Exchange Market Pressures and Monetary Policy: Empirical Investigation of the Pakistani Experience

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Abstract

This paper has two primary objectives. The first is to construct an exchange market pressure index (EMPI) by using a structural vector auto regression (SVAR) model for the period from January 1991 to April 2019 in Pakistan[3]. The second is to assess the effectiveness of monetary policy in controlling foreign exchange market pressures. We find that the central bank of Pakistan actively participated in the foreign exchange market to keep exchange rate parity overvalued. We also find several episodes in which the central bank did not allow the exchange rate to change despite heavy pressures in the exchange market. Consequently, Pakistan has exhausted USD 112 billion to provide market support to keep exchange parity at a prescribed level. Also, if policymakers had not attempted to manage the exchange rate, the current parity level would be around Rs. 177.43 per dollar, which is only Rs. 35.92 higher than the current exchange rate of Rs. 141.51 per dollar. Lastly, the monetary policy is effective in controlling short-term exchange market pressures in Pakistan, but the policy is ineffective in the medium and long term. Therefore, the central bank should not protect exchange rate parity through direct and indirect excessive interventions in the exchange market.

Keywords: Exchange Market Pressures, Intervention Index, Monetary Policy, SVAR model

JEL: C32, E 52, F31

1. Introduction

A consistently overvalued exchange rate has pushed the economy of Pakistan into a state of profound economic misery. The authorities approached the International Monetary Fund (IMF) for support after several imbalances. Specifically, the ambition to keep the exchange rate overvalued created large fiscal deficits that steadily depleted foreign exchange reserves and increased external and public debt. The current situation is no exception, as Pakistan approached the IMF for the third time during last decade and for the 22nd time overall. Interestingly, the underlying dynamics of the economy have not changed. That is, the authorities have tried to overvalue exchange rate parity despite several internal and external imbalances. Consequently, the foreign exchange reserves have been severely depleted. The depletion of foreign exchange reserves generated additional pressure on the foreign exchange market. This, in turn, led policymakers to quickly perform specific actions to avoid a currency crisis. Therefore, accurate measurements of the timing and the intensity of these pressures are crucial for policymakers to design appropriate and proactive strategies.

This measurement is straightforward to record in a country that follows a flexible market exchange regime because exchange market pressures fully reflect the movements of the exchange rate. However, the country allows only a particular portion of exchange market pressures to translate into exchange rate movement in the managed float exchange rate regime, with the remaining pressures managed via direct and indirect foreign exchange market interventions. Therefore, countries need to construct a measure that can account for the managed part of the

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[3] It's a Pre-COVID analysis.

pressures in addition to changes in the exchange rate.[4] This type of measure is referred to as an exchange market pressure index (EMPI) in the international economics literature.[5]

Pakistan adopted a *market-based* exchange rate regime in 1982. However, since then, the country has not allowed the exchange rate to reach its market value. Therefore, it is argued that exchange parity overvaluation has been the norm in Pakistan. Consequently, the protection of exchange rate parity has become so prevalent among policymakers that they have injected a massive amount of foreign exchange reserves to keep exchange rate parity at their *desired* levels. However, every effort they have made to keep the parity at the *desired* level in the medium term has resulted in the eventual depletion of international foreign exchange reserves, leaving the *country requiring bailout packages to make payments sustainable*. Therefore, Pakistan is an excellent setting for an in-depth analysis of exchange market pressures.

In addition, the literature reveals that monetary policy is used to manage exchange market pressures. However, there is a lack of convincing evidence that monetary policy can be used to control market pressures. Generally, the literature is divided into two major discussions. One discussion concludes that monetary policy is effective in controlling exchange market pressures (Tanner, 2000; Fiador & Biekpe, 2015; Panday, 2015) while the other highlights its ineffectiveness (Kyin et al., 2013; Akosah & Dasah, 2015)[6]. The State Bank of Pakistan (SBP) is not exempt. It intervenes in the money market through monetary policy and direct interventions in the open market.

As mentioned earlier, Pakistan has recently approached the IMF for the third time in the last decade. Surprisingly, the sequence of economic events in the years preceding these approaches have been similar. In each case, Pakistan kept domestic currency artificially overvalued for two to three years. This was followed by a substantial depreciation in the exchange rate, a drastic decrease in foreign exchange reserves, and a tightening of monetary policy in the year immediately before the IMF was approached for a bailout. For instance, in 2008, the local currency depreciated by 32 percent, foreign exchange reserves declined by 44 percent, and the policy rate climbed by 500 basis points in the year preceding the IMF program. A very similar turn of events occurred before the IMF program in 2013. The country witnessed a 15-percent depreciation of the local currency, a 40-percent decline in foreign exchange reserves, and a 100-basis-point increase in the policy rate. Before the current IMF program, the country witnessed a 47-percent decrease in the local currency, a 38-percent decline in foreign exchange reserves, and a 650-basis-point rise in policy rate. There is a clear link between monetary policy and exchange market pressures. The question is whether monetary policy interventions are effective.

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[4] Generally, these potential exchange rate changes are warded off by the central banks through market interventions to keep the value of the domestic currency near a certain pre-decided level.

[5] Girton and Roper (1977), Weymark (1995), Eichengreen et al. (1995), and Weymark (1997) explain that EMP is an aggregation of exchange parity movements, changes in a country's reserve holdings of foreign currency, and movements in interest rates. Exchange rate movements cover the fraction of pressures that the central bank has allowed to materialize. The movements in reserve holdings of foreign currencies and interest rate movements represent the fraction of market pressures managed and warded off by the central bank. The entire debate is on "what coefficient we should use for movement in country's reserve holding in foreign currency and interest rate movements."

