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Exchange Market Pressure and Monetary Policy: Evidence from Pakistan

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Abstract

The study employs the Girton and Roper (1977) measure of exchange market pressure (defined as the sum of exchange rate depreciation and foreign reserves outflow), to examine the interaction between exchange market pressure and monetary variables, viz. domestic credit (Reserve Money) and the interest rate. Evidence from impulse response functions suggests that domestic credit has remained the dominant tool of monetary policy for managing exchange market pressure. The increase in domestic credit upon increases in exchange market pressure (during 1991-98) was imprudent. The results suggest that fiscal needs/growth objectives might have dominated external account considerations during this period. Post 9/11 there is evidence of sterilized intervention in the forex market. The interest rate has also weakly served as the tool of monetary policy during the hay days of foreign currency deposits (1991-98). The finding implies that, for the interest rate to work as tool of monetary policy vis-a-vis exchange market pressure, a reasonable degree of capital mobility is called for.

1. Introduction

Exchange market pressure generally refers to disequilibrium in the money market. Knowledge of the mechanisms and instruments that help achieve money market equilibrium has important policy implications. Monetary approaches to balance of payments and monetary approaches to the exchange rate respectively hold that, under the fixed exchange rate regime, the money market equilibrium is achieved through changes in foreign reserves while in the case of a pure float, the exchange rate bears the adjustment burden[1].

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[1] To understand the mechanisms, for different exchange rate regimes, that help achieve equilibrium under the monetary approach see Frenkel (1976) Mussa (1976) &and Pilbeam (1999).

Under the managed float exchange rate regime, changes in the exchange rate and variation in foreign reserves are the two sides of the same coin - hide one and the other shows up. For example, post 9/11 the State Bank of Pakistan (SBP) actively intervened in the forex market - first to smoothen the appreciation of the exchange rate by purchasing foreign currency from the forex market thereby building up foreign reserves. Moreover, since November 2004, SBP has been providing foreign currency from reserves for oil imports to avoid depreciation of the exchange rate. Therefore under a managed float, to examine the disequilibrium in the money market, we need a composite variable that incorporates changes in the exchange rate as well as variation in foreign reserves. Girton and Roper (1977) construct the requisite composite variable as the 'simple sum of exchange rate depreciation and variation in foreign reserves scaled by monetary base' and call it exchange market pressure (*emp*).

This study uses the composite variable *emp* rather than foreign reserves or the exchange rate, to study the interaction between monetary variables and the external account. Specifically, the study examines the nature of the influence of monetary variables *viz.* domestic credit and the interest rate upon exchange market pressure and vice versa. The analysis is likely to facilitate monetary management. The study will also reveal whether the instrument of domestic credit or the interest rate has been used by the authorities to manage exchange market pressure. The use of domestic credit implies quantitative monetary management, i.e. directly varying the level of money supply whereas the use of the interest rate implies market-based monetary management. The two monetary regimes carry different implications for the economy.

The study is organized as follows: Section 2 is devoted to the review of the literature on the *emp* model, Section 3 develops the theoretical and empirical framework for the study, Section 4 concerns data issues, Section 5 reports and analyzes the results from the econometric investigation and Section 6 concludes.

2. Literature Review

Seminal work on exchange market pressure as a composite variable comes from Girton and Roper (1977). They developed a model to explain both the exchange rate movement and variation in foreign reserves and referred to the composite variable $(r + e)$ as exchange market pressure, where r represents the change in foreign reserves scaled by monetary base (reserve money) and e reflects the percentage change in the exchange rate over the period under consideration.

2.1. Girton and Roper's emp Model

The main theoretical proposition of the Girton and Roper (henceforth GR) model is that the domestic money market equilibrium if disturbed is restored through some combination of the currency depreciation/appreciation and foreign reserves outflow/inflow. The excess domestic money supply will cause a combination of currency depreciation and reserves outflow while excess domestic money demand will cause some combination of currency appreciation and reserves inflow to restore the money market equilibrium.

GR's model organizes the analysis around demand and supply of national monies. According to their formulation, *emp* is a function of growth in domestic credit, growth in foreign money supply and the differential between growth of domestic and foreign real income. The assumptions, explicit and implicit, in the GR model are: Stable demand for money function (money multiplier is held constant), purchasing power parity holds, flow equilibrium in the money market and domestic and foreign interest rates are assumed to grow at equal rate, that is, the interest rate differential is held constant.

GR's model differs from other monetary models of Balance of Payments (BOP) in three respects. First, the dependent variable is exchange market pressure, defined as the sum $r + e$, rather than the BOP *per se*, second the model takes the view that a country's monetary policy can be judged as tight or loose only through comparison with the monetary policy being implemented in rest of the world. Third GR's model holds for all exchange rate regimes (of the dependent variable $r + e$, r and e are respectively zero, under floating and fixed exchange regimes, and the rest of the model remains unchanged).

The GR model has been applied extensively, with certain modifications. The applications include Cannolly and Silveira (1979) to Brazil, Paradhan et al. (1989), to India, Modeste (1981) to Argentina, Kim (1985) to Korea and Wohar and Lee (1992) to Japan, Thornton (1995), Tanner (2001) for six East Asian countries, Kamaly and Erbil (2000) for three MENA region countries, Tanner (2002) for 32 countries and Bautista and Bautista (2002) for Philippines.

The recent *emp* models, by assuming a small open economy, obviates from monetary dependence apparent in GR's model. The earlier models held that foreign disturbances are transmitted to the home country through growth in foreign money supply. However, the recent models rely

upon interest rate differentials and inflation differentials to carry-over the foreign disturbances to the domestic economy. The recent models have also relaxed the assumption that purchasing power parity holds. Another improvement affected at the empirical stage in recent studies is that these, by using VAR, take care of the endogeneity in the *emp* model that earlier studies failed to tackle. Till Thornton (1995), the *emp* model was primarily used only to validate the monetary approach. However recent studies tend to examine whether the tool of monetary policy, *viz-a viz* exchange market pressure, has been domestic credit or the interest rate.

All the studies listed above validate the monetary approach. Most of the studies referred above have tested the efficacy of the *emp* model by using foreign reserves as the sole dependent variable rather than the composite variable *emp*. Except for Wohar and Lee (for Japan) and Paradhan et al. (for India), others find that the fit deteriorates significantly when foreign reserves (r) is used as the sole dependent variable. This proves the efficacy of the *emp* model. Tanner (2001, 2002) and Bautista and Bautista (2005) find that the feedback relation from exchange market pressure to domestic credit is positive. The authors take this to be a sign of sterilization of reserves outflow. Kamaly and Erbil (2000), Tanner (2001, 2002) find that domestic credit has been the dominant tool for managing exchange market pressure in the countries examined. Bautista and Bautista (2005), which examines *emp* in Philippines, covers the Asian currency crises period as well. They find that during the crises period exchange market pressure increases with the increase in the interest rate differential. This finding is against the conventional wisdom. The authors infer from this that in times of currency crisis, the interest rate cannot be relied upon as a tool of monetary management *viz-a-viz* exchange market pressure.

