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Unofficial and Official Exchange Rates Dynamics: A Case of Pakistan

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Abstract

This empirical study has been undertaken to investigate dynamic relationship between nominal unofficial and official exchange rates of Pak-rupee against US$ by using ARDL and error correction models. Monthly data for the period of 1948M04 to 2001M06 has been used. Statistical results conclude that both exchange rates are cointegrated. Error correction mechanism also confirms existence of long run relationship between two nominal exchange rates. Further, estimated error correction term indicates that nominal unofficial exchange rate corrects last month's disequilibrium at the speed of 6.0972 percent. Toda and Yamamoto (1995) causality test indicates that causality does exist from nominal unofficial to official exchange rate in case of Pakistan. Restoration of nominal unofficial exchange rate to long run equilibrium implies that short-term fluctuations in official exchange rate can be forecasted in developing countries like Pakistan and central bank can align official exchange rate with unofficial exchange rate.

Key Words: Unofficial, Official, Exchange Rates, Pakistan

JEL Classification: F31, G15, G18

1. Introduction

Coexistence of unofficial and official exchange markets in developing countries is a normal phenomenon. The economy of a nation is directly affected by the extent of gap between exchange rates of two markets. Emergence of unofficial foreign exchange market is basically a result of imbalances between demand and supply of foreign currency, which forces the diversion of a foreign currency from the official foreign exchange market to unfavorable unofficial foreign exchange market. Moreover, the unofficial markets also emerge owing to strict government regulations or procedures that restrict direct access to the official market and act as catalyst in creating

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disequilibrium in foreign exchange markets (Gupta, 1981; Agénor, 1992; and Kiguel and O'Connell, 1995).

Unofficial foreign exchange rate in Pakistan and across the globe are determined on daily basis in response to endless combination of economic conditions such as balance of international payments, money supply, both internal and external factors, and foreign remittances and especially the risk involved in holding savings in Pak-rupee. The difference between unofficial and official exchange rates can further be widened due to corruption, bleak law and order situation caused by weak implementation of judiciary system, smuggling, money laundering, tax relaxations, currency substitution, domestic inflation, lack of property and contract rights, and political instability (Oskooee and Goswami, 2004).

State Bank of Pakistan (SBP) authorities has not used the above stated factors to determine official exchange rate. This led to misalignment between official and unofficial exchange rates. Further, the restrictions imposed on free access to foreign exchange after the birth of Pak-rupee, and imbalances between demand and supply of foreign exchange also created an unofficial foreign exchange market in Pakistan.

Pak-rupee started its journey from official exchange rate of Rs. 3.31 per US$ on 1948M04 and reached at Rs. 63.49 on 2001M06 that represents devaluation of Rs. 60.18 or 1818.127 percent. Contrast to this, unofficial exchange rate started its journey from Rs. 4.50 per US$ on 1948M04 and reached at Rs. 66.65 per US$ on 2001M06 with a depreciation of Rs. 62.15 or 1381.111 percent. Furthermore, average premium is recorded as Rs. 2.69 per US$ or 39.994 percent of official exchange rate throughout period of the empirical study from 1948M04 to 2001M06. Therefore, as per Ghei and Kamin (1996) criteria it can be said very safely that unofficial foreign exchange market existed from 1948M04 to 2001M06 in Pakistan.

Prior to this study the dynamic relationship between unofficial and official exchange rates has been investigated by Booth and Mustafa (1991), Moore and Phylaktis (2000), Koreatus and Zarangas (2001), Oskooee and Goswami (2004), Diamandis and Drakos (2005), Love and Chandra (2007), Caporale and Cerrato (2008) and Samreth (2010).

This empirical study is a significant contribution in existing knowledge due to use of all data that started from the birth of Pak-rupee and ended on introduction of free float foreign exchange rate. In addition, exchange rate dynamics are investigated by employing ARDL cointegration technique, and used Toda and Yamamoto (1995) technique to estimate Granger Causality.