[6] The ones that conclude ineffectiveness argue that the use of contractionary monetary policy complicates the scenario by adversely affecting the fiscal side and the growth trajectory. The high interest rates and increased cost of borrowing for the private sector will prevent growth. With these kinds of serious repercussions of contractionary monetary policy, one must be very sure about the usefulness of such a policy in controlling exchange market pressures.

Although there is some literature on the effectiveness of monetary policy in controlling exchange market pressures in developing countries, there is hardly any research on this topic in Pakistan specifically. Khawaja and Din (2007), Khan (2010), and Rao (2013) discussed the construction of an EMPI in Pakistan, but none of them discussed the effectiveness of monetary policy in controlling exchange market pressures. Moreover, the methodologies of constructing an EMPI can also be questioned on various grounds. Therefore, the present study offers two significant contributions to the existing literature. First, an accurate EMPI is constructed based on a model-dependent approach to separate the allowed and managed exchange market pressures. Second, the effectiveness of monetary policy in controlling the exchange market pressures is gauged.

There are three major findings of the present study. First, we find that the central bank has actively managed exchange market pressures through direct interventions. Pakistan has exhausted around USD 112 billion (more than its external debt level) to provide market support to keep the exchange rate at a prescribed level. Interestingly, the mentioned amount of foreign exchange reserves exceeds the country's total external debt. Second, we find that if policymakers had not attempted to manage the exchange rate, the current parity level would be around Rs. 177.43 per dollar, which is only Rs. 35.92 higher than the current exchange rate of Rs. 141.51 per dollar. Third, we find that the monetary policy remained effective in controlling short-term exchange market pressures, had no effect in the long term, and was counterproductive in the medium term. In the medium term, rather than controlling exchange market pressures, monetary policy itself creates them.

The rest of this article is divided into three sections. Section 2 elaborates the methodology and procedure of quantifying exchange market pressures and the effectiveness of monetary policy in controlling these pressures. The empirical findings are then presented in section 3. Specifically, we give estimates of the structural vector auto regression (SVAR) model. Then we discuss the EMPI and intervention index in detail to distinguish allowed exchange market pressures from managed exchange market pressures. A counterfactual analysis as compare to existing exchange rate parity is also presented in this section. Next, we describe an impulse response function to gauge the effectiveness of the monetary policy in controlling exchange market pressures. Lastly, section 4 provides the conclusions of this study.

2. Quantification of Exchange Market Pressures and the Effectiveness of Monetary Policy

Exchange market pressures can be quantified by an EMPI so that movements in exchange rate parity are properly managed and are not allowed via central bank interventions in the foreign exchange market. Initially, Weymark (1995) defined EMPI as:

$$empi_t = \Delta e_t + \eta \Delta res_t. \qquad 1$$

The first part of the right hand of equation 1 denotes the change in the exchange rate during period t (e_t). The second part shows the η weighted change in foreign exchange reserves. The second part is the managed part of the exchange market pressures. Most of the empirical work in the late 1990s and early 2000s was based on the work of Weymark (1995) and used change in foreign exchange reserves as a proxy for central bank intervention. However, Patnaik and Shah (2011) note that changes in foreign exchange reserves are not an appropriate proxy for this variable.

Therefore, Rao (2013) calculates EMPI by using actual intervention data in the case of Pakistan. The EMPI, then, can be defined as:

$$empi_t = \Delta e_t + \eta[int_t/fxinf_t], \qquad 2$$

where *int* represents central bank interventions through the purchase and sale of foreign exchange, and *fxinf* is foreign exchange inflows. The central issue in the construction of *empi* is the calculation of η. There are two major approaches for the calculation of η: the model-dependent approach and the model-independent approach. This study follows the model-dependent approach to assess the case of Pakistan.

The existing literature on the construction of exchange market pressures in Pakistan has two significant weaknesses.[7] First, almost all of the existing literature, except the study conducted by Rao (2013), has relied on the model-independent approach for the construction of an EMPI.[8] It is argued that EMPIs based on a model-independent approach are static and cannot adequately represent an economy across different structural phases.[9] However, in the model-dependent approach, the magnitude of direct and indirect interventions in foreign exchange markets has a close association with the overall structure of the economy. The effectiveness of foreign exchange interventions may vary when the structure of the economy is altered.

Second, almost all studies – again, except that conducted by Rao (2013) – have utilized changes in foreign exchange reserves to construct EMPIs. However, the economic literature suggests that an EMPI should be constructed using data pertaining to central bank interventions in the foreign exchange market.[10] Khawaja and Din (2007) and Khan (2010) have used changes in a country's foreign exchange reserve holdings in foreign currencies as a proxy for market interventions in foreign exchange markets.[11] We argue that changes in foreign exchange reserves could serve as a proxy for central bank interventions if those interventions are the only factor driving them. Indeed, this is not the case in Pakistan. Therefore, this proxy for interventions yields deceptive outcomes about the pressures in the presence of other contributing factors in foreign exchange reserves. Moreover, these studies take an implicit assumption that the economy works with stable structural relationships and the money demand function.[12] Surely, this assumption does not hold true for Pakistan. Therefore, we argue that an EMPI for Pakistan based on existing studies would not

[7] The literature in the case of Pakistan is scarce. See, for example, Khawaja and Din (2007), Khan (2010), and Rao (2013).

