

## ***How External Shocks and Exchange Rate Depreciations Affect Pakistan? Implications for Choice of an Exchange Rate Regime***

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*A structural vector autoregression (VAR) model shows that external shocks are important in driving economic fluctuations in Pakistan and their importance has increased since September 11, 2001. The primary source of external shocks is foreign remittances, while foreign output has a limited effect. Keeping fixed external factors, an exogenous real exchange rate depreciation shock lowers output—a positive effect on real net exports (largely resulting from import compression rather export expansion)—is more than offset by a decline in domestic demand. The absence of common shocks with major trading partners, the importance of remittances, conventional expansionary effects on the trade balance following a real currency depreciation, and only limited evidence that credibility of anti-inflationary policy would improve with a currency peg support greater exchange rate flexibility. However, the rather large contractionary effects of real exchange rate depreciation on domestic demand suggest that greater exchange rate flexibility could destabilize aggregate output.*

### **1. Introduction**

This paper examines the sources of economic fluctuations in Pakistan using a structural vector autoregression (VAR) methodology. Specifically, we determine the extent to which changes in output, inflation, and real exchange rate are driven by external shocks and the role that real exchange rate shocks play in driving the

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economy. The primary goal of the analysis is to highlight the implications of the results for choice of exchange rate regime in Pakistan.<sup>1</sup>

It is now generally well-understood that the traditional literature on the choice of exchange rate regimes might be only of limited relevance to developing countries because of the special problems they face.<sup>2</sup> One such problem is that exchange rate depreciations are often contractionary rather than expansionary in these countries.<sup>3</sup> This means that one key advantage of floating exchange rates—that of providing an appropriate adjustment mechanism to various kinds of shocks—is negated; exchange rate flexibility with “contractionary devaluations” could actually destabilize, rather than stabilize, the economy.

On the other hand, there is also a near-consensus that should these countries decide to peg their currencies, the only viable pegs would be to hard currencies like the dollar, euro, or the yen. And this means that these countries are unlikely to satisfy the criterion of having common shocks with their potential anchor currency countries.

So, under these special circumstances, what should developing countries do: fix or float? There is no clear-cut answer. There is an argument for fixing that, since these countries do not gain much from exchange rate flexibility, they might as well fix to have a nominal anchor for inflation and increase credibility of anti-inflation policy more credible. But then there is a counterargument also: exchange rate depreciations have been contractionary in the historical record of developing countries only because these depreciations have been dominated by forced exits from non-viable pegs in crisis times.<sup>4</sup> Therefore, contractionary devaluations do not indicate that exchange rate flexibility is destabilizing but rather that soft (or adjustable) pegs do not work.<sup>5</sup>

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<sup>1</sup> This is the shortened version of the paper Ahmed, Ara, and Hyder (2005), which contains more details and additional results.

<sup>2</sup> The classic works of Mundell (1961), McKinnon (1963), and Kenen (1969) on optimal currency areas represent the traditional literature.

<sup>3</sup> The literature on contractionary devaluations dates back several decades and has continued to expand in recent years. See, for example, Diaz Alejandro (1963), Cooper (1971), Krugman and Taylor (1978), Edwards (1989), Lizondo and Montiel (1989), Agenor (1991), Kamin and Klau (1996), Kamin and Rogers (2000), Ahmed et al (2002), and Ahmed (2003).

<sup>4</sup> This argument was one motivation behind Reinhart and Rogoff (2004) introducing a new category of exchange rate regime of “freely falling” for very high inflation, frequent depreciation episodes in their “natural” classification scheme.

<sup>5</sup> There is also a related debate in the literature about the bipolar view—free floats and hard fixes being the only sustainable option—versus the view that intermediate regimes are possible and even, in some cases, desirable. For the arguments made on the two sides of this debate, see, for example, Williamson (1996), Frankel (1999), and Fischer (2001).

Among the key considerations for a developing country in deciding to fix or to float would, therefore, be: how important are external shocks overall, the extent to which the country departs from the important traditional criterion of having common shocks with the potential anchor country, and whether exchange rate depreciations are contractionary or expansionary.

If devaluations are contractionary, the channels through which this is occurring can be relevant too. In the older literature on contractionary devaluations, the key channel emphasized was that since key inputs had to be imported, devaluation could worsen the trade balance instead of improving it. The modern literature highlights reasons such as currency mismatches on domestic balance sheets.<sup>6</sup> In this situation, currency depreciation increases the domestic currency value of domestic liabilities, which has a negative effect on wealth and, therefore, consumption and investment. Thus, domestic demand can fall as a result of currency depreciation. There can be indirect effects as well, whereby devaluation leads to loss of investor confidence and lack of access to international capital markets, with adverse consequences again for domestic absorption.<sup>7</sup> The implications of fixing versus floating can be different depending on the reasons why devaluations might be contractionary.

In light of the above discussion, in this paper we specifically focus on the following questions with respect to Pakistan's economy: (1) How important are external shocks (terms of trade shocks, shocks to outputs/incomes of major trading partners, and foreign remittance shocks) in driving economic fluctuations? (2) Are exchange rate depreciations contractionary or expansionary? (3) What are the channels through which exchange rate changes affect the economy and how important is their effect relative to other factors? (4) What are the implications of the results for the choice of exchange rate regimes?<sup>8</sup>

The remainder of this paper is organized as follows: section 2 provides a selective review of previous findings for Pakistan on the effects of remittances and exchange rate changes on the economy; section 3 lays out our empirical

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<sup>6</sup> See, for example, Eichengreen and Hausmann (1999) and Cespedes, Chang, and Velasco (2000).

<sup>7</sup> This leads developing countries to have a rational "fear of floating" as argued by Calvo and Reinhart (2002) and Hausmann, et al. (2001), for example.

<sup>8</sup> Most empirical evidence from developing countries on the performance of economies under different exchange rate regimes is of the cross-country variety; see, for example, Husain, et al. (2005). Husain (2004) develops a template based on a *large number* of relevant criteria, which can be applied to individual countries. Here we focus in detail on just two key criteria for Pakistan—the importance of external shocks and whether devaluations are contractionary or expansionary.

methodology; section 4 presents our empirical findings and provides an interpretation of the results; and section 5 concludes them.

## **2. Review of Previous Results**

The previous related work for Pakistan has focused on the role of external factors (in particular their relationship with exchange rate movements), effects of changes in exchange rates on real variables and implications for choice of exchange rate regimes, and the relationship between exchange rates and prices.

Khan (1986) considered the impact of trade terms, real GNP of industrial countries, real interest rates in international capital markets, and capital flows on Pakistan's real exchange rate over the period 1977 to 1984. He concluded that the effect of these external factors on real exchange rate movements was often contrary to that predicted by the theory.

Ahmed and Ali (1999) used a simultaneous equation framework to trace the pattern and speed of adjustment of the nominal exchange rate and domestic price level in response to domestic and external shocks using data for the period 1982:II to 1996:IV. They considered shock to money supply and real output as domestic shocks and shock to export prices, import prices, and foreign exchange reserves as external shocks. Comparing the responses of prices and exchange rates to various shocks, they also concluded that, in the short run, the price level response to shocks was not in the direction that would offset the exchange rate response and leave the real exchange rate unchanged, but in the long run it was. Thus, they surmised that purchasing power parity (PPP) did not hold in the short run.

