NOMINAL BILATERAL EXCHANGE RATE AND NOMINAL FOREIGN DIRECT INVESTMENT: EVIDENCE FROM PAKISTAN AND SRI LANKA

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ABSTRACT

This paper explores the dynamics between nominal bilateral exchange rate and nominal foreign direct investment in Pakistan and Sri Lanka by using bivariate cointegration and Granger causality mechanism. Annual data from 1973 through 1993 are employed in this study. The ADF (Augmented Dickey-Fuller) unit root test reveals nonstationarity in each variable in levels (both without and with trends) at 5 percent level of significance in both countries. Subsequently, the ADF test does not depict cointegrating relationship between the aforementioned variables in both countries. As a result, simple Granger causality test is performed. The test results reveal that the nominal exchange rate movements cause movements in nominal foreign direct investment in Pakistan. In contrast, no Granger causality is detected between these two variables in Sri Lanka.

INTRODUCTION

The body of literature in international trade and finance that seeks to explain the determination of exchange rates by using the purchasing power parity (PPP) theory, interest rate parity (IRP) theory, and portfolio balance theory is vast and expansive. To our knowledge, inadequate attention has been paid to the dynamics of foreign direct investment and exchange rates in less developed countries (LDCs). A growing interest has been observed since mid-1980s in the topic studying the link between foreign direct investment (FDI) and exchange rates in U.S. from the home country perspectives of U.S. multinational corporations.

Cushman (1985) and Froot and Stein (1991) explore the factors that might contribute to correlation between the external value of the dollar and the level of foreign investment in the U.S. They have found that modeling a link between FDI and exchange rates would require some beliefs in the long-run and short-run deviation from PPP on the cross-border investment process. Caves (1989), Froot and Stein (1991), Harris and Ravenscraft (1991) and Swenson (1993) have concluded that a depreciating dollar is associated with both higher flows of FDI into the U.S. and higher foreign takeover premia. Dewenter (1995) re-examines this issue but has not been able to unveil any statistically significant relationship between the levels of nominal exchange rate and nominal foreign direct investment.

This issue from the perspectives of host countries (LDCs) remains notably under-researched. So, it is important that such an academic exercise be pursued in the context of some LDCs that have a clear record of striving hard for attracting foreign direct investment primarily to spur economic growth and promote employment.

Foreign direct investment is generally enticed by a country's long-term economic outlook. It also depends on a host of macroeconomic, political and market entry variables. When a nation's economy begins to grow, it may be able to attract both long- and short-term capital from abroad in the presence of political stability and a congenial environment for foreign investment. Long-term capital inflow occurs as a result of long-term foreign direct investment in plants and equipments. Additionally, foreign firms' local financing needs of working capital and their subsequent borrowings in local financial markets would drive up the real interest rate in the host country. This, in turn, would attract a larger amount of capital from abroad in the form of portfolio and direct investment by offering relatively higher returns. Foreign direct investment and portfolio lending are likely to cause an increase in the demand for the currency of the recipient LDCs. This will shift the demand curve of the local currency to the right, ceteris paribus, causing the LDC's currency to appreciate against foreign currencies.

A counter-argument advocates that changes in exchange rates also affect the flows of foreign direct investment (Lee and Sullivan 1995). The currency area theory, advanced by Aliber (1970) and Heller (1981), argues that a strong currency causes outflows of foreign direct investment and a weak currency causes its inflows. Thus one can build a case of possible bidirectional causality between foreign direct investment and exchange rates. The research endeavor on this issue continues to evolve gradually confronting data problems and a limited role of market forces in the determination of exchange rates in less developed countries.

This article, therefore, seeks to explore the long-term and short-term dynamics between nominal bilateral exchange rate and nominal foreign direct investment in Pakistan and Sri Lanka by using bivariate cointegration and Granger causality mechanism. These two South Asian countries have been selected because they accord enormous policy importance to the promotion of international trade and outward orientation. Furthermore, they offer a wide range of fiscal and financial incentives to attract foreign direct investment. They may also be used as models for a host of LDCs in similar economic and financial circumstances.