[8] In literature, there are two main strands on the construction of exchange market pressures: the model-dependent and the model-independent approaches. The former approach was initiated by Girton and Roper (1977) and popularized by Roper and Turnovsky (1980) and Weymark (1995). This approach advocates the use of a stochastic macro model to construct an EMPI. Protagonists of the second strand campaign for not using the macro model for EMPI construction (Eichengreen *et al.* 1995, Kaminsky and Reinhart 1999, and Pontines and Siregar 2007).

[9] Roper and Turnovsky (1980) and Weymark (1995) have indicated that the economy is not static over time. Hence, static parameters cannot represent the economy over time.

[10] Girton and Roper (1977), Roper and Turnovsky (1980), Weymark (1995), Eichengreen *et al.* (1995), Kaminsky and Reinhart (1999), and Pontines and Siregar (2007).

[11] The monetary authority intervenes in the foreign exchange market through the injection and mopping up of foreign currency in ready and forward markets. However, the governments/authorities generally claim that no market interventions should be carried out to support the exchange rate and, thus, force central banks to provide public data on the level of interventions. This generates another problem of how to find an appropriate proxy for the central bank's direct interventions.

[12] For example, expenditure patterns, saving behaviors, and the general attitudes of economic agents.

accurately represent the fundamental pressures facing Pakistan's economy. Hence, using such an EMPI to assess the effectiveness of monetary policy would lead to misleading conclusions.

Before moving to the assessment of the effectiveness of monetary policy, we calculate η for the construction of an EMPI by using a model-dependent approach by augmenting the framework of Tanner (2000). Generally, the existing literature on EMPIs in developing countries uses Tanner's (2000) model. However, this model is not representative of developing countries. Tanner (2000) ignores many important factors like trade dynamics and the fiscal behavior of the government. Therefore, Tanner's model suffers from omitted variable bias when used in developing countries. The current study has addressed this issue in the case of Pakistan. Specifically, we construct an EMPI through a model-dependent approach by using an SVAR model. This study also offers an intervention index that reflects the size of pressures warded off by the central bank of Pakistan from January 1991 to April 2019.

Six essential variables are used to calculate EMPI. These are output (denoted by *y*), interest rate (denoted by *i*) exchange rate (denoted by *e*), inflation (denoted by π), private sector credit (denoted by *psc*), and state bank interventions (denoted by *int*). To calculate EMPI, we set up a six-equation macro model for an open economy in SVAR settings. Theoretical restrictions are applied.[13] The resultant SVAR model is as follows:

$y_t = \beta_{10} + \beta_{14} i_t + \beta_{16} e_t + \varepsilon_t^y$	Dynamic IS equation	3
$\pi_t = \beta_{20} + \beta_{21} y_t + \beta_{24} i_t + \beta_{26} e_t + \beta_{27} E_t[\pi_{t+1}] + \varepsilon_t^\pi$	Dynamic Philips Curve	4
$psc_t = \beta_{30} + \beta_{31} y_t + \beta_{34} i_t + \varepsilon_t^{psc}$	Credit Dynamics	5
$i_t = \beta_{40} + \beta_{41} y_t + \beta_{42} \pi_t + \beta_{46} e_t + \varepsilon_t^i$	Monetary Policy Function	6
$INT_t = \beta_{50} + \beta_{54} i_t + \beta_{56} e_t + \varepsilon_t^{INT}$	Intervention Equation	7
$e_t = \beta_{60} + \beta_{62} \pi_t + \beta_{64} i_t + \beta_{65} INT_t + \varepsilon_t^e$	Exchange Rate Equation	8

Following the literature, we utilize output (denoted by *y*) with a large-scale manufacturing index due to limitations regarding the monthly frequencies of available data in Pakistan. The monthly data for January 1991 to April 2019 are taken from the Pakistan Bureau of Statistics. Researchers have used several indicators to represent interest rates. This study uses the T-bill rate with a three-month maturity for two reasons. First, T-bills were the primary policy rate for markets before 2007-08. Second, all the other rates follow changes in T-bill rates with a maturity of three months. The monthly data for January 1991 to April 2019 are acquired from the SBP.

The exchange rate is quantified through a weighted average exchange rate and taken from the SBP. The consumer price index is used to signify inflation. The monthly data from January 1991 to April 2019 are taken from the Pakistan Bureau of Statistics. Given the constraints on rational expectations, this study has relied on adaptive expectations to model the expectation component for the dynamic Philips curve. A lagged value of consumer-price-index-based inflation is used as an adaptive expectation.

We use credit disbursements to model the credit dynamics of the private sector. The dynamics of private sector credit are important in developing an EMPI. An EMPI explains the dynamics of

[13] The behaviors of the equations and restrictions are based on existing literature in the context of Pakistan.

growth in domestic credit and the resultant monetary base from domestic sources. The monthly data for January 1991 to April 2019 are acquired from the SBP.

The data series of the central bank's interventions is not directly available. Therefore, we use different sources to prepare this series. First, data from January 2004 to June 2012 are directly acquired from the SBP. After this, data sharing was discontinued by SBP. The data from July 2012 onwards and for the period from January 1991 to December 2003 are constructed based on foreign exchange reserves. There are several factors which can generate foreign exchange reserves (e.g., debt servicing, accumulation of new debt, financing of balance of payment deficits, interventions in the exchange market). The data related to all indicators, except market interventions, are publicly available. Therefore, it is feasible to construct a data series for market intervention based on the residual of the equation. Principal sources of this data and their causative factors are the SBP, Debt Coordination Office of Ministry of Finance, and the Economic Advisors' Wing of the Ministry of Finance.

