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REAL INTEREST RATE PARITY IN PAKISTAN: A COMPARATIVE STUDY

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ABSTRACT

The empirical existence of Real Interest Rate Parity between Pakistan and its trading and financial allies is scrutinized in this research paper. It hypothesizes that real interest rates are equal between these economies. The equality of Real interest rate is analysed among Canada, China, France, Germany, Hong Kong, Japan, Korea, Kuwait, Malaysia, Saudi Arabia, United Arab Emirates, UK, USA and Pakistan during the time period of 1972 Q1 to 2012 Q3. After the deregulation and international integration in the real and financial markets the interaction of major economic variables have become increasingly important. Real interest rate differential model is applied for the determination of exchange rate, which is based on real interest rate parity (RIP) theory, a combination of inflationary expectation of flexible-price model and sticky-price model. Panel cointegration and Panel-VAR techniques are used. Results of the techniques are supported the existence of Real Interest Rate Parity. These results are consistent with the earlier studies that tested real interest parity and nominal exchange rate move simultaneously. This study concludes that for achieving a significant role in the international transactions, it is imperative to improve the working of the domestic markets and then move towards the international markets. This research paper also suggests that without the coordination

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among all policies (monetary, fiscal, trade and exchange rate) consistency among macroeconomics targets is not possible. Paper's result strongly supported the existence of RIP for the whole sample period.

Key Words: *real interest parity; inflationary expectation; panel-cointegration*

INTRODUCTION

According to real interest rate parity hypothesis, real interest rates become equal between countries when inflation forecasts according to rational expectations and there are free movements of interest and goods arbitrage. In a globalised world, real interest rate parity indicates that either financial and goods markets of different countries are integrated or not. Mishkin (1984) initially tested this hypothesis later several studies have done for the same. Baxter (1994) empirically evaluated the relationship between real exchange rates and real interest differentials during the period of free floating between USA and five other countries: UK, Switzerland, Japan, Germany and France, and between France and Germany, during the time span 1973 Q1 to1991 Q2. The study found strong correlation between real exchange rates and real interest differentials using band-spectral methods with trends and business cycles frequencies. Findings of the study also explained that earlier studies could not find this link as they employed first-difference filter. Ferreira and Leon-Ledesma (2007) results supported the evidence of RIP for developed countries with the emerging markets, where risk premia are large as compared to developed countries. Dreger (2008) investigated the impact of real interest parity on nominal exchange rate, covering more than 100 years' time span 1870-2006, and 15 countries out of which 13 are European countries including UK and rest are USA and Japan. The study concluded that deviation from real interest parity is main cause of lack of financial and real markets integration among the sample countries. Chang and others (2012) found robust empirical evidence supporting the validity of RIP in long run while testing this parity between China and ten other Asian countries. These East Asian countries are highly influenced by the Chinese economy's movements. Shi and others (2012) employed real interest rate differential to examine the existence of interest rate parity in Canada, France, Japan, Singapore and UK as compared to USA. Their result supported the existence of the parity as real interest rates are mean reverting and real interest parity differential occurred in most of the sample countries.

The real interest rate differential model is the combination of inflationary expectation of flexible-price model and sticky-price model. Frankel (1979) combined these models and developed a general monetary exchange rate model. According to

this model there are rapid adjustments across the world's goods, financial and foreign exchange markets and maintaining neutrality of monetary policy. An inflationary expectation leads to rise in interest rate. The nominal interest rate and nominal exchange rate are proportionately related to inflation rate expectation keeping real interest rate at constant level.

Expected inflation rate in goods market is related to the return in capital market through the Fisher Effect equation

$$n_{d,t} = r^{e}_{d,t+1} + \Delta\pi^{e}_{d,t+1} \quad (1)$$

$$n_{f,t} = r^{e}_{f,t+1} + \Delta\pi^{e}_{f,t+1} \quad (2)$$

Where and are expected real interest rates for domestic and foreign countries, respectively. If Purchasing Power Parity (PPP) and Uncovered Interest Parity (UIP) hold simultaneously, there must be an existence of Real Interest Parity (RIP). That is,

$$r^{e}_{d,t+1} \overline{(3)} r^{e}_{f,t+1}$$

The Real Interest-Rate Parity indicates that the real return on capital must be equal across countries. So, this parity condition holds independently of any exchange rate, and reveals that the nominal interest rate differential reflects the expected inflation differential (Fama, 1975).

