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What Determines the Behaviour of Real Exchange Rate in Pakistan?

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1. INTRODUCTION

It is now widely acknowledged that the role of the real exchange rate is crucial in the adjustment process of the economy. While exchange rates are, generally, relative prices of national currencies under a floating rate regime, they may be viewed as being determined by the interaction of supply and demand in the foreign exchange markets. This premise, though uncontentious, renders simply a beginning for comprehending the determination of the exchange rate and its ensuing relationship to various macroeconomic variables and to policy. It has been argued rather forcefully [e.g., Edwards and Wijnbergen (1987); Edwards (1988, 1988a); Khan (1986); Khan and Lizondo (1987)] that any analysis in this regard to be labelled as comprehensive would characterise the exchange rate as being determined by a complex process of interaction simultaneously with other variables in the national and international macroeconomy rather than being determined simply by '*purchasing power parity*' (PPP) as proposed by Cassel (1918). Citing Cassel's writings in this context, Officer (1976) noted the reasons for such a departure from a stable relationship between the real exchange rate and the *PPP* as being due to frequent trade restrictions, distorted tariff policies, speculations in the foreign exchange market, large capital outflows, government's heavy handed intervention in the foreign exchange markets, etc.

Like other developing countries, exchange rate policy has significant implications on Pakistan's macroeconomy. Pakistan's rupee was delinked from the US dollar on January 7, 1982. Under the current arrangement of a managed float system the State Bank of Pakistan quotes, on a weekly basis, the exchange rate between the Pakistani rupee and all major currencies. Since 1982 the dollar value of the rupee has declined by more than 60 percent. In real terms, the fall in the exchange rate is even higher. Due to the recent foreign exchange liberalisation reforms in Pakistan, the depreciation of the currency has accelerated. The Indian government has recently devalued its currency as well. Pakistan being a small open

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economy (SOE) is quite vulnerable to the external shocks in terms of both unfavourable world trade and deterioration of terms of trade with its major trading partners. Being a close competitor in the international market, it will have important ramifications on the real exchange rate and as a result on exports, balance of payments, external debt and international competitiveness.

Despite the importance of exchange rate policies on the economy, not many studies on this issue have been undertaken for Pakistan during the last decade since it has switched to a flexible rate system. Though a recent article by Ahmed (1992) in this context attempted to address the problem of exchange rate policy in Pakistan by simply testing the long-term stable relationship between the exchange rate and the domestic and foreign relative prices commonly known as *Purchasing Power Parity* (PPP) theory, the methodology of the study used was rather limited.

Given that a simple version of *PPP* may not be sufficient to explain the complex behaviour of the real exchange rate in Pakistan, the purpose of this paper is to empirically estimate a *vector autoregression* (VAR) model of a set of relevant key *real* and *monetary* variables that influence the real exchange rate. This approach will enable us to analyse and identify more precisely the complex interrelations among potential policy instruments (e.g., tariff, deficit financing, domestic credit creation, devaluation, etc.), intermediate targets and ultimate objectives of the exchange rate policy. The estimation results may be used to assess the *Central Bank's* ability to avoid exchange rate misalignment and, furthermore, it will also help identify the factors on which the *Central Bank* should focus its attention if the Bank is to achieve the goal of exchange rate policy.

The paper proceeds as follows: in Section 2, we briefly present the variables to be included and the methodology used in the empirical determination of the behaviour of the real exchange rate. In Section 3, we analyse the important results of our estimation. Section 4 presents some concluding remarks.