Several researchers have remittances from abroad to be an important influence on the Pakistan economy. For example, Nishat and Bilgrami (1991), using a standard Keynesian macro model and applying a three-stage least squares (3SLS) estimation technique over the period 1960 to 1988, computed the remittance output multiplier to be about 2.5—that is, a Rs. 1 million increase in remittances would increase GNP by about Rs. 2.5 million, according to their results. Moreover, Haque and Montiel (1992) show that growth in workers' remittances substantially appreciated the real exchange rate over the period 1982 to 1991. Specifically, workers' remittances and official transfers explained 80 percent of the variation observed in the effective real exchange rate over the period. Khan's paper, discussed earlier, also found that remittances play a critical role in movements of the balance of payments and the real exchange rate.

The traditional literature on whether currency depreciation improves the trade balance has focused on whether the Marshall-Lerner stability condition is satisfied. Hassan and Khan (1994) concluded that the Marshall-Lerner stability condition was satisfied, using data over the period 1972 to 1991. By contrast, Khan and Aftab (1995), using a somewhat different sample period of 1983 to 1993, concluded that the Marshall-Lerner condition was not satisfied. They also examined disaggregated export data, again finding little support that devaluation improves export performance. Using data disaggregated by Pakistan's four major trading partners, Akhtar and Malik (2000) concluded that real devaluation was likely to improve Pakistan's trade balance with the United Kingdom and Japan but not with the United States or Germany.

The error-correction model of Aftab and Aurangzeb (2002) supports the existence of a J-curve in the short run, whereby the trade balance first deteriorates in the first two quarters following currency depreciation but then improves. Results in Rehman and Afzal (2003) are also consistent with a J-curve, with a negative effect on the trade balance of exchange rate depreciation for about six quarters and then turning positive.

There seems to be only very limited work done in the case of Pakistan on the output effects of exchange rate changes and on the choice and consequences of different types of exchange rate regimes. Khan (1986) finds some merit in a policy of some flexibility of the exchange, arguing that this enhances the ability of the authorities to adjust to a variety of external shocks, which are important for the economy. Ahmed (1992) studied the determinants of the nominal exchange rate since the advent of managed float in 1982 to 1987, using monthly data. He found that in the long run, movements in the Rupee appeared to offset the relative inflation differential between Pakistan and its major trading partners, consistent with the targeting of a constant real exchange rate.<sup>9</sup>

Most studies for Pakistan do not seem to find a high pass-through from exchange rate changes to prices. Studies finding little evidence of substantial pass-through include Haque and Montiel (1992), Siddiqui and Akhtar (1999), and Choudri and Khan (2002). One study that appears to be an exception and finds stronger evidence of pass-through over the period 1982 to 1996 is Ahmed and Ali (1999).

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<sup>9</sup> Nabi (1997) also discussed the management of the exchange rate as a principle tool of trade policy.

### 3. Empirical Model and Methodology

In order to isolate the causal influence of exchange rate shocks on the economy, it is important to control for key external factors that might influence both the real exchange rate and domestic output and inflation. The key external factors directly controlled for in this study are terms of trade, output/incomes of trading partners (foreign output), and remittances from abroad.

The empirical methodology is to estimate a six-variable structural vector autoregression (VAR).<sup>10</sup> A structural VAR is basically a dynamic simultaneous equation model. Of the six variables we consider, three (the terms of trade, foreign output, and remittances) are determined only by external factors and labeled “external variables” while the remaining three (real exchange rate, output, and inflation) are influenced by domestic factors *in addition to external factors*, and are labeled “domestic variables”.

#### Structural VAR

Specifically, we estimate the following system of structural equations:

$$AX_t = \sum_{j=1}^k B_j X_{t-j} + u_t \equiv B(L)X_{t-j} + u_t \quad (1)$$

where  $X$  refers to the vector of stationary variables in the model,  $A$  is the matrix of contemporaneous interactions between the endogenous variables,  $B_j$ 's are matrices representing lagged effects with  $B(L) = \sum_{j=1}^k B_j L^j$  being matrix polynomials in the lag operator, and  $u$  is a vector of *i.i.d.* structural disturbances with covariance matrix  $D$ , which is diagonal. Intercept terms are included in the empirics but have been omitted here for the sake of convenience.

It will be useful to partition  $X$  into “external” and “domestic” variables along the lines discussed earlier and also to partition the structural disturbances correspondingly. Thus,

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<sup>10</sup> This follows the approach taken by Ahmed (2003) for a panel of Latin American countries.

$$X \equiv \begin{pmatrix} X_1 \\ X_2 \end{pmatrix} = \begin{pmatrix} \Delta tot \\ \Delta fy \\ \Delta rm \\ \Delta rer \\ \Delta y \\ \Delta p \end{pmatrix}; \quad u \equiv \begin{pmatrix} \varepsilon \\ \eta \end{pmatrix} = \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \eta_1 \\ \eta_2 \\ \eta_3 \end{pmatrix} \quad (2)$$

where the external stationary variables—represented by  $X_1$ —are the rate of change of the terms of trade ( $\Delta tot$ ), foreign output growth ( $\Delta fy$ ), the growth rate of remittances from abroad ( $\Delta rm$ ) and the domestic stationary variables—represented by  $X_2$ —are the rate of depreciation of the real effective exchange rate ( $\Delta rer$ ), domestic output growth ( $\Delta y$ ), and domestic inflation ( $\Delta p$ ).<sup>11</sup> The vector  $\varepsilon$  represents the vector of external shocks (the terms of trade, foreign output, and remittance shocks, respectively); and the vector  $\eta$  represents the vector of domestic shocks (a domestic real exchange rate shock, a domestic output shock, and a domestic price level shock, respectively)—i.e. after accounting for the influence of the external shocks on these variables.

It is well-known that the assumptions that the fundamental economic disturbances in the vector  $u$  are *i.i.d.* and, therefore, have a diagonal covariance matrix do not fully identify structural models like Equation (1). To meaningfully analyze the effects of various shocks, further identification restrictions are needed. We place coefficient restrictions on the  $A$  and  $B$  matrices shown below:

$$A \equiv \begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ * & 1 & 0 & 0 & 0 & 0 \\ * & * & 1 & 0 & 0 & 0 \\ * & * & * & 1 & 0 & 0 \\ * & * & * & * & 1 & 0 \\ * & * & * & * & * & 1 \end{pmatrix} \quad (3)$$

<sup>11</sup> Unit root tests conducted using the Augmented Dickey Fuller (ADF) test suggested that a VAR with all variables in growth rates was a more appropriate choice than a VAR with all variables in log deviations from trend.

$$B(L) \equiv \left( \begin{array}{cc|ccc} B(L)_{11} & B(L)_{12} & & & & \\ B(L)_{21} & B(L)_{22} & & & & \end{array} \right) = \left( \begin{array}{ccc|ccc} * & * & 0 & 0 & 0 & 0 \\ * & * & 0 & 0 & 0 & 0 \\ * & * & * & 0 & 0 & 0 \\ \hline * & * & * & * & * & * \\ * & * & * & * & * & * \\ * & * & * & * & * & * \end{array} \right) \quad (4)$$

where an asterisk denotes that the coefficient is unrestricted.

Given that Pakistan can be considered a small open economy, the external variables are assumed to be exogenously given, which is reflected in  $A_{12}$  and  $B(L)_{12}$  being null matrices. Note that this makes the system block recursive.