$$\pi^{e}_{d,t+1} - \pi^{e}_{f,t+1} = n_{d,t} - n_{f,t} \quad (4)$$

According to this model, equilibrium exchange rate are determined by the interest rate differentials between domestic and foreign countries.

$$\Delta e = n_d - n_f \quad (5)$$

This interest rate differential depends on the inflation differential between these countries.

$$n_f = \pi_d - \pi_f \quad (6)$$

RESEARCH METHODOLOGY

For investigating the presence of real interest rate parity among fourteen countries this study applied; Panel unit root, for checking stationarity of the data series, panel cointegration, for finding out long run relationship among the variables and finally the panel VAR. These methodologies are based on theoretical foundation of exchange rate determination models. The sample countries are Pakistan, North American countries; Canada, UK, USA, European Countries; Germany, France, Asian countries;

Japan, Peoples Republic of China, Japan, Korea, Kuwait, Malaysia, Saudi Arabia, United Arab Emirates. All these countries are major partners of Pakistan in trade and finance. For finding out the existence of Real Interest Rate Parity model; exchange rates, inflation rates, and interest rates of each country are used as variables.

Consumer price indices are used as inflation, which are suitable to analyze the behavior of consumers and savers of any economy, Mishkin (1984). Treasury bill rates are used as nominal interest rate data, which are assumed less risky and perfect substitutes among each other. Real interest rates are obtained by getting the difference between nominal interest rate and expected inflation rate of each country. Nominal exchange rates are used as exchange rates data of each country, where value of dollar in term of each currency (£/$). After that all nominal exchange rates are converted in terms that each currency in term of Pakistani Rupee, as used by Kemal and Haider (2005).

Panel Data Tests

Utilization of Panel data philosophy gave precision of relapse. Rehashed perceptions on people permit probability of segregating impacts of imperceptibly contrasts between people. It is useful for dynamic investigations and to make causal surmising by upgrading the transient requesting and afterward impact control for factors that shift over the long haul.

In any case, there are additionally a few cut-off points to the advantages of Panel data: Variety after some time may not exist for some significant factors or might be expanded by estimation mistake. Panel data forces a fixed planning structure; ceaseless time endurance investigation might be more useful. A Panel with waves doesn't give time the data of a cross-section. However, there is exceptionally solid proposal to draw clear derivations from Panels.

Numerous new writings propose that Panel unit root tests are more remarkable than unit root trial of individual time arrangement. This examination likewise applied this test, which processes one of the accompanying five sort's tests: Levin, Lin and Chu (LLC) (2002); Breitung (2000); Im, Pesaran and Shin (2003) (IPS), Fisher-type tests using ADF and PP tests, and Hadri (1999). These tests are simply multiple-series unit root tests and applied to panel data structures. Panel and individual unit root tests have similarity, but they are not alike.

The examinations are computed under two assumptions; First, when tests are assuming a common autoregressive structure for all series, as "Common root" and second, when tests assume different autoregressive coefficients in each series, as "Individual root".

The following is AR (1) process for panel data:

$$y_{it=}\varphi_{i}y_{it-1} + X_{it}\vartheta_{i} + \varepsilon_{it}(7)$$

where i= 1, 2, 3, 4,…….,N cross-sections, over the time periods t=1,2,3,4,…..T.

The Xit is the exogenous factors with any fixed impacts or individual patterns, φi are the autoregressive coefficients, and the mistakes εit are autonomous eccentric aggravation. On the off chance that, φi< 1 is supposed to be feebly (pattern) fixed and on the off chance that φi = 1, at that point Yt contains a unit root.

Panel co-integration tests permit leading a few tests to register the panel co-integration. The Pedroni test is accessible for bunches containing seven or lesser arrangement. The Deterministic trend detail indicates the exogenous regressors to be remembered for the second-stage regression. Singular intercept is chosen if individual fixed impacts are incorporated. The Kao test just takes into consideration Singular capture. Automatic selection decides the optimum lag by utilizing Akaike, Schwarz, Hannan-Quinn, information criteria. What's more most optimum lag is to be utilized in programmed choice for each cross-section dependent on the quantity of perceptions.