An important objective of carrying out this empirical study is to estimate dynamic relationship between both exchange rates. In case of existence of long run relationship between two rates, the direction of causation shall also be investigated. To complete the above, monthly data on nominal unofficial and official exchange rates shall be used. It is expected that the results of this study will have very useful policy implications. Under this expectation the public policy may affect unofficial exchange rate indirectly through changes in the official exchange rate. Further, knowledge about long run relationship between unofficial and official exchange rates helps policy makers to formulate policies and financial managers to manage foreign exchange risk.

2. Review of the Literature

Many studies have been conducted to investigate long run relationship between unofficial and official exchange rates of developing countries. In this regard an important study is carried out by Booth and Mustafa (1991) to investigate long run relationship between unofficial and official exchange rates of Turkish Lira versus US$ and West German Mark by applying cointegration approach devised by Granger Representation Theorem. Statistical results indicate that unofficial and official exchange rates of Turkish Lira versus US$ are co-integrated. Similarly, unofficial and official exchange rates of Lira versus German mark are also co-integrated. Further, the estimated ECM leads to the conclusion that any departure of unofficial exchange rate from long run equilibrium adjusts back at the speed of 6.0 percent.

In a study by Moore and Phylaktis (2000), long run relationships between unofficial and official exchange rates were investigated by employing cointegration and error-correction approaches. They used monthly data of unofficial and official exchange rates versus US$ from 1974M01 to 1992M06 of seven Pacific Basin countries: Malaysia, Singapore, Taiwan, Korea, Thailand, Indonesia and Philippines. Moore and Phylaktis (2000) found that all unofficial exchange markets premia fulfil conditions for stationarity for all countries except Singapore. Moreover, unofficial exchange rate causes official exchange rate and surprise devaluations in official rates cause changes of same magnitude in unofficial exchange rates this implies existence of bi-directional causality between unofficial and official exchange rates.

Kouretas and Zarangas (2001) added to knowledge by investigating long run relationship between unofficial and official exchange rates of Greek Drachma versus US$ and used Johansen (1988, 1991) techniques, which were later modified by Johansen and Juselius (1990, 1992) multivariate cointegration approach. Kouretas and Zarangas (2001) found that long run relationship does exist between unofficial and official exchange rates of Drachma versus US$. Further, unit constant premium was found that indicates that the conditions of portfolio models of black markets are fulfilled. By applying ECM, developed by Engle and Granger (1987) and its modification by MacDonald and Kearney (1987), found that any deviation of unofficial exchange rate from long run equilibrium adjusts back in 3.5 months to fade away impact caused by any economic shock.

In another study by Oskooee and Goswami (2004) long run relationship between unofficial and official exchange rates of 31 developing countries is investigated by applying Johansen (1988) and Johansen and Juselius (1990) cointegration approach. They used annual data of thirty one countries for a period of 40-years from 1955 to 1995 and found that Johansen methodology could be applied only on 22 out of 31 countries. The statistical results concluded that 15 out of 22 countries have long run relationship between unofficial and official exchange rates and, only eight countries have weak exogenous unofficial exchange rates. It implies that unofficial exchange rate causes official exchange rate.

Diamandis and Drakos (2005) investigated long run relationship between unofficial and official exchange rates of Argentine, Brazil, Chile and Mexico by using Moore and Phylaktis (2000) methodology. Diamandis and Drakos (2005) concluded that a long run relationship between unofficial and official exchange rates of four major Latin American countries does exist. They also estimated the ECM for vector autoregressive representation of unofficial and official exchange rates. Diamandis and Drakos (2005) found that unofficial exchange rate adjusts to long run equilibrium at the speed of adjustment of 44.3 percent, 36.5 percent, 65.6 percent, and 52.8 percent per month, respectively, in case of Argentina, Brazil, Chile and Mexico.

A study conducted by Love and Chandra (2007) provided evidence of long run relationship between unofficial and official exchange rates of Indian rupee versus US$ by employing Johansen co-integration methodology. They used monthly data of forty years: 1953 to 1993. Results indicate that long run elasticity of the official exchange rate with respect to unofficial exchange rate is $\hat{\beta}$(=1.446) that concludes one-to-one parity between official and unofficial exchange rates does not hold and also implies that unofficial foreign exchange market premium is not constant. They also found unidirectional causality from unofficial to official exchange rate.

