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Effectiveness of Foreign Exchange Intervention: Evidence from Pakistan

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This study addresses the question of whether intervention in foreign exchange market in Pakistan has been successful in either altering the exchange rate level or smoothing the exchange rate fluctuations. We apply GARCH model and the methodology of event study on the daily exchange rate and intervention to address the question. We find the evidence of effectiveness of official intervention on exchange rate level as well as on the variance.

JEL Codes: E58; F31
Key Words: Intervention, Exchange Rate, Event Study, GARCH

1. Introduction

The official intervention of monetary authorities in the foreign exchange market to influence the exchange rate fluctuation is a worldwide phenomenon.[1] The monetary authorities intervene with the objective of maintaining orderly market conditions, which ultimately help to achieve the overall macroeconomic goals. Heavy intervention was witnessed in the beginning of 1973 by developed economies to smoothly shift from the Bretton Woods fixed exchange rate system to free float.[2] However Pakistan, like many of the other developing economies, continued with the fixed exchange rate regime until 1982 when it shifted to managed float. In July 2000, Pakistan shifted to free float which in turn led the PKR/US dollar parity to depict a great deal of volatility. The management of foreign exchange market was indeed not an easy task; especially, when the foreign exchange market was thin and dominated by a relatively small number of agents.

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[1] Official intervention occurs when the authorities buy or sell foreign exchange, normally against their own currency and in order to affect the exchange rate.

[2] The Articles of International Monetary Fund (IMF) were amended to provide that members "would collaborate with the fund and other members to assure orderly exchange arrangements and to promote a stable system of exchange rates." [Article of Agreement of IMF Article IV, p. 5]

The State Bank of Pakistan (SBP) started intervening in the foreign exchange market to moderate the exchange rate fluctuations by both managing the mismatch between US dollar demand and supply and by quelling the speculative moves of a few agents.

Therefore, it would be interesting to analyze the extent to which SBP has been successful in its objective of smoothing exchange rate fluctuations. Furthermore, absence of a study on the very subject in Pakistan also necessitates this analysis. Therefore, the main objective of the current study is to explore two empirical questions. First, does the central bank's intervention influence the direction of exchange rate? Second, does the intervention dampen exchange rate volatility?

The rest of the study is organized as follows. Section 2 discusses empirical studies on the subject. Section 3 describes data while section 4 outlines the methodology. Section 5 summarizes empirical findings followed by conclusions in section 6.

2. Literature Review

The literature on the subject distinguishes between the effects of sterilized and un-sterilized intervention. With respect to the transmission channel of un-sterilized intervention, there is broad consensus that it affects the nominal exchange rate by changing the money supply and interest rates. Regarding the sterilized intervention, the literature identifies two transmission channels through which intervention may affect exchange rate. These channels are Portfolio-balance channel and Signaling channel.

The Portfolio-balance channel suggests that a sterilized purchase of foreign currency increases the amount of publicly held domestic bonds relative to the foreign bond, inducing a depreciation of the domestic currency and vice versa. The signaling channel is characterized by information asymmetries, where a monetary authority has information advantage with respect to current and prospective market fundamentals, conveying which to the market through intervention affects the exchange rate.

However, there is no broad consensus in the literature on the effectiveness of foreign exchange intervention. The aforementioned fact can be supported by the empirical findings of Frenkel et al. (2003) and Baillie and Osterberg (1997), who find either little or no impact or adverse impact of intervention on the exchange rate volatility. Whereas, Fatum and Hutchison (2003a) and (2003b), Kim et al. (2000), Kearns and Rigobon (2005), Pierdzioch and Stadtmann (2004), Chaboud

and Humpage (2005), Fatum (2000), Vitale (1999), and Dominguez and Frankel (1993) find intervention to be effective.
Some of the studies such as those of Disyatat and Galati (2005), Edison et al. (2003) and Neely (2005) find significant impact of intervention on the level and either no or adverse impact on the exchange rate volatility. Moreover, Sarno and Taylor's (2002) review of the existing literature shows that studies of the 1990s were largely supportive of intervention effectiveness whereas those of the 1980s largely rejected the hypothesis that intervention could be effective. One of the possible reasons of difference in the two decades might be attributed to data limitations prior to the 1990s.

Interestingly, irrespective of the controversies in literature on the subject, Neely's (2000) central bankers' survey indicated that central banks remained convinced that intervention is effective in changing the exchange rate. Moreover, it would be worth mentioning that two recent phenomena of use of event studies and high frequency data have advanced the understanding of interventions.