The remaining structure of the paper is as follows. Section II outlines briefly the bivariate cointegration and error-correction methodology. Section III reports the empirical results. Finally, section IV summarizes the results and offers remarks.

BIVARIATE COINTEGRATION AND ERROR-CORRECTION METHODOLOGY

This empirical methodology builds upon the Engle-Granger analytical framework. To search for long-run equilibrium relationship, a cointergration regression is specified as follows:

$$x_t = \alpha_0 + \alpha_1 y_t + z_t \qquad (1)$$

where y = nominal bilateral exchange rate (units of local currency per U.S. dollar), x = nominal foreign direct investment, z = stochastic error term and t = time subscript. Equation (1) is estimated by the ordinary least squares (OLS) and the error-terms are retrieved to perform a test for cointergration.

Secondly, the time series property of each variable is examined by the ADF (Augemented Dickey-Fuller) unit root test. For unit root test, the following equations are considered:

$$x_t = \mu + \beta T + \alpha x_{t-1} + \sum_{i=1}^{k} c_i \Delta x_{t-i}$$

(2)

$$y_t = \theta + \pi T + \psi y_{t-1} + \sum_{i=1}^{k} d_i \Delta y_{t-i} \qquad (3)$$

Presumably, each time series has non-zero mean and non-zero drift. As a result, each estimating equation includes both a constant term and a trend term, as shown above. The usual t-test is applied on $\hat{\alpha}$ and $\hat{\psi}$ in equations (2) and (3), respectively. A failure to reject the null hypothesis of unit root indicates nonstationarity in each variable. Subsequently, the order of integration in the variables is determined by the first or higher order differencing of the level data. To be cointegrated, both variables must have the same order of integration.

Thirdly, the following ADF regression is estimated by using the retrieved residuals from equation (1) to determine the cointegrating relationship between nominal bilateral exchange rate and nominal foreign direct investment:

$$\Delta z_t = a z_{t-1} + \sum_{i=1}^{m} b_i \Delta z_{t-i} + q_t \qquad (4)$$

In the above ADF regression, q_t is the white noise disturbance term. The ADF test is applied on $\hat{a}$ to accept or reject the null hypothesis of no-cointegration by using the critical values, provided in Engle and Yoo (1987), for 50 observations at conventional levels of significance (1%, 5% and 10%).

If x_t and y_t are cointegrated, there must exist an error-correction representation which may take the following form:

$$\Delta x_t = \beta_1 z_{t-1} + \sum_{i=1}^{k} \phi_i \Delta x_{t-i} + \sum_{j=1}^{k} \delta_j \Delta y_{t-j} + u_t \qquad (5)$$

Again, u_t is the white noise disturbance term in this error-correction model. Time series on x and y are cointegrated when $\hat{\beta}_1$ is non-zero. $\hat{\beta}_1$ captures the short-run influence of long-run dynamics. Again, if $\hat{\beta}_1 \neq 0$, then movements in y_t will lead those in x_t in the long run. If $\hat{\delta}_j$'s are not all zero, movements in y_t will lead those in x_t in the short run.

If the series are both integrated and cointegrated, standard F-tests can be applied to verify the hypotheses of both short-run and long-run causality. The possibility of reverse causality can also be examined by switching the dependent and independent variables in model (5). On the other hand, if the series are integrated but not cointegrated, the usual Granger causality test can still be performed by dropping the error-correction term and estimating the simple Granger model (Bahmani and Payesteh 1993). The relevant nominal annual data have been collected from various issues of International Financial Statistics. The sample period spans from 1973 to 1993. This sample period has been considered to account for the flexible exchange rate regime, although the exchange rates in Pakistan and Sri Lanka are not determined predominantly by the market forces. They float their currencies indirectly because of the local currency-linkages to the floating U.S. dollar. Monthly and quarterly time series data on foreign direct investment-flows into LDCs are usually incomplete. Relatively more comprehensive data are usually available only on yearly basis. As a result, the paper employs only the annual data.

