of multiple economic forces, so it is almost impossible for the economists or econometricians to specify each of them in this dynamic world.

The role of inflation in economic growth and efficiency is also a matter of controversial debate. The Classical economists are of the belief that; in the long run, money is neutral in the sense that an increase in money supply increases the prices without affecting the real variables, output and employment. The well-known empirical relationship between inflation and unemployment was discovered by Philip (1958); known as Philips curve that has negative slope. Later on, Phelps and Friedman (1967) raised serious observations on the validity of the curve and contended that in the long run correlation between inflation and unemployment is

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zero. But today economists are in agreement that inflation is helpful in increasing employment and growth at least in short run.

This issue was analyzed by a number of scholars and ended up with different conclusions. For example; Tobin (1972) pointed out that inflation is helpful in downward wage adjustment and generating employment, Akkina (1990) and Barrow (1995) found an inverse relationship between output growth and prices, Bernanke and Gertler (1995) found that an increase in interest rate depresses prices along with GDP growth. Romer (1996) discovered that GDP growth results in price escalation. Mankiw (2001) concluded that the trade-off between inflation and unemployment is reality at least in short run and Samulson (2001) found an inverse U-shaped relationship between inflation and output growth. Akerlof, Dickens and Perry (2001) tested findings of Tobin by time series data and study's results seem to be consistent with Tobin's view. This implies that an increase in money supply has a positive impact on investment and GDP; through the channels of interest rate and stock prices.

As far as Pakistan is concerned, most of the past empirical studies focused the issue with respect to causes and contributory factors of inflation and its redistribution effects. Khan and Senhadji (2001) examined the relationship of high and low inflation with economic growth using panel data for 140 developing and industrialized countries for the period of 1960- 98. This study suggested the threshold level of inflation for both industrialized and developing countries; because after that it exerts a negative effect on economic growth. The threshold levels are 1% to 3 percent for the industrialized and 7% to11 percent for developing countries. Mubarik (2005) estimated the effects of inflation over GDP growth rate for Pakistan using annual data 1973- 2000, and also included population and investment as control variables in the model. The results of this study indicate that an inflation rate of 9% and above adversely affected the GDP growth rate and below that, it is statistically insignificant.

Kamal (2006) examined the joint relationship among money supply, output and inflation for Pakistan in both short run and long run. This study used impulse response function in order to find out time path of variations of the variables; along with co-integration and error correction mechanism for long and short period analysis. The results indicated that a negative relation exists between inflation and output in the short run and becomes positive in the long run. It implied that an increase in output reduces the price level in the short run but increases in the long run. Abbas (2009) also estimated the determinants of inflation for Pakistan using a number of nominal and real variables in the analysis. The most important finding was that an increase in GDP increases the inflation rate as well; very surprising result, which was not supported by theory.

All these studies check the relationship but none has tried to explore the interrelationship between inflation and economic growth. The present study is an attempt to evaluate the nature of relationship between price level, GDP and other

macro variables like money supply, interest rate, exchange rate and foreign exchange reserves in case of Pakistan's economy. All these variables are policy instruments as well and their interactive analysis will provide a comprehensive and precise guideline to the policy makers. Therefore, this study focuses on the following questions.

- Is there any evidence of relationship between inflation and GDP growth?
- What are the long run and short run responses of inflation and output growth to each other?

Since price is a nominal variable and it is influenced by other nominal variables. Therefore, money supply, interest rate, exchange rate and foreign exchange reserves are also included in the study. In order to broaden the scope of the study, further investigation has also been made in order to find out:

- What is the contribution of other nominal variables in influencing GDP and price level?
- How do all variables affect one another during the short run, as well as long run?

## II.      Framework of Analysis, Data and Estimation
## 1.      The Model

Although, the study aims to determine the nature of relationship between price level and output, many other macroeconomic variables cannot be ignored. These variables are important not only in determining one or both of the price level and output, but also in influencing the nature of relationship between the two variables. The nature of relationship among these variables can be analyzed by estimating a VAR model, which is simple in structure and does not impose any a priori restrictions on empirical structure of the economy on the basis of rigid economic theory, though some of the principles of economic theory can still be incorporated in the structure. This advantage becomes especially important if one is interesting in empirical outcomes of research without committing to any particular theory. Simplicity of the construction and estimation procedure is the additional advantages. Following the spirit of simplicity, we choose a medium-sized VAR model containing the following variables.

- Y:  Output, measured by GDP at constant market prices
- P:  Price level, measured by GDP deflator
- M:  Money supply, measured by M2
- E:  Exchange rate, measured as rupees per US dollar
- R:  Foreign exchange reserves held by the State Bank of Pakistan, measured in rupees and deflated by the GDP deflator
- I:  Money market interest rate, represented by the nominal inter-bank call money rate

Indicating the six variables by $X_{it}$ (i = 1, … 6), we specify following six-variables, three lags VAR model consisting of the following six equations.[2]

$$\Delta \log(X_{it}) = \alpha_0 + \sum_{j=1}^{6} \sum_{k=1}^{3} \alpha_{ijk} X_{j,t-k} + \varepsilon_{it} \qquad (1)$$

## 2.    The Data

The analysis is performed on the basis of quarterly data for a period of 84 quarters: 1983-I to 2003-IV. Quarterly data on national income accounts have become recently available in Arbi and Kemal (2004). The reason for choosing the quarterly data is that a quarter appears the right time interval at which short period responses, especially in nominal variables, are observed and one can meaningfully analyze the timings of the cause and effect relationships taking into account the possible feedbacks. The terminating point of data 2003-IV is the last data point available on GDP and related variables. The other terminating point 1983-I is chosen leaving three quarters of adjustment following the de-linking of Pak rupee from the US dollar.

Data of GDP at constant market prices and the GDP deflator are taken from Arbi and Kemal (2004), while the data on all other variables are taken from various issues of International Financial Statistics (publication of IMF) and various annual reports of the State Bank of Pakistan.

## 3.    The Estimation Procedure

Although VAR model consists of a set of Seemingly Unrelated Regression (SUR) equations, yet the estimation technique in practice is Ordinary Least Squares (OLS), unless there is any specific econometric problem such as autocorrelation. The reason for the application of OLS technique lies in a well-known result that if each equation in the SUR model contains the same set of explanatory variables, GLS collapses to OLS (Green (2004). To tackle autocorrelation, sufficient lag structure has to be considered in the specification of the VAR model. However, to preserve parsimony, lag length also need to be justified on the basis of proper tests or performance criteria.

In this study we shall start with a lag of eight periods and then follow 'general to specific' diagnostic/specification procedure. In particular, we applied Wald test on the restriction that all the coefficients at eight-period lag are equal to zero. If this restriction is accepted, the model will be re-estimated with seven-period lag and Wald test will be applied on the restriction that all the coefficients at seven-period lag are equal to zero. This testing procedure will continue till the Wald test results support the rejection of the null hypothesis.

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[2] *The three-period lag structure is specified on the basis of 'general to specific' diagnostic/specification procedure.*

Once the VAR model is estimated, it needs to be interpreted for economic analysis. Unfortunately parameter estimates of the VAR model are most likely to be contaminated by severe multi-colinearity and, hence their direct interpretation is not much useful. Instead the cause and effect relationships are analyzed with the help of Impulse Response Functions (hereafter IRF). An IRF simulates the effect of shock in a specific variable of the model on the same or any other variable of the model. The magnitude of the shock is set equal to one standard deviation of the variable in the first period of simulation and equal to zero in the remaining periods. The responses in the variables are traced over a set of periods such as 10, 50, 100, etc.

In this paper, we deviate from this practice and instead set the magnitude of the shock equal to one percent of the value of the variable in the terminal period of data that is 2003-IV. Furthermore, in addition to temporary shocks we also consider the effects of permanent changes in each variable on all variables of the model.