2.1 The Effectiveness of Monetary Policy in Controlling Pressures

The second significant contribution of the present study is its assessment of the effectiveness of monetary policy to control exchange market pressures. As mentioned earlier, Tanner's (2000) model cannot be generalized to all economies due to its omitted variable bias. Specifically, it overlooks some critical factors which may severely affect an economy like Pakistan's. For example, fiscal and trade dynamics are totally ignored by Tanner (2000). Due to the present Pakistani economy, fiscal dynamics and trade dynamics cannot be ignored. It is argued that intense pressures are piling up from the fiscal and the external side. With this argument in mind, we set up a macro model for the effectiveness of monetary policy in controlling the EMPI.

$$FD_t = \alpha_{10} + \alpha_{12}y_t + \alpha_{15}i_t + \alpha_{16}TD_t + \varepsilon_t^{FD} \quad \text{Dynamic fiscal discipline} \quad 9$$

$$y_t = \alpha_{20} + \alpha_{21}FD_t + \alpha_{24}PSC_t + \alpha_{25}i_t + \varepsilon_t^{y} \quad \text{Output function} \quad 10$$

$$\pi_t = \alpha_{30} + \alpha_{32}y_t + \alpha_{35}i_t + \alpha_{37}EMP_t + \varepsilon_t^{\pi} \quad \text{Dynamic Inflation} \quad 11$$

$$PSC_t = \alpha_{40} + \alpha_{41}FD_t + \alpha_{42}y_t + \alpha_{45}i_t + \varepsilon_t^{PSC} \quad \text{Financial Sector} \quad 12$$

$$i_t = \alpha_{50} + \alpha_{52}y_t + \alpha_{53}\pi_t + \alpha_{57}EMP_t + \varepsilon_t^{i} \quad \text{Taylor rule} \quad 13$$

$$TD_t = \alpha_{60} + \alpha_{62}y_t + \alpha_{63}\pi_{t_t} + \varepsilon_t^{TD} \quad \text{Trade Dynamics} \quad 14$$

$$EMPI_t = \alpha_{70} + \alpha_{71}FD_t + \alpha_{74}PSC_t + \alpha_{75}i_t + \alpha_{76}TD_t + \varepsilon_t^{EMP} \quad \text{EMP} \quad 15$$

Three critical variables are added to this model: fiscal behavior (denoted as *FD*), trade dynamics (denoted as *TD*), and EMPI. Monetary and fiscal policies work in tandem, and it is impossible to gauge the effectiveness of a single policy in isolation. Thus, the major shortcoming of Tanner's (2000) model is that it ignores fiscal behavior while assessing the effectiveness of monetary policy. Generally, fiscal behavior is derived from the gap between government revenue and expenditures. However, data on revenue and expenditure numbers are not available at a monthly frequency in Pakistan. To overcome this constraint, we have utilized the monthly borrowing of the government as a proxy for the government's fiscal behavior. Intuitively, governments rely on banking systems to finance their day-to-day fiscal deficits. The relevant data

from January 1991 to April 2019 is acquired from the SBP. The variable of trade dynamics is constructed by utilizing monthly information regarding exports and imports and is also taken from the SBP. We constructed the EMPI by using equation 2.

3. Empirical Findings

3.1. Unit Root Test

The natural start of any time series analysis is to test the stationarity properties. We follow the standard practice and use the augmented Dickey-Fuller test for this purpose. We find that difference data is stationary at first and perfectly suits the estimation of the SVAR.[14]

3.2. Construction of Exchange Market Pressures Index

The results of the estimated SVAR are presented in Table 1. Almost all variables enter the regressions according to a priori expectations. However, the coefficient of $\boldsymbol{\beta_{65}}$ is the most important outcome for this study. Girton and Roper (1977), Roper and Turnovsky (1980), and Weymark (1995) have explained that an EMPI is the aggregate of exchange rate movements and the pressure not allowed to materialize. The portion which is not allowed to materialize needs a weight so that the managed part of equation 1 can be constructed. The estimated coefficient $\boldsymbol{\beta_{65}}$ provides this weight and enables the aggregation of the allowed and managed parts of the EMPI in our case.

The coefficient indicates the presence of a statistically significant negative association between the central bank's intervention and exchange rate movements. This implies that an increase in central bank interventions helps to keep the domestic currency at an appreciated level. The model diagnosed two lags as the optimal lag length. Hence, the impact of central bank interventions is transitory. This conclusion is consistent with economic intuition. Theoretically, an exchange rate reflects the mismatch between the supply and demand of an exchange rate. The central bank's interventions can bridge only the gap between supply and demand for a specific period. If a country decides to keep its local currency overvalued, then its central bank must continue intervening in the market. Otherwise, as soon as the gap is not bridged, the parity will change.

3.3. Exchange Market Pressures Index (EMPI)

We construct an EMPI by using equation 2, with β_{65} serving as η. Figure 1 illustrates the allowed and warded off components of the exchange market pressures. The dotted line represents the pressures warded off. Pakistan has a long history of controlling exchange market pressures through direct interventions in the foreign exchange market. The positive portion of the dotted line shows that central bank interventions have largely remained positive. This implies that the SBP has injected foreign exchange liquidity into the market by selling foreign exchange. The negative portion of the dotted line represents periods when the SBP opted to build reserves by mopping up the foreign currency from the exchange market.

The solid line in Figure 1 represents the exchange market pressures that policymakers allowed to materialize. The results support the hypothesis that exchange market pressures in Pakistan are generally not allowed to materialize. Several episodes have occurred in which the line remains at zero for a relatively long time. This implies that the SBP has decided not to allow pressures to materialize. Indeed, such periods have corresponded with central bank interventions and have been followed by an overvaluation of the exchange rate. These findings support the proposition that

[14] We are not reporting results for the purpose of brevity.