2. MODEL SPECIFICATION AND METHODOLOGY

In order to identify the *real* and *monetary* instruments that determine the behaviour of the real exchange rate, we closely follow the model proposed by Edwards (1988) for developing economies. The *small open economy* model includes three commodities namely, *non-tradables, importables* and *exportables.* Because of a strong parallel foreign exchange market (or *black market*) in Pakistan, we also assume that the economy operates in a dual exchange rate system with an active government. There are some exchange control restrictions in place which prevent free mobility of capital. Foreign Exchange in terms of U.S. dollars, however, exists and is held by the nationals of the country and is traded in the '*black market*'. The Government uses both *taxes* and *deficit financing* to meet its requirements for consumption of *importables* and non-traded commodities. It is also assumed that the government pursues a *tariff policy* which redistributes the money in a non-distortionary manner. The complete model as discussed above will allow us to analyse the dynamic behaviour of the real exchange rate (RER) and the

spread of official and parallel 'black market' rate (ERSBO). The equation given below summarises the basic thrust of the model:

$$\Delta log(RER) = F\{EDCC, DEF, log(NDEV), log(TOT), log(TARF), 1log(TEP) \; log(KFLO), \Delta(ERSBO), log(RER)_{-1}\} \quad (1)$$

where

RER	=	real exchange rate = (*E* . *WPIU*)/*CPIP*;
E	=	nominal exchange rate;
WPIU	=	wholesale price index for U.S.;
CPIP	=	consumer price index for Pakistan;
EDCC	=	excess supply for domestic credit (*DC*) = {dlog(*DC*–*dlog*(*GDP*)};
GDP	=	real gross domestic product;
DEF	=	ratio of government deficit to (*BD*) lagged value of monetary base or high powered money *MB*);
NDEV	=	nominal devaluation;
TOT	=	terms of trade;
TARF	=	tariff revenues;
TEP	=	technical progress (proxies by growth rate of real GDP); and
KFLO	=	capital inflows.

Equation (1) simply asserts that real exchange rate variations will depend upon *monetary factors* and *real variables* (or *'the fundamentals'*). Monetary factors consist of variables such as *excess supply of domestic credit* (EDCC) and *government deficit as a proportion of monetary base* (DEH) while the real factors comprise of terms of trade (TOT), tariff, nominal devaluation technical progress and capital inflows. It has been argued that the monetary and real factors should both influence the behaviour of the real exchange rate in the short-run, but in the long-run, however, only the real factors may affect the equilibrium real exchange rate.

Based on the above model and under a feasible alternative, an increase in *the tariffs* is likely to cause an appreciation in the equilibrium real exchange rate. This is due to the fact that an increase in the tariff rate will lead to substitution away from *importables* and towards the *non-tradable* commodities creating a current account surplus and, thus, causing an appreciation of the real exchange rate. In the same way an increase in the exogenous *capital flow* will also have the effect of appreciating the RER. The direction of impact of the terms of trade on RER is ambiguous and contingent upon the size of elasticity of demand for importable (ξ_d). For a sufficiently large value of ξ_d one may, however, expect an appreciation of the real exchange rate. The impact of *nominal devaluation* on RER should not only be positive (implying depreciation) but it should be large enough so as to bring the RER to its desired equilibrium value.

As for the monetary macroeconomic policy variables (DEF and EDCC), an increase in them is likely to lead to a loss in international reserves, large current account deficits and an increasing gap between the black and official exchange rate (ERBO). All these factors obviously lead towards an appreciation of RER.

Although the theoretical model as originally proposed by Edwards (1988a) given above guides us in identifying the relevant variables for the determination of dynamic behaviour of the real exchange rate, the exact specification and the complex interlinks of different variables with RER are still unclear. Furthermore, there are limitations in the econometric implementation of the model.

The recently proposed vector autoregression (VAR) technique pioneered by Sims, and further developed by Doan *et al.* (1984), we believe, is probably well suited in this situation, in unveiling some of the stylised facts of the dynamic behaviour of the real exchange rate in Pakistan.

In recent years, in the exchange rate literature, the empirical investigation of a stable long-run relationship between the exchange rate and relative prices [commonly known as purchasing power parity (PPP)] using error correction models by Engle and Granger (1987), has attracted a great deal of attention [e.g., Ahmed (1992); Corbae and Ouliaris (1988); Edison (1987); Taylor (1988)]. In this paper before estimating a VAR model we have also tested the *PPP* theory for Pakistan using the above methodology.