This paper additionally sets up the co-integration property in more exact terms. This is accomplished by applying Paderoni (1999) panel cointegration procedures. The since quite a while ago run harmony between swapping currency scale change, inflation differentials and loan cost differentials may happen because of the presence of outside or inward patterns. To investigate these issues, every factor is isolated into normal and individual constituents. Co-integration between the basic segments alludes strength of outside patterns in this balance. On the off chance that co-integration existed between singular parts, it uncovers that inner patterns are predominant here. This characteristic is valuable for strategy producers and strategy suggestion. On the off chance that the regular parts co-coordinate, worldwide exchange and account are required to hugy affect the cycle of improvement of a public economy. Indeed, this examination uncovers that swapping currency scale change, inflation rate differentials and loan cost differentials (interest rate) are cointegrated in their basic segments just as individual segments.

This paper applied Pedroni technique to construct the tests for the null of no co-integration in panel. For this compute the regression residuals as of hypothesized co-integrating regression. In equation form

$$y_{\imath t} = \alpha_{\imath} + \delta_{\imath}t + \beta_{1\imath}x_{1\imath t} + \beta_{2\imath}x_{2\imath t} + \cdots + \beta_{M\imath}x_{M\imath t} + \epsilon_{\imath t}(8)$$

t=1,2,…,T; refers to number of observations,

i= 1,2,…,N; refers to cross sections (countries)

m=1,2,…,M; refers to number of variables (three)

Vector auto-regression model is used when multiple time series are interrelated and progress through each other.

Panel Unit Root Test

For time arrangement examinations unit root test is a benchmark methodology. As indicated by Engle and Granger, (1987) direct use of OLS or GLS to a non-fixed information gave misleading outcomes. Then again, singular unit root test is less ground-breaking when contrasted with panel unit root test. Hadri (1999), Breitung (2000), Levin, Lin, and Chu (2002), and Im, Pesaran and Shin (2003) presented panel-based unit root tests.

This part applies panel unit root trial of genuine interest differential. Table 1 shows the consequences of panel unit root test with every one of the six techniques for assessment. Levin, Lin and Chu (LLC), Breitung, Im, Pesaran and Shin (IPS), ADF – Fisher, PP - Fisher and Hadri are assessed first with consistent at level, besides with both steady and pattern at level, lastly with consistent from the outset distinction.

Table 1: Panel Unit Root Tests: Individual Effects Estimation

	Method					
Real interest rate differential	LLC	Breitung	IPS	ADF	PP	Hadri
First Difference (C)	-10.1*	-16.7*	-27.32*	607.2*	973.2*	2.22

Note:- All data set are assessed at constant. The null hypotheses of the existence of unit root are rejected at 95 % of statistical significant level and denoted with*.

Panel unit root test results for the real interest rate differential are presented in table 1. According to the result, all tests reject the unit root null for real interest rate differentials at first difference with constant at 5% level of significance and accept the alternative except Hadri. Tests results with an asterisk support that the series of real interest rate differential become stationary at first difference I(1).

Panel-cointegration Tests Results

After panel unit root test this part is identified with panel co-incorporation test

proposed by Pedroni (1999). Pedroni proposed seven parametric and non-parametric insights to test the invalid theory of no co-cointegration against the elective speculation of co-integration. Out of these seven measurements Pedroni utilizes four panel insights and three gathering panel insights. In panel measurements, the auto-regressive term should be the equivalent across all the cross segments. In gathering panel measurements, the parameter (auto-regressive term) is permitted to shift over the cross sections. If the null hypothesis is dismissed in the panel case, at that point the two factors of the panel are co-integrated. Then again, if the null hypothesis is dismissed in the gathering panel case, at that point co-integration among the two factors existed in any event one sets of nation.

Table 2 presents the panel and group statistics; these are the test consequences of panel cointegration between loan fee differentials and inflation rate differential. These test statistics uncover an assurance about the presence of cointegration in the panel. Six out of the seven insights propose cointegration over the panel overall at the 5 percent significant level or better. Be that as it may, variance-ratio statistics recommend no cointegration in panel.

The hypothesis that there is no co-integration between change in loan fees differentials and expected inflation rate differential in every nation's pair in the panel, is firmly dismissed by the statistics. Nonetheless, the alternative hypothesis suggests that there is co-integration in each nation pair is unequivocally maintained by the statistics.