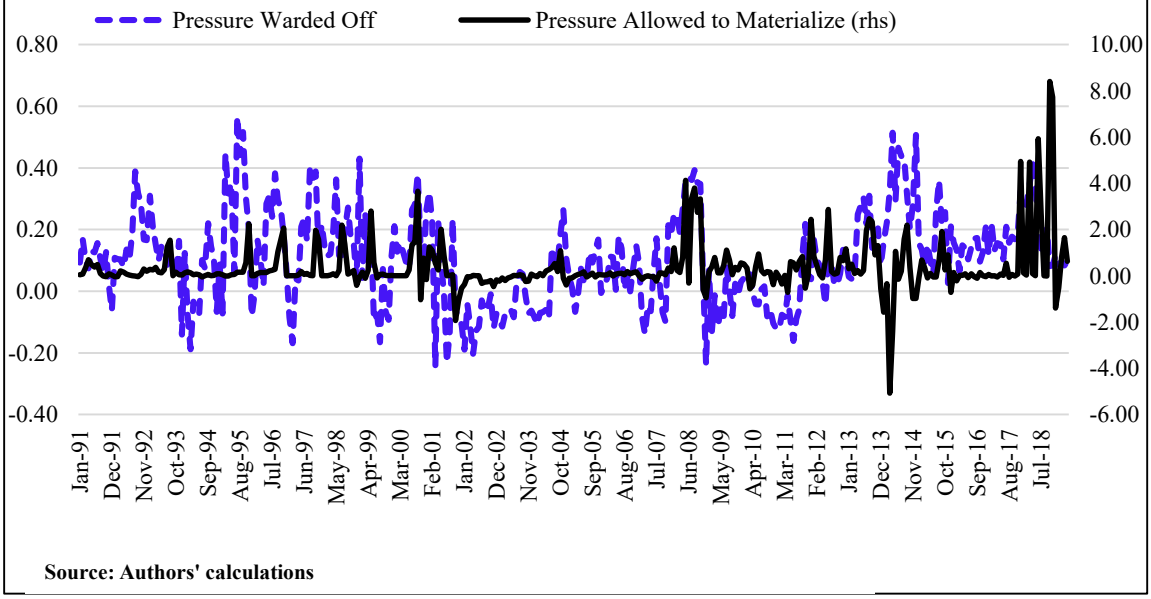
protecting exchange parity is so important to policymakers that they try to use foreign exchange reserves to protect parity and keep it at a desired level.

Table 1. Estimates of Structural VAR models

Panel a: Construction of Exchange Market Pressure Index (from equation 3 to 8)				**Panel b:** Effectiveness of Monetary Policy (from equation 9 to 15)			
Parameters	**Estimates**	**Parameters**	**Estimates**	**Parameters**	**Estimates**	**Parameters**	**Estimates**
β_{14}	-0.0296***	β_{54}	-0.0225**	α_{12}	0.0447*	α_{45}	-0.0116***
	(0.0089)		(0.0102)		(0.0237)		(0.0017)
β_{16}	0.0149***	β_{56}	1.8986***	α_{15}	0.0115***	α_{52}	0.1239**
	(0.0053)		(0.4583)		(0.0036)		(0.0547)
β_{21}	0.1144***	β_{62}	0.0981	α_{16}	0.0327**	α_{53}	0.0398***
	(0.0366)		(0.0879)		(0.0147)		(0.0067)
β_{24}	-0.1258**	β_{64}	-0.0028***	α_{21}	-0.0784**	α_{57}	0.2715***
	(0.0562)		(0.0012)		(0.0302)		(0.0336)
β_{26}	0.1479***	β_{65}	**-0.6244****	α_{24}	1.6246***	α_{62}	0.4950
	(0.0634)		(0.1349)		(0.2389)		(0.3115)
β_{27}	0.0317***	--	--	α_{25}	-0.0119***	α_{63}	0.6672**
	(0.0110)	--	--		(0.0037)		(0.2979)
β_{31}	0.8573***	--	--	α_{32}	-0.0140***	α_{71}	1.6788
	(0.2120)	--	--		(0.0046)		(1.4921)
β_{34}	-0.0553***	--	--	α_{35}	-0.0111***	α_{74}	-1.3272
	(0.0118)	--	--		(0.0027)		(2.7518)
β_{41}	-0.0139	--	--	α_{37}	0.0013***	α_{75}	**-0.2348****
	(0.0119)	--	--		(0.0004)		(0.0924)
β_{42}	0.0874***	--	--	α_{41}	-0.0959***	α_{76}	0.0004*
	(0.0121)	--	--		(0.0280)		(0.0002)
β_{46}	0.2147***	--	--	α_{42}	0.0779***	--	--
	(0.0652)	--	--		(0.0115)	--	--

Note: Standard errors are presented in parentheses. *, ** and *** implies 10 %, 5% and 1 % level of significance respectively.