## III.    Empirical Analysis

As discussed earlier, we have taken one real and five nominal variables in our model. The shock of one percentage point is introduced in each variable one by one and response of each variable is obtained through the process of simulation. This practice makes a total of 36 results for temporary shocks and another 36 results for the permanent shocks. The response functions are then converted into a graphic form for visual comprehension.

### 1.    Temporary Shocks

Temporary shocks are represented by one percentage point increase in period 1 of simulation above the actual value of each variable of the model. The responses of various variables to these temporary shocks, shown in figure 1 to figure 6, are discussed as follows.

The time paths of the responses in various variables to temporary output shock are presented in various panels of figure 1. The output shock seems to be harmful for output itself, which declines as a result of the shock below the normal level after third period and then takes about 20 quarters (or 5 years) to get back to the normal level. The reason is that the shock results in piling up of inventories, which discourages investment and growth in the later periods. The price response to output shock is cyclical; initially there is a rise in prices because of the higher input demand, then declining trend is observed during the next 6 periods as more goods and services are available in the economy. Finally, inflationary pressures are observed again later in time path. This reappearance of price increase can be associated with the decline in the level of GDP as shown in panel (a) of figure 1. The normalization of price level takes a long time.

There is an increase of 0.8 percentage points in money supply in order to accommodate the output growth and it also takes fairly long period of time for the money supply to return to its normal path. The output shock also increases the

demand for import, therefore exchange rate deteriorates along with an increase in output but it converges in short time of 10 periods. Along with the import pressure, the foreign exchange reserves also decline very sharply up to -19 percentage points but convergence occurs soon after 5 quarters. Finally, the response of interest rate is just according to the economic theory; because of the increase in money demand accompanying GDP, interest rate increases by 1.3 percentage points within five periods and then it takes a very long time for convergence.

Figure 2 shows that the response of variables to price shock. The response of prices to price shock is not for a long time period, inflationary effects of price shock dies down within eight quarters. In short time, price shock does not seem to be harmful to output, GDP growth increases to 0.08 percentage points in 8 periods, then decline to -0.07 in the next few quarters. In the early periods higher prices motivate producers to increase output but later on with the normalization of prices businesses considerably reduce investments and then it takes a long time period for output to convergence to its normal time path. Money supply response to price shock is cyclical; initially it reduces to -0.1 percentage points in order to stabilize the price level and then increases to stimulate GDP growth and then the process of convergence sets in.

Price shock encourages imports and discourages exports, therefore exchange rate deteriorates and foreign exchange reserves deplete in the initial periods. Deterioration in exchange rate normalizes in 20 quarters and, hence, the reserves start increasing. Nominal interest rates always increases with the increase in prices, the same has been observed in our simulation, but it takes a very long period of time for market rate of interest to settle back to its original level. The crucial result is that inflationary shock results in positive real effect in terms of GDP in the short run. But in the long run inflationary shock is detrimental to GDP growth.

The analysis of one period money supply shock is presented graphically in figure 3. It shows that money supply is quite responsive to its own shocks and it takes quite a long period of time to achieve convergence. The response of GDP growth to money supply shock is almost the same as to price shock, initially it rises, then fall and finally convergence but its intensity is relatively lower as compared to price shock. It is very well established that the expansionary monetary policy generates inflationary pressures and the same is observed in this experiment. There is a rise in prices of 0.07 percentage point up to fifth period. Thereafter, the price level continues to decline till convergence occurs.

The exchange rate deteriorates with the increase in prices. Therefore money supply shock also results in local currency depreciation but the initial response of exchange rate is appreciation of 0.3 percentage points in the first period. However, foreign exchange reserves increase to 4 percentage points in the initial period as a result of the shock. Intervention in foreign exchange market by the central bank is also a channel of monetary expansion. Besides that, foreign currency accounts are one of the components of money supply in Pakistan. Therefore the reserves also

increase with the increase in money supply. As far as interest rate is concerned, it always follows the inflation rate. Monetary shock stimulates prices and therefore, interest rate keeps on increasing up to 8th period and converges in the long run.

Figure 4 shows that response of variables to exchange rate shock. The response of exchange rate to exchange rate shock is not much persistent; exchange rate normalizes to its normal path in the very next period after the shock. Similarly the output level is also not much affected by the exchange rate shock. The price level and money supply are not very responsive as well. There is a little rise in both variables that settle down very early in the next few periods. All these indicators suggest that openness of our economy is not very high and depreciation does not affect economic activities by a significant margin. However, the level of foreign exchange reserves increases by 1.8 percentage points, which indicates that depreciation of currency, is helpful in boosting the foreign reserves. Interest rate is also responsive to the exchange rate shock; it increases by 0.27 percentage points in the next period and converges after a long time. Financial investors are highly sensitive to gains and losses to their saving. Therefore, depreciation of local currency motivates domestic savers to divert their savings to assets denominated in foreign currency and this shortage of supply in savings results in an increase of interest rate.

The foreign exchange reserves of a country are mainly used to counter speculation and market imperfection. A sizable amount of the reserves enhances the element of stability in the economy. Therefore, there is an overall positive impact of increase in foreign exchange reserves on the economy that is shown by figure 5. Foreign exchange reserves decline to 0.2 percentage points in the third period but converge very early to the normal level. Output and price level also do not respond to this shock; their level remains almost undisturbed. However, there is a small increase in money supply by 0.01 percentage points with the increase in monetary base as a result of the shock. There is a slight appreciation in the exchange rate as well. The market interest rate declines by 0.15 percentage points because of the positive sentiments in money market developed by the increase in foreign exchange reserves.

The time paths of the responses in various variables to the interest rate shock are shown in various panels of figure 6. The response of interest rate to a shock in itself is long lasting and takes 50 periods for convergence. There is a little decline in GDP growth by -0.1 percentage points and it converges after 20 periods in response of the shock. The reason for this decline is that with the increase in interest rate borrowings become expensive, which discourage investment and growth. Prices also increases to 0.1 percentage points but settle back very early. There is a decline in money supply by 0.25 percentage points that could be the outcome of tightened monetary policy to counter the inflationary pressures resulting from the interest rate shock.

Economic theory suggests that an increase in domestic interest rate attracts foreign capital, which in turn results in appreciation of exchange rate and improvement in foreign exchange reserves. The increase in interest rate also

adversely affects private investment and, hence slows down economic activity. As a result, balance of payments deteriorates, exerting adverse pressures on exchange rate and reserves position. Thus, the changes in interest rate can affect exchange rate and foreign exchange reserves in either direction. Our results show that as a result of one percentage point increase in interest rate, exchange rate depreciates by 0.3 percentage points and the reserves decline by 3.2 percentage points.

## 2.     Permanent Shocks

This section covers short-run as well as long-run response of macro variables due to an increase of one percentage point growth in each variable in every period. Due to permanent change, dependent variables do not converge to normality as in case of temporary shocks. This implies that we can observe the long run behavior resulting from permanent changes in various variables. The permanent change in each variable is set equal to one percent and its effects on all the variables are simulated for 100 periods. The results are presented in various panels of figure 7 to figure 12.

The relationship between output and prices is straightforward in terms of quantity of money in circulation and goods and services available in the economy. A relative increase in money supply or decrease in output will push the prices upward and vise versa. According to the simulation results, there is a decline in prices with the increase in GDP but this trend is of a short period of time. After ten periods, prices begin to rise and this trend continues till the end. The decline in prices in the early periods is due to availability of more goods and services than before, but excess demand for factor inputs in order to produce more will increase the levels of wages, rent and interest rate, and consequently results in a permanent price hike.

The immediate response of monetary authorities to output shock is expansionary monetary policy in order to accelerate GDP growth but very soon declining trends in money supply are observed in order to neutralize inflationary pressures. An increase in GDP growth stimulates imports, therefore exchange rate depreciates and foreign exchange reserves deplete very sharply during the first 10 periods. However, exchange rate stabilizes after some periods and the foreign exchange reserves position also improves. The response of interest rate is straightforward as it keeps on increasing because of the ever-increasing demand for capital.