Table 2: Panel Cointegration Test

H_0: No cointegration

	Panel Statistics	Group Statistics
Variance-Ratio	1.834064 (0.0333)	
Rho-Statistic	-72.91* (0.00)	-62.42* (0.00)
PP-Statistic	-29.58* (0.00)	-33.51* (0.00)
ADF-Statistic	-23.01* (0.00)	-25.61* (0.00)

N=13, T=2119

This empirical investigation of the Real Interest Rate Parity by using joint mod-

elling approach of UIP-PPP strongly provides the proof of the presence of RIP in the long run, where changes in interest rate differential and expected inflation rate differential have strong long-run relationship.

For further authenticity of the existence of Real Interest Parity, panel co-integration test is employed for realizing the long term association between changes in exchange rate and real interest differential (RID). Table 3 represents the Pedroni panel co-integration results along with the panel and group statistics. These test results also provide the strong provisionof co-integration in the panel. Six tests statistics among seven suggested 5 per cent significance level or better cointegration over the panel as a whole. However, variance-ratio statistics proposed no co-integration in panel.

The hypothesis that there is no co-integrating relationship between changes in exchange rate and real interest rate differential in each country pair in the panel is rejected by the statistics. However, the alternative hypothesis implying that there is co-integration in each country-pair is strongly accepted by the statistics.

Panel Cointegration Test

Table 3: Exchange Rate Change, Real Interest Rate Differential

H_0: No co-integration

	Panel Statistics	Group Statistics
Variance-Ratio	36.03* (0.00)	
Rho-Statistic	-31.28* (0.00)	-29.03* (0.00)
PP-Statistic	-16.14* (0.00)	-19.10* (0.00)
ADF-Statistic	-16.10* (0.00)	-16.84* (0.00)

N=13, T=2119

Panel VAR Model

The Panel Vector Autoregression (VAR) methodology is also used in the real interest rate differential model; all variables are treated as endogenous variables and allowed for unobserved individual heterogeneity. In other words, growth in interest rates differentials influenced by expected inflation rates differentials and in exchange,

expected inflation rates differentials has an impact on the growth in interest rates differentials. In other test, changes in exchange rates influenced by real interest rate differential and in exchange, real interest rate differential depends on change in exchange rate.

Impulse Response Function

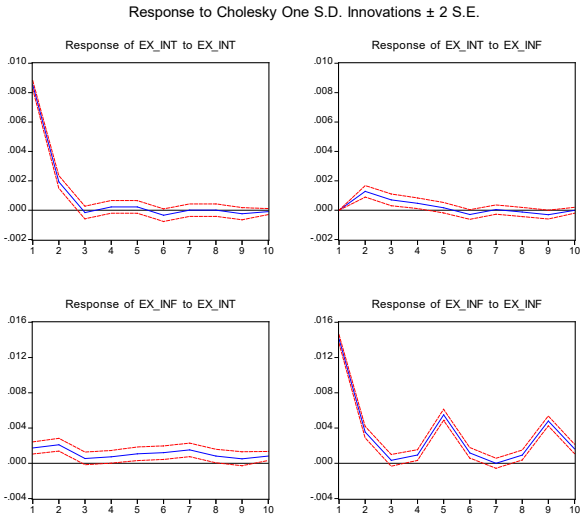
Impulse response function clarifies the impact of one variable because of abrupt changes in other variable in the framework, keeping different stuns at zero. To detach stuns of the VAR errors it is important to deteriorate the residuals such that they become symmetrical. To improve connection between the variables of a framework, impulse response function is utilized to explore the connection between two variables. There is a response of one variable to an impulse in another variable the last call causal for the previous.

Figure 1 uncovers the consequence of Impulse Response Function, from left to right of first column left hand figure communicates the response of progress in financing cost differential to change in loan fee differential; right hand side figure signifies the response of progress in financing cost differential to expected inflation rates differentials. Second column figures from left to right speak to the response of expected inflation rates differentials to change in loan fee differentials, and response of expected inflation rates differentials to change in expected inflation rates differentials repectively.

At the point when the impulse is changed in loan cost differential, the each response of its own is positive however strongly decay till third quarter, and afterward it gets zero and varies around the zero line. The responses of expected inflation rate differential is positive and ascending till first quarter at that point begin to decay and get negative in 6th quarter, after that kept up with low vacillations around the zero line.

Figure 1: Impulse Response Function

$$\Delta(n_d - n_f) \text{and} \left(\pi_d^e - \pi_f^e\right)$$



When impulse is changed in interest rate differential, every response of expected inflation rate is positive with slight fluctuations above the zero line. The response of expected inflation differential of its own is always positive with frequent fluctuations during the whole period.