Among the external variables, it is assumed that the contemporaneous direction of causality goes from terms of trade to foreign output to remittances, which means that  $A_{11}$  is lower-triangular.<sup>12</sup> Remittances can be expected to be influenced by conditions prevailing in the countries from which they are being sent, but are unlikely to in turn affect those conditions. This is consistent with the above causal ordering and also implies that  $B(L)_{11} = 0$ .

Within the domestic variables, the contemporaneous causal ordering is assumed to go from the real exchange rate to domestic output to the domestic price level, which implies a lower triangular  $A_{22}$ . Since prices are usually sticky in the short run, putting the price level last in the causal ordering seems appropriate. However, it is more controversial what the direction of contemporaneous causality is between the real exchange rate and output. Certainly, changes in exchange rate policy, which could be one source of domestically driven shocks to the real exchange rate, can affect output. However, some domestic shocks, such as supply shocks of fiscal shocks, can also affect both output and the real exchange rate. Since, asset markets typically react faster, the exchange rate is likely to respond to these shocks faster than output. Hence, we put the real exchange rate ahead of output in the contemporaneous causal ordering—feedback from output changes to real exchange rate changes with a lag is, of course, allowed.

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<sup>12</sup> Note that the residuals of the reduced-form equations for the external variables revealed very little pair-wise correlation with each other. This means that, in practice, the results are not very sensitive to alternative contemporaneous causal orderings of the external variables.



### Reduced-form VAR and Identification

The structural VAR given in Equation (1) cannot be directly estimated but must be retrieved from the reduced form of the system. The relationship between the structural VAR and its reduced form can be seen by pre-multiplying Equation (1) by  $A^{-1}$  to yield:

$$X_t = A^{-1}B(L)X_{t-1} + A^{-1}u_t \equiv \Gamma(L)X_{t-1} + v_t \quad (5)$$

This is the reduced form of the system, which can be estimated by applying Ordinary Least Squares (OLS). The relationship between the covariance matrix of the structural disturbances ( $D$ ) and that of the reduced-form residuals ( $\Omega$ ) can be written as:

$$E(v_t v_t') \equiv \Omega = E[(A^{-1}u_t)(A^{-1}u_t)'] = E(A^{-1}u_t u_t' A^{-1'}) = A^{-1}DA^{-1'} \quad (6)$$

where  $E$  is the expectations operator. Identifying the structural model from the estimated reduced-form Equation (5) thus involves finding an  $A$  matrix such that  $\Omega = A^{-1}D A^{-1'}$  where  $D$  is diagonal. This process does not, in general, yield a unique  $A$ , which is another way of saying that a simultaneous equation system cannot be retrieved from its reduced form without additional restrictions (e.g. exclusion restrictions). Our postulated exclusion restrictions discussed earlier imply a lower triangular  $A$ , which is enough to make  $A$  unique.

## 4. Results

In this section, we first describe the data and its sources. Then we discuss the properties of the identified structural economic disturbances and present and interpret the impulse responses, variance decompositions, and historical decompositions using the structural VAR model retrieved according to the procedure described above. This is followed by evidence on the channels of transmission of exchange rate changes. Finally, the implications for choice of exchange rate regime in Pakistan are discussed.

### Data

The terms of trade are the ratio of unit value of exports to the unit value of imports. Foreign output is computed as an export-weighted index of the real GDP of Pakistan's 10 major export markets. Foreign remittances are total remittances coming into Pakistan from all countries abroad measured in US dollars. The real

effective exchange rate is a trade-weighted, CPI-based real exchange rate expressed as units of domestic goods that have to be given up to get one unit of the foreign good. Thus measured, a rise in the real exchange rate implies a real depreciation of the Pakistani rupee. Domestic output is real GDP measured at market prices and the price level is the consumer price index. Real Exports and imports are taken from the national income accounts and thus represent exports and imports of final goods. Finally, domestic absorption is defined as real GDP less net exports, and thus represents the sum of real private and government consumption and investment. The sources of the domestic data are *Economic Survey*, Government of Pakistan (various issues) and the international data needed to compute foreign output and the effective real exchange rate are taken from *International Financial Statistics*, IMF.

### **Economic disturbances**

We first estimate a block recursive six-variable reduced-form VAR for Pakistan—the system in Equation (5) above—using annual data from fiscal year 1976-77 to 2004-05. Based on statistical criteria, an initial lag length of 3 is selected for the VAR. However, with six variables and 3 lags, one does not have many degrees of freedom left for the equations for domestic variables, which contain all six variables. Therefore, we use statistical criteria to further restrict the reduced-form system by first testing and placing zero restrictions when coefficients were not found to be statistically significant.

After estimating the restricted reduced-form, the structural model given in Equation (1) is retrieved, utilizing the identification restrictions and procedure described in section 3. This yields the fundamental structural disturbances of interest that are orthogonal to each other by construction. These fundamental innovations, together with their standard deviations, are shown in Figure 1. Note that the volatility of the fundamental output and price shocks, and to some extent of the real exchange rate shocks, appears to have increased since about 1990. This suggests that domestic shocks impinging on the economy have, on average, been bigger in size in the second part of the sample period.

Among the external shocks, both terms of trade and remittances shocks are quite volatile. Moreover, remittances shocks appear to have increased in volatility since the events of September 11, 2001—notice the large positive shock subsequent to the tragedy—while the volatility of foreign output shocks has decreased since about the mid-1980s.

### Impulse responses (IRs)

The IRs present the dynamic responses of the variables to the fundamental economic disturbances plotted against the number of years that have elapsed since the shock occurred.<sup>13</sup>

The IRs to a one-standard deviation terms of trade shock (which represents roughly a 10 percentage point increase in its growth rate) are shown in Figure 2. The dashed lines represent 1.67 standard-error bands (roughly 90-percent confidence intervals).<sup>14</sup> Responses of the growth rates as well as log-levels of all the variables are shown; the latter are obtained by cumulating the IRs of the growth rates and can be interpreted as the percent deviation of the levels of the variables from baseline, plotted over the number of years that have elapsed since the shock. Note that since the log-levels are non-stationary variables, the standard-error bands of their responses will naturally widen over the horizon. The results on the terms of trade shock are striking in that this shock does not appear to have any statistically significant effect on the real exchange rate, output, and consumer prices in Pakistan.

Figure 3 plots the IRs of a shock to a weighted-average of the outputs of our major export markets. A one standard-deviation shock amounts to a rise of about 3½ percentage points in the foreign growth rate. The only significant response is that of the real exchange rate, which shows a cumulative depreciation of about 3½ percent, on balance, after three years relative to the baseline. This result is consistent with the Balassa-Samuelson effect if the rise in foreign output relative to domestic output reflects, in part at least, to an increase in foreign productivity relative to domestic productivity. Also, as foreign economies' growth increases, more remittances tend to come in from them (about a 20 percent increase in remittances relative to baseline after 3 years); although large, this response has a high standard error and is not statistically significant. There is no significant spillover effect to domestic output from the foreign output shock.

In contrast to the other external shocks, an exogenous shock to foreign remittances has rather large effects on Pakistan's economy. As shown in Figure 4, a one standard-deviation shock of about 30 percentage points to the growth rate of remittances causes domestic output growth to rise by ¾ percentage points each year, two and three years later. After three years, there is a cumulative increase in

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<sup>13</sup> They are obtained by inverting the structural VAR to obtain its moving-average representation using RATS.