The simulation results show that the Price level is quite responsive to the shock in itself; it increases at the decreasing rate and stabilize at 3.5 percentage points in about 50 periods. It is probably because initially the effects of repeating exogenous shocks continue to accumulate but the effects of past shocks tend to be eliminated in the long run. Therefore, in the long run the accumulated effect of the price shocks stabilizes to a certain level, which is about 3.5 percentage points. There is a rise in GDP growth during initial ten periods then a declining trend sets in, which continues over a long period of time. During the early stages higher price level generates higher

profits and attracts investments but in the later stages inflationary pressures disturb the economy through high rate of interest and unstable environment, therefore there is a persistent decline in the GDP.

The response of money supply to permanent price increase is quite informative. During the first 25 periods money supply increases, however, as the price shocks accumulate further, the money supply starts decreasing until its growth rate settles at about 0.4 percentage points. Therefore, in short run, central bank follows an accommodating monetary policy to meet the money demand in the light of increased nominal volume of transactions but in the long run, it attempts to fight inflation by tight monetary policy. Exchange rate keeps on deteriorating with increase in prices as it discourages exports and encourages imports. The deterioration is very sharp during the first 15 periods and then marginal in the later periods. In short run there is a sharp depletion of foreign exchange reserves along with depreciation of exchange rate but later on foreign exchange reserves start improving because of the improvement in trade balance following the exchange rate depreciation.

Money supply is very responsive to the shock in itself; it grows at a rapid pace during the first 25 periods, however a declining tendency is observed during the later part of simulations. This is because central bank restricts the money supply in order to control the inflationary pressures. The permanent increase in money supply affects other variables very significantly. During the initial periods output increases by 0.15 percent but soon after it starts declining at diminishing rate and this pattern continues in the long run. The behavior of GDP in response to money supply is similar to that one caused by price shock because permanent monetary expansion results in a permanent rise in prices. As far as foreign exchange rate is concerned, it appreciates in the short run but depreciates in the long run. Foreign exchange reserves continue to increase throughout the period of simulations. The initial response of exchange rate follows positive short-run effect of monetary expansion on output. However, the rising price level soon offsets this short-term effect and exchange rate starts depreciating. Foreign exchange reserves increase in short run because of increase in nominal interest rate combined with appreciation of home currency. The reserve position continues to improve even after exchange rate starts depreciation, which is the likely result of improvement in trade balance following the exchange rate depreciation.

Historically Pakistan is a trade deficit country and due to uncertain political environment it has never been an attractive place for foreign direct investment. Therefore rupee has always been under pressure especially during the decade of 1990's. Economic theory suggests that depreciation of currency is helpful in improving trade balance, although it may aggravate the problems of trade balance in the short-run (mechanics of J-Curve). The effects of permanent increase in exchange rate are shown by figure 10. This shows that a permanent increase in exchange rate by one percentage point does not have any substantial feedback effect from rest of

the economy because on net basis the change remains close to one percentage point and quickly adjusts to its slightly higher long run level. Initially it appreciates a little and then starts depreciation with a gentle pace in the later periods. It is because exchange rate is mainly affected by the international capital flows and insufficient foreign exchange reserves; if the trade is smooth and the reserves are healthy then exchange rate remains stable over a long period of time.

The GDP is not affected during first few periods and then it starts declining marginally during later periods. This can be because the increase in the prices of imported inputs, like oil and capital goods, discourage investment and growth. Depreciation of exchange rate results in inflation as imports become expensive and if some of the imports have low price elasticities such as petroleum products then inflationary pressure cannot be avoided. That is why; prices keep on increasing with the depreciation of exchange rate.

The response in money supply is marginal; it increases to 0.25 percentage points during the initial 25 periods and then stabilizes around this level. The increase in money supply could have been the result of central bank's monetary policy by which it seeks to meet the expected increase in model demand resulting from the price inflation triggered by exchange rate depreciation. Foreign exchange reserves keep on increasing with the depreciation of exchange rate and this could be the result of improvement in balance of trade following the depreciation. But the main factor appears to be significant is the increase in interest rate, which results an improvement in balance of payments (capital account) through capital inflows. The nominal rate of interest keeps on increasing for quite some time due to inflationary effect of exchange rate depreciation.

The figure 11 shows the response of variables to the permanent shock of foreign exchange reserves. This indicates that a permanent increase in foreign exchange reserves is not sustainable; only about 70% of the exogenous increase in foreign exchange reserves sustains in the long run. It is so because data of the reserves follow a cyclical pattern, increase in the reserves is followed by a decrease in next period/periods with the exception of periods 2001 and onward, and especially during 1984 to 1992 the reserves remained under extreme pressure. As discussed earlier, an increase in foreign exchange reserves creates a stable economic environment and all variables response positively to the increase in foreign exchange reserve. There is a slight increase in GDP and money supply but prices remain stable over time (an economist's dream). There is an appreciation of 0.06 percentage points in exchange rate, which is helpful in maintaining the price stability. And interest rate declines to 0.02 percentage points, which is supportive for investment.

The central bank plays an important role in the determination of interest rate. Normally, State Bank of Pakistan increases the prime rate of interest under inflationary pressure and reduces it when economy is in recession. Apart from that, government also influences the central bank, indirectly if not directly, to increase the rate of interest for domestic borrowings when it is under fiscal pressure. This was

happened during late 1990's after nuclear explosions of May 1998. The responses of various economic variables to changes in interest rate are analyzed in figure 12. The rate of interest is highly responsive to the permanent increase in itself; it increases sharply during the first 25 periods or so, and then stabilizes at 6 percentage points. This is so, because financial markets are quite sensitive and if any kind of disturbance or shock is observed, then interest rate is settled at a different equilibrium position.

According to the economic theory high rate of interest discourage investment and reduces economic growth. Interestingly, simulation results confirm this theory as the GDP declines in the long run by 0.7 percentage points in response of permanent shock. Similarly prices are also influenced by the interest rate, as there is an increase of 0.4 percentage points in general price level. Thus, interest rate plays a moderate role in the determination of GDP and prices level. Since the percentage increase in price level is less than the increase in interest rate, real interest rate increases. As a result monetary growth is reduced to check the increased in interest rate. Increase in price level also results in exchange rate depreciation. Foreign exchange reserves are also influenced by the increase in interest rate. Although in the short run foreign exchange reserves declines by 0.8 percentage points, there is a visible improvement in the growth of foreign exchange reserves in the long run.

## Figure: 1. Responses to Output Growth Shock

Fig.1a: Response of Output to Shock in Output

Growth rate
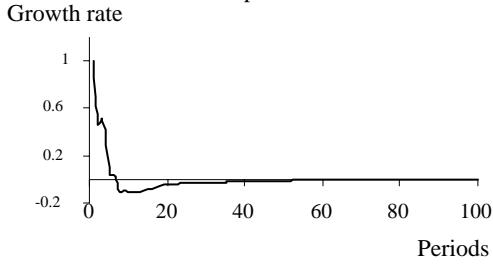
Fig.1b: Price response to Shock in Output

Growth Rate
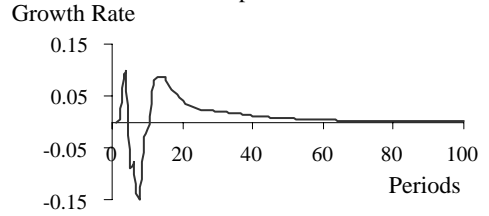
Fig.1c: Monetary response to Shock in Output

Growth Rate
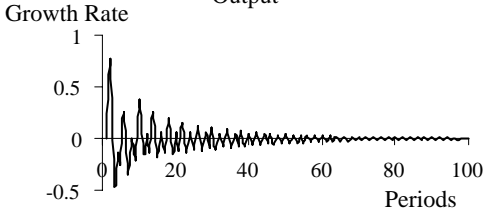
Fig.1d: Exchange Rate Response to Shock in Output