Figure 2: Impulse Response Function

$$\text{e and } (r_d - r_f)$$

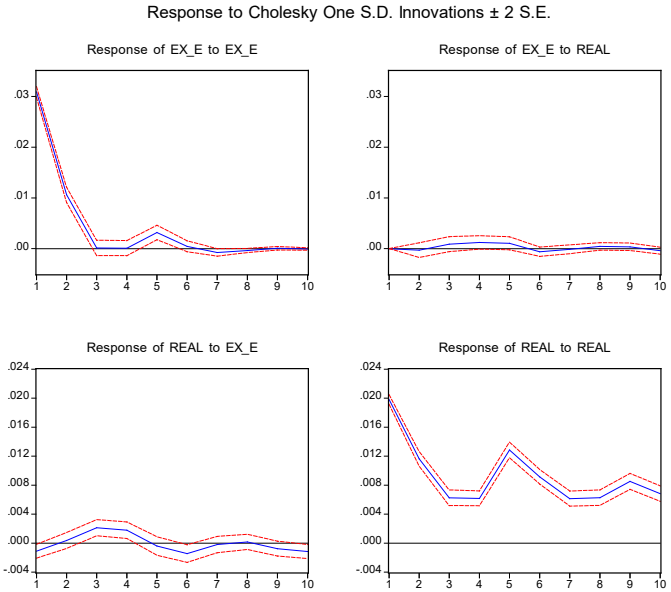


Figure 2 uncovers that the consequence of Impulse Response Function, from left to right of first row two figures express the response of progress in exchange rate to change in exchange rate and response of exchange rate change to genuine loan cost (interest rate) differential respectively. Second row figures from left to right speak to that the response of real interest differential to exchange rate change, and response of real financing cost differential to real interest rate(loan fees) differentials respectively.

At the point when the impulse in exchange rate change, at that point each response of its own is positive with diminishing rate till third quarter, in the wake of keeping up at zero line in final quarter it begins to rise, at that point decreases and gets negative in the seventh quarter lastly varies around the line zero. Each response of genuine loan cost differential is blended in with slight variances around the line zero and stayed steady on zero line in all quarters.

At the point when the impulse is real interest rate differential, each response of development in exchange rate is exceptionally unstable around the zero line. Response of real interest rate (genuine loan fees) differentials of its own impulse, is positive and declining strongly till second from last quarter and kept up till final quarter at that point begins to rise and decays, all vacillations in the response of real interest rate is extremely distant from the line zero.

CONCLUSION

The real interest rate differential model-a blend of inflationary expectation of flexible price model and sticky price model created by Frankel (1979). As per this model there are quick changes across the world's products, foreign and financial markets and maintaining neutrality of monetary policy keeping closeness in the real interest rate across the economies. This paper dependent on "real interest rate differential", results gave the proof of Real Interest Rate Parity model. It hypothesizes that real interest rates are equivalent among Pakistan and its significant exchanging and monetary accomplices. The equality of real interest rate is dissected among Canada, China, France, Germany, Hong Kong, Japan, Korea, Kuwait, Malaysia, Saudi Arabia, UAE, UK, USA and Pakistan during the time span of 1972 Q1 to 2012 Q3. After the liberation and worldwide mix of both monetary and merchandise showcases the association of major financial variables have gotten progressively significant. Out of different models of exchange rate determination, real interest rate differential model is applied. Panel cointegration results firmly upheld the since quite a while ago run connection between real interest rate differential and exchange rate change, and then again since a long time ago run relationship additionally demonstrated between changes in interest rate differential and expected inflation rate differential. In aggregate, there is a presence of real interest parity (RIP) hypothesis over the long haul.

This likewise recommended that the strategy creators ought to keep up the new rules to fortify the connections among nominal interest rate, expected change in exchange rate and anticipated inflation that swelling should build the level of mix of merchandise and monetary business sectors of Pakistan with the remainder of the world business sectors particularly with significant exchanging accomplices. It would likewise give a structure to the approach producers that the consistency among macroeconomic targets is conceivable when there is coordination in the financial, monetary related and exchange rate policies. This study concludes that for achieving a significant role in the international transactions, it is imperative to improve the working of the domestic markets and then move towards the international markets.

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