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**Sources of Inflation in Bangladesh:
Recent Macroeconomic Experience**

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**Research Economist, Policy Analysis Unit
Research Department
Bangladesh Bank**

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Abstract

This paper attempts to analyse the sources of inflation in Bangladesh during FY90-FY06. Using quarterly data from July-September 1989 to April-June 2006, this paper empirically explores the relationship between inflation and its sources under the unrestricted vector autoregressions (VARs) system. The empirical evidence demonstrates that money supply and exchange rates have a significant positive influence on inflation. In addition, the paper identifies a significant negative relationship between deposit rate of interest and inflation. The above results have important policy implications in the sense that they suggest demand management policy is required to maintain domestic price stability in Bangladesh.

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[*] The author is a Research Economist, Policy Analysis Unit (PAU), Research Department, Bangladesh Bank, Dhaka, Bangladesh. The author would like to thank Prof. Syed M. Ahsan, World Bank Institute (WBI) Resident Economic Advisor at the Bangladesh Bank, for his helpful suggestions and comments on the earlier drafts of the paper. However, the views expressed in this paper are of the author's own and do not necessarily reflect the views of the Bangladesh Bank.

Sources of Inflation in Bangladesh: Recent Macroeconomic Experience

1. Introduction

One of the fundamental objectives of sound macroeconomic policy is to maintain price stability vis-à-vis full-employment economic growth. In this context, the main contribution that monetary policy can probably make to economic management in the long-run is maintaining stable and low inflation rates. The popular opinion about the costs of inflation is that inflation makes everyone worse off by reducing the purchasing power of incomes, eroding living standards and adding, in many ways, to life's uncertainties (Lipsey *et al.* 1982: 752). Broadly speaking, the primary effects of inflation are the redistribution of income and wealth associated with unanticipated inflation, which is likely to affect economic activities and resource allocation of the country (Taslim and Chowdhury 1995: 330). In an open economy, the cost of inflation is even higher. If prices and costs in the domestic economy rise at a faster rate than that of trading partners, then all else equal, imports become cheaper and exports dearer, making it increasingly difficult to compete in world trade. Thus, it is necessary to maintain price stability through controlling its channels or sources that are responsible for inflationary impulse, which can help the monetary authority in its policy making process.[1]

Since independence in 1971, Bangladesh has been under a persistent inflationary pressure caused mainly by excess money supply, as mentioned in Hossain (1995: 44). For this reason, in particular, price stability has been as one of the most important policy objectives of Bangladesh authorities over the years. That is presumably the reason why Bangladesh registered a favourable performance in terms of inflation rate compared to its neighbouring countries during the period 1990-2004.[2] During this period, average inflation rate in Bangladesh was the lowest in South Asia, at the same time, average GDP growth rate in the country was also high followed by that of India. However, financial deepening (as measured by broad money supply to GDP ratio) in Bangladesh remained the lowest, with even comparatively lower exchange rate depreciation. All of these factors appeared to have played a significant role for lower inflation rates in Bangladesh compared to its neighbours. However, it is necessary to provide a quantitative benchmark for the relative importance of various sources of inflation in Bangladesh.

The objective of the study is to find out the sources of inflation in the context of Bangladesh over a long time period of FY90-FY06. To do so, first, the paper will explain the trends of inflation and its determinants using yearly data and second, the empirical analysis will be conducted by unrestricted vector autoregressions (VARs) approach using quarterly data for the period of July-September 1989 to April-June 2006. The contribution of this paper to the empirical analysis carried out by earlier studies can be explained in several ways. First, the study uses more sophisticated estimation techniques such as VARs rather than ordinary least squares (OLS) used by the other papers to explain the factors of inflation in Bangladesh. Second, since using annual data in the estimation may understate the possible shocks on inflation, the study uses quarterly

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[1] See, for instance, Taslim and Chowdhury (1995) for a systematic explanation about the cost of inflation and how to control it.
[2] See, for instance, Annex Table 1 for a comparable picture of inflation and its determinants for South Asian Countries.

data rather than annual to observe more frequent response of the determinants of inflation. Third, this study adds to the empirical work on inflation analysis in Bangladesh by extending the coverage of the study to recent data, particularly up to FY03-FY06, which is significant as a period characterized by a flexible exchange rate regime. And finally, the results of the paper intend to provide a quantitative benchmark for the relative importance of various sources of inflation in Bangladesh and will map out the dynamic response of inflation to different shocks as variance decompositions (VDCs) and impulse response functions (IRFs) are used for the estimation purpose.

In the estimation process, the unit root tests are employed for checking time series properties of the concerned variables. The order of the variables is determined using pair-wise Granger causality tests and theoretical underpinnings. In the VAR system, VDCs and IRFs are employed as the final estimation. The results of the empirical analysis suggest that increase in money supply and exchange rate depreciation has a significantly positive but short-run influence on inflation, while deposit rate of interest has a significantly negative but short-run influence on inflation. These results have important implications for the conduct of monetary policy of the country.

The remainder of the paper is organized as follows. Following the introduction in Section 1, Section 2 reviews the literature pertaining to sources of inflation. Section 3 provides a recent overview of inflation in Bangladesh. Both trends of inflation and its determinants are discussed in this section during the period FY90-FY06. The VAR model and estimation methodology employed for empirical analysis in the paper are discussed in Section 4. Section 5 provides data specification and estimated results. Finally, Section 6 summarizes the major findings and their policy implications.

2. Literature Review

The study of causes of inflation has probably given rise to one of the most significant macroeconomic debates in the field of economics. The debates differ in their hypotheses, mainly due to a range of conventional views about the appropriate measure to control inflation and also due to disparity between developed and developing countries. In general, the cause of inflation in developed countries is broadly identified as growth of money supply, based on the famous premise of the great monetary economist, Milton Friedman *"inflation is always and everywhere a monetary phenomenon."* According to Friedman's quantity theory of money there is a general agreement that growth in the quantity of money is the primary determinant of the inflation rate (Mankiew, 1997:156). In developing countries, in contrast, inflation is not a purely monetary phenomenon, but is often linked with fiscal imbalances and deficiencies in sound internal economic policies. Beside, factors typically related to fiscal imbalances such as higher money growth and exchange rate depreciation arising from a balance of payments crisis dominate the inflation process in developing countries, as discussed by Montiel (1989); Sergent and Wallace (1981); Liviatan and Piterman (1986). Seasonal shortages pertaining to agricultural production

and other supply side bottlenecks such as international oil price are also known as the common factors of inflation in developing economies.[3]

In economic theory, causes of the rise in general price level are essentially explained from two broad perspectives: *demand-pull* due to an increase in demand and *cost-push* due to an increase in the costs of factors of production. The causes of demand-pull inflation are related to excess demand resulting from the components of aggregate demand, namely, private consumption, investment, government expenditure and net exports. Any factor that causes an exogenous increase in any of these components will create an excess demand.[4] However, there exists a debate among economists about what actually triggers demand-pull inflation. The monetarists believe that the increase in aggregate demand is due entirely to the money supply increase in the economy. In this regard, they identify budget deficit, especially in developing countries, as one of the main channels through which money supply increases in the economy. On the other hand, non-monetarists or Keynesian argument stressed rigidities in the economy, mostly in the labour market. They assert that increases in spending in excess of the full employment level of output will create shortages and firms will raise prices accordingly.

In contrast, cost-push inflation may occur in the economy if there are increases in the costs of factor inputs, or if there is any kind of supply shock. In developed countries, supply shocks are generally identified as the rise in world oil prices and increases in wage settlements that push up the costs of production. In contrast, along with higher oil prices and wages, factors such as a currency devaluation or depreciation, interest rate increase, indirect taxation or removal of subsidies are referred to as sources of cost push inflation in developing countries. Taslim and Chowdhury (1995: 315) pointed out two aspects of inflation in an open economy. One is the *transmission of trading partner's inflation* to the domestic economy and another is the impact of changes in the relative price of exports and imports, known as the *terms of trade effect*. An increase in the interest rate causes a rise in the cost of borrowing, which ultimately affects prices of the final goods. However, in developed countries, increase in interest rate causes a decrease in spending, which lowers the general price level. Natural calamities such as a drought or a flood as well as political instability can also create supply shocks in these economies and, as a result, may cause inflation.

The role of inflationary expectations is also important in explaining inflationary process in a given period. If workers expect a rise in the inflation rate, they will demand higher nominal wage to keep their real wage stable. Once people come to expect high rates of inflation, the expectation alone will generate further inflation without any change in the existing labour market conditions (Taslim and Chowdhury 1995: 305). In general, if there is a lack of confidence in monetary policy, inflationary expectations are likely to be self-fulfilling.

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[3] For the analysis of determinants of inflation in developing countries, see, for instance, Montiel (1989); Loungani and Swagel (2001); Liu and Adedeji (2000); Ball and Mankiew (1995); Ubide (1997); and Khan and Schimmelpfennig (2006).