3. Preliminary Data Analysis

The SBP's foreign exchange interventions to stabilize exchange rate can be divided into three distinct episodes [Figure 1 and 2]. In the first episode of pre-September, 2001, the dollar demand was higher than dollar supply, so SBP sold foreign currency to finance this excess demand. During the second episode, from September 2001 to March 2004, the dollar supply exceeded the dollar demand, as a result SBP purchased surplus dollar from the market to moderate the abrupt appreciation in the rupee and to protect the export competitiveness. Since April 2004, SBP is selling dollars to support the rupee in the deteriorating external account scenario in the final phase. Moreover, SBP announced to make oil and other lumpy payments from its reserves with effect from November 1, 2004 to quell the speculative pressure on the exchange rate. The graphical analysis suggests that the second and third episodes were more effective in smoothing the exchange rate fluctuations as compared to the first phase.

Importantly, data on official intervention in the foreign exchange market is not publicly available.[3] On account of data limitations, it is not possible to analyze the whole period. Thus the study uses daily exchange rate and net foreign exchange purchases from 1 November 2002 to 31 March 2006.[4]

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[3] Partially available for in house use, nonetheless.
[4] The net purchases imply the purchase of foreign currency minus the sale of foreign currency.

Figure 1. Net Purchases Vs Exchange Rate Volatility

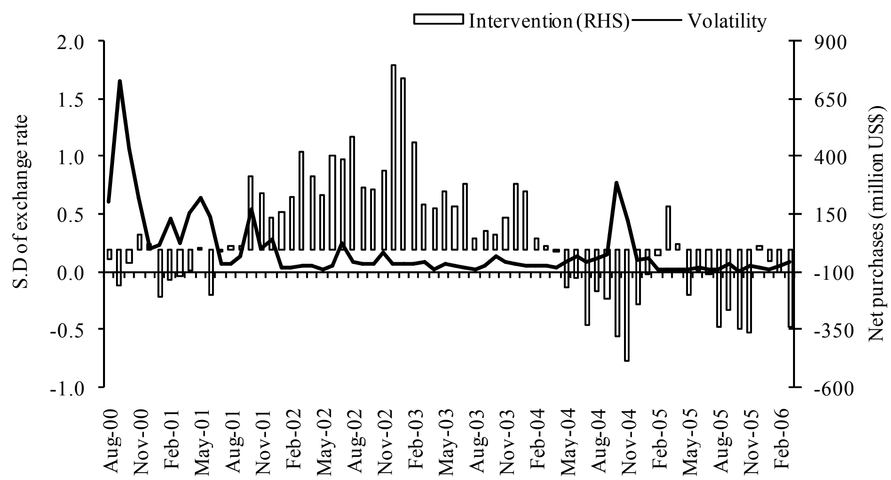

Figure 2. Pak Rupee App(+)/Depp(-) Vs Net Purchases

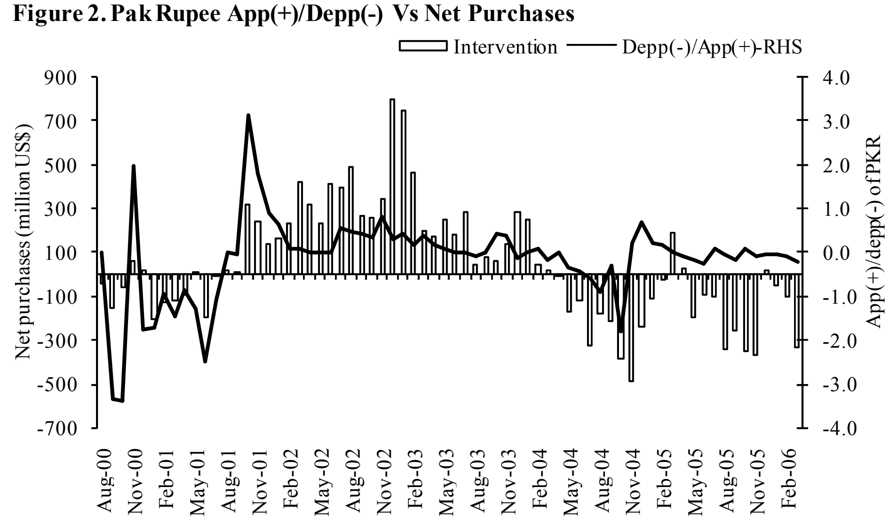

Table 1. SBP's Foreign Exchange Market Intervention, November 1 2002-March 31 2006