Growth Rate
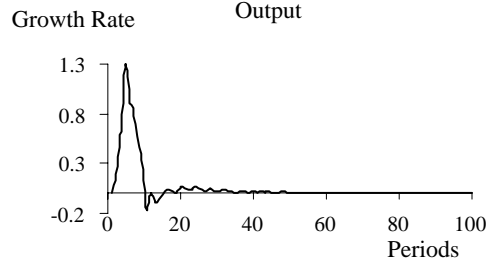
Fig.1e: Response of FOREX to Shock in Output

Growth Rate
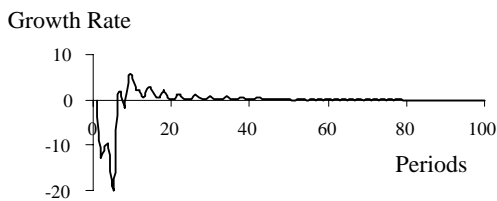
Fig.1f: Interest Rate Response to Shock in Output

Growth Rate
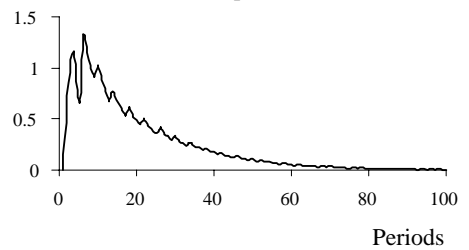
## Figure: 2. Responses to Price Shock

Fig.2a: Response of Prices to Price Shock
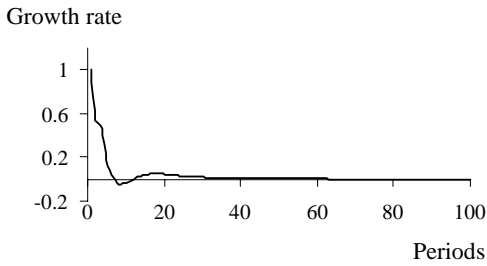
Fig.2b: Response of Output to Price Shock
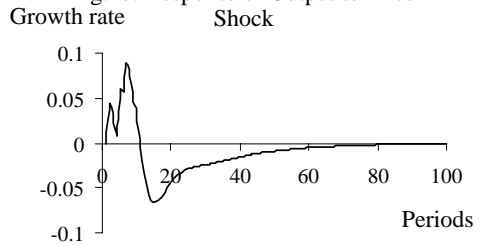
Fig.2c: Monetary response to price Shock
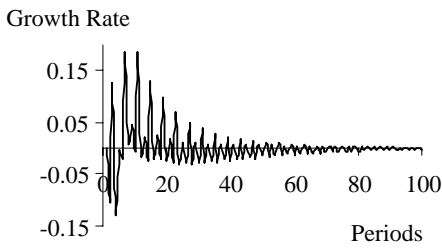
Fig.2d: Exchange Rate Response to Price Shock
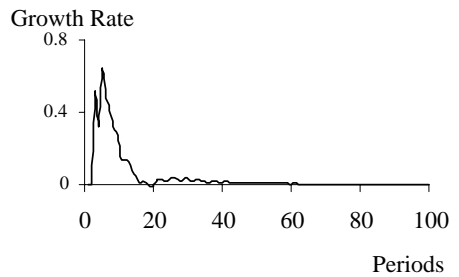
Fig.2e: Response of FOREX to Price Shock
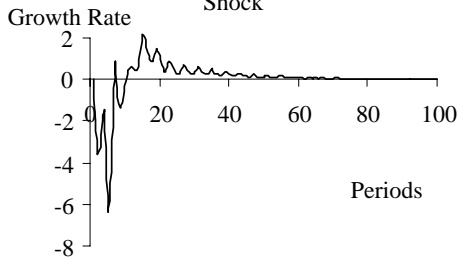
Fig.2f: Interest Rate Response to Price Shock
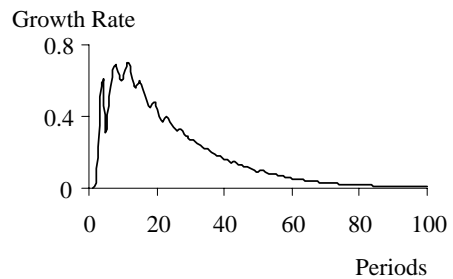
## Figure: 3. Responses to Money Supply Shock

Fig.3a: Response of Money Supply to Monetary Shock

Growth rate
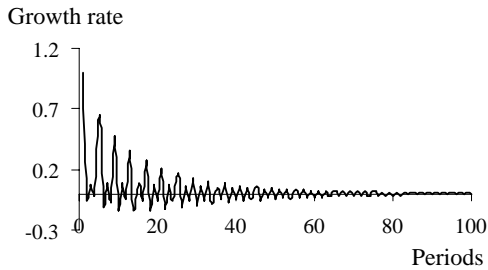
Fig.3b: Output Response Money to Supply Shock

Growth rate
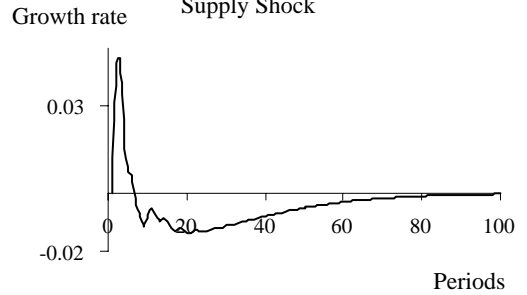
Fig.3c: Price Response to Money Supply Shock

Growth rate
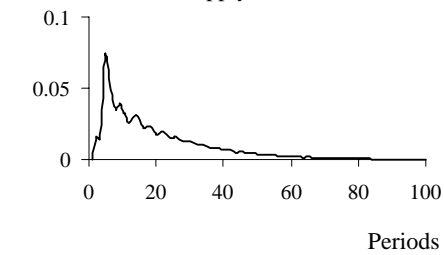
Fig.3d: Exchange Rate Response to Money Supply Shock

Growth Rate
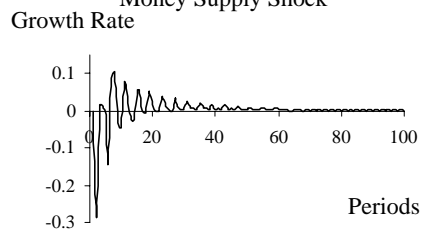
Fig.3e: Response of FOREX to Monetary Shock

Growth Rate
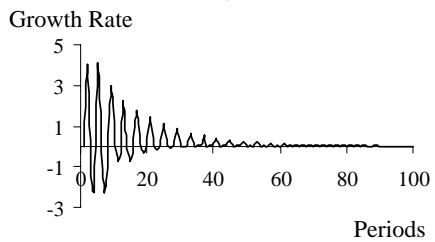
Fig.3f: Interest Rate Response to Monetary Shocks

Growth Rate
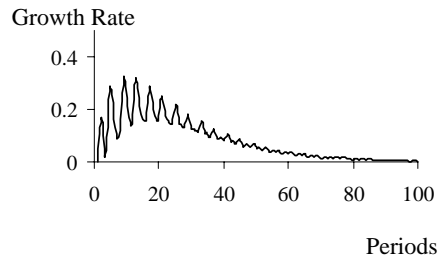
**Figure: 4. Responses to Exchange Rate Shock**