Caporale and Cerrato (2008) found evidence in favor of long run relationship between unofficial and official exchange rates of Iran, India, Indonesia, Korea, Pakistan, and Thailand by adopting time series and heterogeneous panel co-integration approaches and used unofficial and official exchange rates data for the period: 1973M01 to 1998M01. Further, the Caporale and Cerrato (2008) finding is contradictory with key proportionality feature of portfolio balance models devised by Dornbusch*et al.* (1983). In addition, they investigated short run dynamics by estimating impulse response functions using bootstrap methods and found that overshooting caused by short run shocks does not fade away and it takes long time before completely joining back long run equilibrium.

In a study carried out by Samreth (2010) long run relationship is found between unofficial and official exchange rates of Cambodian Riel per US$ by using Autoregressive Distributed Lag (ARDL) approach to co-integration. Further, unrestricted error correction model based on ARDL (2, 4) indicates absolute magnitude of error correction term is 61.9 percent that indicates the speed of adjustment of unofficial exchange rate to long run equilibrium after short term shocks. Samreth (2010) also found bi-directional causality between unofficial and official exchange rates of Cambodia by using Toda and Yamamoto (1995) test.

3. Methodology

Methodology is presented in two sections: 4.1 and 4.2. The first section i.e., Section 4.1 deals with the functional form of the model, ARDL approaches for investigating dynamic relationships between nominal unofficial and official exchange rates of Pakistan. And, Section 4.2 deals with the use of Granger causality test to determine the direction of causality between the rates.

3.1. Functional Form of the Model

To investigate the relationship between nominal unofficial and official exchange rates of Pak-rupee versus dollar the following linear regression model is estimated.

$$Eu_t = \alpha + \beta Eo_t + \varepsilon_t \qquad (1)$$

Where, Eu_t is the nominal unofficial exchange rate in period "t" and is being used as the dependent variable, whereas Eo_t is the corresponding nominal official exchange rate for the same period and is being used as an independent variable. The long run relationship between nominal unofficial and official exchange rates is investigated by using ARDL cointegration approach in the following subsection.

3.1.2. ARDL Approach

Long run equilibrium relationship between nominal official exchange rate (Eo) and nominal unofficial exchange rate (Eu) is investigated by estimating dynamic ARDL model as specified below.

$$Eu_t = \beta_1 + \beta_2 Eo_t + \beta_3 Eo_{t-1} + \beta_4 Eu_{t-1} + \varepsilon_t \qquad (2)$$

where, "Eu_t " and "Eo_t" are nominal unofficial and official exchange rates at levels, respectively, and Eo_{t-1} and Eu_{t-1} are the values of nominal official and unofficial exchange rates lagged by one period. In model (2), β_2 indicates the short run effect of nominal official exchange rate on nominal unofficial exchange rate. Whereas, the long run counterpart effect is obtained by substituting the estimated values of β_2, β_3 and β_4 in the expression:

$$\theta = \frac{\hat{\beta}_2 + \hat{\beta}_3}{1 - \hat{\beta}_4} \qquad (3)$$

The error-correction mechanism representation of ARDL (1, 1) model (2) can be expressed as below.

$$\Delta Eu_t = \beta_1 + \beta_2 \Delta Eo_t + (\beta_4 - 1)(Eu_{t-1} + \theta Eo_{t-1}) \qquad (4)$$

Where, θ is the slope coefficient indicating long run relationship between nominal unofficial and official rates and ($Eu_{t-1} + \theta Eo_{t-1}$) is error correction term. The coefficient of error correction term represents short run adjustment of Eu_t to long run equilibrium. Further, if the coefficient of the error correction term is significant with negative sign then it indicates existence of long run relationship between nominal unofficial and official exchange rates. In addition, negative sign indicates restoration of exchange rate in case of departure from long run equilibrium relationship between nominal unofficial and official exchange rates. Moreover, absolute magnitude of error correction term indicates the speed of adjustment of exchange rate to long run equilibrium between both rates.