Figure 1: Mananged vs Allowed Exchnage Market Pressures



Source: Authors' calculations

3.4. Construction of the Intervention Index

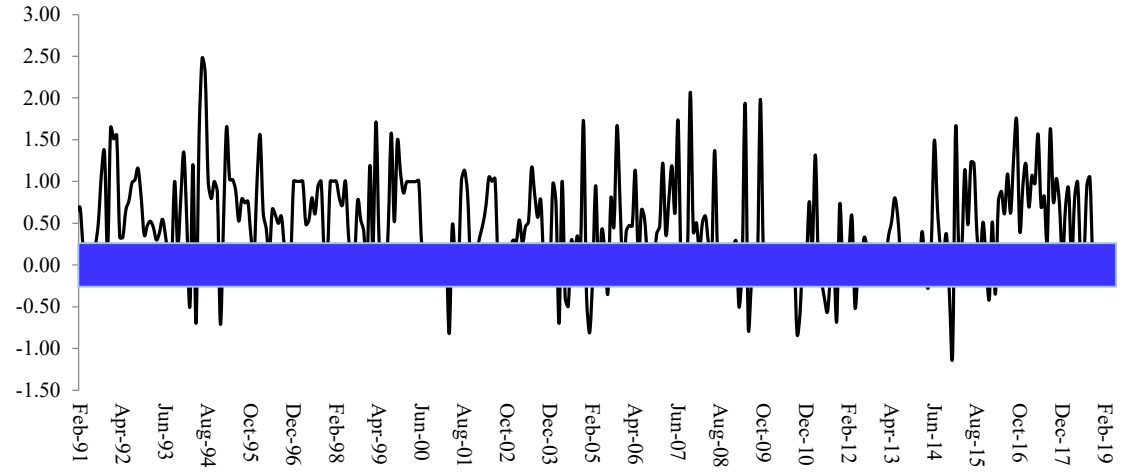
The downside of managing a portion of exchange market pressures is difficult to elaborate intuitively, and this matter limits its usage by policymakers. Therefore, it is preferred to use an intervention index instead of absolute data for the managed part of equation 1. The intervention index is used to calculate the portion of currency pressures relieved by the central bank. More specifically, it is the proportion of managed exchange market pressures in relation to external market pressures.

The intervention index is calculated as:

$$II_t = \frac{\eta[INT_t/FX\ INF_t]}{\Delta e_t + \eta[INT_t/FX\ INF_t]} \qquad 16$$

Generally, intervention indices should be between $-\infty < \text{II} < \infty$. We can think of several possible values for II. First, a value of zero implies that the exchange rate regime is entirely flexible. Second, if the value of II is 1, the exchange rate regime is fixed. Third, if the value of II varies between zero and one, this implies that the country is following managed floating exchange rate regime. There are two other possibilities. A negative value indicates that the central bank has implemented a leaning with the wind policy. In other words, the central bank bought foreign currency from the market in the presence of descending pressures on the local currency. If the value of the index exceeds one, this indicates that the central bank intervened too much when managing pressures. As such, the exchange rate moved in the opposite direction of the market forces. The SBP has continued to intervene in such a way since January 1991 (Figure 2). We also find a few instances in which the central bank practiced a leaning with the wind policy.

Figure 2: Intervention Index (Fraction of Total Market Pressures)



Source: Authors' calculations

There is a provision for central bank intervention under the managed floating exchange rate regime to avoid excess volatility in the exchange rate parity. The central bank of Pakistan can use this provision to avoid excess volatility. If this is the case, then there should be a limit to the bank's ability to manage this provision. We assume that the portion of managed pressures should not exceed one-fifth of the total pressures. Following this recommendation would cause exchange rate

movements to stabilize.[15] On the other hand, if the proportion of managed pressures is beyond 20 percent of the total market pressure, then the intervention is not intended to curb excess volatility but rather to keep parity at some desired level.

The shaded blue area in Figure 2 represents the tolerance band of 20 percent. Pakistan has traditionally intervened in the market at levels beyond this tolerance level. This may imply that interventions are carried out to keep parity at some desired level instead of to curb excess volatility. Interestingly, the central bank has frequently managed more than 100 percent of market pressures and has been successful in changing the direction of the exchange rate movement. Ironically, almost every one of these instances has been followed by a leaning with the wind policy by the central bank. Consequently, the central bank has not only exhausted excessive amounts of foreign exchange reserves to restrict exchange rate movements but has also witnessed depreciation.[16]

3.5. Impact of Central Bank Intervention on Exchange Rate

Impulse responses arise from using the results of the SVAR model to estimate the impact of one variable on another variable. Figure 3 portrays the impulse responses of the exchange rate to one standard deviation shock in central bank interventions. It is evident that the effects related to exchange parity management in response to the interventions made by the central bank only last for a short time. This result is consistent with the common knowledge that central bank interventions can bridge the gap between demand and supply only for a very short time. Baig et al. (2003) relate this to the signaling effects of exchange rate interventions. Economic theory suggests that an increase in the amount of information available to stakeholders makes it harder for anticipated responses between different interventions to be segregated. As is the case with access to information, stakeholders can incorporate potential policy changes into their behavior and, hence, can create a kind of non-response to different policy interventions. Under such circumstances, unanticipated policy shocks are helpful, as the market cannot predict and incorporate the policy changes early.

3.6. Counterfactual Analysis

We present exchange rates with interventions (actual exchange rate) and without interventions (counterfactual exchange rate) in Figure 4. The dotted line represents the exchange rate in the absence of any intervention (i.e., without any management) during the sample period. The central bank was able to manage the exchange rate by only Rs. 35.92 at a considerable cost. We estimate that the central bank has spent USD 112 billion since January 1991 to defend the overvalued parity. These reserves are provided for direct interventions in the exchange market. The solid line in the graph represents the prevailing exchange rate, which incorporates the impact of management. The model suggests that, had there been no interventions, the exchange parity for April 2019 would have been Rs. 177.43 per dollar (the actual exchange rate is Rs. 141.51 per dollar). These numbers suggest that the management of the exchange rate regime through market interventions has failed.