SBP's Purchases of US dollar		
	Number of days	**Cumulated Amount**
>50[b/]	22	1381
>40[c/]	19	860
>30[d/]	32	1093
>20[e/]	50	1205
>10[f/]	94	1299
>0[g/]	133	585
Total Purchases	350	6,424
SBP's Sales of US dollar		
	Number of days	**Cumulated Amount**
>100[a/]	3	329
>50[b/]	19	1251
>40[c/]	17	757
>30[d/]	30	1027
>20[e/]	55	1346
>10[f/]	90	1192
>0[g/]	97	439
Total Sales	311	6,342

[a/] Daily intervention operation of US$ 100 million or greater

[b/] Daily intervention operation of US$ 50 million or greater but less than US$ 100 million

[c/] Daily intervention operation of US$ 40 million or greater but less than US$ 50 million

[d/] Daily intervention operation of US$ 30 million or greater but less than US$ 40 million

[e/] Daily intervention operation of US$ 20 million or greater but less than US$ 30 million

[f/] Daily intervention operation of US$ 10 million or greater but less than US$ 20 million

[g/] Daily intervention operation of US$ 0 million or greater but less than US$ 10 million

During the sample period, SBP intervened on 661 days; of which 350 days witnessed net absorption while 311 days net injection of the foreign currency by the Bank (Table 1). Furthermore, value of all the absorption during one day was less than US$ 100 million while the value of only three days net injection was greater than US$ 100 million. During a day, the value of most of the interventions ranged from US$ 10 million to US$ 30 million. Thus one can argue that the interventions ranging from the aforementioned range are enough to affect the exchange rate. The fact may also be used as one of the indicators of foreign exchange market depth in Pakistan.

4. Methodology

4.1. Parametric Approach: GARCH

The researchers have used both the parametric and non-parametric approaches to measure the effectiveness of official intervention. In the parametric approach, the common way to study the effect of intervention on volatility is with a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model [Baillie and Bollerslev (1989)] where intervention and other variables can influence exchange rate conditional variance. The rationale behind using the GARCH model is the volatility clustering in the exchange rate. In such clustering large changes in exchange rates tend to be followed by further large changes whereas small changes tend to be followed by more small changes. The GARCH model accounts for the time-varying conditional variance structure of the errors in the first-differenced exchange rate series. Among others, some of the prominent studies which use this approach are Fatum and Hutchison (1999), Ito (2002), and Edison et al. (2003).

The current study specifies two equations to empirically investigate the impact of SBP intervention on the level and volatility of exchange rate. The mean Equation (1) measures direct effect of intervention on the exchange rate changes whereas the variance Equation (2) determines the impact of intervention on the exchange rate fluctuations.

The equations specified in the GARCH model are:

$$\Delta ER_t = \alpha_0 + \alpha_1 INT_t + \alpha_2 \Delta ER_{t-1} + \varepsilon_t \tag{1}$$

$$h_t = \beta_0 + \beta_1 INT_t + \beta_2 h_{t-1} + \beta_3 \varepsilon_{t-1}^2 + \beta_4 DSUP + \upsilon_t \tag{2}$$

Where ΔER_t is the change in Pak Rupee per US dollar exchange rate between period t and $t-1$, INT_t is the net inter bank dollar purchases by the SBP, $DSUP$ is the dummy of SBP support for making oil and other lumpy payments from its reserves,[5] h_t is the volatility parameter and, ε_t and υ_t are the disturbance terms. A positive value of ΔER_t implies depreciation of Pak rupee and vice versa. The signs in the mean equation will determine the impact of intervention on exchange rate level and the sign of variance equation will determine the impact on exchange

[5] The value of dummy is zero up till October 30, 2004 and 1 afterwards.

rate volatility. A positive sign of α_1 in the mean equation implies that the net selling of foreign currency by the monetary authority will appreciate the local currency while buying of foreign currency will depreciate the local currency whereas the negative sign of β_1 in the variance equation show a dampening impact of intervention on volatility.[6]

However, the GARCH methodology suffers from the simultaneity problem, simultaneous determination of official interventions and exchange rate, faced by the empirical research on intervention. Unlike the central hypothesis that intervention affects exchange rate, the decision to intervene is also not independent of the movement in exchange rate. The problem would lead to inconsistent estimates of parameters.[7]

Hence to cater for the simultaneity problem and make our result more robust we apply an alternative approach found in financial literature to study the effectiveness of foreign exchange intervention. This is a Non-Parametric Approach called event study.