3. RESULTS

In order to observe the actual trend of exchange rates in Pakistan, in this section, we first present the time series of relative prices, nominal and real exchange rates. (Figure 1) We then discuss the estimated results of cointegration and error correction followed by the results of the VAR model.

Figure 1. Quarterly Time Series Plots for RER, RP and NER

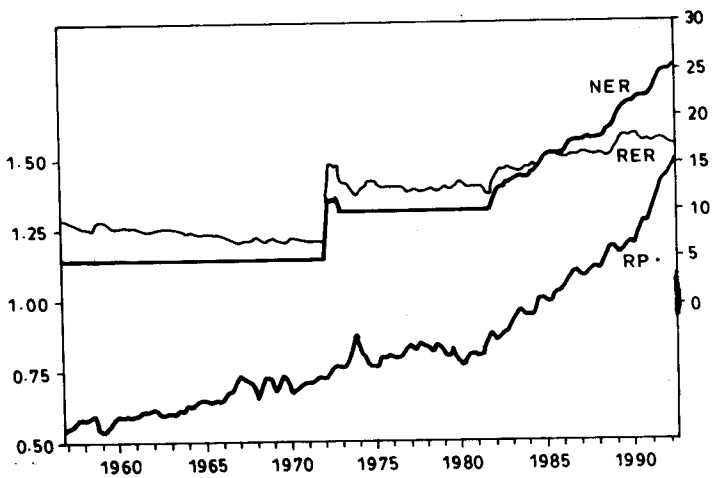


Table 1

Co-integration Regression Results based on Quarterly and Annual Data

Equation	Period	Endogenous	Exogenous			Statistics		
			Const.	In (ER*Pf)	In(P/Pf)	R^2	DW	ADF
CPI Result Quarterly Data								
1.1	1957.1–92.2	In (P)	–0.3001	0.6681		.98	.33	–3.28***
1.2	1957.1–81.4	In (P)	–0.3633	0.6795		.94	.33	–2.46
1.3	1982.1–92.2	In(P)	0.2468	0.5951		.97	.33	–1.44
1.4	1982.1–92.2	In(ER)	2.7224		2.3627	.89	.31	–1.63
WPI Results Quarterly Data								
1.5	1957.1–92.2	In(WP)	–0.4452	0.6923		.97	.35	–3.80**
1.6	1957.1–81.4	In(WP)	–0.3159	0.6688		.92	.35	–3.11***
1.7	1982.1–92.2	In(WP)	–1.4750	0.8308		.98	.49	–2.98
1.8	1982.1–92.2	In(ER)	2.7175		1.2257	.96	.49	–3.08
CPI Results Annual Data								
1.9	1957–91	In(P)	–0.2989	0.6679		.99	.94	–2.67
1.10	1957–81	In(P)	–0.3713	0.6811		.95	.94	–2.05
1.11	1982–91	In(P)	0.3533	0.5805		.98	1.1	–1.94
1.12	1982–91	In(ER)	2.7170		2.5648	.91	1.0	–2.37
WPI Results Annual Data								
1.13	1957–91	In(WP)	–0.3513	0.6786		.98	1.8	–3.62**
1.14	1957–81	In(WP)	–0.2003	0.6511		.95	1.7	–3.06
1.15	1982–91	In(WP)	–1.4367	0.8255		.99	2.0	–3.11
1.16	1982–91	In(ER)	2.7163		1.2495	.98	2.0	–3.36

Notes: 1. As the standard errors in co-integrating regressions are understated due to non-stationary of variables therefore, they are not reported in the above table.

2. Asterisk indicates the rejection of no co-integration in a bivariate time series model based on critical values (1percent for one asterisk, 5 percent for two asterisk and 10 percent for three) provided by Granger and Engle (1987).

Error-correction Regression Results Based on Quarterly Data with CPI as the Price Index

Equation	Period	Estimates
2.1	1958.2-81.4	$\Delta lnP_t = 0.337\ \Delta lnP_{t-1} + 0.335\Delta lnP_{t-4} - 0.472\ EC_{t-1}$
		(0.093) (0.100) (0.028)
		$R^2 = 0.10$ $Q+(4) = 1.03$
2.2	1959.1-81.4	$\Delta^4 lnP_t = 1.244\Delta^4\ lnP_{t-1} - 0.379\ \Delta^4\ lnP_{t-2} - 0.020\ EC_{t-1}$
		(0.103) (0.164) (0.033)
		$R^2 = 0.76$ $Q+(4) = 7.54$
2.3	1982.1-92.2	$\Delta lnP_t = 0.483\Delta lnP_{t-1} + 0.250\ \Delta lnP_{t-3} + 0.330\ \Delta lnP_{t-4} - 0.159\ EC_{t-1}$
		(0.142) (0.143) (0.131) (0.058)
		$R^2 = 0.26$ $Q+(4) = 3.31$
2.4	1982.1-92.2	$\Delta^4 lnP_t = 0.969\ \Delta^4\ lnP_{t-1} + 0.354\ \Delta^4\ lnP_{t-4} - 0.255\ EC_{t-1}$
		(0.138) (0.127) (0.053)
		$R^2 = 0.79$ $Q+(4) = 9.93$
2.5	1982.1-92.2	$\Delta lnE_t = 0.498\ \Delta lnE_{t-1} - 0.068\ EC_{t-1}$
		(0.165) (0.959)
		$R^2 = 0.10$ $Q+(4) = 1.35$
2.6	1982.1-92.2	$\Delta^4 lnE_t = 1.232\Delta^4\ lnE_{t-1} - 0.163 EC_{t-1}$
		(0.157) (0.076)
		$R^2 = 0.58$ $Q+(4) = 11.19$

Notes: 1. The numbers in the parentheses are standard errors.
2. Only the endogenous lag variables significant at 10 percent or less are reported in the table.
3. The $Q + (p)$ statistics is distributed with $F\ (p,\ T - p - k)$ on the null hypothesis of p zero autocorrelations in the residuals from a regression including lagged dependent variable. T indicates the number of observations and k the number of regressors (or lags).

Table 3

Error-correction Regression Results Based on Quarterly Data with WPI as the Price Index

Equation	Period	Estimates
3.1	1958.2-81.4	$\Delta lnW_t = 0.210\ \Delta lnW_{t-2} + 0.220\Delta lnW_{t-4} - 0.153EC_{t-1}$
		(0.095) (0.097) (0.049)
		$R^2 = 0.13$ $Q+(4) = 1.60$
3.2	1959.1-81.4	$\Delta^4 lnW_t = 0.604\ \Delta^4 lnW_{t-1} - 0.294\ \Delta^4 lnW_{t-4} - 0.020EC_{t-1}$
		(0.097) (0.098) (0.064)
		$R^2 = 0.59$ $Q+(4) = 11.26$
3.3	1982.1-92.2	$\Delta lnW_t = 0.468\ \Delta lnW_{t-1} + 0.291\ \Delta lnW_{t-4} - 0.182EC_{t-1}$
		(0.142) (0.162) (0.066)
		$R^2 = 0.14$ $Q+(4) = 1.02$
3.4	1982.1-92.2	$\Delta^4 lnW_t = 1.319\ \Delta^4 lnW_{t-1} + 0.414\ \Delta^4 lnW_{t-4} - 0.142EC_{t-1}$
		(0.161) (0.152) (0.075)
		$R^2 = 0.74$ $Q+(4) = 9.84$
3.5	1982.1-92.2	$\Delta lnE_t = 0.497\ \Delta lnE_{t-1} - 0.128EC_{t-1}$
		(0.164) (0.112)
		$R^2 = 0.14$ $Q+(4) = 1.84$
3.6	1982.1-92.2	$\Delta^4 lnE_t = 1.261\ \Delta^4 lnE_{t-1} - 0.239EC_{t-1}$
		(0.157) (0.121)
		$R^2 = 0.58$ $Q+(4) = 12.05$

Notes: 1. The numbers in the parentheses are standard errors.
2. Only the endogenous lag variables significant at 10 percent or less are reported in the table.
3. The $Q + (p)$ statistics is distributed with $F\ (p,\ T - p - k)$ on the null hypothesis of p zero autocorrelations in the residuals from a regression including lagged dependent variable. T indicates the number of observations and k the number of regressors (or lags).

Table 4

Error-correction Regression Results Based on Annual Data

Equation	Period	Estimates
		CPI RESULTS
4.1	1959-81	$\Delta lnP_t = 0.800\ \Delta lnP_{t-1} - 0.127EC_{t-1}$
		(0.146) (0.118)
		$R^2 = 0.11$ $Q+(4) = 0.09$
4.2	1982-91	$\Delta lnP_t = 1.056\ \Delta lnP_{t-1} - 0.521EC_{t-1}$
		(0.087) (0.129)
		$R^2 = 0.56$ $Q+(1) = 0.11$
4.3	1982-91	$\Delta lnE_t = 0.601\ \Delta lnP_{t-1} + 0.460EC_{t-1}$
		(0.276) (0.362)
		$R^2 = 0.10$ $Q+(1) = 1.23$
		WPI RESULTS
4.4	1959-81	$\Delta lnW_t = 0.389\ \Delta lnP_{t-1} - 0.600EC_{t-1}$
		(0.170) (0.190)
		$R^2 = 0.18$ $Q+(1) = 0.09$
4.5	1982-91	$\Delta lnW_t = 1.055\ \Delta lnP_{t-1} - 0.519EC_{t-1}$
		(0.116) (0.198)
		$R^2 = 0.06$ $Q+(1) = 0.01$
4.6	1982-91	$\Delta lnE_t = 0.550\ \Delta lnP_{t-1} + 0.787EC_{t-1}$
		(0.272) (0.552)
		$R^2 = 0.10$ $Q+(1) = 1.54$

Notes: 1. The numbers in the parentheses are standard errors.
2. The $Q + (p)$ statistics is distributed with $F(p, T - p - k)$ on the null hypothesis of p zero autocorrelations in the residuals from a regression including lagged dependent variable. T indicates the number of observations and k the number of regressors (or lags).

Tables 2, 3 and 4 show the estimated error correction results for alternative cases as mentioned above. In all of these tables, the coefficient of error correction term appears to be significant and larger in case of equations with price adjustment than the nominal exchange rate. These results may suggest that the correction in PPP took place more frequently in terms of adjustment in prices rather than in the nominal exchange rate.

VAR Results

Our model for the determination of the dynamic behaviour of the real exchange rate includes nine key macroeconomic variables namely RER, EDCC, DEF, NDEV, TOT, TARF, TEP, KFLO and ERSBO. All the variables, except EDCC, DEF and ERBO, are in natural logarithmic form.

Following Doan *et al.* (1984) and Sims, an appropriate likelihood-ratio test is used to determine the lag length for the VAR model. Using the sample period 1960 −1991 and based on the significance of the Chi-square value, a lag length of two was adopted in this study.

It has been argued that the distributed lag coefficients estimated using VAR do not provide a clear understanding of the implied dynamic behaviour of the model. Sims, therefore, suggested the use of impulse response coefficients which will enable us to analyse the dynamic behaviour of a variable due to random shocks given to other variables. In fact, the graphs of the impulse response coefficients provide a better device to analyse the shocks and, therefore, the following discussion is devoted to the analysis of these graphs.

In order to capture the dynamic effects we considered responses over fifteen periods to a one standard deviation shock in each variable. Since the primary focus of this study is to analyse the responses of RER and ERSBO due to monetary and real variables, we have only presented the graphs of impulse responses functions of these two variables. Figure 2 portrays the impulse response functions (IRFs) due to shock given in *monetary variables* (e.g., DEF and EDCC) while Figures 3 shows IRFs due to *real variables* (e.g., DEV, TOT, TARF, TEP, KFLO and ERSBO). The following is a summary of the results of impulse responses.

***Monetary Variable*:** Inspection of Figure 2 reveals some interesting results of IRFs for *RER* due to *monetary variables* DEF and *EDCC*. A one standard deviation shock given to DEF clearly leads to a short-run appreciation of RER (indicated by a dip at period 3) as expected theoretically. After a short depreciation the *RER* however again appreciates until period six before reaching a stable level. In order to explain the reason for such a time path of *RER* it is useful to know the sources of financing the deficit in Pakistan. Normally, the government deficit is financed from three sources namely *use of cash balance*, *domestic borrowing* and *foreign commercial borrowing* (FCB). Domestic borrowing to finance the deficit creates pressure on the rate of return on long-term savings instruments. The deficit financed through foreign borrowing, however, creates a temporary surplus in the capital account thereby exerting an upward pressure (appreciation) on the value of domestic currency.

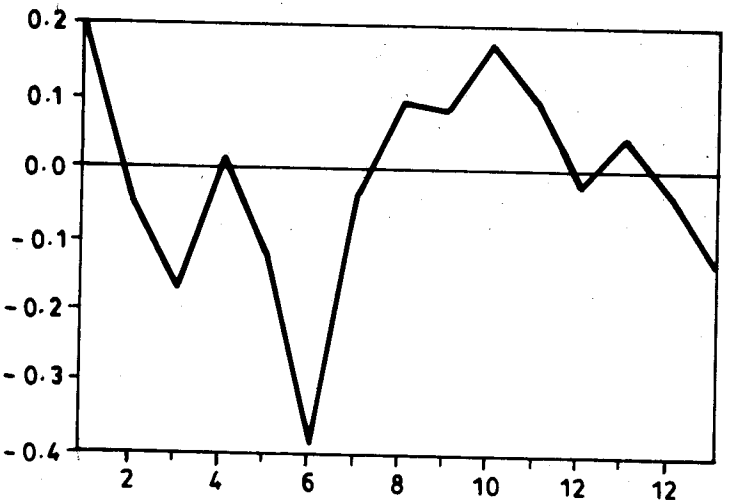
The impact of *excess supply of domestic credit* (EDCC) on RER, as shown at the bottom half of Figure 2, also leads to an appreciation of RER for upto six to seven periods before the long-run stable level is achieved. This is due to the fact that an expansive monetary policy (e.g., increasing EDCC) initially increases the real money stock in the economy. This excess value of the real money stock obviously will create an excess aggregate demand condition in the economy which in turn may generate excess demand for domestically produced non-traded commodities and hence causing higher prices for these non-traded (P) products to clear the market. Other things being equal, a higher value of P will directly lower RER ($= NER^* P^f /P$) implying an appreciation in RER to reestablish equilibrium in the non-traded commodities market.

In both cases, however, in the long-run RER will depreciate, because of eventual decline in the international reserves as public in the due course of time substitutes excess domestic money with foreign currency. Although, theoretically it was argued that the impact of these monetary macroeconomic policy variables on RER be pronounced only in the short-run, in the long run the intensity of these IRFs should diminish. Our results, on Pakistan's economy do not support such a theoretical hypothesis–overvaluation of the rupee persisted for six to seven years. Thus based on the above results one may argue that the inconsistent macroeconomic policies (be it deficit financing or monetary expansion) pursued by Pakistan was responsible for the overvaluation of the rupee in the past.

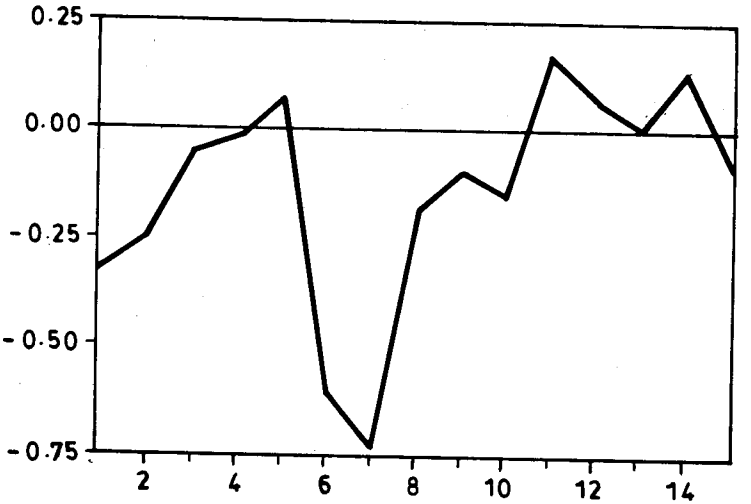
***Real Variables*:** IRFs results due to real variables depicted in Figure 3 are equally interesting and are consistent with theoretical premises, as discussed earlier. Real variables like DEV, TOT, TARF and TEP all have the effect of appreciating the RER. DEV however, seems to have a much stronger short-run effect on RER compared to the other variables. The appreciating effect of TEP on RER lasts for about two years followed by TOT to two and a half years and finally TARF having the effect which lasted for four years. A large short-run value of IRFs of RER due DEV may provide an important opportunity to use the devaluation policy in rectifying the problems of overvaluation of the Pakistani rupee. However, for the devaluation policy to be effective and have a long-term impact on RER it is imperative that the initial causes of shocks in RER (which lead to overvaluation of the rupee) due to monetary macroeconomic policy variables (DEF and EDCC) be obliterated. Otherwise the disequilibrium in RER will persist even after devaluation in the short run. In fact, in the case of Pakistan our results in Figure 2 clearly verify this proposition in the sense that the impact of deficit financing (DEF) and excess domestic credit creation (EDCC) policies on RER did not disappear until six to seven years and thus the macroeconomic policies pursued during this period kept the Pakistani rupee overvalued for an extended period.

The impact of technical progress, proxied by growth in the economy, on RER appears to be short-lived (about two year). The value of the currency starts to depreciate after two years. This result can be explained in the following way. When technical progress occurs it is expected to create export expansion at least in the short run resulting in a balance of payments (BOP) surplus. Such a surplus in the

Fig. 2. Impulse Response Function of RER Due to Monetary Policy Variables

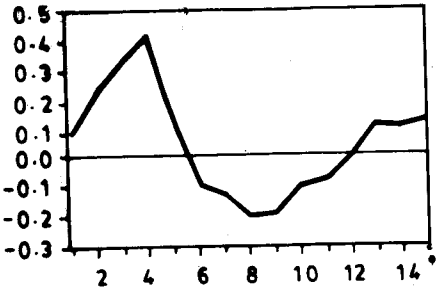


DEF

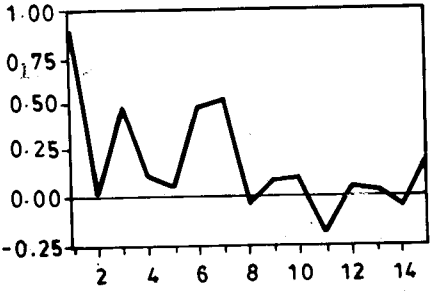


EDCC

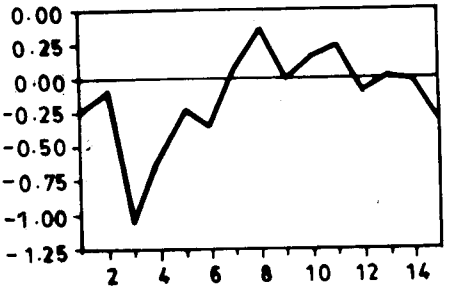
Figure 3. Impulse Response Functions of RER Due to Real Economic Variables



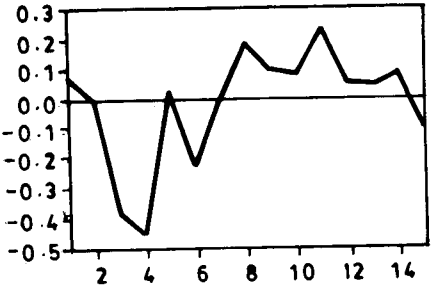
ERSBO



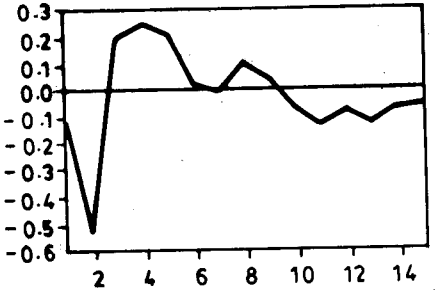
DEV



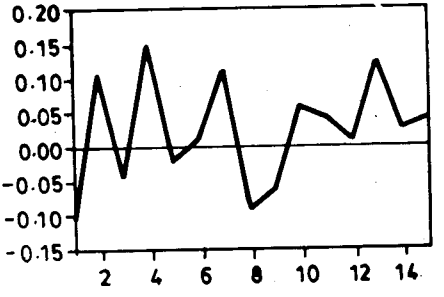
TOT



TARF



TEP



KFLO

BOP will have an immediately appreciating impact on RER. In the long run, however, because of global competition the initial edge in technology will diminish or disappear, causing a slow-down of inflow of foreign exchange and thus depreciating the value of the rupee.

An initial positive effect of ERSBO on RER and subsequent depreciation can also be explained as follows. A sudden unexpected increase in the spread between the black market and the official rate (ERSBO) will build up expectations for further increase in ERSBO in the short run. This obviously will cause an immediate currency depreciation. However, in the long run when expectations of the public are realised the pressure on foreign currency is relieved. Consequently the RER will appreciate to reach the equilibrium value.

4. CONCLUSION

The purpose of the study was to examine the relevance of the PPP in Pakistan and investigate the dynamic path of the built-in forces which tend to bring the real exchange rate towards its equilibrium level. Our results do not support the simple version of PPP in Pakistan. However, a detailed investigation of the monetary and real channels which affect the real exchange rate reveal that monetary expansion, proxies by domestic credit creation and the level of deficit financing, lead to a medium term disturbance in the equilibrium level of the real exchange rate. The autonomous forces work rather slowly to bring it back towards equilibrium. Results regarding the dynamic response of the real exchange rate to changes in real variables are generally consistent with theoretical predictions. However evidence shows that the responses are complex, powerful and prolonged. The variety and complexity of these real and monetary influences also indicates that a somewhat flexible discretionary-managed policy, which is currently being followed in Pakistan, is more suitable than a simple rule-governed policy of the exchange rate.

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Comments on
"What Determines the Behaviour of Real Exchange Rate in Pakistan?"

The VAR technique adopted in this paper is questionable. No theoretical basis exists for use of this technique as such no policy implication can be suggested.

I have a problem with the definition of variables in the model specified. Excess supply of domestic credit is specified as the difference between growth of domestic credit and growth of GDP. The correct specification would be [growth of domestic credit]–[GDP growth + devaluation + foreign inflation]. An assumption would also need to be made about the velocity of money. Technological progress has been proxied by real GDP growth rate, this is also not appropriate because this proxy includes growth attributable to Capital and Labour.

The results presented also show weakness in the model. In a significant number of equations coefficients have a value of greater than one. This suggests that the model is unstable. Possibly additional variables needed to have been specified.

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