Fig.4a: Response of Exchange Rate to Exchange Rate Shock

Fig.4b: Response of Output to Exchange Rate Shock

Fig.4c: Response of Prices to Exchange Rate Shock

Fig.4d: Response of Money Supply to Exchange Rate Shock

Fig.4e: Response of FOREX to Exchange Rate Shock

Fig.4f: Response of Interest Rate to Exchange Rate Shock
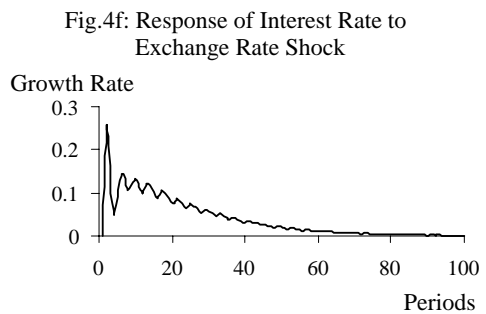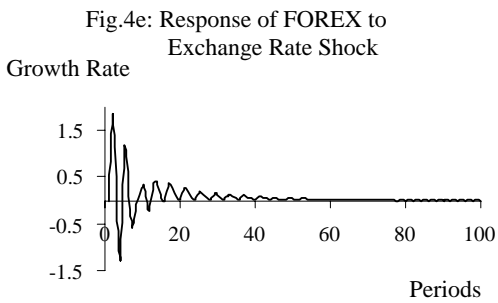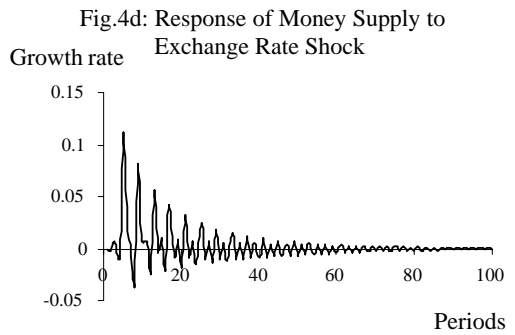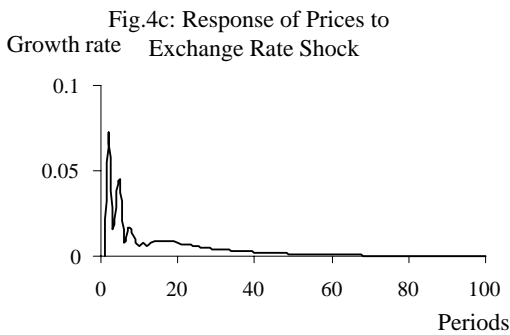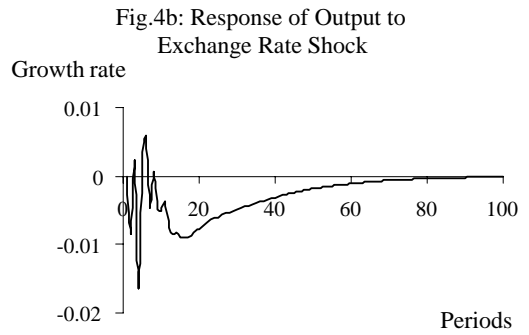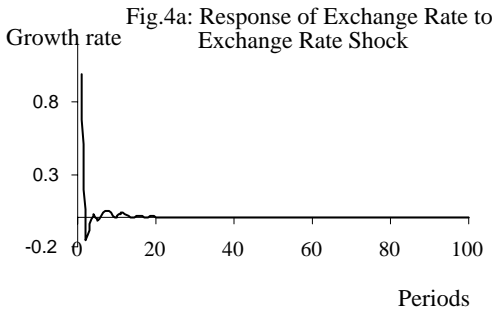
## Figure: 5. Responses to Foreign Exchange Reserve Shock

Fig.5a: Response of FOREX to Shock in FOREX
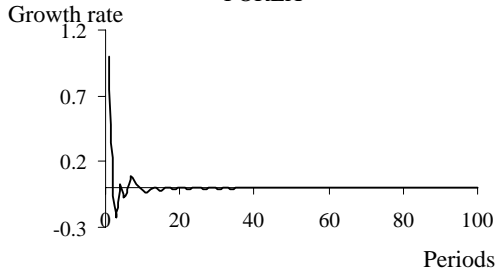
Fig.5b: Response of Output to Shock in FOREX
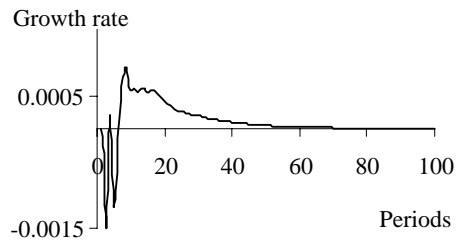
Fig.5c: Response of Prices to Shock in FOREX
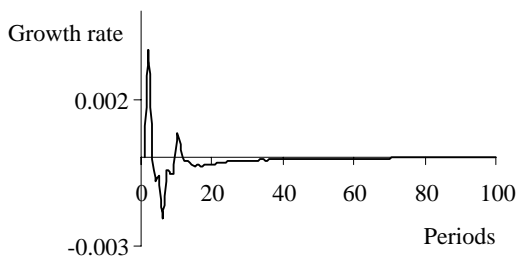
Fig.5d: Response of Money Supply to Shock in FOREX
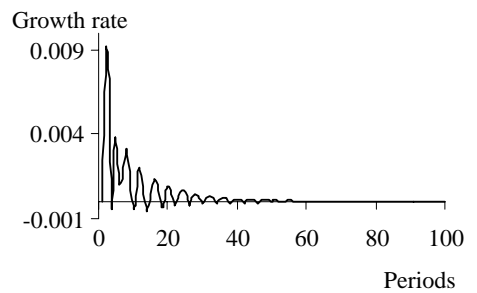
Fig.5e: Response of Exchange Rate to Shock in FOREX
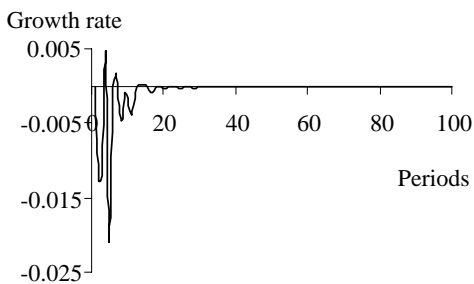
Fig.5f: Response of Interest Rate to Shock in FOREX

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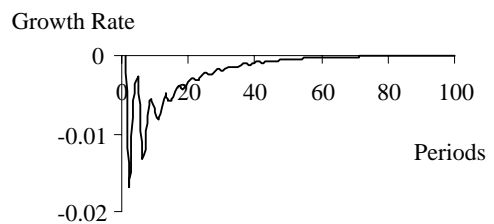
## Figure: 6. Responses to Interest Rate Shock