[15] We have assumed that the tolerance level is 20 percent. It could be more or less than this.

[16] It is obvious that when the foreign exchange reserves remain at a minimum critical level, the central bank must buy from the market in the absence of foreign flows. This act of the central bank applies pressure to the exchange rate parity.

Figure 3: Response of Exchange Rate to Structural one SD shock in Intervention

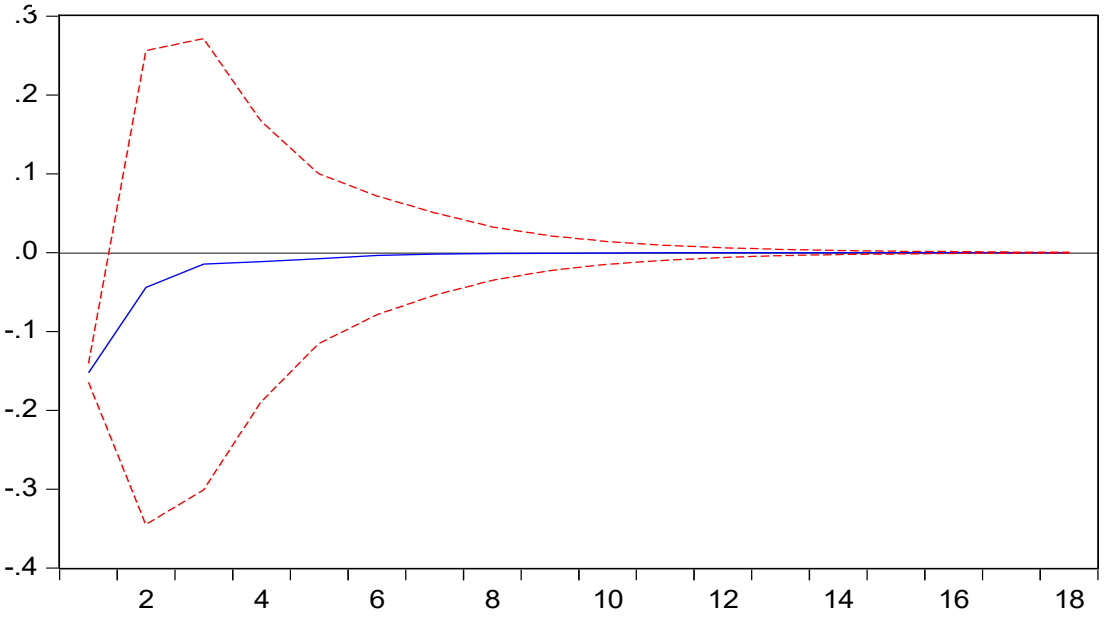
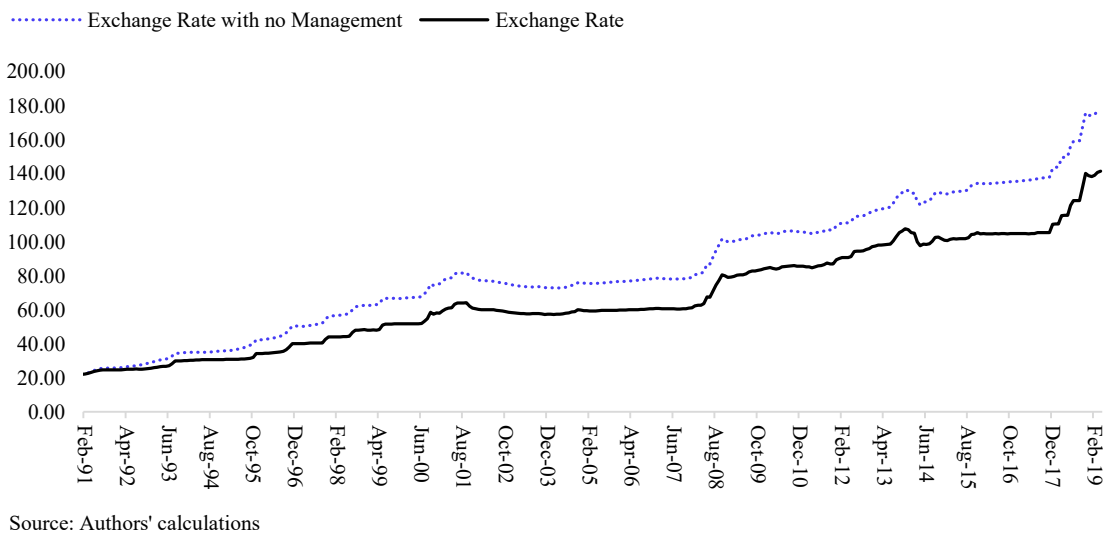