3.2. Granger Causality between Nominal Unofficial and Official Exchange Rates

To investigate Granger causal relationship between nominal unofficial and official exchange rates Toda and Yamamoto (1995) statistical inference vector autoregressive approach is used which is based on Wald test for zero restrictions.

4. Sources of Data

Monthly nominal unofficial (Eu) and official exchange rates (Eo) of Pak-rupee versus dollar are used to estimate dynamic long run relationship between the rates. Both time series are obtained from the sources such as: the websites of Professor Reinhart, International Financial Statistics (IFS) and Khanani and Kalia (a local currency dealer in Pakistan) for the period from 1948M04 to 2001M06.

For the period of 1948M04 to 1998M06 data both on nominal unofficial and official exchange rates were obtained from the website of Professor Reinhart. She collected nominal official exchange rate data for the period 1948M04 to 1998M06 from Pick's Currency Yearbook, various issues of Pick's Black Market Yearbook, World Currency Reports and International Financial Statistics (IFS) of International Monetary Fund (IMF). Whereas, she collected nominal unofficial exchange rate data for the period 1948M04 to 1998M06 from the various issues of Pick's Currency Yearbook, Pick's Black Market Yearbook and World Currency Reports.

The data from 1998M07 to 2001M06 on nominal official exchange rate of Pak-rupee versus dollar were obtained from International Financial Statistics (IFS) where the data on nominal unofficial exchange rate for the corresponding period was obtained from the website of Khanani and Kalia.

5. Empirical Results and Their Analysis

5.1. Unofficial and Official Exchange Rates

Before estimating the long run relationship order of integration is determined for both rates with application of ADF (Augmented Dickey Fuller-ADF) unit root test devised by Dickey and Fuller (1981) and optimal lag length of 13 is used as estimated by Akaike information criterion by using vector autoregressive (VAR) lag selection criteria and results are given in Appendix Table.

Statistical results obtained from ADF unit root test, given in Table 1 below, indicate that null hypothesis of unit root in all cases of Eu and Eo at levels with intercept, 13 lags, and with and without trend cannot be rejected which indicates that both time series have unit root or in other words are non-stationary at levels but are stationary at first difference or in other words are integrated of order one i.e., $Eu_t \sim I(1)$ and $Eo_t \sim I(1)$.

Table 1: ADF Test Results for Unit root

	At Levels I(0)		**At First Difference I(1)**	
Exchange rates	Test Statistics with Intercept & 13 Time Lags	Test Statistics with Intercept, Trend & 13 Time Lags	Test Statistics with Intercept & 13 Time Lags	Test Statistics with Intercept, Trend & 13 Time Lags
Eo	6.65258	3.960936	-19.46256*	-20.56047*
Eu	6.346997	4.060605	-15.46698*	-12.23265*

* Significant at 1% significance level

5.1.1. Autoregressive Distributed Lag ARDL (1, 1) Model for Nominal Exchange Rates

To determine long run relationship between nominal unofficial and official exchange rates of Pak-rupee against US$ ARDL (1, 1) Model has been estimated and empirical results are presented in Table 2. Statistical results for ARDL (1, 1) model given in Table 2 indicate that coefficients of all independent variables are highly significant. The coefficient of nominal official exchange rate $\hat{\beta}_2$ (= 0.336269) being positive and highly significant indicates a direct relationship between nominal official exchange rate and nominal unofficial exchange rate. This coefficient $\hat{\beta}_2$ further indicates that for one rupee devaluation in nominal official exchange rate leads to depreciation in nominal unofficial exchange rate of Pak-rupee against US$ by 0.336269 rupees in the short run. Estimated coefficient of nominal official exchange rate with one lag is -0.262441 and highly significant. It also indicates inverse relationship between nominal official and unofficial exchange rates of Pak-rupee against US$. This implies that the devaluation of one rupee in official exchange rate in the last month causes appreciation of 0.262441 rupee in the next month in unofficial exchange rate of Pak-rupee against US$.