<sup>14</sup> Standard errors for the impulse responses and variance decompositions (shown later) were computed using Monte Carlo simulations with 5000 replications.

output of about 1½ percent. This shock also causes a cumulative real appreciation of the Pakistani rupee of about 5 percent after four years. The strong inflow of remittances does not appear to raise domestic inflation, though.

Finally, Figure 5 depicts the IRs to an exogenous real exchange rate depreciation shock. Since the effects of external shocks have been kept fixed separately, the exogenous real exchange rate depreciation shock can be regarded as domestically-induced and possibly policy-driven. A one standard-deviation shock in this case is roughly a 3 percentage point increase in the rate of depreciation of the real exchange rate. Note that after a statistically insignificant increase in output growth on impact, after a year output growth falls by about half a percentage point and this effect is statistically significant. The level of output goes below baseline after a year and stays below for two years. Thus, real exchange rate depreciations tend to be somewhat contractionary rather than expansionary in the case of Pakistan, consistent with the experience of many other developing countries.<sup>15</sup> There is also some pass-through effect to prices, with the inflation rate rising in response to the real exchange rate depreciation, leading a cumulative effect of nearly 2 percent on the price level.

### Variance decompositions

How much do the external and domestic shocks contribute both as a group and individually to economic fluctuations in Pakistan? This depends not just on the magnitude of the response when a shock of a given size occurs, but also how often and, on average, what size shocks hit the economy. This question can be answered by considering the variance decompositions, which measure the percentage of the forecast error variances at various forecast horizons that are attributable to each of the individual shocks or a group of shocks. These are presented in Tables 1-3, along with their computer-simulated standard errors in parentheses.

As shown in Table 1, at a one-year forecast horizon, only about 20 percent of the forecast error variance of the change in the real exchange rate can be accounted for by external shocks, but this rises to 60 percent for a 3-year horizon. Thus, both external and domestic shocks appear to be important for real exchange rate fluctuations, which is plausible.

The results reported in Table 2 indicate that at a one-year to two-year forecast horizon, the bulk of the forecast error variance of domestic output growth (about

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<sup>15</sup> See Ahmed *et al* (2002) and Ahmed (2003) for some evidence for other developing countries and a comparison of industrial countries with developing countries in this respect.

75 percent to 80 percent) is explained by domestic shocks. However, external shocks become very important at the three-year horizon, accounting for roughly half of the forecast error-variance; remittance shocks alone explain about 20 percent of the error variance. Real exchange rate shocks are also an important determinant of output fluctuations; their contribution to the forecast error variance of output growth peaks at 23 percent for a two-year forecast horizon and is in the neighborhood of 10 percent at other forecast horizons.

External shocks are also important in the variance decompositions of inflation at a greater than one-year horizon, as shown in Table 3, although not as important as for output. About 35 percent of the error variance of the inflation rate at a three-year horizon can be explained by external shocks, but real exchange rate shocks explain only up to about 10 percent of the forecast error variance of inflation

#### **Historical decompositions: Evidence on the importance of post-Sep 11, 2001 shocks**

Casual empiricism suggests that influence of external shocks on the Pakistani economy has increased substantially following the events of September 11, 2001. We can examine this issue more formally by looking at the historical decompositions. Unlike the variance decompositions, which provide a breakdown of the unconditional forecast error variances, the historical decompositions give us the breakdown of the contribution of shocks over a specific period. Specifically, an initial period is chosen and baseline forecasts are made based on data available up to that period. The contributions of the different shocks to the deviation of actual values from the baseline path thus computed constitute the historical decompositions.

Using data up to 2000-01 (the fiscal year immediately prior to the one in which September 11, 2001 falls) to make the baseline forecasts, historical decompositions for domestic output growth for the fiscal years 2001-02 (labeled 2002) through 2004-05 (labeled 2005) are shown in Figure 6. Note that in 2005 the actual growth rate of real GDP at market prices was 7.8 percent, whereas the baseline forecast in the absence of any shocks after 2001 would have been 3.4 percent. Once we add the influence of the three external shocks, we get quite a bit closer to the actual growth rate; for example, in 2005, growth would have been 6.2 percent if only the external shocks had hit the economy (second panel). Thus all

the shocks taken together appear to have been very important in driving fluctuation in real GDP growth over this period.<sup>16</sup>

The third panel indicates that clearly the main external influence since 2001 has been shocks to remittances; with remittance shocks alone, the growth rate in 2004-05 would have been 6.3 percent, which is even slightly closer to actual growth than with all the external shocks taken together. The results indicate that growth would have been roughly 2½ percentage points less in each of FY2004 and FY2005 had remittances shocks since 2001 not impinged on the economy.

### **Channels of transmission**

The results discussed thus far do not tell us whether currency depreciations are contractionary because the trade balance deteriorates in response, instead of improving, or whether domestic demand falls, or both. The natural way to study this would be to augment our VAR system to include trade variables and domestic absorption. But this is not feasible here as the annual data are available only since about 1975 or so, and a larger VAR system will quickly run into degrees of freedom problem. Instead, therefore, we examine the issue by replacing the output variable in our VAR system by domestic absorption (the sum of private and government investment and consumption), real exports, and real imports in turn.

The IRs to a real exchange rate shock from each of these three alternative models are presented in Figures 7-9. Figure 7 shows the strong contractionary effects of real currency depreciation on domestic absorption are much bigger than the contractionary effects on output presented earlier. Specifically, a one standard-deviation shock to the rate of change real exchange rate (which is still about a 3 percentage point shock) lowers domestic absorption growth by about 0.2 percentage points on impact and about ¾ of a percentage point a year later. Cumulating the growth effects, there is a negative effect on the level of domestic absorption after four years of over 2 percent, and this is statistically significant.

The above results suggest that contractionary effects of devaluation on domestic absorption are partially offset by a conventional improvement in net exports, leading to a smaller contractionary effect on output itself. The relative size of the adjustment in exports versus imports can be examined by estimating the model with exports and the model with imports. As depicted in Figure 8, export growth expands by about 2 percentage points after a year in response to about the same-

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<sup>16</sup> The expanded version of our paper—Ahmed, Ara, and Hyder (2005)—analyzes the historical decompositions of real exchange rate changes and domestic inflation as well.

size real exchange rate depreciation shock as above, but the initial growth response of exports is negative and subsequently it turns positive too, so there is only a very modest net positive effect on the level of exports over time, which is not statistically significant.

Figure 9 shows that there is a negative effect on imports, which is quite a bit bigger in magnitude than the positive overall export effect—after two years the level of imports is down by a little more than 3 percent (statistically significant). Thus, the conventional response of an improvement in the trade balance following real depreciation of the currency appears to be occurring largely through a compression of imports rather than an expansion of exports.

### **Implications for exchange rate regime**

The shocks to the outputs of its major trading partners are not a very important source of fluctuations in Pakistan's economic growth or inflation. This absence of common shocks suggests that there is not a good case for Pakistan fixing its currency to the dollar or to the currency of one of its other major trading partners on the basis of the traditional fixed-exchange rate arguments.

The results also suggest that there might only be limited scope in the case of Pakistan to improve the credibility of anti-inflationary policies through fixing the exchange rate. Although there is a fairly large pass-through effect to prices from exchange rate depreciation shocks, such shocks do not explain much of the forecast error variance of inflation. Also, the credibility gains from fixing an exchange rate are maximized when free capital mobility is allowed, which forces a country to give up its independent monetary policy. But free capital mobility is not an appropriate assumption in the case of Pakistan.