Fig.6a: Response of Interest Rate to Interest Rate Shock

Fig.6 b: Response of Output to Interest Rate Shock

Fig.6c: Response of Prices to Interest Rate Shock

Fig.6 d: Response of Money Supply to Interest Rate Shock

Fig.6e: Response of Exchange Rate to Interest Rate Shock

Fig.6 f: Response FOREX to Interest Rate Shock
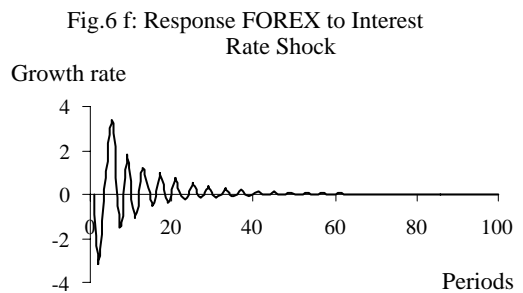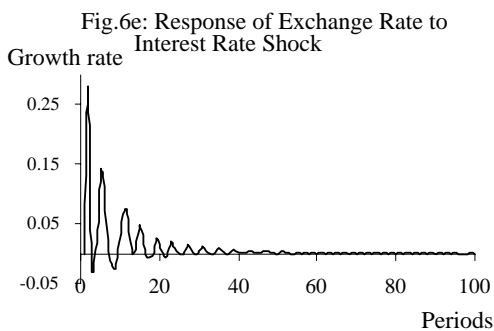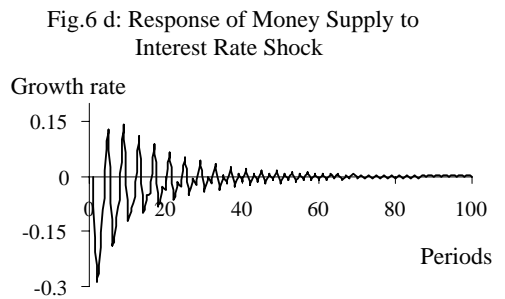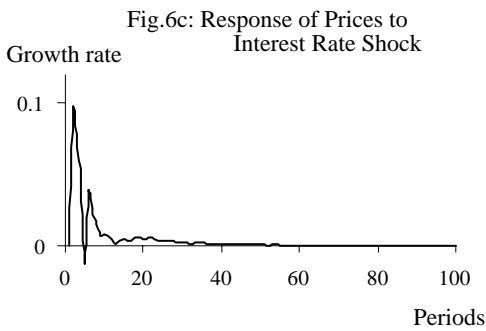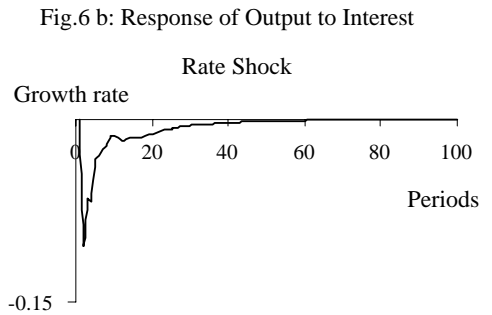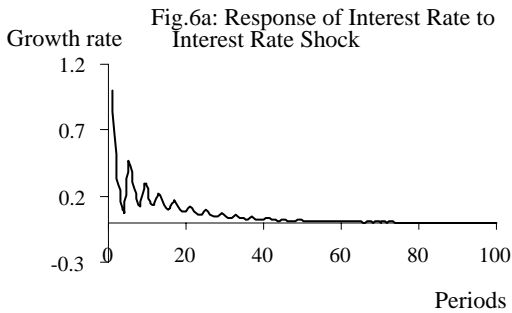
## Figure: 7. Responses to Permanent Increase in Output

Fig.7a: Response of Output to
Permanent Increases in Output

Growth rate
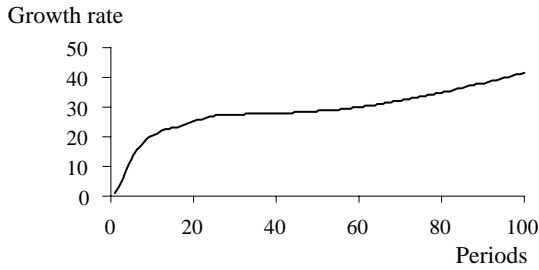
Fig.7b: Response of Prices to
Permanent Increase in Output

Growth
rate
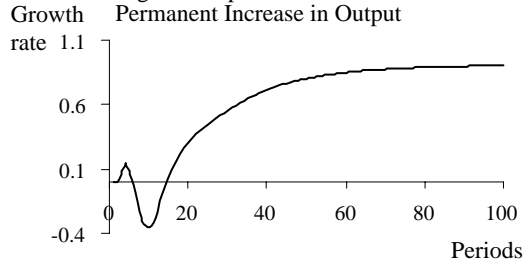
Fig.7c: Response of Money Supply to
Permanent Increase in Output

Growth rate
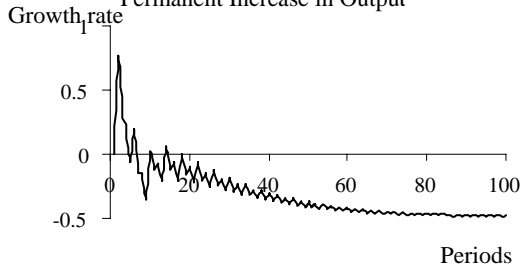
Fig.7d: Response of Exchange Rate to
Permanent Increase in Output

Growth rate
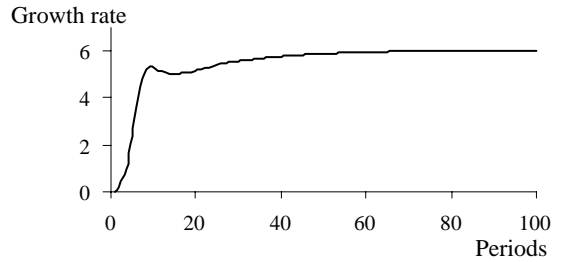
Fig.7e: Response of FOREX to
Permanent Increase in Output

Growth rate
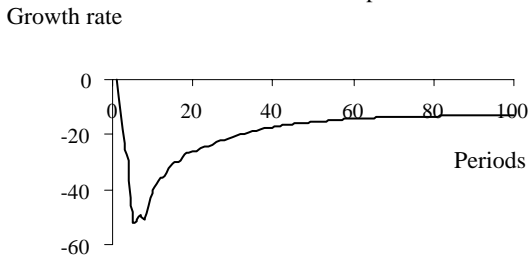
Fig.7f: Response of Interest Rate to
Permanent Increase in Output

Growth rate
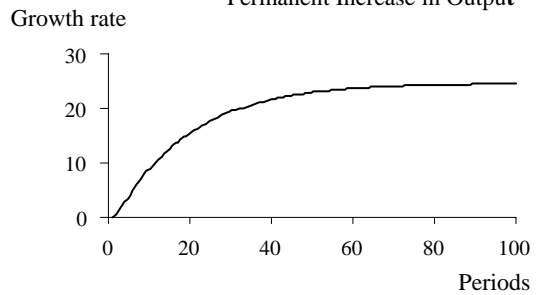
## Figure: 8. Responses to Permanent Increase in Price Level

Fig.8a: Response of Price level to
Permanent Increase in Price Level
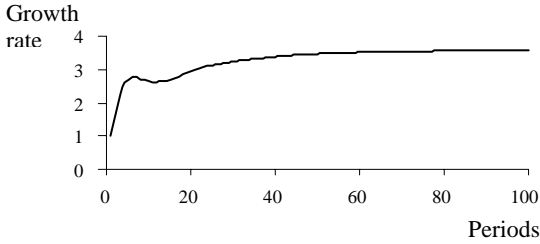
Fig.8b: Response of Output to
Permanent Increase in price Level
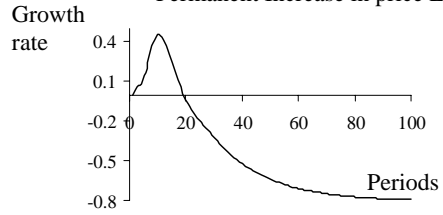
Fig.8c: Response in Money Supply to
Permanent Increase in Price Level
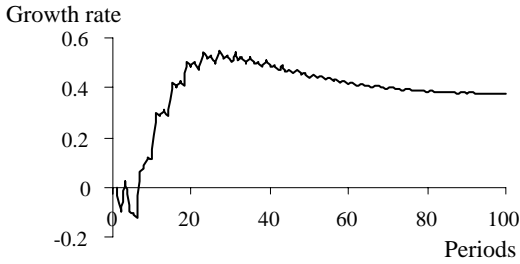
Fig.8d: Response of Exchange Rate to
Permanent Increase in Price Level
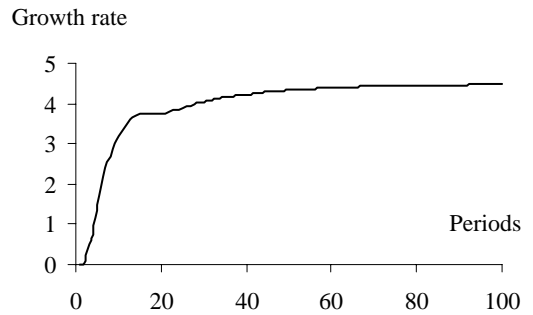
Fig.8e: Response of FOREX to
Permanent Increase in Price Level
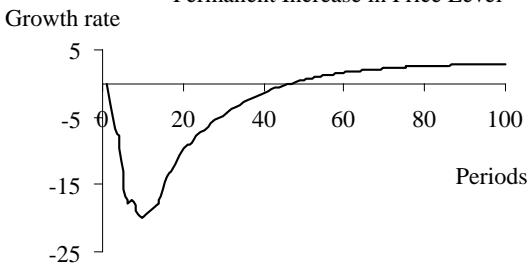
Fig.8f: Response of Interest Rate to
Permanent Increase in Price Level