4.2. Non-parametric Approach: Event Study

The methodology evaluates the success of intervention in affecting the exchange rate by defining an event, pre-event and post-event windows over which the exchange rate is examined. Therefore, the starting point is to define and identify the aforementioned windows carefully. The next important task is to define the measure of success.

4.2.1. Defining the Event

Period is an important consideration in defining the events. Too short a period of an event may lead to identify a single episode as two different episodes, while a too long period may not be able to distinguish the two separate episodes.

In this study, event is defined as a period of days with SBP intervention in one direction (in terms of purchases or sales) and possibly including a number of days with no intervention.[8] This definition leads to making another important decision

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[6] The Variance equation uses the absolute value of net purchases.

[7] . Also observed by Fatum and Hutchison (2003b, p. 382), "The issue of endogeneity arises in our study [and every intervention study] since the central bank usually takes its cue to intervene on the basis of observed exchange rate movements."

[8] The definition of the event is taken from Fatum (2000).

of treating how many consecutive days of no intervention as the part of one and the same event. During the period under consideration, the maximum number of consecutive days of no intervention was 12. However, a maximum 5 consecutive days of no intervention was decided not to be counted as a period of single event. Thus an event is defined as a period of days of intervention in one direction including no more than five consecutive days of no intervention.[9]

4.2.2. Defining the Pre-event and Post-event Windows

The pre-event and post-event windows are aimed at capturing the no intervention performance of the exchange rate. Therefore, their length needs to be set accordingly. Defining the pre-event and post-event windows length was indeed not an easy task in the case of Pakistan; especially, when SBP was selling the dollar to support the exchange rate one day and was buying the dollar from the market on the other day. Therefore, a window length of two days is finally chosen as it ensures minimum overlapping of pre-event and post-event windows.

4.2.3. Defining a Successful Event

Three success criteria are applied to study the effectiveness of intervention.[10] These are *Direction Criterion*, *Smoothing Criterion* and *Reversal Criterion*. The *Direction Criterion* suggests the intervention to be a success if the subsequent movement in the exchange rate is similar to the direction in which the central bank is intervening, for example, the value of Pak Rupee increases relative to US dollar after the dollars are sold by SBP in the inter-bank market. Thus, according to this criterion an event is a success if either, $(INT_i > 0$ and $\Delta ER_{i+} > 0)$ or $(INT_i < 0$ and $\Delta ER_{i+} < 0)$. Where, INT_i is the total amount of US dollar intervention during the event i and ER_{i+} is the Pak Rupee-US dollar movement in the associated post-event window. The positive values of INT_i represent purchases of US dollar while the negative values represent sales of US dollar whereas the positive value of ΔER_{i+} represents depreciation of Pak Rupee and the negative value of the same represents the appreciation of Pak Rupee in the associated post-event window.

[9] Considering more than 5 consecutive days of no intervention as part of the single event decreases the number of events whereas considering less than 5 consecutive days of no intervention as part of the single event lead to over lapping of the pre and post event windows. Moreover, 5 consecutive days of no intervention includes the working days only.
[10] The three criteria are applied by Fatum and Hutchison (2003, p. 399).

With respect to the *Smoothing Criterion* an event is successful if intervention is associated with a smoothing of exchange rate movement. This criterion is successful if the event is successful according to direction criterion and either,

$$\left(INT_i > 0 \text{ and } \Delta ER_{i+} > \Delta ER_{i-}\right) \text{ or } \left(INT_i < 0 \text{ and } \Delta ER_{i+} < \Delta ER_{i-}\right).$$

Where, ER_{i-} is the exchange rate change during the associated pre-event window. However, both the criteria are useful if the central bank follows "leaning against the wind" policy.[11] In case of "leaning with the wind policy"[12] the above mentioned criteria are not successful.

To address this shortcoming, the analysis distinguishes between the "leaning with the wind" and "leaning against the wind" events on the basis of exchange rate movement of the associated pre-event window. The *Reversal Criterion* suggests that the *Direction Criterion* should be applied to "leaning against the wind" events only.