Moreover, external shocks in general do form a very important influence on Pakistan's economy even if they are not in large part common shocks with important trading partners of the type that might lead to common business cycles. In particular, shocks to remittances are major determinants of the forecast error variance of Pakistan's real GDP growth. There is also clear evidence that the importance of such shocks for Pakistan has increased since September 11, 2001. Some exchange rate flexibility might be a useful tool for Pakistan to deal with such shocks, with the exchange rate appreciating in response to positive shocks to remittances (which has happened to some degree in recent years) and depreciating in response to negative shocks.

Our empirical results also suggest that exchange rate flexibility can act as a stabilizing influence on the trade balance. We find a conventional improvement in net exports following real exchange rate depreciation, but in large part this is because imports fall and only in small part because exports improve.

Thus far, there appears to be a case for allowing a substantial degree of flexibility in Pakistan's exchange rate. But our results also indicate that Pakistan suffers from the typical developing country syndrome of real exchange rate depreciations having a contractionary effect on domestic demand. This effect appears to be large enough to more than offset the positive effect of currency depreciation on output coming from an improvement in net exports. Thus, on net, exchange rate flexibility may not help stabilize output, even if it stabilizes the trade balance.

The negative effect on domestic demand of currency depreciation probably is a reflection of the special problems that Pakistan has historically shared with many developing countries—currency mismatches on domestic balance sheets resulting from an inability to borrow long term in domestic currency, “fickle and moody” international capital flows that are subject to sudden starts and stops, and lack of credibility and stability of domestic policies. The history of these problems, and the resulting implications, makes the case for substantial flexibility of exchange rates mixed. However, if the recent improvements in the stability and credibility of macroeconomic policies continue, this should bolster the case for a more flexible exchange rate regime going forward.

## **5. Summary and Conclusions**

In this study, we posed the following questions for Pakistan's economy: How important are external shocks (terms of trade shocks, shocks to outputs/incomes of major trading partners, and foreign remittance shocks) in driving economic fluctuations? (2) Are exchange rate depreciations contractionary or expansionary? (3) What are the channels through which exchange rate changes affect the economy and how important is their effect relative to other factors? (4) What are the implications of the results for the choice of exchange rate regime? We estimated a structural VAR using annual data over the period 1977 to 2005 and considered impulse responses, variance decompositions, and historical decompositions to address the above questions. Our empirical analysis suggests the following answers:

First, with regard to the importance of external shocks, terms of trade shocks appear to have very little effect on Pakistan's real exchange rate, domestic output, and domestic prices. Foreign output shocks lead to a real depreciation of the rupee



but their spillover effects on domestic output are rather modest. By contrast positive shocks to remittances from abroad lead subsequently to a significant increase in domestic output and a substantial real exchange rate appreciation, but very little response of the domestic price level. As a group, external shocks explain roughly about a fifth to half of the fluctuations of domestic output around baseline at a one- to two-year horizon; shocks to remittances alone explain about 20 percent of the fluctuations of output at a two-year horizon. For inflation, external shocks as a group explain about 10-35 percent of the deviations around baseline. The importance of external shocks has increased post-September 11, 2001; output growth in 2004 and 2005 would have been about 2½ percentage points less each in the absence of any remittance shocks after September 11.

Second, real exchange rate depreciation shocks lead to a modest fall in domestic output, indicating that depreciations are contractionary rather than expansionary. The inflation rate rises indicating some pass-through effect on prices. Although the pass-through effect is fairly substantial in magnitude, it is not very precisely determined and thus statistically insignificant.

Third, turning to the transmission mechanisms, net exports display a conventional positive response to a real exchange rate depreciation shock, largely driven by imports falling rather than exports rising. But the positive effect on net exports is more than offset by a contractionary effect on domestic absorption, which results in a net negative effect on overall output. Thus the channels of transmission are that real imports show a conventional fall following real currency depreciation, exports exhibit only a weak expansionary response, and domestic demand falls substantially. Likely, the fall in domestic demand is driven by the special problems of developing countries that have been highlighted in the literature, such as currency mismatches on domestic balance sheets, volatile international capital flows, and a historical record of lack of credibility of macroeconomic policies.

Finally, the implications of the results for the choice of exchange rate regime are rather mixed. Several results point to a case against fixing the exchange rate: Pakistan does not share common shocks with its major trading partners and there is not much evidence that it would reap much gain in credibility of anti-inflationary policy either from fixing. Moreover, remittance shocks cause fairly large fluctuations, which exchange rate flexibility would provide an appropriate adjustment mechanism to. In addition, it appears that exchange rate flexibility would help to stabilize external imbalances as well. But working against greater flexibility of the exchange rate is the substantial negative effects on domestic demand of currency depreciation, which more than offset the positive effect on net

exports. Thus, greater exchange rate flexibility may end up destabilizing rather than stabilizing aggregate output growth.

In sum, a *potential* case for greater exchange rate flexibility and the ability of exchange rate changes to act as an appropriate adjustment mechanism to shocks exists in Pakistan. But it is tempered by typical problems of a developing country that lead to a (rational) “fear of floating.” With Pakistan’s macroeconomic policies becoming more stable over the past few years, it has had a bit more room to pursue countercyclical monetary policy and allow greater exchange rate flexibility perhaps. Other country experiences—such as Mexico’s since its currency crisis of 1995—also show that, with improvement in policies and in the monetary framework, developing countries can graduate and the exchange rate can become a better adjustment tool. If the monetary framework and policies in Pakistan continue to mature, one would perhaps in time be able to give a more unqualified recommendation for a policy of greater exchange rate flexibility.

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## Appendix: Tables and Figures

**Table 1: Variance Decomposition of the Growth of Real Effective Ex. Rate**

Percentage of the k-step ahead forecast error variance of growth of real effective exchange rate explained by								
k (years)	External shocks			Domestic shocks			All External shocks	All Domestic shocks
	Terms of Trade shock	Foreign Output shock	Remittances shock	Real Exchange Rate shock	Domestic Output shock	Domestic Price (CPI) shock		
1	4.3 (5.9)	7.1 (7.8)	7.4 (7.7)	81.3 (11.3)	0* -	0* -	18.7 (21.5)	81.3 (11.3)
2	8.8 (8.9)	16.5 (11.9)	16.0 (11.1)	53.0 (13.7)	3.3 (3.3)	2.4 (3.4)	41.3 (31.8)	58.7 (20.4)
3	10.0 (9.1)	31.2 (13.9)	16.0 (10.9)	37.1 (11.6)	2.4 (2.1)	3.3 (3.5)	57.2 (33.9)	42.8 (17.2)

Notes: Standard errors are in parenthesis.

\*0\* indicates contribution constrained to be zero as a consequence of the identification assumptions.

**Table 2: Variance Decomposition of the Growth of Domestic Output**

Percentage of the k-step ahead forecast error variance of growth of domestic output explained by								
k (years)	External shocks			Domestic shocks			All External shocks	All Domestic shocks
	Terms of Trade shock	Foreign Output shock	Remittances shock	Real Exchange Rate shock	Domestic Output shock	Domestic Price (CPI) shock		
1	4.6 (6.0)	9.7 (9.5)	4.4 (5.7)	7.6 (7.5)	73.8 (13.0)	0* -	18.6 (21.3)	81.4 (20.5)
2	7.3 (7.4)	11.4 (9.2)	6.8 (6.5)	23.4 (10.4)	45.9 (11.6)	5.2 (5.8)	25.5 (23.0)	74.5 (27.8)
3	8.3 (7.8)	15.9 (10.9)	19.9 (12.1)	11.1 (6.0)	19.0 (6.9)	25.7 (11.0)	44.2 (30.8)	55.8 (24.0)

Notes: Standard errors are in parenthesis.