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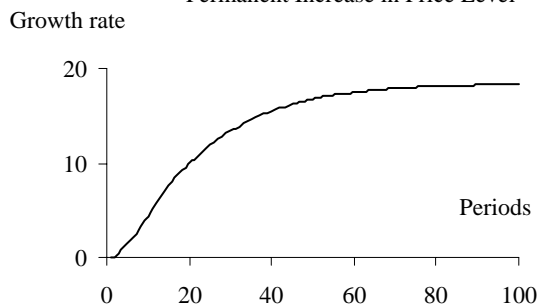
## Figure: 9. Responses to Permanent Increase in Money Supply

Fig.9a: Response of Money Supply to
Permanent Increase in Money Supply
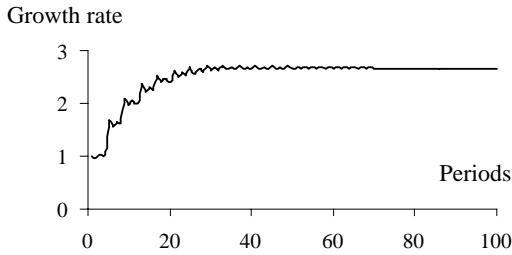
Fig.9b: Response of Output to
Permanent Increase in Money Supply
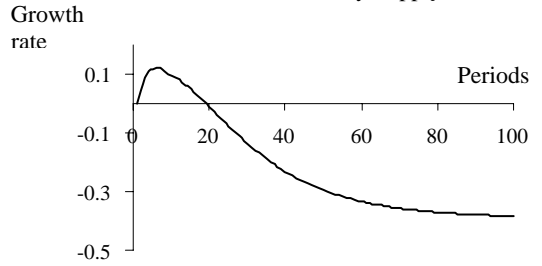
Fig. 9c: Response of prices to
Permanent Increase in Money Supply
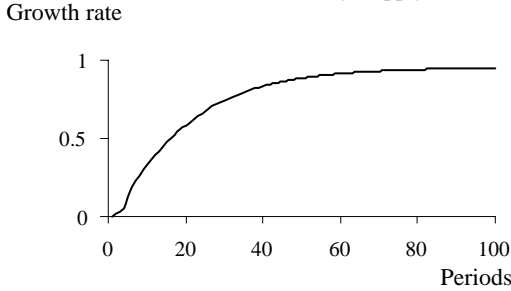
Fig.9d: Response of Exchange Rate to
Permanent Increase in Money Supply
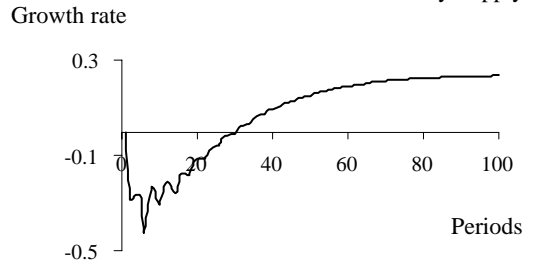
Fig.9e: Response of FOREX to
Permanent Increase in Money Supply
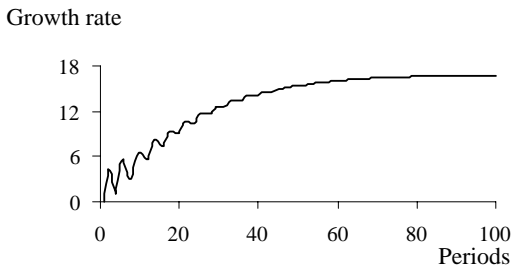
Fig.9f: Response of Interest Rate to
Permanent Increase in Money Supply
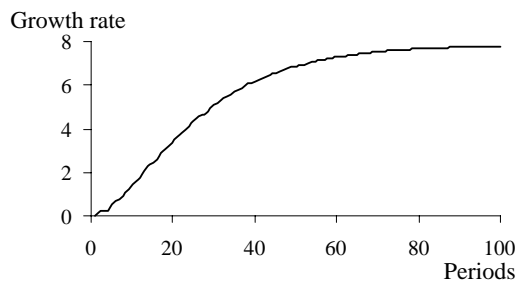
## **Figure: 10. Responses to Permanent Depreciation in Exchange Rate**

Fig10a: Response of Exchange Rate to
Permanent Depreciation in Exchange Rate
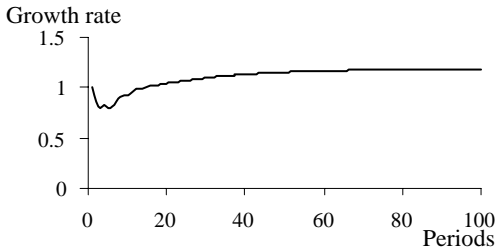
Fig.10b: Response of Output to
Permanent Depreciation in Exchange Rate
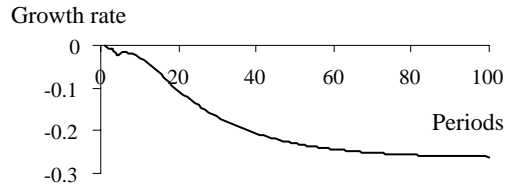
Fig.10c: Response of Prices to
Permanent Depreciation in Exchange Rate
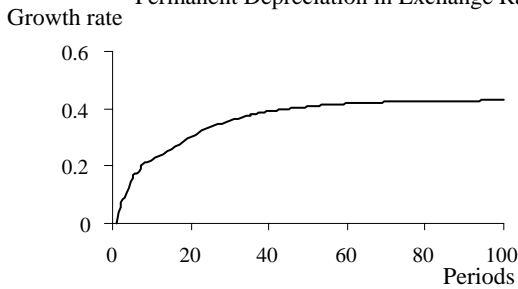
Fig.10d: Response of Money Supply to
Permanent Depreciation in Exchange Rate
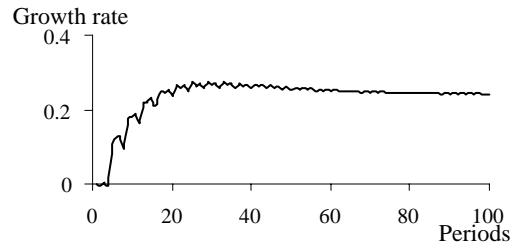
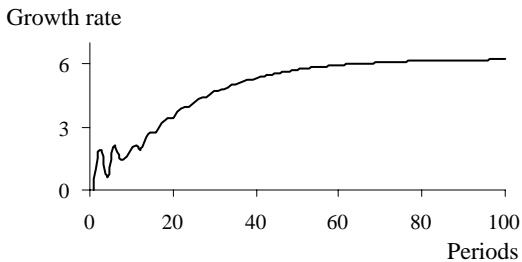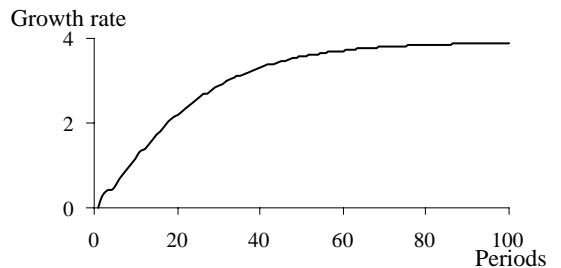Fig.10e: Response of FOREX to
Permanent Depreciation in Exchange Rate

Fig.10f: Response of Interest Rate to
Permanent Depreciation in Exchange Rate

## Figure: 11. Responses to Permanent Increase in Foreign Exchange Reserves

Fig.11a: Response of FOREX to
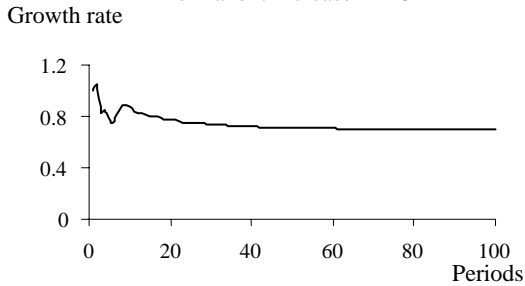Permanent Increase in FOREX