The statistical test applied is the non-parametric Sign Test for the median. The statistics verifies the random or systematic pattern of the *Direction* or *Reversal* in the direction of exchange rate changes following intervention events. The Sign Test tests the null hypothesis that the population corresponding to the sample has a median value equal to zero against the alternative that the median is larger than zero. A significant Sign Test indicates that the observed number of successes is not a random finding attributable to the equal probability of the appreciation or depreciation.[13]

Along with its benefits, however, the event study methodology also suffers from some caveats. Firstly, the approach does not help to identify the particular channel through which intervention works and secondly, the approach is useful only in analyzing the short run linkages between the exchange rate and intervention.

5. Empirical Results

5.1. Parametric Model: GARCH

Augmented Dickey Fuller Test was applied to determine the order of integration of the data. The test showed that exchange rate time series is integrated of order

[11] When the central bank tries to slow down or reverse the exchange rate trend.
[12] When the central bank intervenes in support of an ongoing exchange rate trend.
[13] The sign test is used by Fatum and Hutchison (2003).

one, I (1), that is, stationary at first difference while the intervention series is stationary at level, that is, integrated of order zero, I (0).

The estimates of the mean equations show that direction of the exchange rate is mainly determined by its own lag value. Moreover, SBP foreign exchange interventions are also significant in changing the direction of the exchange rate, though with a very small magnitude (Table 2).

Similarly, the estimates of the variance equation depict the role of intervention in smoothing the exchange rate fluctuations (Table 2). The results show that SBP presence in the inter-bank market is effective in dampening the exchange rate volatility. However, the magnitude of the coefficient is again very small. Moreover, the coefficient of SBP support dummy indicates that SBP announcement to make oil payments from its reserves has also played a significant role in stabilizing the exchange rate. The results also show that GARCH model is highly significant in taking care of conditional heteroskedasticity in the exchange rate. Moreover, the sum of ARCH and GARCH coefficient is less than unity which indicates the stability of the model.[14]

5.2. Non-parametric Test: Event Study

To capture the behavior of Pak Rupee against US dollar, the APPENDIX identifies 137 intervention events over the sample period. It describes the

Table 2. Dependent Variable: Δ*ER*
(Convergence achieved after 64 iterations)

	Coefficient	Std. Error	z-Statistic	Prob.
INT	0.0001	0.00	-2.00	0.05
Δ(ER(-1))	0.3724	0.03	13.56	0.00
Variance Equation				
C	0.00	0.00	9.2	0.00
h_{t-1} [ARCH(1)]	0.17	0.02	11.6	0.00
ε^2_{t-1} [GARCH(1)]	0.80	0.001	100	0.00
INT	-9E-07	0.00	-4.2	0.00
Dsup	-3E-05	0.00	-6.2	0.00

R-squared: 0.15, Adjusted R-squared: 0.14, Durbin-Watson stat: 1.86, S.E. of regression: 0.04.

[14] The normality of residual was also checked by applying the Jarque-Bera test. The Correlogram of residual at the level and square was also tested. The errors were also found to be random rather than systematic. All these tests show the robustness of the model.

exchange rate movement during the pre-event and post-event windows, the total amount of intervention for each event and the number of days of intervention during the events. Moreover, 66 events were identified as "leaning against the wind" while 71 events were identified as "leaning with the wind". Similarly, 71 events witnessed net absorptions while 66 events witnessed net injection by the SBP.

Table 3 explains the Sign Test results on the net absorption and net injections separately. Regarding the results based on the *Direction Criterion*, 41 out of the 71 net absorption events and 39 out of 66 net injection events were successful. On the whole, 80 out of 137 events were successful in altering the direction of exchange rate in the post-event window according to the direction criterion.[15]

Similarly, "reversal" criterion applied on the "leaning against the wind events" show 24 out of the 31 events of net absorption and 19 out of 35 events of net

Table 3.Total Intervention in Inter-bank Market
(5-Day " tranquility" definition and two day event windows)

Non-parametric Sign Test of " Direction"

	Number of Events	Number of Successes	P-Value
USD Purchases	71	41	0.04
USD Sales	66	39	0.03
Total Purchases and Sales	137	80	0.01

Non-parametric Sign Test of " Reversal"

	Number of Events	Number of Successes	P-Value
USD Purchases	31	24	0.00
USD Sales	35	19	0.12
Total Purchases and Sales	66	43	0.00

Non-parametric Sign Test of " Smoothing"

	Number of Events	Number of Successes	P-Value
USD Purchases	31	27	0.00
USD Sales	35	27	0.00
Total Purchases and Sales	66	54	0.00

[15] It is possible that the objective may not always be to alter the exchange rate. Edison et al. (2003) argue that the intervention in the foreign exchange market may have different objective, for example, to correct the misalignment, to manage the disorderly market, to signal/accommodate monetary policy and to build reserves.

injection as successful. Likewise, as a whole, 43 events out of the total 66 events of SBP intervention in the inter-bank market were identified as successful.