\*0\* indicates contribution constrained to be zero as a consequence of the identification assumptions.

**Table 3: Variance Decomposition of Domestic CPI Inflation**

Percentage of the k-step ahead forecast error variance of growth of CPI Inflation explained by								
k (years)	External shocks			Domestic shocks			All External shocks	All Domestic shocks
	Terms of Trade shock	Foreign Output shock	Remittances shock	Real Exchange Rate shock	Domestic Output shock	Domestic Price (CPI) shock		
1	5.0 (6.7)	3.5 (4.5)	3.5 (5.0)	4.0 (5.2)	3.2 (4.3)	80.8 (10.6)	12.0 (16.1)	88.0 (20.1)
2	12.9 (11.3)	7.6 (7.7)	8.5 (8.1)	4.5 (5.1)	3.2 (3.9)	63.4 (13.3)	28.9 (27.1)	71.1 (22.3)
3	15.0 (12.3)	10.1 (9.3)	9.8 (7.9)	7.2 (6.6)	3.4 (3.8)	54.5 (14.0)	34.9 (29.5)	65.1 (24.5)

Notes: Standard errors are in parenthesis.

**Figure 1: Plots of Fundamental Disturbances**

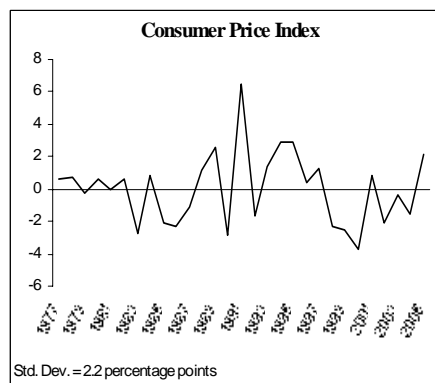
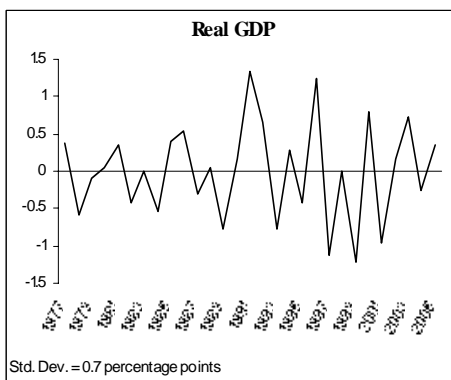
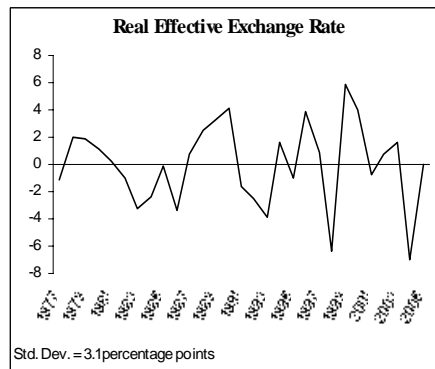
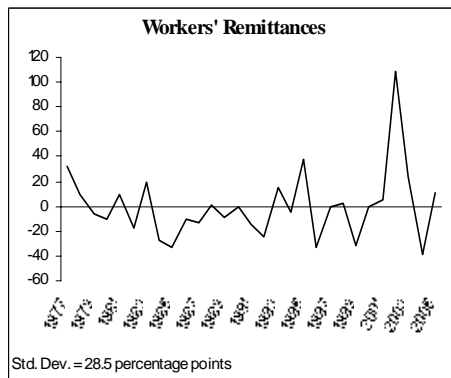
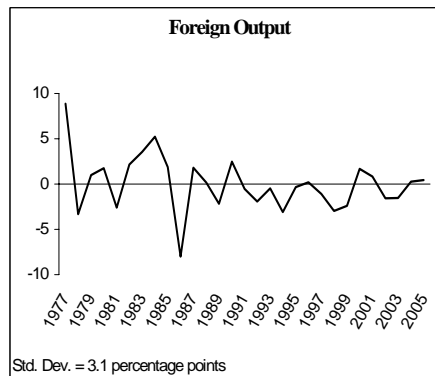
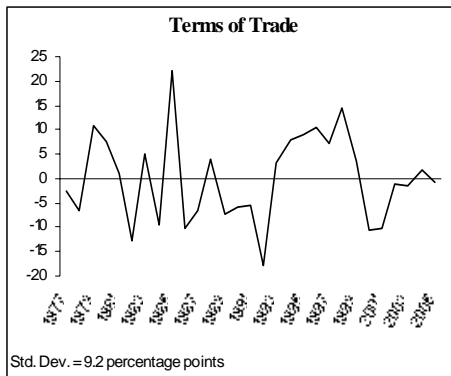