Table 2: Empirical Results for ARDL (1, 1) Model

Variable	Coefficient
C	0.155223 (2.615790)
EO	0.336269 (4.807555)
EO(-1)	-0.262441 (-3.781796)
EU(-1)	0.932762 (57.53224)
R-squared	0.997375
Adjusted R-squared	0.997363
F-statistic	80304.28
Prob(F-statistic)	0.000000
Durbin-Watson stat	2.086037

Note: Included observations: 638 after adjustments. Numbers in parentheses are “t” values

Meanwhile, coefficient of the unofficial exchange rate with one lag is highly significant. The magnitude of this coefficient lies between -1 and +1 ($-1 < 0.932762 < 1$) that indicates ARDL (1, 1) model is stable in long run or in other words it will converge to its equilibrium. Estimated value of the slope coefficient of long run relationship between nominal official and unofficial exchange rates is 1.09801 which is obtained by substituting the values of $\hat{\beta}_2$, $\hat{\beta}_3$ and $\hat{\beta}_4$ in expression (3). The value of long run relationship implies that one rupee devaluation in nominal official exchange rate causes 1.09801 rupee depreciation in the nominal unofficial exchange rate of Pak-rupee against US$ in the long run. In addition, it indicates that nominal official and unofficial exchange rates do not respond equally to any shock which results in non-constant premium in the long run.

5.1.2. Estimating Long run Relationship between Nominal Unofficial and Official Exchange Rates with ARDL (1, 1) Model

Phillips and Loretan (1991) suggested that co-integrating ARDL (p, q) model can overcome misspecification of simple linear regression model which is due to omission of lagged variables. Now, to investigate long run relationship between nominal unofficial and official exchange rates ARDL (1, 1) model can be used because both nominal Eu and Eo time series are $Eu_t \sim I(1)$ and $Eo_t \sim I(1)$, respectively.

Under steady-state long run equilibrium between dependent variable (Eu_t) and independent variable (Eo_t), $Eu_t=Eu_{t-1}=Eu_{t-2}=Eu_{t-3}$----and $Eo_t=Eo_{t-1}=Eo_{t-2}=Eo_{t-3}$,------. Then ARDL (1, 1) model (2) can be re-parameterized to express steady-state long run equilibrium as:

$$\mathbf{Eu}_t = \frac{\beta 1}{(1-\beta 4)} + \frac{\beta 2 + \beta 3}{(1-\beta 4)}\mathbf{Eo}_t + \frac{\varepsilon t}{(1-\beta 4)} \quad (5)$$

$$\mathbf{Eu}_t = \alpha' + \beta' \mathbf{Eo}_t + \varepsilon'_t \quad (6)$$

where $\alpha' = \frac{\beta 1}{1-\beta 4}$, $\beta' = \frac{\beta 2 + \beta 3}{(1-\beta 4)}$ and the co-integrating vector is [1, α' and β']. Using this co-integrating vector the equilibrium error is found as:

$$\varepsilon'_t = \mathbf{Eu}_t - \alpha' - \beta' \mathbf{Eo}_t \quad (7)$$

The estimated equilibrium error ε'_t is [1, -2.3085606, -1.09801]. This estimate was obtained by estimating ARDL (1, 1) model (3) and then substituting these estimates in steady state long run equilibrium model (7) as given below.

$$\varepsilon'_t = Eu_t - 2.3085606 - 1.09801 Eo_t \qquad (8)$$

To determine long run relationship between nominal unofficial and official exchange rates of Pak-rupee against US$ two-steps residual based co-integration approach devised by Engle and Granger (1987) has been used and its results are presented in Table 3 below.

Table 3: Long run Relationship with ARDL (1, 1) Model

Null Hypothesis: ε'_t has a unit root

Exogenous: None

Lag Length: 2 (Automatic - based on HQ, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.636959	0.0003
Test critical values:	1% level	-2.568603	
	5% level	-1.941322	
	10% level	-1.616365	

*MacKinnon (1996) one-sided p-values.