Based on the results of Sign Test according to “smoothing” criterion, 27 events of net absorption and net injection each were successful. Thus almost 80 percent of the total interventions of SBP in the inter-bank market were successful in smoothing the fluctuations in the exchange rate. Moreover, in the entire three criterions the null hypothesis of no link between the intervention events and the subsequent short-run exchange rate movements is clearly rejected.

To sum up, the results of the non-parametric Sign Test suggests that SBP was successful in altering the level as well as in dampening the volatility in the exchange rate. However, the effectiveness was more pronounced in the case of smoothing the exchange rate fluctuation as against altering the direction of the exchange rate.

6. Conclusion

The study has used both the parametric and non-parametric techniques to conduct the analysis of the effectiveness of foreign exchange intervention. It identifies the change in the direction and smoothing of exchange rate fluctuations as the measure of effectiveness and uses daily data on exchange rate and net absorption to conduct the very analysis. GARCH results indicate that intervention was effective in altering both the direction of the exchange rate as well as in smoothing the exchange rate fluctuations. However, the magnitude of the coefficient was very small. The results also show the announced intervention to be effective in smoothing the exchange rate fluctuations.

On account of the simultaneous determination of the exchange rate and intervention, there are some concerns on the use of this methodology in the intervention literature. To address this concern another common approach of event study in the financial literature was used. The non-parametric Sign Test based on the criteria of direction, reversal and smoothing was applied on the events defined in the study. The results of the event study confirmed the effectiveness of intervention on both the level and volatility of the exchange rate. Nevertheless, the effects of intervention on dampening the exchange rate volatility are more pronounced as compared to the effect on the level.

In a nutshell, the empirical evidence suggests that SBP has been successful in smoothing the fluctuations in the exchange rate through the intervention.

Moreover, the Bank has also been successful in altering the exchange rate level to some extent as well.

The use of event study and high frequency intra-day data has contributed significantly in increasing the understanding on the subject. The current study has used the event study in Pakistan's case but due to data constraints the intra-day data could not be used. The use of intra-day data on exchange rate in Pakistan's case may help in providing some other useful insights on the subject.

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Appendix: Total Intervention in the Inter-bank Market
(5 days "tranquility" definition, 2-day window length)

Date of Event	Average daily % change in the PKR/USD exchange rate over preceding two days	Total Amount Million US$	Number of days of intervention during the period	Average daily % change in the PKR/USD exchange rate over subsequent two days
Nov 01,02-Aug 15,03	0.061	3444	160	-0.048
Aug 26,03-Sep 29-03	-0.002	109.5	14	0.003
Oct 14,03-Nov 07-03	-0.009	153	13	-0.016
Nov 17,03-Mar 05-04	0.082	656.7	45	-0.002
Mar 16,04-Mar 19-04	-0.025	-21.6	3	-0.029
Mar 22,04	-0.029	1	1	0.042
Mar 25,04	-0.010	-25	1	0.073
Apr05,04-Apr 10-04	0.001	17	2	-0.054
Apr12,04-Apr 14-04	-0.042	-14	2	0.010
Apr15,04	-0.031	1	1	0.012
Apr22,04	-0.002	-10	1	-0.009
Apr23,04-Apr 24,04	-0.001	5	1	0.019
May05,04-May 24,04	0.012	-164.3	12	-0.029
May 25,04-May 26,04	0.037	5	1	-0.013
May27,04-June26,04	0.029	-183.5	19	-0.060
June 28,04	0.018	85	1	-0.014
June 29,04-Jul 29,04	-0.026	-370.2	21	-0.045
Jul 30,04	-0.055	6	1	-0.061
Jul 31,04-Aug 26,04	-0.046	-184	15	0.006
Aug 27,04-Aug 30,04	0.037	10	1	0.005
Aug31,04-Sep 08,04	0.005	-45	4	-0.013
Sep 15,04-Dec 09,04	-0.024	-1137.5	44	-0.012
Dec 10,04-Dec11,04	0.006	5.7	1	-0.069
Dec 13,04-Dec16,04	-0.025	-106.5	3	0.146
Dec 17,04-Dec21,04	-0.143	0.8	1	0.102
Dec 22,04-Dec28,04	-0.015	-88.7	5	-0.054
Dec 29,04-Jan 03,05	0.060	41.6	3	-0.056
Jan 04,05-Jan 12,05	0.027	-143.1	6	0.090
Jan 13,05-Jan 17,05	0.005	17.3	2	0.045
Jan 18,05	0.020	-17.1	1	0.086
Jan 19,05	-0.024	50	1	0.122
Jan 24,05	0.045	-22.5	1	0.069
Jan 25,05-Jan 26,05	0.086	49	2	-0.021
Jan 27,05-Feb 02,05	0.069	-66	5	-0.005
Feb 03,05	0.002	13	1	-0.017
Feb 04,05-Feb 16 ,05	0.004	-106.4	7	0.007