Figure 2: Responses to a shock to Terms of Trade

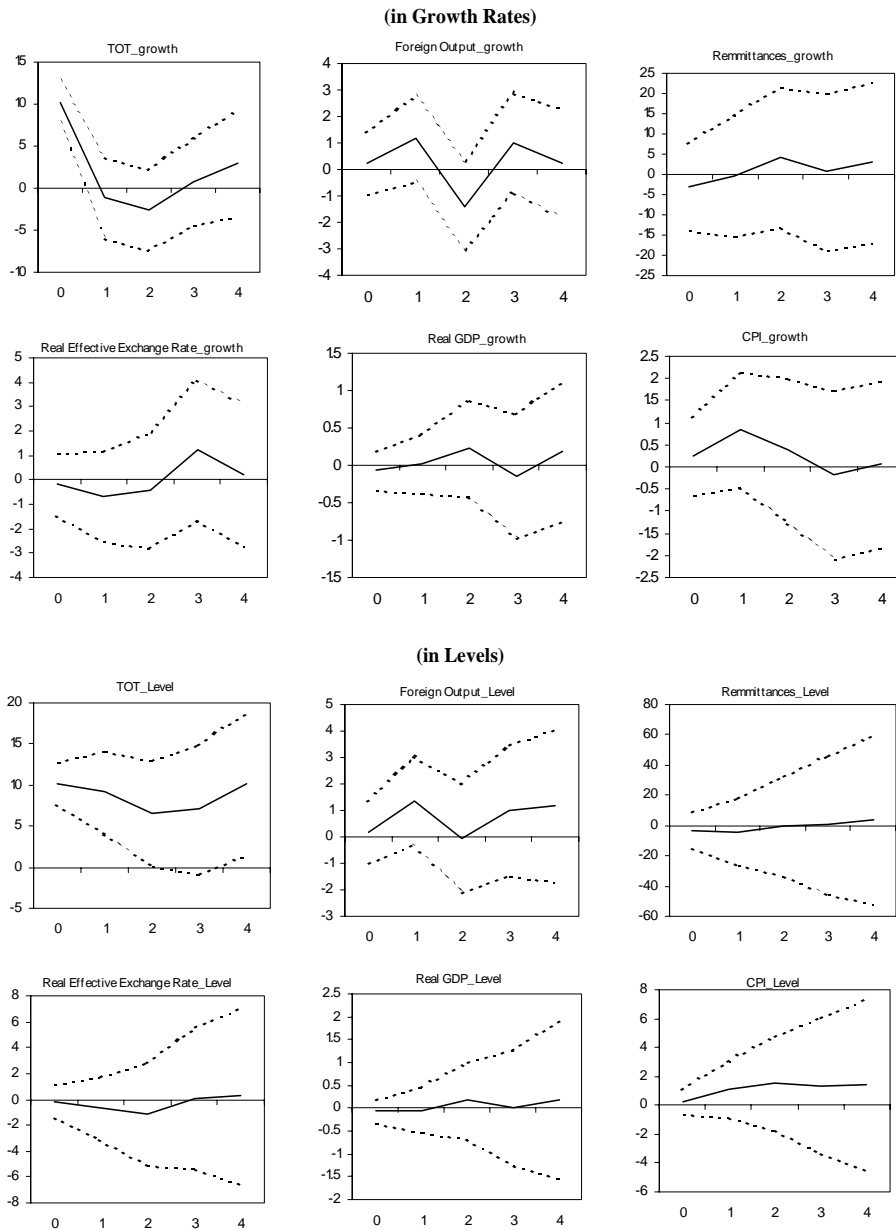
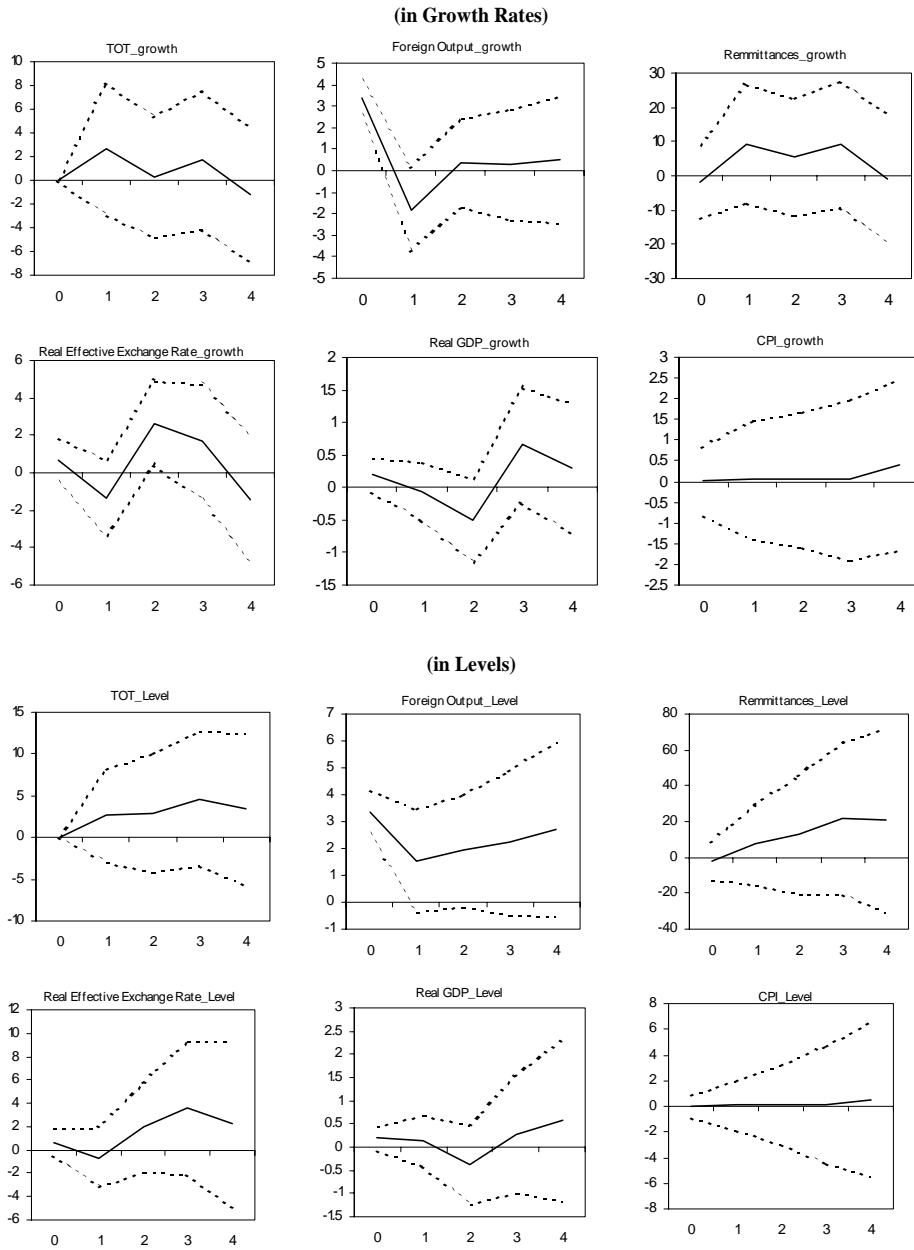


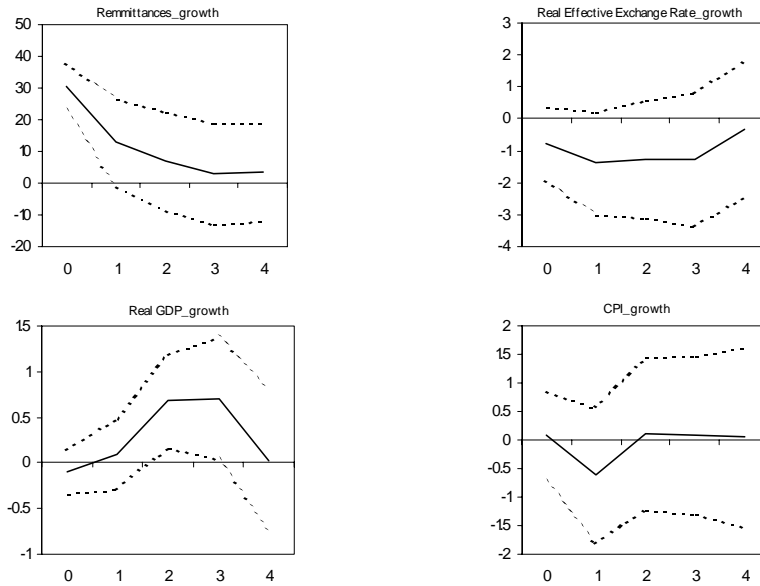
Figure 3: Responses to a shock to Foreign Output



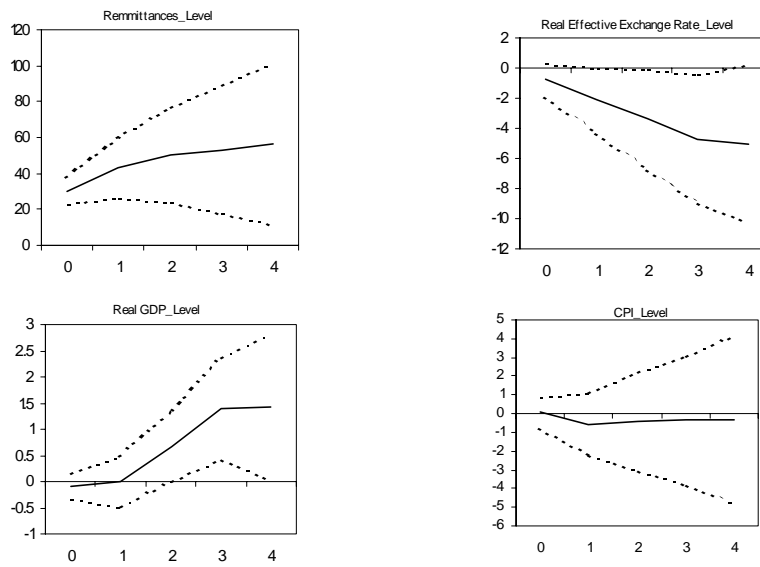


**Figure 4: Responses to a shock to Workers' Remittances**

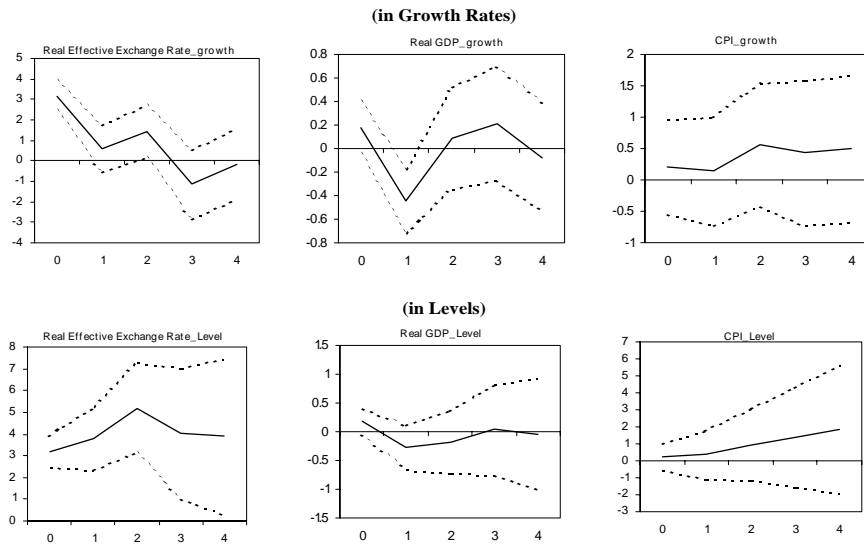
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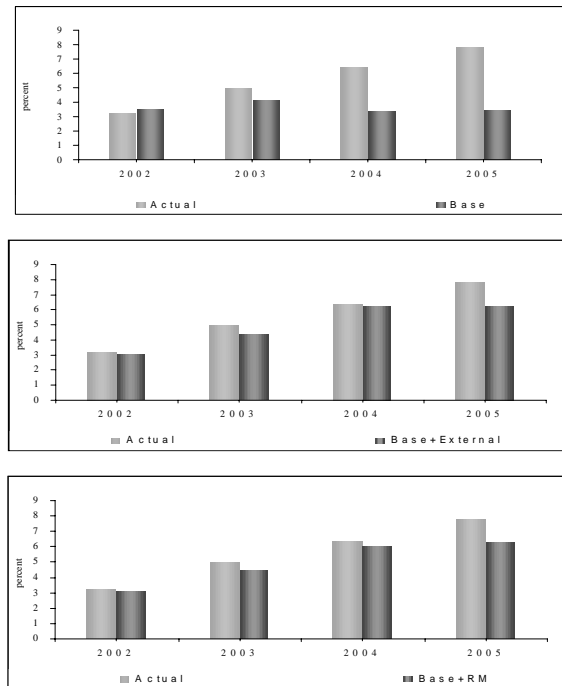
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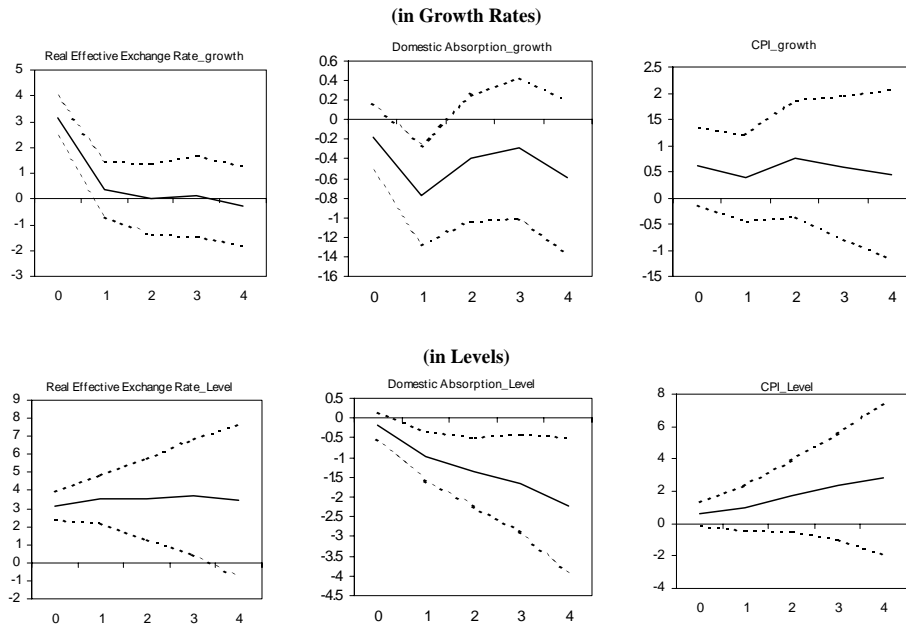
**Figure 5: Responses to a shock to Real Effective Exchange Rate**



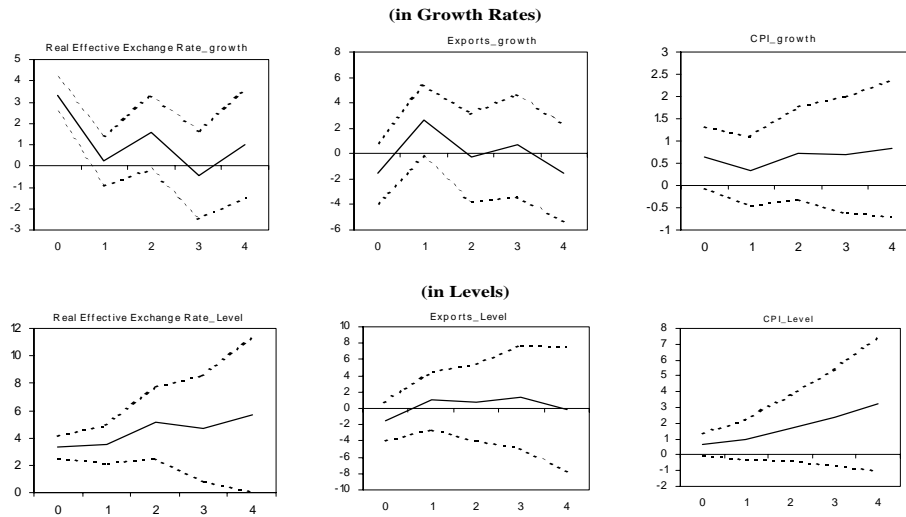
**Figure 6: Historical Decomposition of Growth of Domestic Output**



**Figure 7: Responses to a shock to Real Effective Exchange Rate (Absorption Model)**



**Figure 8: Responses to a shock to Real Effective Exchange Rate (Export Model)**



**Figure 9: Responses to a shock to Real Effective Exchange Rate (Import Model)**