3. Theoretical and Empirical Framework

3.1. The Model

We use a model similar to the one used by Kamaly and Erbil (2000) and Tanner (2001, 2002). The model is:

$$emp_t = dc_t - \beta y_t + \alpha \dot{i}_t - \pi_t^* + z_t \qquad (3.1)$$

Where:

emp_t : Exchange Market Pressure at time t,

dc_t : Growth in domestic credit (scaled by monetary base)

y_t : Growth in real income

i_t : Growth in nominal interest rate

π_t^* : Growth in international inflation

z_t : Deviation from PPP rate

The system given by equation (3.1) has endogeneity — not only the domestic credit and interest rate influence exchange market pressure (*emp*) but *emp* also influences the two variables[2]. Given the endogeneity in equation (3.1), we use VAR framework to estimate equation 3.1[3]. The VAR framework for equation 3.1 can be written as:

$$q_t = a_0 + \sum_{J=1}^{P} A_j q_{t-j} + \delta z_t + \lambda \pi_t^* + e_t \qquad (3.2)$$

where $q_t = dc_t, emp_t, y_t, i_t$, A_j is a vector of coefficients of the endogenous variables, δ and λ represent the coefficients of the two exogenous variables: z_t and π_t^* and $e_t = e_{dc_t}$, e_{i_t} e_{y_t} e_{emp_t} is a vector of innovation. Each element of the innovation vector e_t is in turn composed of own error terms w_t and contemporaneous correlation, based on assumed *Ordering*, with other innovation ($\beta_{i's}$).

3.2. Identification of IRF's: Choleski decomposition:

An unrestricted VAR system as given by equation (3.2) is under identified. To identify the impulse response functions (IRF's) *Choleski* decomposition is used to impose restrictions on the four variables in the VAR. *Ordering* of the variables assumed for the purpose is: [dc_t i_t y_t emp_t]. Sensitivity of the results to following alternate *orderings* will be tested.

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[2] For detailed reasoning in this regard see Kamaly and Erbil (2000).

[3] To ascertain the suitability of VAR framework for estimation of a system like equation (3.1) see Tanner (2001, 2002) and Kamaly and Erbil (2000) and Gujarati (1998). For technical aspects of VAR framework see Enders (1995).

1) $[dc_t \ i_t \ emp_t \ y_t]$

2) $[dc_t \ emp_t \ i_t \ y_t]$

3) $[emp_t \ dc_t \ i_t \ y_t]$

3.2.1. Economic rationale for the assumed ordering

Domestic credit, being a policy variable, influences all other variables contemporaneously but is itself influenced by own contemporaneous innovation only. The interest rate despite being a policy variable is partly determined in the market; therefore its exogeneity ranking is lower than domestic credit. Real income is known to be influenced by monetary variables, and therefore its exogeneity ranking is lower than the two monetary variables. Monetary variables as well as real variables do influence the level of the exchange rate and foreign reserves. Hence the lowest exogeneity ranking is that of exchange market pressure.

3.3. Hypotheses

Our hypotheses of interest are extracted from equation (3.2). These are:

- $\beta_{emp_t.dc_t} w_{dc_t} > 0$ and,
- $\beta_{emp_t.i_t} w_{emp_t} > 0$

The first one implies that a shock to innovation in domestic credit has a positive impact on exchange market pressure while the second one posits that the impact of a shock to innovation in the interest rate on exchange market pressure is positive. The discussion on the theoretical foundations of the hypotheses follows.

3.3.1. Domestic credit: Positive Relationship with emp

The positive influence of a shock to innovation in domestic credit on exchange market pressure stems from the monetary approach: According to the monetary approach to BOP, payment imbalances reflect disequilibrium in the money market. The approach posits that BOP deficits and BOP surpluses respectively correct for the excess supply of money and excess demand for money. In the case of a free float, the adjustment burden falls on the exchange rate while under a managed float, the foreign reserves and

the exchange rate together (i.e. *emp*) shoulder the adjustment burden. The monetary authority, using its own discretion, determines the adjustment proportion.

Given the foregoing, an increase in domestic credit is offset by exchange rate depreciation or foreign reserves outflow or some combination of the two; that is, an increase in exchange market pressure. Hence the positive impact of a change in domestic credit on exchange market pressure occurs.

3.3.2. Interest Rate: Positive Relationship with emp

The theoretical foundation for the relationship between a shock to innovation in the interest rate and exchange market pressure is drawn from the theory of money demand and interest rate parity theory.

According to Keynesian theory of money demand, the interest rate bears a negative relationship with money demand. The following flow chart shows the channel through which the interest rate exercises influence on exchange market pressure:

> Increase in interest rate → decrease in real money demand → foreign reserves outflow/exchange rate depreciation → increase in exchange market pressure.

We predict a positive relationship between the interest rate and exchange market pressure. Frenkel (1979) discusses how there are conflicting views, *viz.* Chicago view and Keynesian view regarding the relationship between the interest rate and exchange rate. The essence of the Chicago view is indicated in the flow chart given above i.e. the increase in the interest rate causes the money demand to decline, which in turn causes the exchange rate to depreciate. This view predicts a negative relationship between the interest rate and exchange rate. The Keynesian view argues that an increase in the domestic interest rate, given the foreign interest rate, makes the domestic securities more attractive. This attracts foreign capital into the country that causes the foreign reserves to increase and the exchange rate to appreciate. Thus the Keynesian view predicts a negative relationship between the interest rate and the exchange rate. The view assumes perfect capital mobility and one condition for capital mobility is that domestic and foreign securities should be equally risky. (Pilbeam, 1998, p. 162)

To assess the applicability of the Keynesian view in Pakistan, let us assume that the interest rate in Pakistan is sufficiently higher than that in the US. Can we expect that Americans will transfer money from their banks in the US to banks in Pakistan? Certainly not, and the reason is that money in Pakistani banks is not considered as safe as in the US. As Pakistani securities are perceived as more risky relative to foreign ones, we therefore do not expect the Keynesian view to hold in Pakistan. Given the non applicability of the Keynesian view we feel that only the Chicago view is at work in Pakistan and therefore we posit a positive relationship between the interest rate and exchange market pressure.

4. The Data

4.1. Data Span

The data span of the study is: 1991:04-2005:12. Given that the exchange market pressure model is particularly applicable to managed floats (though it is possible to use the model for other exchange rate regimes as well), one logical starting point of the data span is January 08, 1982 — the day Pakistan adopted a managed float. However we use 1991 as the starting point because of the following reason. Prior to March 1991, the interest rate was regulated by SBP, and the interest rate on Government Treasury Depository Receipts (GTDRs), whose features are similar to that of Treasury Bills now in vogue, was changed only once during the eight years preceding March 1991. This is enough to conclude that the interest rate was not being used as an instrument of monetary policy prior to 1991. Since our objective is to determine whether the dominant tool of monetary policy *vis-à-vis* exchange market pressure is 'interest rate' or 'domestic credit', we cannot include data prior to March 1991. Hence the small sample of 14.9 years that we have. Besides we use three sub-spans spanning over 7.2, 7.7 and 4.4 years. The characteristics of these sub-spans are indicated in Table-4.1 below.

Table-4.1: Data Span: Characteristics

From	To	Peculiarity	Length (Years)
1991:04	2005:12	Initiation of the move towards market based monetary policy (Full span)	14.9
1991:04	1998:05	Life period of Foreign Currency Deposits (FCDs)	7.2
1998:06	2005:12	Post-FCDs freeze / 9/11	7.7
2001:09	2005:12	Post 9/11	4.4

The motivation for the full span of 14.9 years has been discussed above. The motivation for the sub spans follows:

4.1.2. Sub Spans: 1991:04-1998:05 & 1998:06-05

Foreign Currency Deposit Accounts (FCDs) during their short active life had been not only a key source of foreign currency for the authorities but had led to *dollarization* as well. Both in turn influenced exchange market pressure and the monetary policy. The developments call for analysis of the relationship that prevailed between the exchange market pressure and the monetary variables. Secondly in May 1998, when Pakistan became a nuclear power, foreign aid sanctions were imposed on Pakistan. The post-freeze/post-sanctions span will allow us to examine as to how the authorities managed the pressure in the crisis period.