Cont…

Appendix Continued

Date of Event	Average daily % change in the PKR/USD exchange rate over preceding two days	Total Amount Million US$	Number of days of intervention during the period	Average daily % change in the PKR/USD exchange rate over subsequent two days
Feb 17,05-Feb 21 ,05	-0.010	64.1	2	0.017
Feb 22 ,05	0.011	-19.7	1	-0.009
Feb 23,05-Mar 10 ,05	0.028	207.9	12	-0.003
Mar11,05-Mar 14 ,05	-0.002	-10.6	2	-0.019
Mar15,05-Mar 17 ,05	0.876	14.5	3	-0.021
Mar18,05-Mar 22 ,05	-0.021	-54.6	3	0.043
Mar24,05-Mar 26 ,05	-0.003	55.9	2	-0.032
Mar28,05-Mar 29 ,05	-0.032	-34.2	1	-0.005
Mar30,05-Mar 31 ,05	-0.032	50.1	2	-0.002
Apr 01,05-Apr 02 ,05	-0.005	-27.2	1	0.002
Apr 04,05-Apr 09 ,05	-0.002	40.6	4	0.043
Apr 12 ,05	0.021	4	1	-0.016
Apr 13 ,05	0.043	-12.7	1	-0.019
Apr 14 ,05	-0.001	52.7	1	-0.021
Apr 15,05-Apr 23 ,05	-0.016	-19.9	3	-0.013
Apr 25 ,05	0.005	0.6	1	-0.014
Apr 26,05-Apr 28 ,05	-0.004	-7.7	2	-0.007
Apr 29,05-Apr 30 ,05	-0.008	3.9	1	-0.013
May 02,05-May04 ,05	-0.007	-45.6	2	-0.014
May05 ,05	-0.017	4	1	0.002
May 06,05-May11 ,05	-0.019	-43	3	0.015
May12 ,05	0.002	24	1	0.018
May 13,05-May18 ,05	0.015	-126.8	4	-0.005
May 19,05-May23 ,05	-0.003	54.3	3	-0.007
May24 ,05	0.000	-23.8	1	-0.004
May25 ,05	-0.012	2.4	1	-0.012
May 26,05-Jun 01,05	-0.007	-41.9	3	-0.039
Jun 02,05-Jun 04,05	-0.040	26.9	2	-0.007
Jun 06,05	-0.023	-11.6	1	0.001
Jun 07,05-Jun 08,05	-0.017	2.2	2	0.016
Jun 09,05	0.001	-2.9	1	0.015
Jun 10,05-Jun11,05	0.000	24.1	1	-0.008
Jun 13,05-Jun15,05	0.015	-24.3	3	-0.012
Jun 16,05-Jun17,05	-0.014	68.8	2	-0.021
Jun 18,05-Jul07,05	-0.012	-211.2	12	0.035
Jul08,05	0.011	1.7	1	-0.003
Jul 09,05-Jul19,05	0.023	-111	6	-0.001
Jul 20,05-Jul23,05	-0.013	46.5	3	0.001