Fig.11b: Response of Output to
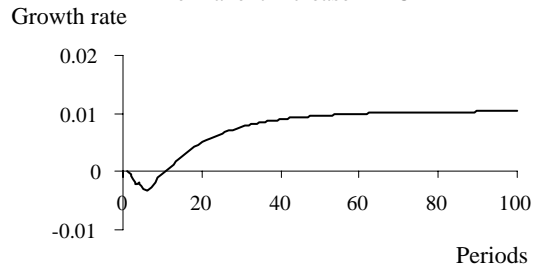Permanent Increase in FOREX

Fig.11c: Response of Prices to
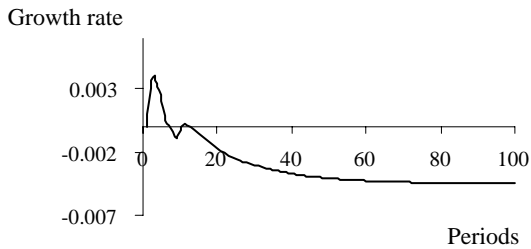Permanent Increase in FOREX

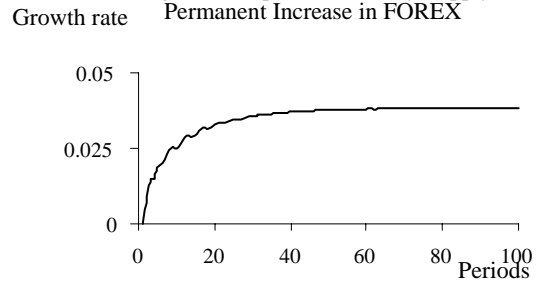Fig.11d: Response of Money Supply to
Permanent Increase in FOREX

Fig.11e: Response of Exchange Rate
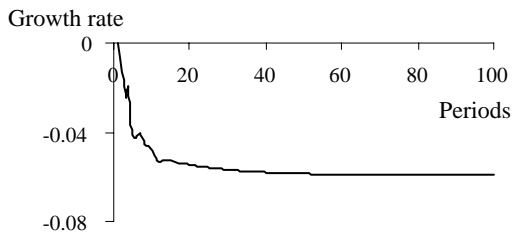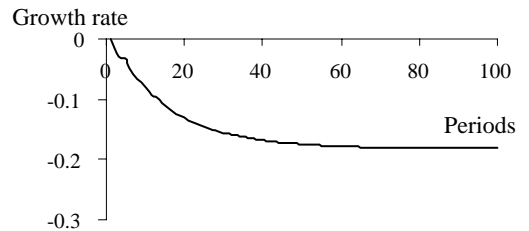to Permanent Increase in FOREX

Fig.11f: Response of Interest Rate to
Permanent Increase in FOREX

## Figure: 12. Responses to Permanent Increase in Interest Rate

Fig.12a: Response of Interest Rate to
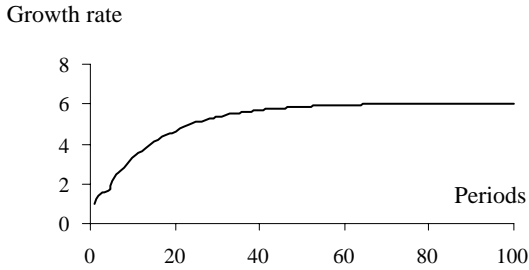Permanent Increase in Interest Rate

Fig.12b: Response of Output to
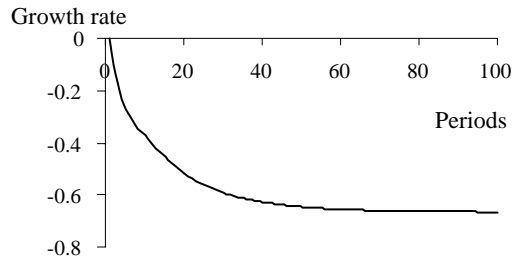Permanent Increase in Interest Rate

Fig.12c: Response of Prices to
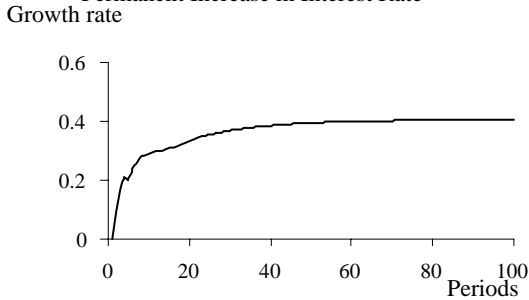Permanent Increase in Interest Rate

Fig.12d: Response of Money Supply to
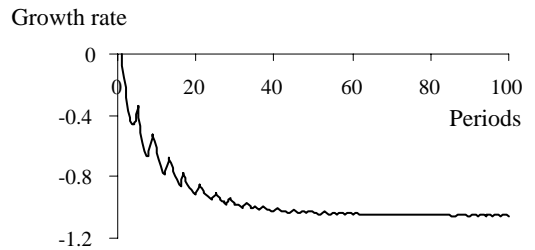Permanent Increase in Interest Rate

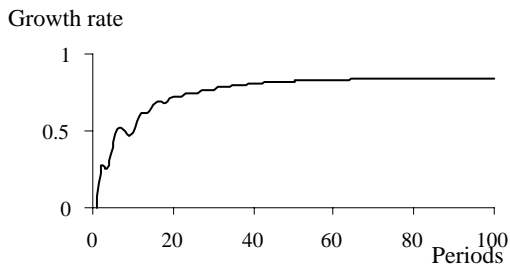Fig12e: Response of Exchange Rate to
Permanent Increase in Interest Rate

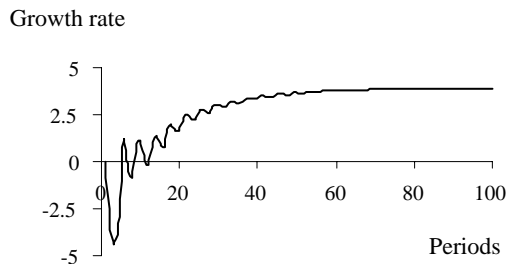Fig.12f: Response of FOREX to
Permanent Increase in Interest Rate

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## IV.     Conclusions and Policy Implications

The main findings of this study are that GDP growth in the long run; pressurizes prices. Therefore, inflation keeps on increasing along with GDP. If there is an increase in prices in the short run, it will cause an increase in GDP as well. However, in the long run, inflationary pressure depresses the output. Therefore, there is an evidence of optimum rate of inflation with respect to output growth and targeted inflation rate is not necessarily zero. As far as money supply is concerned, it is helpful in boosting output in the short run but during the long period it is also harmful for the economy. Furthermore, uncontrolled money supply generates inflationary pressure as well. The deterioration of exchange rate depresses the level of output and results in price escalation. The accumulation of foreign exchange reserves is helpful both for stabilization of prices and output growth. Finally, stable rate of interest over a long period of time is an ultimate necessity for stable prices and higher level of output.

Authorities at the policy making need to control the high rate of inflation but should not target to zero percent inflation as it could have depressing effects on economic growth. At the same time, interest rate should not be allowed to escalate because it is harmful for both prices and output growth. It means that a moderate level of inflation is the desirable target in order to achieve stable growth in output without high inflation.

The level of foreign exchange reserves need to be maintained at a standard position but not to the extent that it produces high inflation through exchange rate depreciation. The reserves are very helpful for stable economic environment. Authorities need to try to stabilize exchange rate over a long period of time because its depreciation inflates prices and depresses output growth. All in all it appears that a controlled and sustained growth in money supply, which may be slightly higher than the output growth, could be the key for the stability of economic growth, price, exchange rate and foreign exchange reserves.

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