The strict PPP(Purchasing Power Parity) implies that real exchange rate should be constant. As a result, if the PPP holds, the real exchange rate is stationary and only the nominal exchange rate is likely to be nonstationary (Taylor and Sarno, 1998). The empirical evidence on the validity of the PPP are generally mixed. Even though the PPP does not hold empirically, the graphic plots of both real and nominal exchange rates in many instances portray a similar pattern of comovements. As a result, the choice between the real and nominal exchange rates may not be of any serious economic and statistical consequences. Since the primary focus of this paper is to explore the possibility of a cointegrating relationship between two variables, nominal bilateral exchange rate and nominal foreign direct investment are considered.

EMPIRICAL RESULTS AND CONCLUSIONS

The ADF unit root test results corresponding to equations (2) and (3) are reported as follows:

Table 1*
Unit Root Test (Models 2 and 3)

PAKISTAN				
Variable	ADF without trend	ADF with trend	Optimum Number of Lags	First Difference
ER	-1.29882	-0.44568	4	-12.75
FDI	0.63163	1.79965	4	-21.67
SRI LANKA				
ER	-0.32605	1.27216	4	-17.11
FDI	-1.25983	1.22967	4	-15.20

Where, ER(y) = nominal bilateral exchange rate (host country currency units per U.S. dollar), and FDI(x) = nominal foreign direct investment.

*Critical values at 5% level of significance are 3.410 (with trend) and 2.8600 (without trend). These critical values are generated by the application of RATS.

The above empirical results support the null hypothesis of unit root (both without and with trends) at 5 percent level of significance both in Pakistan and Sri Lanka. This implies that nominal bilateral exchange rate and foreign direct investment in each country are individually non-stationary in levels at the above level of significance.

Further observations reveal that each series is I(1) since the first differencing of the level data restores stationarity in each variable.

Next, the estimates of ADF regression (4) for cointegration between nominal bilateral exchange rate and nominal foreign direct investment are reported as follows:

Table 2*
Cointegration Tests Based on ADF Procedures (Model 4)

PAKISTAN				
X_t	Y_t	ADF Statistics	CRDW	R^2
ER	FDI	1.975(2)	1.945	0.3149
SRI LANKA				
ER	FDI	-1.877(2)	1.977	0.0561

*The critical values of ADF statistics for 50 observations, reported in Engle and Yoo (1987), are -4.12, -3.29, and -2.90 at 1, 5 and 10 percent levels of significance, respectively. The appropriate lag-structures in parentheses are chosen by (FPE) criterion. The ADF statistics are calculated by using RATS.

The ADF test results depict that there are no evidence of any long-run equilibrium relation between the aforementioned variables both in Pakistan and Sri Lanka. This conclusion is based on the comparison of the associated pseudo t-value of $\hat{a}$ against the critical values at -4.12, -3.29 and –2.90 respectively at 1, 5 and 10 percent levels of significance, as provided in Engle and Yoo (1987), for 50 observations in table 3. The CRDW (Cointegrating Regression Durbin-Watson) test contradicts the above inference since its critical values for a two-variable case and 50 observations are less at 1.49, 1.03 and 0.83 for 1, 5 and 10 percent levels of significance respectively as compared to the calculated values in table 2. The critical values of CRDW are obtained from table 4 in Engle and Yoo (1987). The CRDW can be used to get a rough indication as to whether there is cointegration. It should be noted that the CRDW test has low power to reject the null hypothesis of no-cointegration against alternatives close to the unit circle. This statistic is not asymptotically similar as are ADF tests. Hence, this statistics does not appear to be too useful for testing cointergration (Engle and Yoo, 1987). In this conflicting situation, this paper opts to side with the finding of ADF test. However, an argument can be made for its use on the ground that its distribution is invariant to nuisance parameters such as the constant (Banerjee et al, 1986). To add further, the low values of R^2 indicate small-sample bias in the cointegrating vector estimators. In other words, (1-R^2) is an indicator of the bias in the OLS estimator. The bias goes to zero as R^2 goes to 1.