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Appendix Continued

Date of Event	Average daily % change in the PKR/USD exchange rate over preceding two days	Total Amount Million US$	Number of days of intervention during the period	Average daily % change in the PKR/USD exchange rate over subsequent two days
Jul25,05	-0.002	-24.3	1	0.007
Jul26,05	-0.006	25.8	1	0.001
Jul 27,05-Aug 01,05	0.001	-34.2	4	-0.003
Aug 02,05	-0.004	9.5	1	-0.013
Aug 03,05-Aug 06,05	-0.002	-70.7	3	-0.012
Aug 08,05	0.000	12.4	1	-0.022
Aug 09,05-Aug 11,05	-0.001	-114.5	3	0.022
Aug 12,05-Aug 13,05	-0.017	23.9	1	-0.009
Aug 15,05	0.022	-6.8	1	0.004
Aug 16,05-Aug 18,05	0.003	46.2	2	-0.001
Aug 19,05-Aug 25,05	0.001	-149.3	5	0.027
Aug 26,05-Aug 27,05	-0.003	5.2	1	-0.037
Aug 29,05-Aug 30,05	0.027	-69	2	-0.001
Aug 31,05	-0.037	1	1	-0.015
Sep 01,05-Sep 05,05	-0.003	-28.3	2	-0.021
Sep 06,05	-0.008	13.7	1	0.001
Sep 07,05	-0.016	-9	1	0.003
Sep 08,05	-0.021	4	1	-0.006
Sep 09,05-Sep 10,05	0.001	26.2	2	-0.001
Sep 12,05-Sep 15,05	-0.006	65	4	-0.037
Sep 16,05-Oct 20,05	-0.071	-636.4	23	0.007
Oct 21,05-Oct 22,05	0.009	46	1	-0.012
Oct 24,05-Oct 26,05	0.007	-17.7	3	0.017
Oct 27,05	-0.020	5.9	1	0.004
Oct 28,05-Oct 31,05	0.008	-51.5	2	-0.001
Nov01,05-Nov 02,05	0.004	3.8	2	-0.020
Nov07,05-Nov 21,05	-0.001	-297.4	9	0.089
Nov 22,05	0.012	1.5	1	0.019
Nov23,05-Nov 29,05	0.063	-123.2	4	-0.009
Nov30,05-Dec 01,05	-0.002	52.7	2	-0.029
Dec02,05-Dec 07,05	-0.009	-73.7	4	0.019
Dec08,05-Dec 12,05	0.019	86.2	3	-0.036
Dec13,05-Dec 14,05	-0.010	-36.8	2	-0.029
Dec15,05-Dec 17,05	-0.036	91.3	2	0.001
Dec 19,05	-0.013	-56.7	1	0.075
Dec20,05	-0.030	7.2	1	0.042
Dec21,05-Dec 22,05	0.001	-6.6	2	0.008
Dec23,05-Dec 26,05	0.042	12.3	1	0.008

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Appendix Concluded

Date of Event	Average daily % change in the PKR/USD exchange rate over preceding two days	Total Amount Million US$	Number of days of intervention during the period	Average daily % change in the PKR/USD exchange rate over subsequent two days
Dec27,05-Dec 28,05	0.028	-61.4	2	-0.015
Dec29,05-Dec 31,05	0.003	51.3	2	-0.062
Jan 03,05Jan 09,05	0.031	-145.8	5	-0.004
Jan 13,05Jan 16,05	0.018	9.3	1	-0.013
Jan 17,05	-0.031	-33.2	1	0.038
Jan 18,05Jan 28,05	-0.052	149.3	8	-0.014
Jan 30,05	0.012	-30.4	1	-0.055
Jan 31,05	-0.011	0.7	1	-0.033
Feb01,05 Feb 02,05	-0.014	-43.1	2	0.027
Feb03,05 Feb 06,05	-0.033	17.2	2	0.012
Feb 07,05	0.008	-23.8	1	0.008
Feb10,06 Feb13,06	-0.009	27.8	2	-0.009
Feb14,06 Feb15,06	-0.029	-17.2	2	-0.003
Feb 16,06	-0.009	14.7	1	-0.042
Feb17,06 Feb23,06	0.009	-117	4	0.120
Feb 24,06	0.009	27.1	1	0.060
Feb25,06 Feb27,06	0.065	-22.8	1	-0.079
Feb 28,06	0.060	34	1	-0.065
Mar01,06 Mar09,06	-0.017	-101.1	7	0.001
Mar10,06	-0.007	7.1	1	-0.024
Mar11,06 Mar14,06	0.011	-36.6	2	-0.072
Mar15,06	-0.034	38.9	1	-0.031
Mar16,06 Mar21,06	-0.127	-143.5	4	0.104
Mar22,06 Mar25,06	-0.004	89	2	0.045
Mar27,06 Mar31,06	0.116	-187.8	5	-0.026