Statistical results given in Table 3 indicate that Augmented Dickey Fuller test statistic (= -3.636959) is significant as its corresponding critical value is -3.33 found by MacKinnon (1991) at 5% significance level. This implies that the null hypothesis of unit root at levels without intercept and trend for equilibrium error "ε'_t" time series cannot be accepted. Thus, it can be concluded that equilibrium error "ε'_t" time series is stationary at level, which shows that the nominal unofficial and official exchange rates are co-integrated or simply have long run equilibrium relationship.

5.1.3. ECM Representation for ARDL (1, 1) Model

The estimated results of ECM (4) are given in Table 4. Statistical results given in Table 4 indicate that the coefficient of error correction term (= -0.060972) is highly significant with expected sign. This confirms that both nominal unofficial and official exchange rates are co-integrated. In addition, magnitude of error correction term |0.060972|indicates speed of adjustment of nominal unofficial exchange rate in case of any departure from long run equilibrium followed by short term shock. In other words, nominal unofficial exchange rate corrects 6.0972 percent of its last month's departure from long run equilibrium. This indicates that it will take 16.400971 months to fade away complete impact of short term shock.

Table 4: ECM Representation for Model (4)

Variable	
C	0.149189 (4.427822)
DEO	0.314352 (4.766945)
ECT(-1)	-0.060972 (-4.708955)
R-squared	0.073816
Adjusted R-squared	0.070894
F-statistic	25.26451
Prob(F-statistic)	0.000000
Durbin-Watson stat	2.226479

Note: Included observations: 637 after adjustments. Numbers in parentheses are "t" values

5.2. Causality Testing

The direction of causality between nominal unofficial and official exchange rates is tested by using Toda and Yamamoto (1995) technique. For this purpose optimal lag length and order of integration of nominal unofficial and official exchange rates have already been computed. All criteria except Schwarz Information Criterion (SIC) recommend the optimal lag length of 13. Therefore, the lag length of 13 is used to take the next steps of Toda and Yamamoto (1995) test for causality. Since unofficial and official exchange rates are integrated of order one ~I(1) this implies that *dmax*=1. Having estimated values of optimal lag length and integration order of nominal unofficial and official exchange rates, separately, Granger-causality test based on Toda and Yamamoto (1995) approach is conducted and results are given in Tables 5 and 6. Statistical results given in Table 5 indicate that the null hypothesis (H_0) that is the nominal official exchange rate does not cause nominal unofficial exchange rate is accepted as the value of Chi-square (=12.45536) is highly insignificant. Therefore, it can be concluded that causality from nominal official exchange rate to nominal unofficial exchange rate does not hold.

Table 5: Toda and Yamamoto Granger Causality Test:

H_0 :Eo does not cause Eu

Wald Test:
Equation: Untitled

Test Statistic	Value	Df	Probability
F	0.958104	(13, 596)	0.4919
Chi-square	12.45536	13	0.4907

Null Hypothesis:

C(15) = C(16) = C(17) = C(18) = C(19)
= C(20) = C(21) = C(22) = C(23)
= C(24) = C(25) = C(26) = C(27) = 0

Restrictions are linear in coefficients.

Now the direction of causality from nominal unofficial to official exchange rate has been tested by Toda Yamamoto (1995) and the results are presented in Table 6.

Table 6: Toda and Yamamoto Granger Causality Test:

H_0: Eu does not cause Eo

Wald Test:

Equation: Untitled

Test Statistic	Value	Df	Probability
F	13.87339	(13, 596)	0.0000
Chi-square	180.3540	13	0.0000

Null Hypothesis:

C(1) = C(2) = C(3) = C(4) = C(5) = C(6) = C(7) = C(8)

= C(9) = C(10) = C(11) = C(12) = C(13) = 0

Restrictions are linear in coefficients.

Statistical results given in Table 6 indicate that the null hypothesis H_0 that is nominal unofficial exchange rate does not Granger Cause nominal official exchange rate cannot be accepted as the value of Chi-square statistics is 180.3540 with p-value of 0.0000. Therefore, it can be concluded that causality from nominal unofficial exchange rate to nominal official exchange does hold.