Figure 4: Exchange Rate with Management vs No Management



Source: Authors' calculations

3.7. Effectiveness of Monetary Policy and Exchange Market Pressures

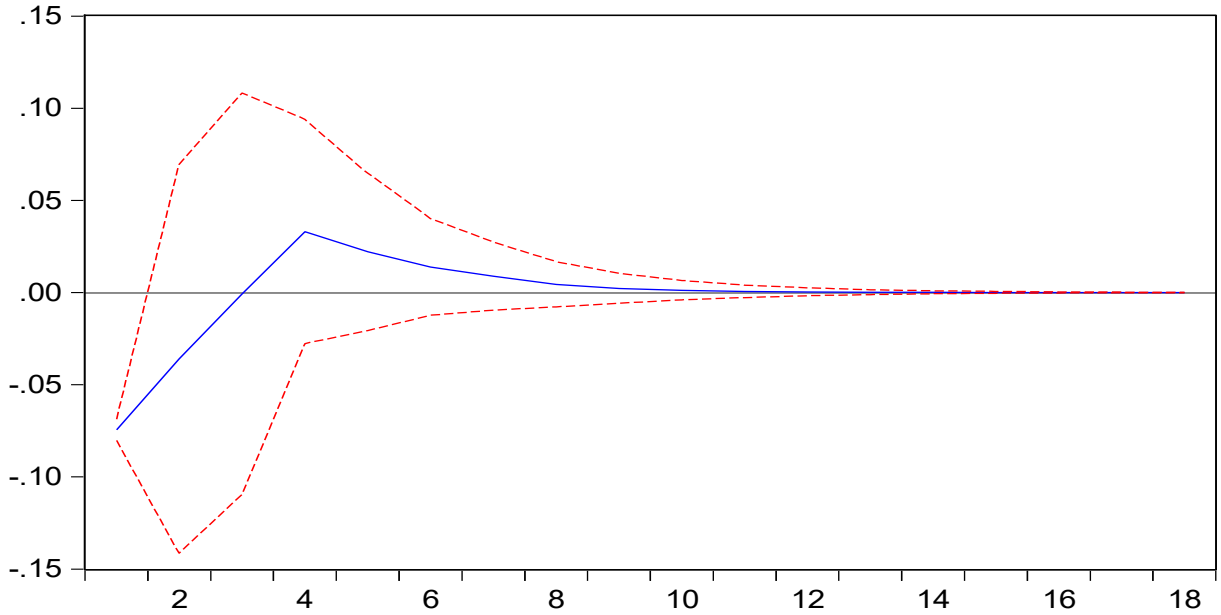
The second objective of this study is to test the effectiveness of monetary policy to manage exchange market pressures. For this purpose, equations 9-15 are estimated by using an SVAR model. The estimates are presented in Table 1 (panel b). The most important coefficient is α_{75}. This enters significantly negatively in the equation of external market pressures. This suggests that using monetary policy to control exchange market pressures in Pakistan is successful. This finding is in line with the findings of Fiador and Biekpe (2015), Panday (2015), and Tanner (2000). Although monetary policy has a significant impact on the control of exchange market pressures in Pakistan, the magnitude of this impact requires more investigation. The optimal lag length is two,

which suggests that the impact of monetary policy is transitory and can work only in the short term. This indicates that using monetary policy is effective for the short-term management of exchange market pressures. This also implies that monetary policy can control transitory pressures in the market. Furthermore, the permanent nature of pressures requires the improvement of the supply and demand equilibrium in the market as opposed to the use of monetary policy.

The impulse response function confirms this finding. Figure 5 illustrates the reaction of exchange market pressures to a structural one standard deviation shock in monetary policy rates. The response clearly indicates the effectiveness of monetary policy in the short run and shows that the impact tapers off within two months. It also indicates that using the monetary policy restricts exchange market pressures for two months after the policy intervention while exaggerating the pressures from the third to sixth months after the policy intervention. Therefore, the authorities should carefully use monetary policy and introduce desired structural reforms into the exchange market to obtain the best possible outcomes from tightening monetary policy. The use of monetary policy in isolation could yield only a few superficial benefits and could exacerbate market pressures.

Interestingly, the findings of the SVAR model are consistent with actual happenings in the economy of Pakistan. Whenever the authorities use monetary policy to control exchange market pressures, it brings immediate relief to the exchange rate parity. However, in the medium and long term, such a policy becomes either neutral or counterproductive. Caldas and Ferrari (2019) note that a credible monetary policy can reduce exchange rate uncertainties. However, as mentioned earlier, no previous study has assessed the use of monetary policy for controlling exchange market pressures in Pakistan.

Figure 5: Response of Exchange Market Pressure to Structural one SD shock in Monetary Policy Rate



4. Conclusion

This study bridges a gap in the literature by constructing an EMPI through a dynamic macro model that is solved using an SVAR model and utilizing actual intervention data in the case of Pakistan. We also construct an intervention index for Pakistan that reflects the magnitude of the pressures warded off by the central bank of Pakistan from January 1991 to April 2019 on a monthly

basis. The constructed index clearly depicts the extent to which the central bank of Pakistan actively manages exchange market pressures. We find that Pakistan has exhausted around USD 112 billion – which is USD 10 billion higher than the external debt of the country – to provide market support to keep exchange parity at a prescribed level.[17] However, this policy has largely failed, as billions of dollars in spending has improved the exchange rate by only Rs. 35.92 per dollar. If policymakers had not attempted to manage the exchange rate, the current parity level would be around Rs. 177.43 per dollar instead of the current exchange rate of Rs. 141.51 per dollar.

The findings of this study offer four practical policy implications. First, the central bank should not protect exchange rate parity through direct interventions in the exchange market beyond a certain level. This may result in exhausting foreign exchange reserves in most cases, and parity will correct itself through market forces as soon as the central bank decides to refrain from bridging the supply-demand gap. Second, the central bank should limit the implicit political promise of defending the overvaluation of exchange rate parity. Most of the time, this leads to massive foreign currency loans and fund management programs. Third, the central bank should regularly monitor a technically correct and comprehensive indicator (e.g., external market pressures) to make informed and timely decisions. Fourth, the central bank cannot rely on monetary policy to control exchange market pressures for the medium-to-long term.

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[17] The foreign exchange reserves that were exhausted in the failed attempt to manage the exchange rate are higher than the total external debt of the country.

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