Finally, based upon the evidence from ADF test for cointergration, simple Granger causality test is performed by estimating model (5) and its reverse specification with the exclusion of the error-correction term (z_{t-1}). The results are reported as follows:

Table 3*
Estimation of Error-Correction Model (5) and its Reverse Specification Without the Error-Correction Term

De pen den t	Co nst ant	ΔX_{t-1}	ΔX_{t-2}	ΔX_{t-3}	ΔY_{t-1}	ΔY_{t-2}	ΔY_{t-3}
ΔX_t (Pakistan)	0.6446 98 (0.104 629)	-0.0131 16 (0.335 013)	0.1414 03 (0.394 231)	0.1085 66 (0.367 210)	0.0266 4 (0.013 90)	0.0100 57 (0.015 438)	0.0109 11 (0.015 759)
ΔX_t (Sri Lanka)	3.4968 3 (1.209 48)	-0.0233 0 (0.282 91)	0.0554 4 (0.284 63)	- 0.5941 9 (0.278 48)	0.0036 67 (0.020 738)	0.0268 24 (0.027 117)	- 0.0381 61 (0.027 268)

Pakistan:

*Direction of Causality	F-test
FDI $\neq$ ER	1.2791
ER $\Rightarrow$ FDI	3.5219

Sri Lanka:

*Direction of Causality	F-test
FDI $\neq$ ER	1.1543
ER $\neq$ FDI	0.8176

Note: 1) The symbol means "does not cause" in Granger Sense;
2) The critical values of F distribution are 2.73, 3.71, and 6.55 for 10%, 5%, and 1% levels of significance respectively. The critical values of t distribution are 1.76, 2.145, and 2.624 for 10%, 5%, and 1% levels of significance respectively.

Granger causality is found to stem from nominal bilateral exchange rate to nominal foreign direct investment in Pakistan. The joint F-test, however, shows no Granger causality between nominal bilateral exchange rate and nominal foreign direct investment in Sri Lanka.

SUMMARY AND REMARKS

To summarize, the ADF unit root test reveals that each variable is individually nonstationary in levels (both without and with trends) at 5 percent level of significance in Pakistan and Sri Lanka. Both variables, at the same time, depict I(1) behavior. But, the ADF test for cointegration does not support any long-run equilibrium association between the variables of our interest in both countries. However, the CRDW test contradicts this finding. The estimates of model (5) and its reverse specification with the exclusion of the error-correction term show some evidence of unidirectional Granger causality flowing from nominal bilateral exchange rate to nominal foreign direct investment in Pakistan. In contrast, no evidence of causal connection is found between the variables in Granger sense in Sri Lanka. To note, the proper lag-structures in tables (2) and (3) are chosen by Akaike's (1973) final prediction error (FPE) criterion to overcome the problem of over- or under- parameterization that might induce bias and inefficiency in the parametric estimates.

The results imply that Pakistan should take into account the influences of the changes in the nominal bilateral exchange rate on the inflows of nominal foreign direct investment. In addition to fiscal and monetary incentives, Pakistan should be able to exploit nominal exchange rate policy as an effective tool to attract nominal foreign direct investment. However, the effectiveness of the aforementioned incentive schemes hinges on the political stability and the foreign investors' perception of a congenial investment climate in the host countries which are beyond the scope of this paper.

In contrast, since the inflows of nominal foreign direct investment and nominal bilateral exchange rates in Sri Lanka have no causal influences on each other, this country should not be overly concerned about the stability of nominal exchange rate due to erratic oscillations in nominal foreign direct investment inflows. As a result, it should not use nominal exchange rate policy as an effective tool to attract nominal foreign direct investment. This country should rather seek to entice nominal foreign direct investment by offering a wider range of fiscal and monetary incentives to spur long-run economic growth.

In closing, the findings of this paper in bivariate settings should be considered with due caution since the use of Johansen's procedure for multivariate models may sometimes come to different conclusions regarding these interrelationships (Darrat and Dickens, 1999). To add further, Lutkepohl (1982, 1993) state that bivariate Granger causality are suspects due to the omission-of-variables bias. Finally, the results from the Johansen test may also concur with the Engle-Granger test regarding the absence or presence of cointergration in bivariate models (Darrat and Dickens, 1999).

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