4.1.3. Sub-Span: 2001:10-2005:12

Certain events triggered by 9/11 led to a dramatic reduction in exchange market pressure. It is important to see how the monetary policy reacted to the change in the direction of exchange market pressure. Hence we use the data-span 2001:09-2005:12.

4.2. Frequency

Data frequency is monthly. The motivation for using high frequency data (among others) is that the data includes domestic credit, interest rate, exchange rate and foreign reserves. These variables have dynamic properties that can be best captured with high frequency data. Besides, as mentioned above, we have a relatively small sample of 14.9 years. Given the small sample size, the use of annual data is ruled out for reliable econometric investigation. Similarly, the smaller sub-spans, referred above, rule out the use of even quarterly data.

4.3. Variables

The variables included in the empirical model given by equation (3.2) are: Exchange Market Pressure (emp_t), Domestic Credit (dc_t), Interest rate [Six month T-bill rate: (i_t)], Real income [Proxy: Industrial production (y_t)][4], International inflation [Proxy: U.S. inflation ($\hat{\jmath}^*_t$)] and Deviation from purchasing power parity (z_t).

[4] Monthly data on real income is not available. The use of industrial production as a proxy for real income is well established.

Of the six variables mentioned above, data for the series i_t, y_t and $\hat{j}^*_t$ are directly available in published statistics while data for the series dc_t, emp_t and z_t is to be generated. This in turn requires data on additional variables. (The generation of the series is discussed in Annexure A). In all we required data on: nominal exchange rate, foreign reserves, industrial production index, domestic credit, interest rate and CPI (US and Pakistan). The data was obtained from International Financial Statistics (IFS) CD-ROM (May 2006).

4.4. Stationarity

All the data series have been tested for the absence of unit root. The tests employed include Dickey Fuller/ Augmented Dickey Fuller (ADF) and the seasonal unit root test proposed by proposed by Baeulieu and Miron (1993). We employ the seasonal root test because the monthly data is more prone to seasonality. The ADF test, as well as the seasonal unit root test, shows that all the series exhibit stationarity. The result is not surprising as the model employs all variables in growth form.

5. VAR Estimation of *emp* Model

VAR estimation involves regressing each one of the endogenous variables on its own lags. To estimate the VAR system, we must decide the lag order of the endogenous variables to be incorporated in the VAR system. Besides, following the standard AIC method for selection of the lag order, we additionally ensure that residuals of the regressions that form part of the VAR system do not exhibit serial correlation. Use of the foregoing process delivers the lags mentioned against each data span in Table-5.1. These lags are in conformity with AIC method as well.

Table-5.1: Data Spans: Lags of Dependent Variables for VAR system

	Interval	Duration: No. of Years	Lags of dependent variable
Full span	1991:04-2005:12	14.9	4
Post liberalization	1995-2005	11	3
FCD Span	1991-04-1998-05	7.2	2
Post FCD Freeze/Post-aid sanctions/ 9/11	1998:06-2005:12	7.7	2
Post 9/11	2001:09-2005:12	4.4	2

5.1. Impulse Response Functions (IRF's):

The main tool of the unrestricted VAR system is the Impulse Response Function (IRF) generated by a shock to innovation in each of the endogenous variables. Accordingly, after estimation of the VAR system (for each data span) given by equation (3.2), IRF's have been generated by shocks to innovation to the endogenous variables. The results are presented below.

5.1.1. Effect of Domestic Credit growth on Exchange Market Pressure:

The relevant IRF's (Table-5.2 and fig. 5.1) show a positive and contemporaneous effect of domestic credit growth (dc_t) on exchange market pressure (emp_t).

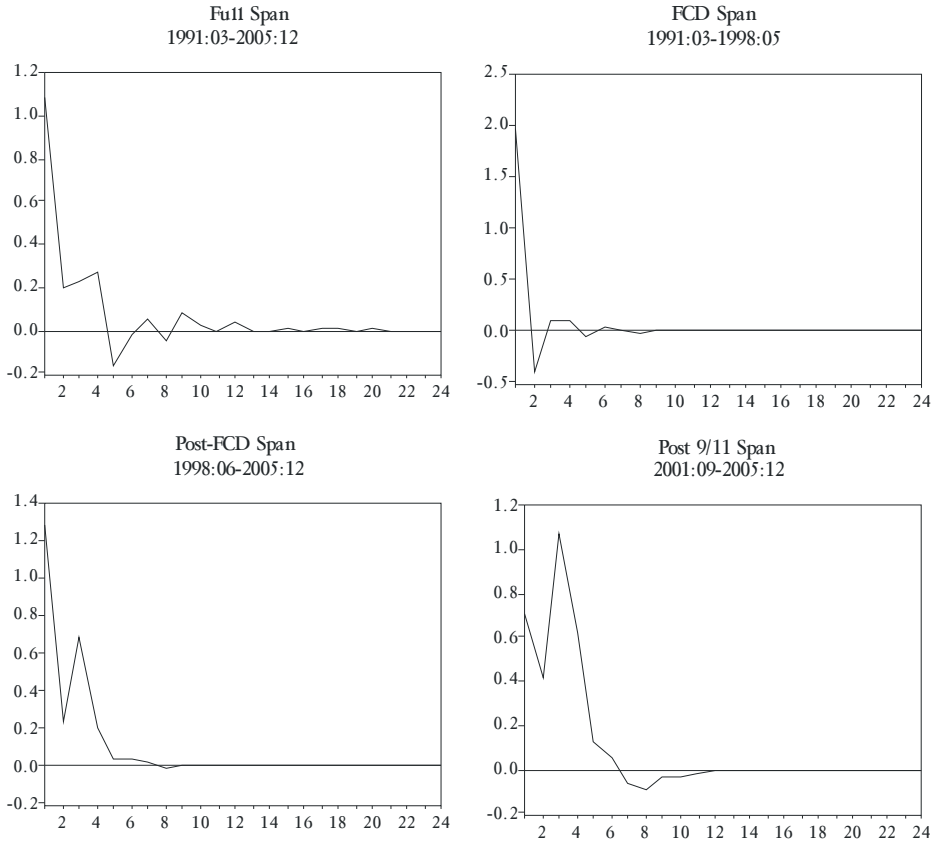
Table-5.2: Shock to: Innovation to Domestic Credit Impact upon: Exchange Market Pressure

Periods	Data Spans			
	Full	**FCD**	**98-05**	**9/11**
1st	1.09	1.99	1.29	0.70
	(5.52)	(7.38)	(5.25)	(2.59)
3rd			0.68	
			(2.56)	

t-statistics in parenthesis

The positive and contemporaneous impact of a shock to domestic credit growth on exchange market pressure is as hypothesized and is in conformity with the monetary approach — an increase in domestic credit causes the exchange rate to depreciate or the foreign reserves to deplete or some combination of the two, that is, exchange market pressure.

Fig. 5.1
Impulse Response Function
Shock to: Innovation to Domestic Credit
Impact upon: Exchange Market Pressure



The monetary approach holds that, given full employment, the newly created domestic credit is spent on the import of goods and services or on acquisition of assets abroad. In Pakistan, outward capital mobility being highly restricted, it is primarily the import of goods and services that causes the response.

5.1.2. Feedback Relation: Effect of Exchange Market Pressure on Domestic Credit:

The relevant IRF's (Table-5.3 and fig. 5.2) for the full data span (91-05) and the sub span that covers the life of FCDs (91-98) depict a positive impact of the shock to exchange market pressure (emp_t) on domestic credit

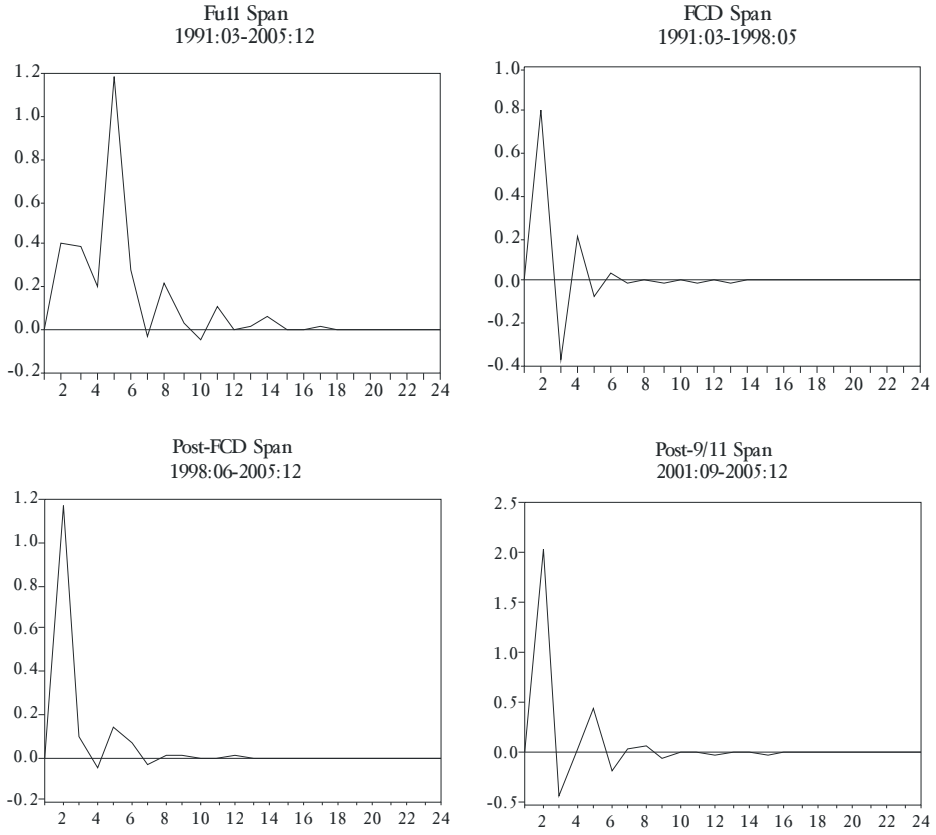
growth (dc_t). No statistically significant response is noticeable in the post FCD freeze/post-aid sanctions period and the post 9/11 span.

Table-5.3: Shock to: Innovation to Exchange Market Pressure
Impact upon: Growth in Domestic Credit

	Data Spans			
Period	**Full**	**FCD**	**98-05**	**9/11**
2nd		0.81 (2.18)	nil	nil
5th	1.17 (2.16)			

t-statistics in parenthesis

Fig. 5.2
Impulse Response Functions
Shock to: Innovation to Exchange Market Pressure
Impact upon: Growth in Domestic Credit



Though the response of domestic credit growth to a shock to exchange market pressure is positive in the first two spans, prudence, however demands just the opposite; that is, the authorities when faced with exchange market pressure (emp_t) should contract the growth rate of domestic credit so as to curb exchange market pressure (emp_t). This should be the response in the light of the prediction of monetary theory and the positive impact of positive domestic credit growth on exchange market pressure observed earlier (Table-5.2).

Despite the response being, *prima-facie*, imprudent as far as controlling exchange market pressure is concerned, the result is in conformity with what others have found for different economies. Tanner (2001, 2002) for Mexico and six East-Asian countries and Bautista and Bautista (2002) for the Philippines also find a positive feedback from exchange market pressure (emp_t) to domestic credit growth (dc_t). Their findings confirm a key element of Mexican and the East-Asian currency crisis, that the authorities sterilized foreign reserves outflow and responded by providing additional liquidity to the banking system. This worsened the already high exchange market pressure [Bautista and Bautista (2002)]. The observed positive response of domestic credit (dc_t) to exchange market pressure shock (emp_t) suggests that authorities in Pakistan too, tend to sterilize foreign reserves outflows on the pattern noticed in the economies referred to above. Perhaps it is the fiscal needs/the urge boost growth that prompted such sterilization.

Another possible explanation offered by Tanner (2001) for East-Asian countries, that could be valid for Pakistan as well, is that the banking sector, when faced with a high probability of loan defaults, tries to minimize their stakes, by offering more credit to the defaulters in the hope of rehabilitating the projects and thereby enabling them to repay the loans. This explanation seems partly true in case of Pakistan as well; the 1990s has seen loan restructuring exercises being undertaken by commercial banks to rehabilitate sick projects. This was done under the auspices of the government/SBP. Besides, the non-recovery of loans by the banks could have led to a liquidity crunch and the central bank, in order facilitate fresh lending, responded with an increase in domestic credit.

To understand the absence of a statistically significant response in the post FCD freeze span (98-05) and post 9/11 span (01-05), note that after 9/11 the foreign reserves registered tremendous improvement and the exchange rate, for the first time in Pakistan's history, was on an appreciation course. The increase in foreign reserves and exchange rate appreciation between September 2001 and December 2003 is given below in Table-5.4.

Table-5.4: Exchange Rate Appreciation & Increase in Foreign Reserves

	Sept. 2001	Dec. 2003	Appreciation/Increase
Exchange Rate	Rs. 64.20	Rs. 57.21	12 percent
Foreign Reserves	$ 2,149	$ 10,941	409 percent

Post 9/11 the surge in foreign reserves was due to (i) rescheduling/write-off of foreign debt; (ii) remittance of money by overseas Pakistanis through formal channels instead of the informal channels used earlier[5]; (iii) feeling of insecurity amongst Pakistanis residing in the West and (iv) and return of Pakistanis residing without proper documents in United States.

Given the improvement in foreign reserves and appreciation of the exchange rate, the exchange market pressure remained consistently negative for 27 months (Oct.01-Dec.03). Even during the following two years, the exchange market pressure remained negative for eight out of 24 months. Thus out of the total span of 52 months, the exchange market pressure had remained negative for 35 months - this covers two-thirds of the post 9/11 span. Thus there is reason to believe that monetary policy in the post 9/11 span would be different from the one practiced earlier. Initially the impact was so sudden that in just two months following 9/11, the exchange rate had appreciated by over 5 percent and the foreign reserves had registered an increment of 47 percent.

The appreciation of the exchange rate was hurting the export competitiveness of the country. Besides, events following 9/11 had also adversely influenced exports, at least in the short run. Given this, the authorities purposely slowed down the appreciation of exchange rate to, (i) limit the damage to Pakistan's export competitiveness (SBP 2001)[6] and (ii) to afford time to the exporters to adjust to the changed environment. Consequently the central bank purchased substantial foreign currency from the forex market against domestic currency, thereby increasing domestic credit. The year-wise intervention activity of the central bank is depicted below in Table-5.5.

[5] The change in channel was due to an international crack-down on informal channels of remitting money.

[6] For detailed discussion regarding the favorable impact of 9/11 on Pakistan's external account see SBP annual report (2001, pp. 54-60). For monetary policy put into practice to factor in the new developments see pp. 79-80 of the same report.

Table-5.5: Purchase/Sale of Foreign currency by SBP

($ in million)

Period	Interbank (net)	Kerb Purchases	Net Addition to Foreign Reserves
1999-2000	-797.0	1,633	836
2000-2001	-1,126	2,157	1,031
2001-2002	2,483	1,376	3,859
2002-2003	4,546	429	4,975
2003-2004	897	-	897

Note: The negative sign with the figures indicates sale of foreign currency

Source: SBP annual reports (Various issues)

Thus to maintain competitiveness of the country's exports, domestic credit was increased consequent upon a fall in exchange market pressure (SBP 2002-03, p.144 & 163). Given the foregoing explanation, the innovation to the exchange market (decrease in this case) should have generated a negative response (increase in this case) from domestic credit during the sub-spans 'post FCD-freeze' and 'post 9/11'. The question then arises why a 'nil' rather than negative response is observed. The answer lies in sterilization of the intervention activity referred above. For illustrative purpose the sterilization activity, of the State bank, during 2001-02, is indicated in Table-5.6.

Table-5.6: Sterilization in 2001-02

(RS. In billions)

		Impact on SBP	
		NFA	NDA
1	Interbank US $ purchases (net)	150	
2	Kerb Purchases	84	
3	Government borrowing from commercial banks (RS. 160.4 billion)		
4	Retirement of Government securities with SBP		-287
5	Net Impact	234	-287
6	Net impact on Reserve Money (Domestic Credit)		-53

NFA: Net foreign Assets NDA: Net Domestic Assets

The domestic credit growth of RS.234 billion due to the purchase of foreign currency during 2001-02 by the State Bank was more than offset by the retirement of government borrowing from SBP (Table-5.6 — serial no. 6). Thus the intervention activity in 2001-02 was completely sterilized. Similarly, out of the foreign currency purchased worth RS.291 billion in 2002-03, RS.206 million was sterilized (SBP 02-03, p. 79). It is because of this kind of sterilization that, despite the huge foreign currency purchases against domestic currency, no significant response is observed during the post 9/11 span from exchange market pressure to domestic credit.

5.1.3. Shock to Interest Rate: Impact upon Exchange Market Pressure

The statistically significant responses of exchange market pressure (emp_t) to an interest rate shock are reported below (Table-5.7 and fig. 5.3):

Table-5.7: Shock to: Innovation to Interest Rate

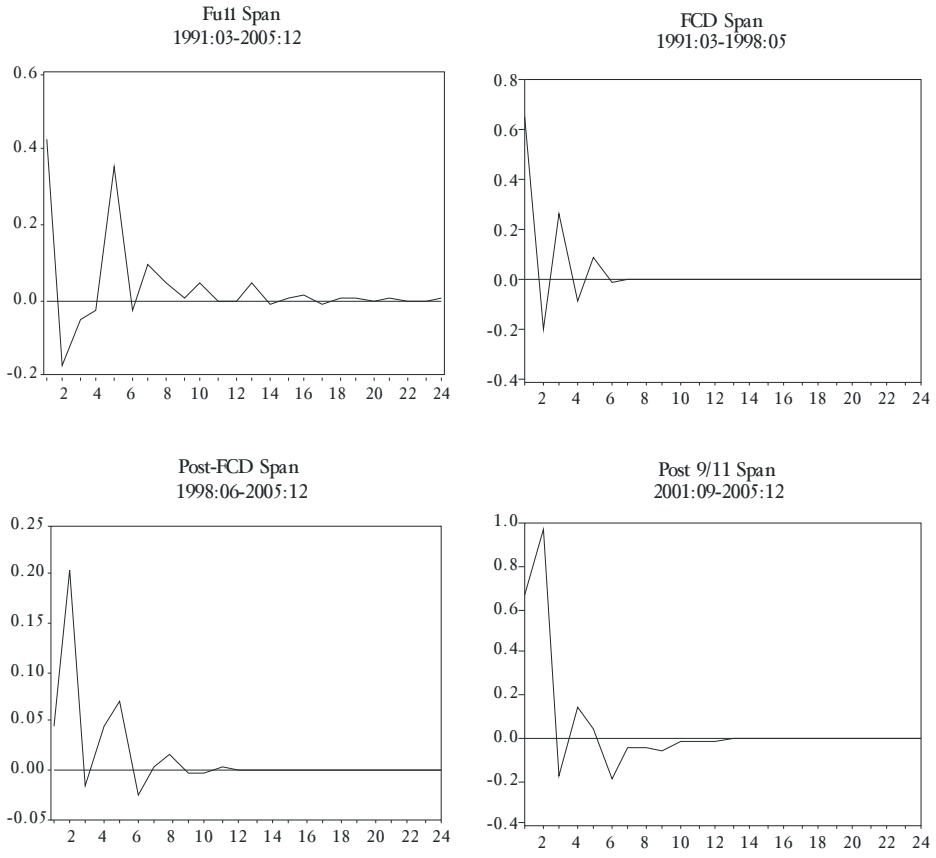
Impact upon: Exchange Market Pressure

Period	Data Spans			
	Full	**FCD**	**98-05**	**9/11**
1st	0.43	0.66		0.67
	(2.28)	(3.06)	nil	(2.61)
2nd				0.97
				(2.89)

Note: t-statistics in parenthesis

The impact of a shock to the interest rate on exchange market pressure is, as hypothesized, positive in all the data spans. No statistically significant response is observed in the span 98-05. First, we take up the positive response observed in the two sub spans, that is the FCD span and the post 9/11 span and then we move on to the positive response observed in the full span and the absence of response in the span 98-05 — the post FCD-freeze span.

Fig. 5.3
Impulse Response Function
Shock to: Innovation to Interest Rate
Impact upon: Exchange Market Pressure



The positive influence of the interest rate on exchange market pressure during the FCD span (1991:04-1998:05) can be explained in terms of the theory of money demand and the change in attractiveness of domestic securities ***vis-a-vis*** international securities. The following flow chart explains the channel through which FCDs might have influenced exchange market pressure consequent upon shock to interest rate:

> Increase in interest rate → decrease in money demand→ exchange rate depreciation → increase in yield on FCDs → increase in FCDs volume → change in exchange market pressure

A possible explanation for the impact of an interest rate shock on exchange market pressure, as given in the foregoing flow chart, is that the increase in the interest rate reduced money demand that in turn caused the exchange rate to depreciate. It is noteworthy that the total yield on foreign currency deposits (FCDs) comprised the interest earned on FCDs plus the exchange rate depreciation. The higher the exchange rate depreciation, the greater the yield on FCDs. As the exchange rate depreciation caused the yield on FCDs to increase, the depreciation contributed to an increase in the volume of FCDs with commercial banks. The surrender of foreign currency thus mobilized by banks to SBP increased foreign reserves thereby contributing to a decline in exchange market pressure. However on the other hand exchange rate depreciation contributed to the increase in exchange market pressure.

Given the positive as well as negative impact of FCDs on exchange market pressure, the authorities had a dilemma at hand. The fact that (by and large) the interest rate, during the FCD span, maintained an upward course and the ultimate response of exchange market pressure to an interest rate shock is positive (i.e. increase) suggests that the alleviation impact due to increases in foreign reserves was more than offset by the exchange rate depreciation. (During the span the interest rate recorded an increment of 744 basis points while the exchange rate depreciated by 87 percent — Table-5.8). The view is corroborated by the SBP annual report 1997-98 that warns the government of the negative implications of FCDs[7].

Table-5.8: Exchange Rate Appreciation & Increase in Interest Rate

	April 1991	May 1998	Increase/ Depreciation
Interest Rate	8.80 %	16.24 %	744 basis points
Exchange Rate	23.50	44.05	87 percent

This brings us to the question of why the government persisted with the scheme if the net impact of the scheme on exchange market pressure was negative. The ensuing analysis provides the answer. The import coverage ratio, that measures the country's ability to meet its imports from forex reserves alone, is one measure used to determine the safe/optimal level of foreign reserves. The import coverage ratio that prevailed during the FCD span is shown below (Table-5.9).

Table-5.9: Foreign Reserves as Percentage of Imports

[7] SBP annual report 1997-98, pp. 109-23

Year	Imports ($ in billions)	Reserves (12-Month avg.) ($ in billions)	Import coverage (Avg. Resv*. as % of imports)
90-91	8,325	366	4.27
91-92	8,998	534	5.39
92-93	10,049	808	8.04
93-94	8,685	1,186	13.66
94-95	10,296	2,642	25.66
95-96	12,015	1,626	13.53
96-97	11,241	1,040	9.25
97-98	10,301	1,268	12.31

*Avg. of reserves at the beginning and end of the year.

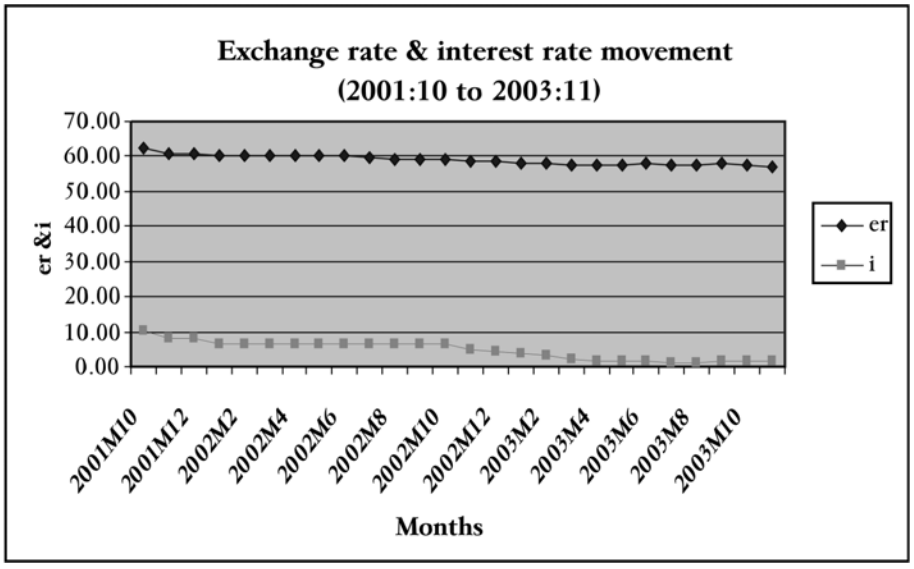
Assuming that foreign reserves volume of less than 12 weeks of imports (i.e. 25 percent of annual imports) reflects a crisis-like situation, then it is evident from Table-5.9 that during the entire FCD-span, the reserves held were precariously low in relation to imports and only once did these barely crossed the danger mark of 25 percent of imports. Another indicator of foreign reserves adequacy is the *Guidotti rule*, which says that reserves should be enough to meet scheduled external debt payments as well as the projected current account deficit (excluding interest payments) for the next 12 months. On this criterion, as well, Pakistan did not have enough reserves at the beginning of any fiscal year till 2002-03 (SBP 2002-03, p. 162).

It was this low level of foreign reserves that forced the government to continue with the FCD scheme and embrace the vicious cycle of *interest rate hike-exchange rate depreciation.* Hence the positive response of the interest rate to a shock to exchange market pressure during the FCD span. It appears that it is the FCDs channel, described above that has been operative during the span. The view gains substance from the opinion that post FCD-freeze span (98:06-05:12) does not exhibit any impact of an interest rate shock on exchange market pressure (Table-5.7).

Regarding the positive impact of the interest rate on exchange market pressure during the post 9/11 span, an entirely different explanation is in order than the one given for the FCD span.

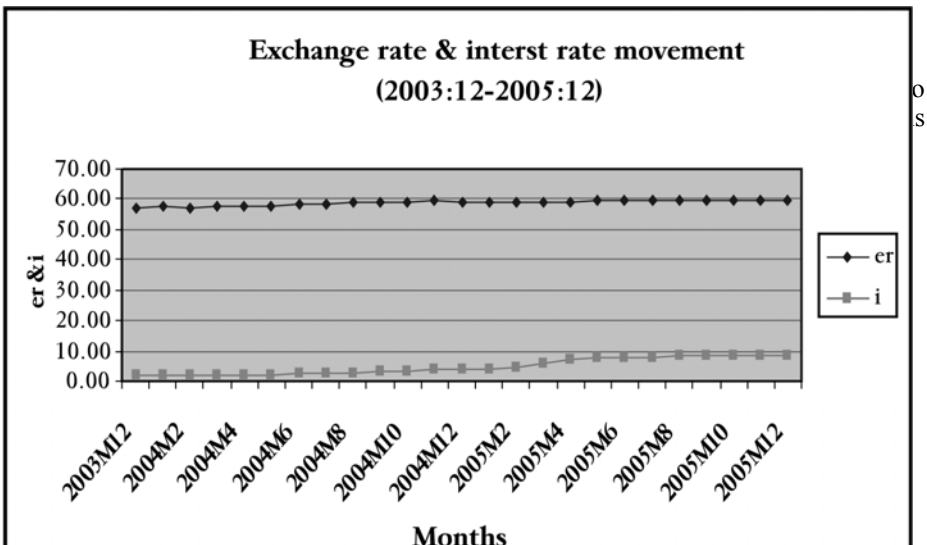
Post 9/11, the movement of the interest rate and exchange market pressure can be studied in two distinct parts. One; the period from 2001:09 to 2003:12 when the exchange rate was appreciating (8 percent appreciation), foreign reserves were on the rise and the interest rate declined by 929 basis points. Second; the period from 2004:01 to 2005:12 when the exchange rate was depreciating (5% depreciation) and interest rate was on the rise: (704 basis points increase)[8]. The positive relationship observed between the movements in the exchange rate and the interest rate during the two periods is depicted in fig. 5.4 and fig. 5.5

Figure 5.4



It is evident from fig. 5.4 that from 9/11 till December 2003 the interest rate was declining and the exchange rate was on an appreciation course, thus representing the positive relationship between the two. Starting from January 2004 the interest rate set on an upward course and the exchange rate also broke its appreciation spell to set on a depreciation course once again. (Fig 5.5) The positive relationship shown in two figures is in conformity with the theory and is as hypothesized.

Figure 5.5



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5.1.4. Feedback Relation: Effect of Exchange Market Pressure on Interest Rate

The statistically significant responses of the interest rate (i_t) to a shock in exchange market pressure (emp_t) are noted below (Table-5.10 and fig. 5.6).

Table-5.10: Shock to: Innovation to Exchange Market pressure
Impact upon: Interest Rate

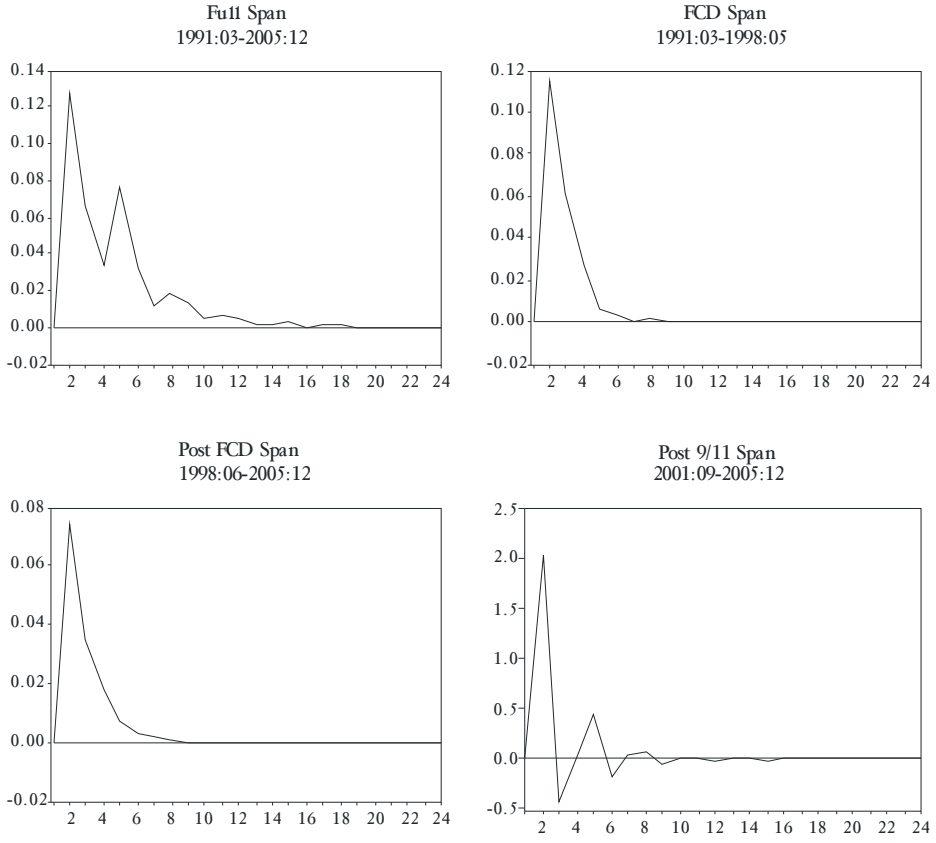
Period	Data Spans			
	Full	FCD	98-05	9/11
1st				0.07*
				(1.66)
2nd	0.13	0.12	0.07*	
	(3.70)	(2.40)	(1.68)	
3rd				0.07*
				(1.64)
5th	0.08			
	(2.26)			

Note: t-statistics in parenthesis

Significant at 10 percent level

Fig. 5.6
Impulse Response Function
Shock to: Innovation to Exchange Market pressure

Impact upon: Interest Rate



The positive feedback from exchange market pressure to the interest rate is observed in all the data spans (Table-5.10). First we examine the response during the FCD span and then take up the responses in post-freeze and post 9/11 span.

Explanation for the positive feedback from exchange market pressure to the interest rate is found in what the literature labels 'interest rate defense of exchange rate' (Flood & Jeanne, 2000, Tanner, 2002). Under this strategy the authorities, when faced with exchange market pressure, respond with influencing a hike in domestic interest rate. Given the international rate, the increase in the domestic interest rate encourages capital inflows and vice versa, provided capital mobility conditions are fulfilled.

The 1990's was not a good decade for the external account scenario of Pakistan. Inflows from a major source, *viz.* remittances from overseas Pakistanis, had been on a declining course since 1983 (1981-82: $2.9

billion, 1999-00: $0.98 billion). Besides, the international geo-political environment being not too favorable, foreign lending, bilateral as well as multilateral, was scanty and even that was available only on harsh terms. Given this scenario, the authorities, in March 1991, allowed residents to hold Foreign Currency Deposits (FCDs) with commercial banks. The deposit accounts were frozen in May 1998[9]. During this period, as the exchange market pressure was relatively high the authorities might have purposely influenced an upward movement in interest rate to attract deposits in foreign currency accounts. Regarding the high *emp* it is noteworthy that during this span, the exchange rate depreciated by 87 percent (Table-5.7) and except for FY 94-95 foreign reserves covered imports merely to the extent of 14 percent or even less (Table-5.10).

Another possible explanation for the hike in the interest rate, during the major part of the '90s in response to the shock to exchange market pressure can be found in the ***dollarization*** phenomena. As economic agents purchased foreign currency from the kerb market for holding FCDs, the additional demand for foreign currency in the kerb market caused the Rupee to depreciate and improved the FCDs' yield (interest on deposits plus exchange rate depreciation), but the depreciation also contributed to inflation and to control inflation the authorities had to respond with the increment in the interest rate. Whatever the mechanics, an important piece in the cycle leading to the interest rate hike is the exchange rate depreciation, which is a component of exchange market pressure. Hence the positive feedback from the interest rate to exchange market pressure.

Given the polar objectives of encouraging FCDs (as these contributed to the increment in foreign reserves) through ***dollarization*** and controlling inflation, the authorities had a dilemma at hand. Given the dilemma the authorities went for the vicious circle of ***exchange market pressure-interest rate hike.*** The vicious circle went on during the seven year life of FCDs; however its impact seems so pronounced that the positive impact of emp_t on i_t is observed even when the full span of 14.9 years is considered. (The magnitude of exchange rate depreciation and interest rate hike during the FCD span is shown in Table-5.8.)

The positive impact of (emp_t) on (i_t) for the span 1998-05 and 2001-05 is accounted for in the following manner: The positive feedback from

[9] The freeze on FCDs meant that, against the terms of the contract, account holders were allowed to withdraw only the Rupee equivalent against the money in foreign currency that they had deposited. This had shattered the confidence of the depositors and inflows into the account almost stopped, thereby reducing the demand for foreign currency in the kerb market and contributing to *de-dollarization*.

exchange market pressure to the interest rate during the post-FCD freeze span can be studied in two distinct parts, that is the pre 9/11 and post 9/11 period. The first shock, during the span, came as the multilateral/bilateral lending agencies imposed aid sanctions on Pakistan as the country went nuclear in May 1998. The second shock occurred with 9/11. Four measures undertaken in the wake of aid-sanctions led to a decrease in exchange market pressure. These include: (i) freeze on foreign currency accounts; (ii) introduction of a two tier exchange rate in July 1998 and a pure float in May 1999; (iii) rationing of imports; and (iv) Saudi Oil facility. The impact of these measures on exchange market pressure is discussed below.

We have argued earlier in this section that FCDs had led to ***dollarization*** and in section 5.1.3, and that the net impact of FCDs seemingly caused a persistent increment in exchange market pressure. With the freeze on these deposits, ***dollarization*** and hence the exchange rate depreciation on this count came to a halt and therefore the pressure declined.

The two-tier exchange rate, introduced on July 22, 1998, required conducting the transactions involving foreign exchange at a composite rate, which was based on a certain specified ratio (initially 50:50) of the official rate (announced by SBP) and floating interbank rate (determined on the basis of demand and supply of foreign currency in the interbank market). Except for certain specified goods that were allowed to be imported at official rate, the rest of trade was done only at the composite rate. Following the aid-sanctions/FCD-freeze, for the following 10 months (June 98-April 99) the exchange rate was held static at Rs. 46 to one dollar. The Rupee was devalued by 12.3 percent in May 1999 to attain a value of Rs. 51.69 and was then held static again around this level for yet another 16 months, that is, until August 2000. The interbank rate on the other hand continued to depreciate in line with market conditions.

Thus though the official rate was held static for sufficient length of time, the introduction of the composite rate, that depended on interbank rate as well, had in fact meant the ***de facto*** devaluation of Rupee. It was this ***de facto*** devaluation, which was fairly large, that had discouraged imports and therefore led to a reduction in the trade deficit. Besides, some rationing of imports in the initial period, after the emergence of crisis, had also contributed to a reduction in the trade deficit. The reduction, in turn, helped to contain exchange market pressure. Finally, the Saudi oil facility, negotiated after the aid-sanctions, allowed the country to import a major chunk of its oil needs for credit. This, by reducing the outflow of foreign currency, also served to contain exchange market pressure. It was the

combined effect of the four measures discussed above that exchange market pressure on average declined, despite the aid sanctions and the freeze on FCDs in two years (i.e. 98-99 and 99-00) following aid sanctions/FCD freeze (Table-5.11).

Table-5.11: Trade deficit & Exchange Market Pressure

($ in millions)

	Year					
	1997-98	**1998-99**	**1999-00**	**2000-01**	**2001-02**	**2002-03**
Trade Deficit	-1,867	-2,085	-1,412	-1,269	-294	-536
Exports	8,434	7,528	8,190	8,933	9,140	10,889
Imports	-10,301	-9,613	-9,602	-10,202	-9,434	-11,425
emp_t (Avg.)*	1.34	0.07	0.34	1.7	-3.6	-4.2

While analyzing the feedback from exchange market pressure to the interest rate, we had indicated that the relatively high exchange market pressure in the FCD span had forced the authorities to adopt interest rate defense of the exchange rate. Now that the pressure declined, the need for such defense was no longer there and hence the decline in the interest rate consequent upon the decrease in exchange market pressure.

Regarding the positive feedback from the interest rate to exchange market pressure during the second part of the span, that is the post 9/11 span, again we had discussed earlier (in section 5.1.2) that post 9/11 for 35 months out of the 53 months span, the exchange market pressure remained not only low but even negative. Given the low pressure, the need for defending the Rupee was not there and this allowed the SBP to reduce the interest rate that otherwise was also required to give a boost to economic activity. The following statements emanating from SBP confirm the point.

> Improvement in the external sector also had a major impact on SBP policies ---- the absence of pressures on the exchange rate allowed SBP to reduce the Bank discount rate. (SBP Annual report 2001-02, p. 156).

> The continued forex inflows ---- during FY03 allowed, the SBP to reduce the discount rate to an all-time low at 7.5 percent in November 2002. (SBP Annual report 2002-03, p. 147).

The foregoing discussion explains how the low exchange market pressure during the post-FCD freeze span and the post 9/11 span contributed to the decline in the interest rate. This accounts for the positive impact, during the two spans, of the shock to exchange market pressure on the interest rate.

5.2 Sensitivity Analysis

As indicated earlier under the theoretical framework, VAR results are sensitive to *ordering* of variables of the system. To guard against the possibility of *ordering*-based result, the results have been checked against sensitivity to *ordering*. The main *ordering* used in this study is [*dc-i-y-emp*]. Significant IRF's for the full data span under some alternate *orderings* are presented in Table-5.12.

Table-5.12: Sensitivity to Ordering of variables

Shock to innovation to:	Impact upon	Period	Ordering Used *dc-i-y-emp*	Alternate Orderings		
				dc-i-emp-y	*dc-emp-i-y*	*emp-dc-i-y*
dc_t	emp_t	Ist	1.09	1.08	1.08	0.35
			(5.52)	(5.53)	(5.52)	(1.74)
emp_t	dc_t	Ist				3.86
						(5.53)
		5th	1.17	1.33	1.48	
			(2.16)	(2.41)	(2.65)	
i_t	emp_t	Ist	0.43	0.43	0.27	0.27
			(2.28)	(2.28)	(1.70)	(1.72)
emp_t	i_t	Ist			0.10	0.11
					(2.28)	(2.60)
		2nd	0.13	0.14	0.16	0.16
			(3.70)	(3.88)	(4.23)	(4.13)
		3rd			0.08	0.09
					(2.16)	(2.39)
		5th	0.08	0.07		0.10
			(2.26)	(2.08)		(2.63)

Note: t-statistics in parenthesis

It is apparent from the Table-5.12 that the results are, by and large, robust. The *ordering* that has emp_t in the first place (and thus prior to dc_t) alters the coefficients significantly however the change in *Ordering* only

affects the size of the coefficients; the direction of response remains unaffected.

6. Conclusion

Exchange market pressure represents disequilibrium in the money market. This study, in the spirit of Girton and Roper (1977) takes the view that since a managed float involves changes in the exchange rate as well in variation in foreign reserves, to study disequilibrium in the money market/characterize the external account, we need to focus upon a composite variable that incorporates changes in foreign reserves as well as variation in the exchange rate. Following Girton and Roper we refer to the composite variable thus developed as exchange market pressure.

We developed a time series of exchange market pressure in accordance with the definition of Girton and Roper to examine the interaction of the monetary variables *viz.* domestic credit and the interest rate with the exchange market pressure. Innovation to domestic credit, as well as to the interest rate, generates a positive response from exchange market pressure. Both the results are in conformity with the theory. The impact of domestic credit is much stronger (i.e. the size of the coefficients is relatively larger), as compared to the interest rate, and the impact of domestic credit is observed in all the data spans examined while the impact of interest rate on exchange market pressure is not observable in the post-FCD freeze span (1998:06-2005:12). The two findings together imply that domestic credit has been the dominant tool of monetary policy *vis-a-vis* managing exchange market pressure. Our results also show that post 9/11, given the unexpected and sharp decline in exchange market pressure, domestic credit was actively used to manage the pressure, so as to avoid a larger adverse impact on export competitiveness. The intervention was largely sterilized to protect the economy from the inflationary impact of an increase in money supply.

Feedback from exchange market pressure to domestic credit is positive in all the data spans examined. The response, though against conventional wisdom, is in conformity with the findings of previous studies. The apparent reason for the imprudent response lies in monetary policy being influenced by; (i) fiscal needs, (ii) the eagerness to boost growth (iii) the need to make-up for the liquidity crunch created from the default on bank loans, and (iv) the need to create additional liquidity to revive the sick industries.

FCDs had provided some inward capital mobility (1991-98). The observance of a response from the interest rate to exchange market pressure, though a weaker one in the pre-freeze period and absence of the same in post-freeze period, serves to emphasize that for the interest rate to work as a tool of monetary policy, ***vis-a vis*** exchange market pressure, a reasonable degree of capital mobility is called for.

The feedback relation from exchange market pressure to the interest rate is also positive and is observed in all the data spans examined. For the FCD span, the response implies an interest rate defense of the exchange rate. The purpose of this is to control inflation, stemming from exchange rate depreciation, that itself was due to ***dollarization***. Post FCD-freeze/post 9/11 ***dollarization*** came to a halt for (i) want of avenues (FCDs that served as avenues were frozen) and (ii) due to a dramatic improvement in the external account; therefore the need to defend the Rupee vanished. Therefore there was a decrease in the interest rate in response to the decrease in exchange market pressure.

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Annexure A

Domestic credit

Reserve Money being composed of domestic and foreign components, the domestic credit is worked out as the difference between total Reserve Money and the foreign component of Reserve Money. The foreign component is obtained by multiplying the month-end foreign reserves outstanding with the relevant month-end nominal exchange rate. To work out the Domestic Credit in the manner referred above, we need data on the following series.

- Reserve Money
- Foreign Reserves
- Nominal Exchange rate

Exchange Market Pressure

Exchange market pressure (*emp*), defined as sum of exchange rate depreciation and foreign reserves outflow scaled by monetary base (Reserve money) requires data on the following:

- Nominal exchange rate
- Foreign Reserves
- Reserve Money

The data required for generating the Exchange market pressure series is exactly the same as required for generating domestic credit series.

Deviation from Purchasing Power Parity

As explained earlier under theoretical framework deviation from purchasing power parity (PPP) is to be worked out as per equation (A-1) which after slight algebraic manipulation is reproduced below for ready reference.

$$z_t = e_t + \pi_t^* - \pi_t \qquad \text{(A-1)}$$

To generate the series 'Deviation from PPP' (z_t) we need data on the following:

- Nominal exchange rate
- International price level (Proxy: US CPI)
- Domestic price level (CPI)