[4] See, Taslim and Chowdhury (1995: 291-293) for a detailed explanation of the possible channels how these factors can create excess demand. Among others, the explanation includes higher consumption demand due to higher income, higher investment demand due to optimistic view of the investors about the economy as well as government expansionary fiscal and monetary policies for creating more output and employment.

There are a number of empirical studies, both cross country and country specific, regarding the determinants of inflation. For example, Loungani and Swagel (2001) give empirical evidences and develop stylized facts about the inflation process in developing countries. In searching for the determinants of inflation in developing countries, Loungani and Swagel (2001) find for that money growth and exchange rate regimes – factors typically related to fiscal imbalances – are more important in countries with floating exchange rate regimes than in those with fixed exchange rates. Again, inertial factors also dominate the inflation process in developing countries with fixed exchange rate regimes.[5]

Among country specific studies, Liu and Adedeji (2000), Ubide (1997), Leheyda (2005), and Khan and Schimmelpfennig (2006) are noted to have clear ideas about the determinants of inflation in developing countries. Most of the studies stress money supply as the major source of inflation in the respective economies. For example, in explaining inflation in Iran, Liu and Adedeji (2000) found that an excess money supply generates an increase in the rate of inflation which, in turn, intensified asset substitution (from money to foreign exchange). The study also found a permanent rise in real income as an inflation reducing factor in the long-run through increasing the real demand for money. Even though, the study of Ubide (1997) had a similar result with regards to money supply, it stresses, basically, the combination of monetary policy with seasonal behaviour of agricultural production and a collection of irregular events corresponding to agro-climate conditions as the explanation for Mozambique's inflation pattern. A recent study by Khan and Schimmelpfennig (2006), based on Pakistan data, indicate that monetary factors have played a dominant role in its recent inflation. Interestingly, changes in the wheat support price influenced inflation only in the short-run.

There are a number of studies in Bangladesh context where the dominant factors explaining the inflationary process in Bangladesh have been examined; though only a few of them are recent. In an early study, Taslim (1982) attempted to analyze the inflationary process in Bangladesh in light of the structuralist-monetarist controversy using the data for FY60 to FY80. The author systematically tested both the views in the context of Bangladesh as well as a hybrid model considering both views together. The findings clearly indicate that the rate of change of money supply and devaluation are the most significant explanatory variables. Any devaluation of the domestic currency is followed by an almost equal proportionate increase in the rate of inflation, while an increase in money supply does not induce an equal proportionate increase in the inflation rate as would be suggested by an extreme monetarist view.[6] In contrast, in formulating a model of inflation for Bangladesh, Begum (1991) considers a detailed approach that concentrates both on aggregate supply and demand. The empirical test shows that the significant variables for inflation are agricultural and import bottlenecks, government expenditure, rate of interest, wage rate, bank credit and expected inflation. The results regarding agricultural bottlenecks, rate of interest and credit show the dominance of the supply-side cost-push effect, while the results

[5] Chopra (1985) suggested that inflation may have a substantial inertial component arising from the sluggish adjustment of inflationary adjustment of inflationary expectations or the existence staggered wage contracts as discussed in Loungani and Swagel (2001).
[6] A recent study by Hossain (2002) investigates the exchange rate responses to inflation in Bangladesh during the period from FY73-FY99 and finds that the effect of devaluation on inflation was not significant, and this result remained robust throughout the sample period; rather it is past inflation that usually leads to devaluation in Bangladesh. In tracing the sources of inflation in Bangladesh, the paper argued that broad money supply growth and real output growth remain two key determinants of inflation.

regarding import bottlenecks, government expenditures, wage and expected inflation show the dominance of the demand side effect.

On the other hand, in investigating the relationship between money, prices, output and exchange rate in Bangladesh during the period 1974-92, Chowdhury *et al.* (1995) find that the inflationary process in Bangladesh cannot be explained exclusively by the monetarist or the structuralist factors. The paper noted that monetary shocks have a strong, but relatively short-run, impact on inflation, and therefore suggested that tight money may put a short-term dampening effect on inflation and help stabilize the foreign trade sector, but may also cause a slowdown in the economy. Using co-integration techniques, error correction models and the estimated quarterly data, Akhtaruzzaman (2005) attempted to identify the variables that are believed to generate inflation in Bangladesh during the period 1973-2002. The paper observes that inflation is negatively related with real income. In addition, both the level and rate of the devaluation of exchange rate, growth of money supply and deposit interest rate have statistically significant role in explaining the inflationary process in Bangladesh.

The analysis of above empirical studies in the context of Bangladesh suggests that both monetary and structuralist factors are relevant in explaining the inflationary process. Thus it is necessary to consider variables that are available on quarterly basis and have theoretical backings in formulating the inflation model to identify the factors that can explain inflation in Bangladesh.

3. Overview of Recent Inflation in Bangladesh

3.1 Trends in Inflation

Bangladesh has experienced sustained inflation hovering in the 1.94 to 8.66 per cent range during FY90-FY06, as shown in Table 1. The inflation rate, on average, was 5.17 per cent during the last one and a half decade; the latter half of 1990s experienced higher than average inflation as compared to early 1990s and the beginning of the new decade. One of the most debated current issues in Bangladesh is to find out why inflation fluctuates and how to control it. There has been a general consensus that supply side bottlenecks, growth in money supply, imported inflation through depreciation of the exchange rate and inflationary expectations have been responsible for the persistence of inflation in Bangladesh. Observing segregated (food and non-food) data, the historical trend of inflation indicates that inflation in Bangladesh varies directly with food prices. That is, overall inflation of the country is high when food inflation is higher and vice versa. This is due to the fact that the weight of food items in the overall CPI, on average, is more than 58 per cent, as shown in Annex Table 2. However, it may be noted that higher non-food inflation was also observed in the said period and contributed jointly with food inflation to the persistent overall inflation.

Food and non-food inflation averaged 5.27 per cent and 5.11 per cent respectively during the last one and half decades. The periodical analysis suggests that food inflation was higher than average in the second half of 1990s, whereas non-food inflation was higher in the early 1990s. Shortages in agricultural production due to damage of 1998 flood were the basic reason for higher food inflation in the latter half of 1990s. Non-food inflation was mainly driven by the prices of imported fuel and rise in transport and communication charges.

A few observations are also revealed if inflation is analyzed from the rural-urban perspective. Both in rural and urban areas, food inflation dominates over non-food inflation over the study period except for a few years in the early 1990s. Interestingly, rural inflation dominates over urban inflation over the period in the sense that overall inflation of the country varies directly with the change in rural inflation. When rural inflation is higher, national inflation is also higher and vice versa.

Table 1: Trends in Inflation: FY90-FY06

Year	National			Rural			Urban		
	General	Food	Non-food	General	Food	Non-food	General	Food	Non-food
FY90	3.81	2.54	6.31	3.43	1.98	6.55	4.21	4.05	4.44
FY91	8.19	7.97	8.61	8.76	8.58	9.14	6.43	6.17	6.80
FY92	4.51	4.13	5.20	4.30	3.80	5.33	4.86	5.12	4.50
FY93	2.71	1.84	4.27	2.32	1.52	4.61	2.90	2.76	3.10
FY94	3.24	2.91	3.86	3.47	2.92	3.90	3.11	2.89	3.40
FY95	8.77	9.15	8.07	9.30	9.75	8.42	7.63	7.52	7.79
FY90-FY95	**5.20**	**4.75**	**6.05**	**5.27**	**4.76**	**6.32**	**4.86**	**4.75**	**5.00**
FY96	5.53	5.86	4.67	5.82	5.77	5.91	4.99	6.25	3.30
FY97	3.96	3.67	4.47	3.67	3.32	4.53	4.47	4.47	4.46
FY98	8.66	10.46	5.99	10.46	11.03	9.06	5.99	6.18	5.54
FY99	7.06	9.30	3.95	9.30	8.96	10.13	3.95	4.33	3.00
FY00	2.79	2.68	3.08	2.68	2.10	4.09	3.08	2.99	3.28
FY96-FY00	**5.60**	**6.39**	**4.43**	**6.39**	**6.24**	**6.74**	**4.50**	**4.84**	**3.92**
FY01	1.94	1.39	3.05	1.38	1.18	1.89	3.04	3.83	1.13
FY02	2.79	1.63	4.61	1.63	1.44	2.09	4.61	4.57	4.70
FY03	4.38	3.46	5.66	3.46	4.05	2.09	5.66	5.91	5.00
FY04	5.83	6.92	4.37	5.44	6.55	3.18	5.48	9.15	4.14
FY05	6.48	7.91	4.33	6.62	7.99	4.27	6.14	7.71	4.49
FY06	7.16	7.76	6.40	7.36	7.62	6.90	6.68	8.09	5.14
FY01-FY06	**4.76**	**4.85**	**4.74**	**4.33**	**4.99**	**3.20**	**5.28**	**6.62**	**4.05**

*Sources: Statistical Year Book (various issues), Bangladesh Bureau of Statistics (BBS).*

An important inference can be drawn from the above analyses; food and rural inflation have very strong impact on national inflation. Since food items dominate other components in terms of relative weights in the overall CPI and since most people live in the rural areas, consumption of food is higher in the rural areas than in urban areas. This might be the reason that food demand is higher in rural areas, creating more food inflation there. This is also shown in Annex Table 2 that weights of food items in the rural areas are far higher than in the urban areas. Thus inflation is more apparent in the food consumption for rural areas. It clearly implies that if the policy makers want to control the overall inflation of the country, it will be a prudent policy if food inflation in rural areas can be controlled.

3.2 Factors Influencing Inflation

Historically, inflation rates in Bangladesh have stayed at a modest level, generally, well under 10 per cent. In the early 1990s, the average inflation rate was 5.20 percent; ranging between 2.71 per cent (FY93) and 8.19 per cent (FY95), as shown in Table 2. Except for the first two years

during the abovementioned period, inflation rate varied mainly with growth in nominal money supply. Besides money supply growth, a close association of inflation with change in the index of prices of agricultural production and change in the index of prices of industrial production is observed as shown in Figure 1. However, moderate economic growth and modest change in the wage index contributed to the relatively low rate of inflation (i.e., lower than 5 per cent) in four out of six years. Substantial depreciation in the exchange rate in FY91, higher money supply growth and lower deposit rate in FY95 contributed to the comparatively higher inflation rates in these two years, as shown in Table 4. It may be significantly noted that the said period also marked a major drive towards economic liberalization of the economy. Thus, integration with the world economy could be one of the major factors in explaining reasons of inflation in Bangladesh.

Figure 1: Changes in Inflation Rates with Agriculture and Industrial prices: FY90-FY06
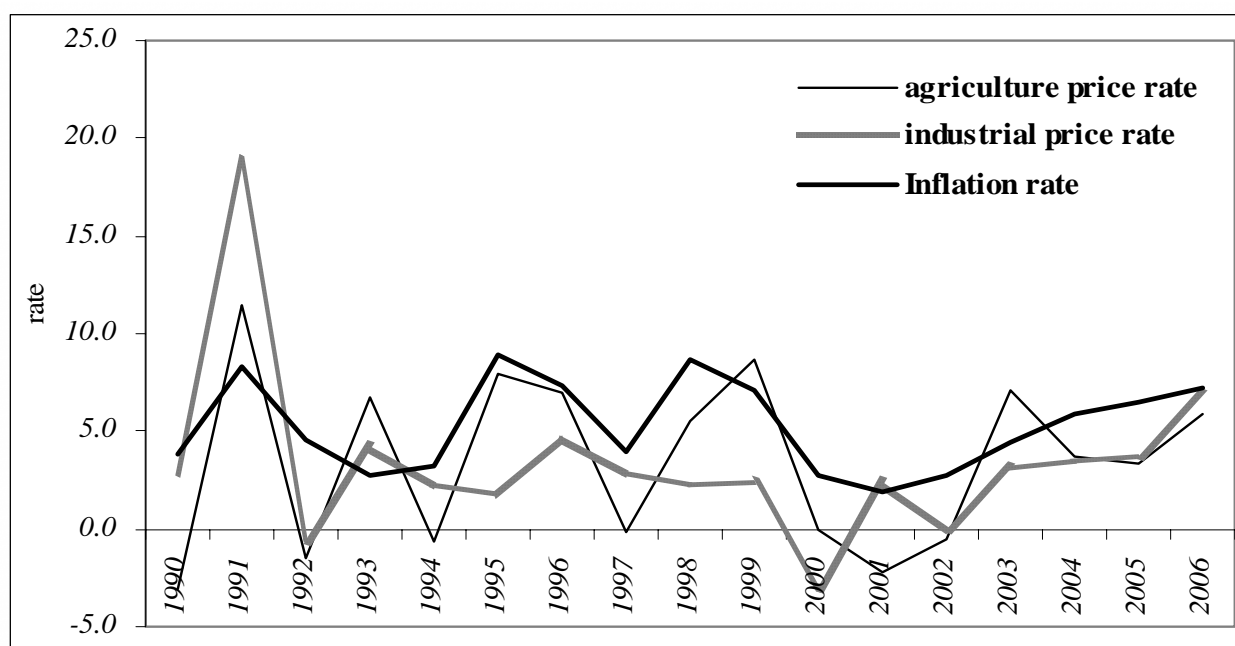
Notes: Agriculture price rate is defined as the change in yearly index of wholesale prices of agricultural products, whereas industrial price rate is defined as the change in yearly index of wholesale prices of industrial products. Source: Statistical Year Book (various issues), BBS.

During the second half of 1990s (FY96-FY00), average inflation rate was higher in comparison with inflation rates during FY90-FY95. The high inflation rates during the three years, FY96, FY98 and FY99, in particular, contributed to the comparatively higher average inflation during the period. Supply shortages in the rural areas originating from political instability in FY96 and disruption due to floods in 1998 caused serious shortfall of food and also hampered all other agricultural production, which ultimately caused higher inflation rates in these three years. A lower growth rate, because of lower production and relatively higher depreciation of the exchange rate due to food imports, also contributed to the higher inflation rate in the flood affected years. Among other factors, growth of M2 and inflation rates were actually moving in different directions in this period. However, Bangladesh has been successful in maintaining comparatively lower inflation rate, generally under 10 per cent, in the second half of 1990s. As a

whole, sharp improvements in food supply situation and good monetary management in the 1990s contributed to a substantial slowdown in inflation to single digits, as also mentioned in Ahmed (2006).

Table 2: Bangladesh Economy: Factors Influencing Inflation: FY90-FY06

Year	Growth of M2	Inflation Rate	GDP growth rate	Exchange rate depreciation	Lending rate	Deposit rate	Wage rate
FY90	16.88	3.81	3.02	-2.37	14.83	9.09	8.01
FY91	12.14	8.19	3.24	-7.74	14.99	9.22	4.07
FY92	14.08	4.51	4.35	-6.47	15.12	8.78	4.53
FY93	10.55	2.71	4.34	-2.53	14.39	7.22	5.50
FY94	15.43	3.24	4.19	-2.15	12.78	6.05	4.38
FY95	15.96	8.77	4.61	-0.50	12.22	5.09	4.58
FY90-FY95	**14.17**	**5.20**	**3.96**	**-3.63**	**14.06**	**7.58**	**5.18**
FY96	8.24	5.53	4.47	-1.62	13.41	5.60	6.24
FY97	10.99	3.96	5.21	-4.31	13.69	6.55	4.69
FY98	10.17	8.66	5.34	-6.07	14.02	7.01	7.59
FY99	12.81	7.06	4.99	-5.43	14.16	7.24	5.54
FY00	18.62	2.79	6.14	-4.45	13.86	7.29	6.10
FY96-FY00	**12.17**	**5.60**	**5.23**	**-4.38**	**13.83**	**6.74**	**6.03**
FY01	16.60	1.94	5.41	-6.76	13.75	7.07	3.97
FY02	13.13	2.79	4.36	-6.04	13.16	6.85	5.83
FY03	15.59	4.38	5.33	-0.81	12.78	6.48	10.96
FY04	13.84	5.83	5.82	-1.76	11.01	6.05	6.31
FY05	16.81	6.48	5.93	-6.65	10.93	5.61	5.85
FY06	19.51	7.16	6.71	-9.44	11.51	6.19	6.44
FY01-FY06	**15.91**	**4.76**	**5.63**	**-5.25**	**12.19**	**6.37**	**6.58**

Notes: GDP base year: 1995-96=100; CPI base year: 1995-96=100, Exchange rate: Period average Taka/US$, Deposit rate: Rate of deposit interest on scheduled banks (weighted average as at end-quarter); Lending rate: Rate of interest on advances by scheduled banks (weighted average as at end-quarter); Wage Index base year: 1969-70=100.
Sources: 1. Statistical Year Book (various issues), BBS. 2. Economic Trends (various issues), Bangladesh Bank (BB).

During the first six years of the present decade (FY01-FY06), Bangladesh economy experienced comparatively low average inflation rates compared to that in the 1990s, though the trend has been on the up-side. Buffer agricultural production contributed to lower inflation rates in the three successive years following floods. However, inflation accelerated to 4.38 per cent during FY03, compared to 2.79 per cent in FY02, and continued to rise and reach at 7.16 per cent in FY06. The higher inflation rates during FY03-FY06 are also associated with higher rates of GDP growth, money supply growth and larger depreciation of the exchange rate, particularly in the last two years. Exchange rate might have played a significant role in causing inflation in this period because of the introduction of flexible exchange rate regime since May 2003. The combination of flexible exchange rate and further integration with the international trade could have adversely affected the prices of imported items, which may explain the overall price index of the country.

4. The Model and Methodology

Any empirical model, in order to be relevant, should harbour two distinct characteristics: i) it will need to capture the equilibrium relationships among the variables; and ii) it will need to capture the adjustment to equilibrium following a shock (Patterson 2002: 599). That is, a combination of modeling equilibrium and dynamic adjustment is important for an empirical analysis. In this regard, vector autoregressions (VARs) is known as a new macroeconomic framework which captures the above dynamics in the multivariate time series models for forecasting purpose and policy analysis.[7] The paper employs unrestricted VARs for the following five variables: money supply (M2), weighted average deposit interest rate, real GDP, nominal exchange rate and consumer price index (CPI), keeping the advantages of the VAR approach in mind.

The times series properties of the concerned variables will be identified using three techniques: the Dickey-Fuller (DF) test, the Augmented Dickey-Fuller (ADF) test and Phillips-Perron test before the estimation of VARs.[8] All of the above tests and the unrestricted VAR models will be performed in the levels of the variables; even though some of the concerned time series variables are likely to be non-stationary and contain unit roots, I(1). However, it is important to take a decision about the ordering of the variables in the VAR system. Both the theoretical backing and empirical analysis have been examined in deciding this issue. In addition, Granger (1969) causality tests have been performed for the final decision about the ordering of the variables. Thus, the final model in respect to sources of inflation in Bangladesh has been estimated in the paper under the unrestricted VAR system with the following order of variables:

Inflation Model: *LM2 DEPOSIT LRGDP LER LCPI* [9]

where,
LM2 = Log of Money Supply (M2);
DEPOSIT = Deposit Rate of Interest by Scheduled Banks
LRGDP = Log of real GDP
LER = Log of Exchange rate
LCPI = Log of CPI

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[7] VAR approach has been introduced by Sims (1972, 1980). A detailed and systematic analysis of VAR approach is found in Rahman (2005) and Ahmed and Islam (2006).

[8] These tests have been followed by Dickey and Fuller (1979, 1981) and Phillips and Perron (1998).

[9] The system of equations of the VAR model for this study can be represented as

$$LM2_t = \alpha_{10} + \sum_{j=1}^{s} \alpha_{11j} LM2_{t-j} + \sum_{i=1}^{q} \alpha_{12i} DEPOSIT_{t-i} + \sum_{k=1}^{m} \alpha_{13k} LER_{t-m} + \sum_{l=1}^{n} \alpha_{14l} LRGDP_{t-l} + \sum_{r=1}^{p} \alpha_{15r} LCPI_{t-l} + e_{1t}$$

$$DEPOSIT_t = \alpha_{20} + \sum_{j=1}^{s} \alpha_{21j} LM2_{t-j} + \sum_{i=1}^{q} \alpha_{22i} DEPOSIT_{t-i} + \sum_{k=1}^{m} \alpha_{23k} LER_{t-m} + \sum_{l=1}^{n} \alpha_{24l} LRGDP_{t-l} + \sum_{r=1}^{p} \alpha_{25r} LCPI_{t-l} + e_{2t}$$

$$LER_t = \alpha_{30} + \sum_{j=1}^{s} \alpha_{31j} LM2_{t-j} + \sum_{i=1}^{q} \alpha_{32i} DEPOSIT_{t-i} + \sum_{k=1}^{m} \alpha_{33k} LER_{t-m} + \sum_{l=1}^{n} \alpha_{34l} LRGDP_{t-l} + \sum_{r=1}^{p} \alpha_{35r} LCPI_{t-l} + e_{3t}$$

$$LRGDP_t = \alpha_{40} + \sum_{j=1}^{s} \alpha_{41j} LM2_{t-j} + \sum_{i=1}^{q} \alpha_{42i} DEPOSIT_{t-i} + \sum_{k=1}^{m} \alpha_{43k} LER_{t-m} + \sum_{l=1}^{n} \alpha_{44l} LRGDP_{t-l} + \sum_{r=1}^{p} \alpha_{45r} LCPI_{t-l} + e_{4t}$$

$$LCPI_t = \alpha_{50} + \sum_{j=1}^{s} \alpha_{51j} LM2_{t-j} + \sum_{i=1}^{q} \alpha_{52i} DEPOSIT_{t-i} + \sum_{k=1}^{m} \alpha_{53k} LER_{t-m} + \sum_{l=1}^{n} \alpha_{54l} LRGDP_{t-l} + \sum_{r=1}^{p} \alpha_{55r} LCPI_{t-l} + e_{5t}$$

where, $e_{1t}, e_{2t}, e_{3t}, e_{4t}$ and e_{5t} are the random disturbance terms, and *s, q, m, n* and *p* are the number of lag lengths.

The results of Granger Causality tests on the respective variables that have been used in the VAR model are given in Annex Table 3. Its results indicate that money supply causes real GDP and CPI during FY90-FY06. That means the order of *LRGDP* and *LCPI* will be after *LM2*. Since the paper investigates the effects of all variables on *LCPI*, it will understandably be placed last. Now, as Granger causality did not indicate anything about the relationship between deposit interest rate (*DEPOSIT*) and *LM2*, deposit rate of interest was placed after *LM2* in the study. Moreover, *LM2* has been considered as the main shock variable in the model as it has been assumed that inflation is created or adjusted in the economy through money supply. *DEPOSIT* is placed before *LRGDP* as it is assumed that lending rate will vary in the same direction of deposit rate. Thus any change in the deposit rate will affect total investment as well GDP through the change in lending rate. Finally, it is seen that exchange rate and CPI causes each other; that is, there is observed both way causality between exchange rate and CPI. Since *LCPI* is placed in the last position, exchange rate is placed before *LCPI*.

It would be interesting to see the impact that flexible exchange rate scheme adopted since May 2003, on inflation because it has been already empirically established that exchange rate changes are important in explaining inflation in countries with floating exchange rate regimes than in those with fixed exchange rates.[10] Since the price of oil is administered in Bangladesh, it is very unlikely to observe the real effect of oil price hikes on the overall price level in Bangladesh. Thus the paper does not consider oil price as a separate determinant of inflation in the context of Bangladesh. The wage rate is not considered here because of the developing country nature, labour is assumed to be abundant. The quarterly data on budget deficit and government expenditures are not available, which hinders the analysis on the supply side determinants of inflation.

Using Choleski decomposition, VAR models will be identified according to the requirement of Choleski decomposition which requires that the concerned variables be placed on the basis of the speed at which variables act in response to shocks (Ahmed and Islam 2006). As the paper is trying to investigate the sources of inflation in Bangladesh, CPI has been placed last in the model. Finally, variance decompositions (VDCs) and impulse response functions (IRFs) have been estimated to observe the relative impact of concerned variables on CPI.

5. Data and Empirical Evidence

5.1 Data Specification

In the model that has been employed in the paper, quarterly data on real GDP, money supply (M2), deposit rate of interest of scheduled banks, nominal exchange rate and CPI for the period of October-December 1990 to April-June 2006 have been used. The data have been collected from the Bangladesh Bureau of Statistics (BBS) and *Economic Trends*, Statistics Department, Bangladesh Bank (BB). All of the time series variables have been adjusted for seasonality using

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[10] See, for instance, Loungani and Swagel (2001).

Census X12 procedure and used in log form, except for the deposit rate of interest rate.[11] The detailed explanation of the variables are as follows:

Broad Money Supply (LM2):

Quarterly data on broad money supply was collected from Economic Trends, BB as M2 is considered as the broad money supply. It includes outstanding amount at the end of the each quarter which comprises of net foreign assets (with both Bangladesh Bank and Deposit Money Bank or DMB), total domestic credit (summation of Net Government Credit from domestic sources, Other Public Sector Credit and Private Sector Credit) and Net Other Assets.

Real GDP (LGDP):

Quarterly data on real GDP (base year: 1995-96=100) at producer prices has been calculated from available yearly data that was collected from BBS. In deriving quarterly data from annual, quarterly valued added in agricultural production has been constructed according to the seasonal production of each agriculture crops and distributed into quarters accordingly. The valued added in industrial and service sectors are distributed equally into four quarters of each year as little variation is observed in these two sectors.

Deposit Rate of Interest (DEPOSIT):

DEPOSIT has been collected from Economic Trends, BB, which is defined as the rate of interest of all Scheduled Banks and estimated on the basis of weighted average as at end of quarter.

Nominal Exchange Rate (LER):

LER has been collected from Economic Trends, BB, which is the period average BDT/USD at the end of each quarter.

Consumer Price Index (LCPI):

Monthly data for CPI has been collected from BBS and quarterly CPI has been constructed by making average of monthly CPI at the end of each quarter.

5.2 Empirical Evidence

The results of the unit root tests, based on DF, ADF and PP tests, on the variables have been reported in Table 3. The tests show that the variables *LRGDP, LCPI, LM1, LM2* and *LER* are non-stationary and contain unit roots I(1). In contrast, the variable *DEPOSIT* is found to be stationary or I(0). In the following sections, the estimated results of the VAR models in terms of VDCs and IRFs will be presented.

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[11] This procedure has been developed and extensively used by the U.S. Census Bureau and found in *Econometric Views 4 (EViews 4.1)* package.

Table 3: Unit Root Tests with DF, ADF and PP

Variables	DF		ADF		PP		Decision
	Without trend	With trend	Without trend	With trend	Without trend	With trend	
LRGDP	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
LCPI	I(1)	I(0)	I(1)	I(0)	I(1)	I(1)	I(1)
LM1	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
LM2	I(0)	I(1)	I(1)	I(0)	I(1)	I(1)	I(1)
LER	I(0)	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
DEPOSIT	I(0)**	I(0)	I(0)	I(0)	I(0)	I(1)	I(0)

Notes: 1. Lag length for DF tests have been decided on the basis of Schwartz Information Criterion (SIC); 2. Lag length of ADF tests have been decided on the basis of Akaike's Information Criterion (AIC); 3. Maximum Bandwidth for PP tests have been decided on the basis of Newey-West (1994); 4. All tests have been performed on the basis of 5-percent significance level using Econometric Views 4.1 Package; 5. ** means significant at 10 percent levels.

5.2.1 Sources of Inflation (1989:3 to 2006: 2)

Table 4 shows the results from variance decompositions (VDCs) for inflation model regarding the determinants of inflation in Bangladesh which have been estimated over the period FY90-FY06. The estimation utilizes the optimal lag of 12 that makes the residuals of the model white noise (Annex Figure 1.1) as well as recursive residuals that suggests stability in the parameters of the equations in the model although there are minor episodes of instability (Annex Figure 1.2).

The VDCs presented in Table 6 for each variable at forecast horizons of 1 quarter through 12 quarters, i.e., 3 years, give the share of fluctuations in a given variable that are explained by shocks in other relevant variables as well as itself. The results derived from VDCs indicate that the *LM2* and *DEPOSIT* shock does not have statistically significant explanatory power of predicting the movements in other variables at any time horizon except for their own future path. However, the shock in *LM2* has a statistically significant explanatory power of forecasting the movement in *LRGDP* starting with time horizon 4, i.e., year-1. In particular, *LM2* shock alone explains 23.6 per cent of the forecast error variance of *LRGDP* at time horizon 12, i.e., year-3. This suggests that money supply is a moderate determinant of fluctuation in real output.

Table 4: Variance Decomposition-Inflation Model (1989:3-2006:2)

Variance Decomposition of LM2:					
Quarter	LM2	DEPOSIT	LRGDP	LER	LCPI
1	100.00*	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
2	94.31*	3.81	0.06	1.82	0.0001
	(6.22)	(5.33)	(2.51)	(3.26)	(1.59)
4	91.66*	6.21	0.27	1.02	0.84
	(8.92)	(7.86)	(3.59)	(3.22)	(2.59)
8	86.98*	8.05	0.841	2.51	1.62
	(13.48)	(11.44)	(5.13)	(6.13)	(4.93)
12	83.15*	6.08	1.72	4.47	4.58
	(16.18)	(12.64)	(6.24)	(8.01)	(6.99)

		Variance Decomposition of DEPOSIT:			
Quarter	LM2	DEPOSIT	LRGDP	LER	LCPI
1	0.32	99.68*	0.00	0.00	0.00
	(2.53)	(2.53)	(0.00)	(0.00)	(0.00)
2	1.04	97.64*	0.25	1.05	0.02
	(4.00)	(5.18)*	(1.87)	(2.44)	(1.19)
4	1.64	96.35*	1.19	0.54	0.278
	(5.87)	(8.16)	(4.32)	(2.89)	(2.49)
8	5.13	82.33*	6.48	1.15	4.91
	(8.58)	(15.42)	(8.94)	(5.48)	(7.11)
12	6.82	69.48*	11.24	1.13	11.33
	(9.31)	(18.23)	(11.22)	(7.02)	(10.57)
		Variance Decomposition of LRGDP:			
Quarter	LM2	DEPOSIT	LRGDP	LER	LCPI
1	1.28	0.72	98.01*	0.00	0.00
	(3.44)	(2.95)	(4.48)	(0.00)	(0.00)
2	4.82	0.97	93.80*	0.36	0.05
	(5.88)	(4.18)	(7.48)	(2.38)	(1.89)
4	17.49*	1.58	77.42*	3.17	0.33
	(7.22)	(5.75)	(9.40)	(4.73)	(2.80)
8	19.74*	2.42	71.42*	5.00	1.41
	(7.35)	(6.53)	(9.70)	(5.46)	(3.52)
12	23.60*	2.65	66.29*	5.34	2.11
	(8.00)	(7.35)	(10.04)	(5.67)	(4.04)
		Variance Decomposition of LER:			
Quarter	LM2	DEPOSIT	LRGDP	LER	LCPI
1	13.47	9.61	0.01	76.91*	0.00
	(7.99)	(6.72)	(1.73)	(9.15)	(0.00)
2	18.17	19.14*	0.05	62.60*	0.04
	(10.17)	(9.53)	(2.89)	(11.45)	(1.19)
4	22.08	30.06*	0.79	46.93*	0.13
	(12.54)	(13.68)	(4.76)	(12.66)	(2.28)
8	34.38*	26.63	0.80	37.46*	0.73
	(13.77)	(14.74)	(5.95)	(11.99)	(4.87)
12	38.72*	20.61	3.70	28.38*	8.58
	(13.20)	(14.79)	(6.90)	(10.30)	(8.89)
		Variance Decomposition of LCPI:			
Quarter	LM2	DEPOSIT	LRGDP	LER	LCPI
1	10.64	19.21*	4.93	6.39	58.82*
	(7.28)	(8.48)	(4.56)	(4.60)	(9.68)
2	21.57*	12.13	3.57	11.71	51.01*
	(10.71)	(7.63)	(4.87)	(7.09)	(9.86)
4	18.44*	11.15	10.38	9.14	50.87*
	(11.54)	(10.22)	(9.35)	(7.43)	(10.81)
8	20.30	7.12	16.11	9.20	47.25*
	(13.46)	(11.73)	(12.19)	(9.27)	(11.81)
12	26.34	6.06	16.20	8.67	42.71*
	(13.91)	(13.56)	(11.87)	(9.63)	(11.36)
Cholesky Ordering: LM2 DEPOSIT LRGDP LER LCPI					

*Notes: (i) The first entry in each cell is the point estimate of the percentage of forecast error variance of variable 'i' as explained by shocks to variable 'j'. (ii) Monte Carlo simulated standard errors are reported in the parentheses by employing 1000 random draws; (iii) * denotes the statistical significance of point estimates at 5-per cent level assuming that the estimates are asymptotically normally distributed.*

The shock in *LM2* has a statistically significant explanatory power of forecasting the movement in *LER* starting with time horizon 8, i.e., year-2. In particular, *LM2* shock alone explains 38.72 per cent of the forecast error variance of *LER* at time horizon 12, i.e., year-3. Similarly, the *DEPOSIT* has a statistically significant explanatory power of forecasting the movement in *LER* starting with time horizon 2. In particular, *DEPOSIT* shock alone explains 30.06 per cent of the forecast error variance of *LER* at time horizon 4, i.e., year-1. The above results suggest that money supply and deposit interest rate are moderately strong determinants of fluctuation in nominal exchange rate in Bangladesh.

Finally, the shocks in *LM2* and *DEPOSIT* have statistically significant explanatory power of forecasting the movement in *LCPI* starting from quarter 2 and quarter one, respectively. That is, the shocks in *LM2* and *DEPOSIT* account for 18.44 per cent and 19.21 per cent of the fluctuations in *LCPI*, respectively, suggesting that money supply and nominal deposit rate of interest are the relatively weak determinants of fluctuations in inflation in Bangladesh during FY90-FY06.

The key findings that emerged from the above analysis are as follows:
- Inflation in Bangladesh can be explained by money supply growth as money supply has statistically significant power of forecasting the movement in CPI. It might be channeled through either the effects of money supply on GDP or the effects of money supply on exchange rates.
- The deposit rate of interest is a relatively weak determinant of fluctuations in inflation in Bangladesh, whereas deposit rate of interest is a moderately strong determinant of nominal exchange rate, but only in the short run.
- Money supply is a moderate determinant of fluctuation in real output, at the same time, money supply is a moderately strong determinant of fluctuation in nominal exchange rate in Bangladesh during the period FY90-FY06.

5.2.2 Response of Inflation to Shocks (1989:3 to 2006: 2)

Figure 2 shows the impulse responses for inflation for the sample period FY90-FY06 of Bangladesh under the VAR system.[12] The IRFs will show the response of inflation to shocks to a one standard deviation shock to each of the five influences considered above (including inflation itself). The results show that the shock in *LRGDP* has no statistically significant impact on *LM2*, *DEPOSIT*, *LER* and *LCPI*, which is similar to the outcome of VDCs. This indicates that the impact of output shock has not been transmitted to inflation in Bangladesh during the last one and half decades. It is also noticeable that the shock in *LM2* has a significant and positive impact on *LRGDP* only in quarter 3 indicating a very short-run positive influence of money supply on GDP.

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[12] Each impulse response function (IRF) has been reported with a one-standard-deviation confidence interval (i.e., 95 per cent confidence interval) level represented by dashed line and a response is considered to be significant if it does not contain the zero line within its confidence bands (i.e., ± 2 s.e.). The standard errors of IRFs are computed by the Monte Carlo method described in *Econometric Views 4.1* Package, using 1000 draws from the estimated asymptotic distribution of the VAR coefficients and the covariance matrix of the innovations.

Likewise, it is also noticeable that the shock in *LM2* has a significant and positive impact on *LER* only upto 3rd quarter and then dissipates over the rest of the period, indicating a moderately short-run positive influence of money supply on nominal exchange rate. At the same time, the shock in *DEPOSIT* has a significant and positive impact on *LER* only upto 3rd quarter and then dissipates over the rest of the periods indicating a moderately short-run positive influence of deposit interest rate on nominal exchange rate.

And finally, the shock in *LCPI* has no statistically significant impact on *LM2*, *DEPOSIT*, *LER* and *LRGDP*, which is also very much in line with the outcome of VDCs. However, an exogenous increase in inflation has a persistent effect, with a statistically significant increase in inflation for 6 quarters or 1.5 years following the initial response. This is an important finding for policy makers in their decision making process, since control of inflation is based on past realized inflation. However, it is more important to observe the response of inflation to money supply, nominal exchange rate and deposit interest rate. First of all, the response of *LCPI* to *LM2* shock is positive and significant only up to two and a half quarters suggesting a short-run positive influence of money supply on inflation. Similarly, the response of *LCPI* to *LER* shock is positive and significant only up to 2nd quarter, which indicates a short-run positive influence of nominal exchange rate on inflation. The above results suggest that expansionary policies, whether reflected in higher money supply or exchange rate depreciation, lead to higher inflation, and the impact is statistically significant in the context of Bangladesh during the period FY90-FY06.

Lastly, the shock in *DEPOSIT* has a significant and negative impact on *LCPI* only up to the quarter 2 indicating a short-run negative influence of interest rate on inflation. This seems to be an interesting result in the sense that interest rate is supposed to respond positively with inflation as suggested by the economic theory. Since the paper did not observe any kind of effect of inflation on interest rate throughout the estimation process, the above result brings a few thoughts about the relationship between interest rate and inflation. It seems that increase in nominal deposit interest rate in Bangladesh makes people spend less or save more. This is usually a normal picture in the developed world, where changes in interest rate affects peoples' decision in terms of spending. In Bangladesh, lower investment opportunities might be the appropriate explanation for such behaviour of inflation due to change in deposit interest rate.

In conclusion, the results from IRFs suggest that increase in money supply and exchange rate depreciation have a positive influence on inflation, whereas increase in deposit interest rate has a negative influence on inflation in Bangladesh; although all of the above effects are short-run influence.

Figure 2: Impulse Responses: Inflation Model (1989:3-2006:2)

Response to Cholesky One S.D. Innovations ± 2 S.E.
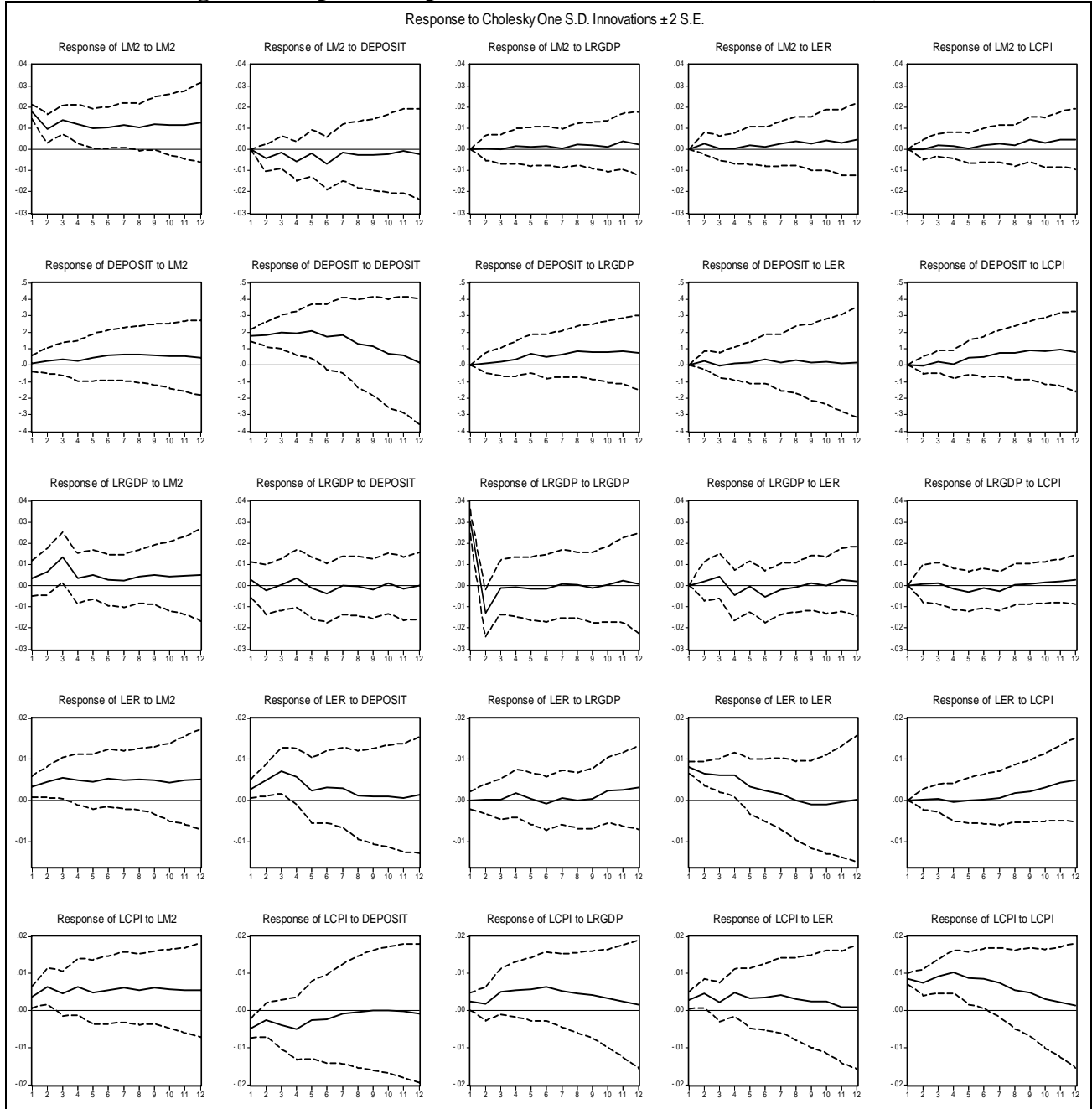
6. Conclusions and Policy Implications

The purpose of this paper was to find out the sources of inflation in the context of Bangladesh during the period FY90-FY06. In this regard, the paper explained the historical trends of inflation, role of factors such as money supply growth, exchange rate depreciation and interest rates and their interrelationships. It is observed that Bangladesh experienced a moderate level of inflation during the last one and half decades. The data reveal the fact that inflation in Bangladesh varies mainly with food prices and rural inflation, especially since the mid-1990s. In

regard to relationship with sources of inflation, the data reveal that money supply growth and exchange rate depreciation appear as significant.

An assessment of the empirical evidence has been performed using the unrestricted VAR model, where a quarterly data set is used for variables, namely, money supply, deposit interest rate, real GDP, nominal exchange rate and CPI for the period FY90-FY06. The major findings that emerge from the analysis are as follows:

- The empirical findings strongly support the historical data that inflation in Bangladesh during FY90-FY06 has been a monetary phenomenon. In particular, VDCs support the view that money supply has an explanatory power of forecasting the movements in consumer price index, although the fluctuations seem relatively weak. On the other hand, IRFs show a short-run but positive influence of money on inflation, which is very much in line with the outcome of VDCs. The finding of this paper justifies cautions and restrained monetary policy stance taken by Bangladesh Bank to control inflation.
- Exchange rate depreciation positively affects inflation in Bangladesh as suggested by the results from IRFs. In particular, IRFs depict a short-run positive influence of nominal exchange rate on CPI. This result is expected, as depreciation results in higher prices of import items and thus reflected in the import price index. It had been observed that among supply side factors, import price index is the most significant variable (Majumder, 2006).[13] Thus domestic inflation in Bangladesh can be controlled by influencing the import price index through exchange rate stability.
- The results from both VDCs and IRFs suggest that deposit interest rate has a significant and negative impact on CPI, give an explanation for demand side management in the economy. This arises from the fact that increases in interest rate result in decreases in spending, which ultimately reflects in lower prices of the final goods.
- The estimated VDCs suggest that money supply affects both output and exchange rate in the short-run indicating that money supply is a moderate determinant of fluctuation of output but a strong determinant of fluctuations in the exchange rate in Bangladesh. Results from IRFs also support those of VDCs in the sense that money supply has a significantly positive influence on output only in the 3rd quarter, while it has a significantly positive influence on exchange rate up to 3rd quarter. Both results jointly establish the fact that money supply increases output and the exchange rate in Bangladesh.
- Finally, it has been observed that deposit interest rate has a significantly positive influence on exchange rate, supported by both VDCs and IRFs.

The results of the empirical analysis support a strong demand side management in the Bangladesh economy. Probably this is one of the principal contributions of this paper emerging from the empirical investigation. The paper presents evidence which suggests that the contribution of money supply increase to inflation is more significant than other variables such as nominal deposit rate of interest and nominal exchange rate. Though the findings of this paper did not consider the effect of exchange rate regimes on inflation, however, many developing country experiences suggest that the move from fixed exchange rate regimes to flexible exchange rate regimes can be inflationary (Loungani and Swagel, 2001). Thus, there is need for

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[13] In this regard, it is clarified that this paper could not consider import price index as another factor of inflation due to data unavailability on a quarterly basis. However, yearly data on import price index is available.

conducting prudent monetary policy on a continuous basis in order to control the rate of inflation, stabilize the foreign exchange market, and improve real demand for money, so as to maintain internal macroeconomic stability and to face external challenge in the long-run.

The findings of this study should be viewed with caution since it has several limitations that might usefully be addressed in future work. First, the paper hardly considered the supply side factors of inflation such as food supply shortage either due to seasonality or natural disasters, import price index or wage rate index. Since some policy makers argue that supply side factors have a close association to inflation in the Bangladesh economy, a closer look on the cost behaviour in the relevant period would be useful in the policy making process. Thus a systematic investigation is needed to examine the effects of supply side factors on inflation in Bangladesh. Second, inflation in developing countries is often linked to fiscal deficits; availability of quarterly data on fiscal deficit would greatly benefit the analysis of the relationship between inflation and fiscal imbalances in the country.

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Annex Table 1: Inflation and its Factors in South Asia: FY90-FY04

	Average Period	Bangladesh	India	Nepal	Pakistan	Sri Lanka
Inflation rate	1990-95	4.20	10.16	10.50	11.72	9.83
	1996-00	3.82	5.85	6.49	7.57	7.80
	2001-04	3.39	4.02	3.87	5.28	9.04
	1990-04	3.83	6.87	7.17	8.40	8.88
GDP growth rate	1990-95	4.65	5.33	5.14	4.61	5.57
	1996-00	5.21	5.79	4.83	3.27	5.04
	2001-04	5.12	6.19	2.94	4.10	3.58
	1990-04	4.96	5.71	4.45	4.03	4.86
M2/GDP ratio	1990-95	24.74	49.44	33.06	43.72	31.49
	1996-00	28.72	56.41	41.99	45.03	35.92
	2001-04	36.84	70.36	53.78	44.00	40.36
	1990-04	29.29	57.34	41.57	44.23	35.33
Exchange rate depreciation	1990-95	-0.27	-4.83	-3.42	-0.31	2.13
	1996-00	-2.79	-1.65	-1.25	-5.77	-1.79
	2001-04	-1.43	1.40	0.33	-0.20	-0.15
	1990-04	-1.42	-2.11	-1.70	-2.10	0.21
Real interest rate	1990-95	3.79	-0.24	-2.90	-0.53	2.61
	1996-00	2.62	2.09	-1.47	2.44	1.99
	2001-04	4.51	1.85	-0.74	1.83	-0.23
	1990-04	3.59	1.09	-1.84	1.04	1.65

Source: World Development Indicators, 2006 (WDI 2006), World Bank (WB) and International Financial Statistics (IFS), International Monetary Fund (IMF).

Annex Table 2: Composition of the Bangladesh CPI: Weights in FY96

Category	Rural Weights (in percent)	Urban Weights (in percent)
1. Food, beverage and tobacco	**62.96**	**48.80**
A. Food	60.48	44.53
i. Rice	23.79	11.28
ii. Fish (fresh) & Dry fish	9.81	8.14
iii. Vegetables	6.12	4.24
iv. Other food items	20.76	20.87
B. Beverage and tobacco	2.48	4.27
2. Non-food	**37.04**	**51.20**
A. Clothing and Footwear	6.88	6.79
B. Gross rent, fuel and lighting	14.69	22.17
C. Educational Expenses	2.69	5.23
D. Luxury goods	2.28	1.75
E. Transport and Communication	2.98	7.07
F. Medical and Health expenses	2.79	2.97
G. Other non-food items	4.73	5.22

Notes: (i) The composition of Bangladesh CPI in terms of its weights in both rural and urban areas is based on 1995-96 Household Expenditure Survey (HES); (ii) Other food items consist of cereals, pulses, eggs, dry fish and meat, fruits, spices, edible oils and fats, milk and milk products etc.; (iii) Other non-food items include furniture and household equipment, recreation etc.
Source: Compiled from Shahiduzzaman (2006).

Annex Table 3: Results of Granger Causality

| Pair-wise Granger Causality Tests			
Null Hypothesis:	*Obs*	*F-Statistic*	*Probability*
LCPI does not Granger Cause DEPOSIT	64	1.03	0.39
DEPOSIT does not Granger Cause LCPI		0.44	0.78
LER does not Granger Cause DEPOSIT	64	0.80	0.53
DEPOSIT does not Granger Cause LER		1.88	0.13
LM2 does not Granger Cause DEPOSIT	64	0.82	0.52
DEPOSIT does not Granger Cause LM2		1.95	0.11
LRGDP does not Granger Cause DEPOSIT	64	0.28	0.89
DEPOSIT does not Granger Cause LRGDP		0.39	0.81
LER does not Granger Cause LCPI	64	2.24	0.08
LCPI does not Granger Cause LER		2.32	0.07
LM2 does not Granger Cause LCPI	64	2.84	0.03
LCPI does not Granger Cause LM2		0.32	0.86
LRGDP does not Granger Cause LCPI	64	1.90	0.12
LCPI does not Granger Cause LRGDP		0.74	0.57
LM2 does not Granger Cause LER	64	1.44	0.23
LER does not Granger Cause LM2		1.89	0.12
LRGDP does not Granger Cause LER	64	1.60	0.19
LER does not Granger Cause LRGDP		1.04	0.39
LRGDP does not Granger Cause LM2	64	0.44	0.78
LM2 does not Granger Cause LRGDP		4.41	0.003

Annex Figure 1.1: Correlogram of Residuals: Inflation Model (1989:03-2006:2)
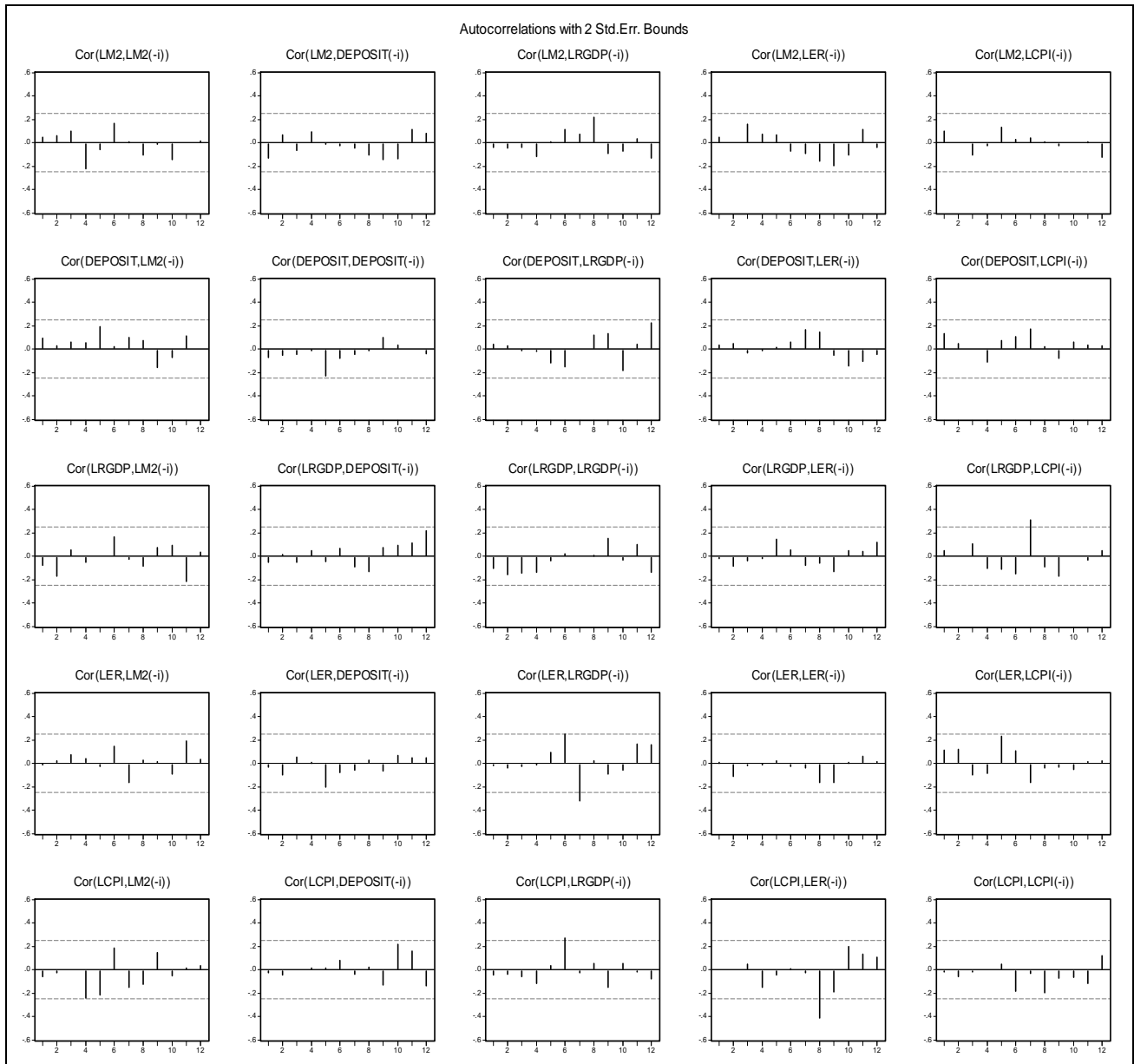
Note: Optimal lag length 12 has been used to make the residual almost white noise.

Annex Figure 1.2: Stability Test-Recursive Residuals
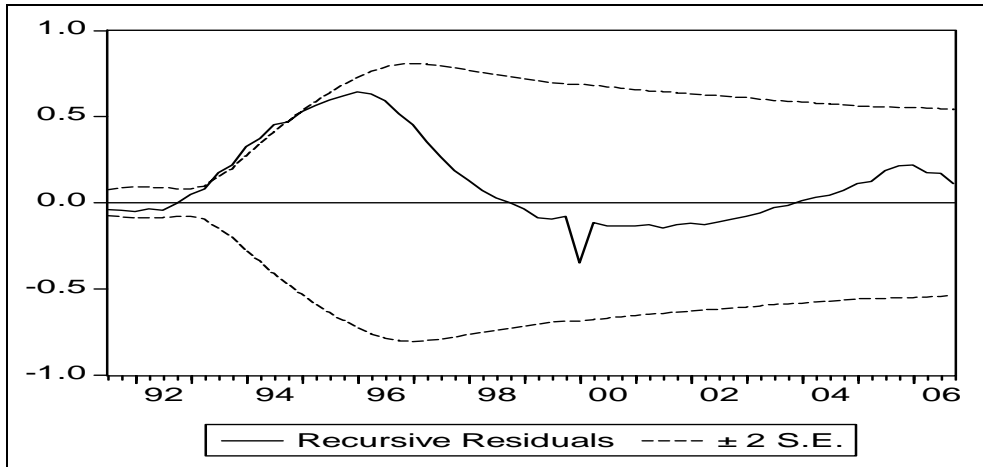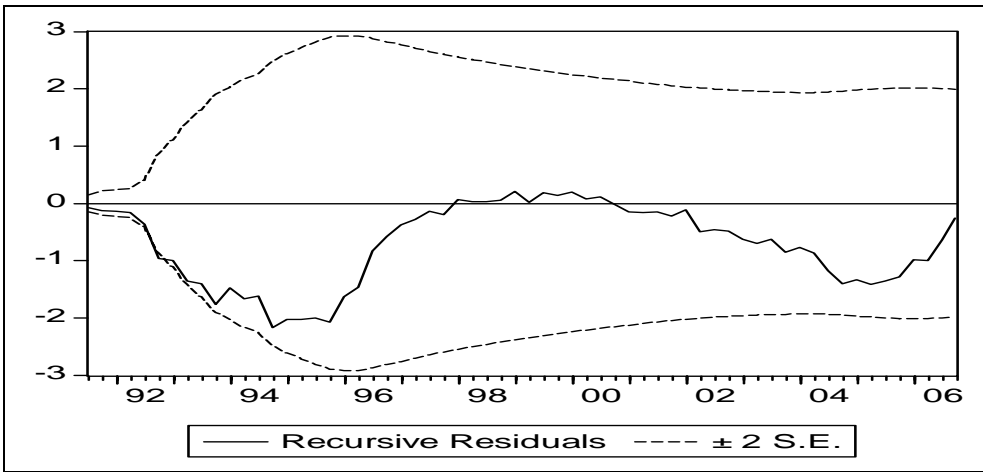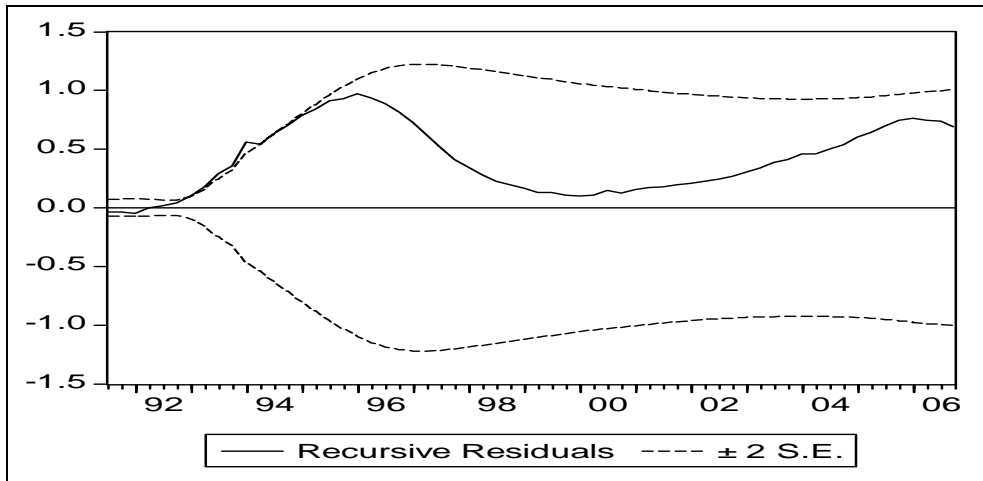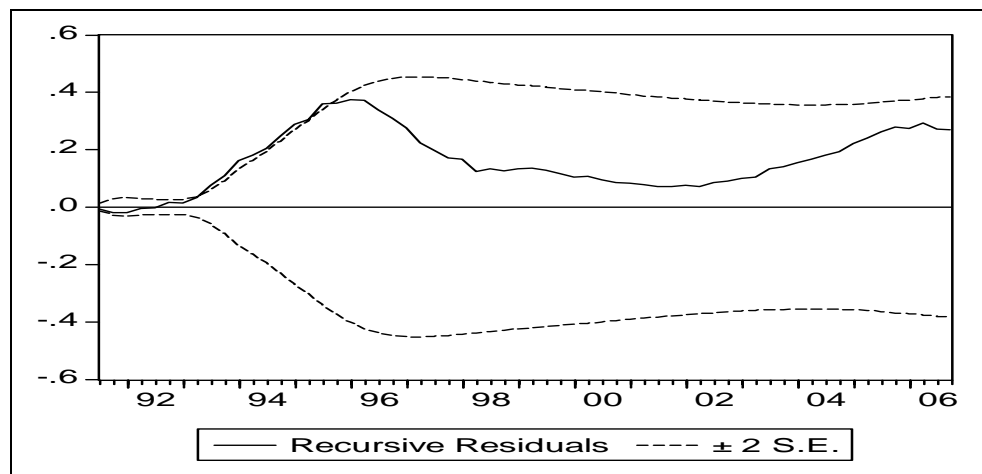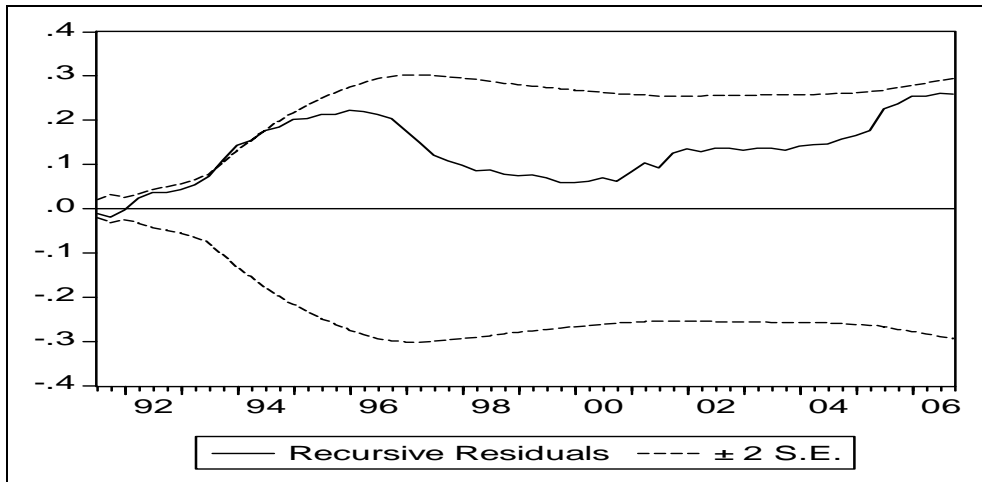
Note: Residuals outside the standard error bands (i.e. ± 2 s.e.) suggest instability in the parameters of the equation in the VAR model.