7. Conclusion and Policy Implications

This empirical research has been undertaken to investigate long run relationship between nominal unofficial and official exchange rates of US$/PKR by using ARDL and error correction models. A monthly data has been used from 1948M04 to 2001M06 that makes results more reliable. It also investigates the direction of causation between two rates.

The estimated results of the models lead to conclusion that both nominal unofficial and official exchange rates have long run equilibrium relationship with each other. These findings are in line with Booth and Mustafa (1991), Moore and Phylaktis (2000), Kouretas and Zaragas (2001), Oskooee and Goswami (2004), Diamandis and Drakos (2005), Love and

Chandra (2007), Caporale and Cerrato (2008) and Samreth (2010). Furthermore, Toda and Yamamoto (1995) causality test indicates that the causality exists from nominal unofficial exchange rate to nominal official exchange rate in case of Pakistan. This finding is in line with findings of Oskooee and Goswami (2004), Love and Chandra (2007) and Moore and Phylaktis (2000) but differ from Samreth (2010).

The long run coefficient associated with nominal unofficial exchange rate estimated by ARDL (1, 1) is model 1.09801 which indicates that nominal unofficial exchange rate does not depreciate equally in response to devaluation of nominal official exchange rate of US$/PKR and constant premium does not hold in case of Pakistan. These findings are in line with the findings of Love and Chandra (2007) but differ from Kouretas and Zarangas (2001) and Diamandis and Drakos (2005). It implies that the concerned official authorities are not getting the desired equal response in nominal unofficial exchange rate due to any devaluation in nominal official exchange rate.

The error correction representation of ARDL (1, 1) model shows existence of long run relationship between nominal unofficial and official exchange rates of Pak-rupee against US$. Moreover, the estimated error correction term indicates that nominal unofficial exchange rate corrects last month’s disequilibrium at the speed of 6.0972 percent and takes 16-17 months before it fades away disequilibrium in long run relationship followed by a shock. These findings are in line with Diamandis and Drakos (2005), Kouretas and Zarangas (2001), Love and Chandra (2007) and Caporale and Cerrato (2008).

Implication of these results is of great importance especially in case of managing foreign exchange risk. Financial managers with prior knowledge about long run relationship between nominal unofficial and official exchange rates speed of adjustment and direction of causality between two rates can minimize currency risk and hedge against international arbitrage. Implication of this study will also help the central banks to align official exchange rate with unofficial exchange rate with an ultimate goal of free float exchange rate reflecting true market forces in developing countries like Pakistan.

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Appendix

Table 1: VAR Optimal Lag Length Selection Criteria for Eo and Eu

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3743.273	NA	560.2178	12.00408	12.01830	12.00960
1	-979.7957	5500.382	0.080770	3.159602	3.202257	3.176177
2	-944.7544	69.52110	0.073121	3.060110	**3.131202***	3.087736
3	-938.6117	12.14769	0.072620	3.053243	3.152772	3.091919
4	-929.2144	18.52338	0.071375	3.035944	3.163910	3.085670
5	-928.0431	2.301342	0.072025	3.045010	3.201413	3.105787
6	-923.6130	8.675639	0.071926	3.043631	3.228471	3.115459
7	-917.6391	11.66068	0.071473	3.037305	3.250581	3.120183
8	-913.5788	7.899297	0.071460	3.037112	3.278825	3.131040
9	-912.4158	2.255230	0.072114	3.046204	3.316355	3.151183
10	-897.7658	28.31388	0.069695	3.012070	3.310657	3.128099
11	-887.3629	20.03891	0.068280	2.991548	3.318572	3.118627
12	-881.7811	10.71638	0.067936	2.986478	3.341939	3.124608
13	-862.1508	**37.56181***	**0.064618***	**2.936381***	3.320278	**3.085561***
14	-860.9025	2.380541	0.065192	2.945200	3.357535	3.105431
15	-859.5642	2.543606	0.065752	2.953731	3.394503	3.125013

* indicates lag order selected by the criterion
Included observations: 624
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion