International Journal of Social Science and Economic Research

ISSN: 2455-8834

Volume:02, Issue:11 "November 2017"

THE INTERNATIONAL FISHER EFFECT AND JAPAN: AN EMPIRICAL ANALYSIS (2002-2017)

[1]Aashish Khubchandani, [2]Krish Abrol

[1]Podar International School (IB and CIE)-Secondary Section, Ramee Emerald building, Near Shamrao Vitthal Bank, S.V. Road, Khar (West), Mumbai, 400052, India.

[2]Oberoi International School, Oberoi Garden city, near Oberoi Mall, Off Western Express Highway, Goregaon (East), Mumbai, 400063, India.

ABSTRACT

In order to test the extent of the validity of The International Fisher Effect's relation between Nominal Interest Rate differentials and Exchange Rate changes, quarterly average exchange rate and short-term interest rate data from 2002 to 2017 were analyzed between Japan and The United States, The United Kingdom, Canada, Australia, South Korea and The Eurozone. Z-tests were employed to calculate p-values, and residual terms were tested using their Durbin-Watson Statistics. The analysis concludes, at a 5% significance-level, that the effect held in the case of Japan versus Canada and, partially, South Korea while conclusively not holding true for Japan versus The United States, The United Kingdom, Australia, and The Eurozone.

Keywords: International Fisher Effect, Japan, International Finance, Exchange Rates.

1. INTRODUCTION

This paper aims to empirically test the extent of the validity of the International Fisher Effect in the case of Japan between 2002 and 2017 by analyzing quarterly short-term interest rates and changes in exchange rates.

Japan was chosen for this analysis due to its historically low interest rates, testing the extent of the International Fisher Effect in circumstances of relatively high and low (before and after 2007-2009 interest rate cuts) interest rate differences resulting from these low interest rates. The other countries chosen, against which the Japanese interest rates and exchange rate changes were compared, included The United States of America, The United Kingdom, Australia, Canada and South Korea. Additionally, the Eurozone was chosen too. These developed countries were chosen

ISSN: 2455-8834

Volume:02, Issue:11 "November 2017"

as empirical evidence has suggested that the effect may not hold for developing countries (Alam, M.M. et al, 2017), attributable to their lack of completely internationalized industries, causing ineffective free flow of money between markets.

2. THEORETICAL FRAMEWORK

2.1 Fisher's Effect

Fisher's Effect suggests that Nominal Interest Rate i is a determinant of Real Interest Rate r and Expected Inflation Rate π^e in the following relationship:

$$(1+i) = (1+r)(1+\pi^e) \quad (2.1)$$

Known better by its linear approximation,

$$i \approx r + \pi^e \quad (2.2)$$

Given the assumption of perfectly mobile capital markets worldwide, this parity condition leads to its generalized form, which states that "real returns are equalized worldwide through arbitrage" (Sundqvist, 2002) due to the fact that arbitrage among perfectly mobile capital markets allows a worldwide integration of capital markets, as lower real returns in one country would cause capital outflows to countries with higher rates of real returns until such expected real returns equalize globally, given the assumption of perfect substitutability among foreign and domestic assets (Shapiro 1998, 163-167).

If these assumptions hold, then the equated real interest rates globally would result in nominal interest rate differentials between two countries equating their forecasted inflation differential. This results from the real interest rates worldwide equating as follows, where h refers to the home country and f the foreign counterpart in question:

$$r = i_h - \pi_h^e = i_f - \pi_f^e \quad (2.3)$$

Rearranged, this is:

$$i_h - i_f = \pi_h^e - \pi_f^e \quad (2.4)$$

Which allows the following approximation (Demirag & Goddard 1994, 75):

$$\frac{1+i_{h,t}}{1+i_{f,t}} = \frac{1+\pi_{h,t}^e}{1+\pi_{f,t}^e} \quad (2.5)$$

ISSN: 2455-8834

Volume:02, Issue:11 "November 2017"

2.2 Purchasing Power Parity

The second theory constructing the International Fisher Effect is *Purchasing Power Parity (PPP)*, the idea that exchange rates adjust and offset the inflation rate differentials among nations. Absolute PPP suggests that the real price of a good must equate internationally: the law of one price. By contrast, Relative PPP states that the exchange rate between two countries will adjust and represent changes in the price level of the same two countries over time (Solnik 2000, 36-37). This understanding of relative PPP suggests that one would observe comparatively low currency depreciation for countries with low inflation rates, when measured against countries with relatively higher inflation rates (Shapiro 1998, 159).

However, as stated by Webster (1987) and evidenced by Galliot (1971), the effects of PPP tend to fail in the short run but work in the long run; therefore, this paper will also only consider changes and stabilization in the long run.

The purchasing parity relation can be described through the following formula, where S_t is the value of one unit of foreign currency in domestic currency at time t, and S_{t+1} is the spot exchange rate for time t+1:

$$\frac{S_{t+1}-S_t}{S_t}=\frac{\pi_{h,t}-\pi_{f,t}}{1+\pi_{f,t}} \qquad (2.6)$$

2.3 The International Fisher Effect

Recalling equations 2.5 and 2.6:

$$\frac{1+i_{h,t}}{1+i_{f,t}}=\frac{1+\pi^e_{h,t}}{1+\pi^e_{f,t}} \quad \text{and} \quad \frac{S_{t+1}-S_t}{S_t}=\frac{\pi_{h,t}-\pi_{f,t}}{1+\pi_{f,t}}$$

The International Fisher Effect's Relation, as follows, can be derived:

$$\frac{S_{t+1}-S_t}{S_t}=\frac{i_{h,t}-i_{f,t}}{1+i_{f,t}} \qquad (2.7)$$

which is the proposition that changes in spot exchange rates between two countries will equate differences in nominal interest rates.

ISSN: 2455-8834

Volume:02, Issue:11 "November 2017"

3. EMPIRICAL ANALYSIS

3.1 Econometric Model

The results of the International Fisher Effect are a product of investors acting rationally on current information and exchange rate expectations, allowing the relation between actual spot rates and expected spot rates in period *t+1* to be denoted as follows (Sundqvist, 2002):

$$S_{t+1} = E(S_{t+1}, \varphi_t) \quad (3.1)$$

Where ϕ_t is the information set in period *t*. Since this equation holds true only on average, an error term (expected to cancel out) could be added as follows:

$$S_{t+1} = E(S_{t+1}, \varphi_t) + \mu_{t+1} \quad (3.2)$$

Thus, given unbiased and rational expectations, the following regression model could be produced:

$$\frac{S_{t+1} - S_t}{S_t} = \alpha + \beta\left(\frac{i_{h,t} - i_{f,t}}{1 + i_{f,t}}\right) + \mu_{t+1} \qquad (3.3)$$

Where, according to the International Fisher Effect,

$$H_0: \alpha = 0, \beta = 1$$

A Z-test will be employed to test the validity of the effect, and Ordinary Least Squares estimates will be made for α and β. The residual terms μ_{t+1} will be tested by calculating their Durbin-Watson Statistic to identify possible autocorrelations in these residuals.

The Z-scores for each of the two coefficient will in turn be used to calculate p-values. These p-values, at a 5% significance level, will allow the Null Hypothesis to be rejected if applicable.

3.2 Data Used

Average quarterly Short-term Nominal Interest Rate data from The OECD (Organization for Economic Co-operation and Development) were used. All were 90-day bonds assumed to have identical risk characteristics, defined as follows:

- Japan: Certificates of deposit
- The United States: Certificates of Deposit
- The United Kingdom: 3-month Treasury Securities

ISSN: 2455-8834

Volume:02, Issue:11 "November 2017"

- South Korea: Certificates of Deposit
- Australia: Bank Bills
- Canada: 90-day Corporate Paper
- Eurozone: 3-month lender's rate

Quarterly average spot exchange rates of daily data (calculated as the number of units of foreign currency per Japanese Yen) too were extracted from The OECD's database.

3.3 Results

General Observations included the fact that R-squared values across all tests were remarkably low, suggesting that the impact of the International Fisher Effect, even wherever it held, was likely relatively low, and that quarterly average exchange rates between 2002 and 2015 have been largely influenced by other factors. The Durbin-Watson Tests for all data sets suggested little to no positive autocorrelations among residues.

The Results from analyzing Japan's data against those of The United States, The United Kingdom, The Eurozone and Australia all suggest that the International Fisher Effect does not hold, but since all the results show that α can be safely approximated to the Null-Hypothesis value of 0, it can be inferred that a zero interest differential between Japan and the respective country would likely result in no change in Exchange Rates. The Null hypothesis was rejected for all these instances.

Table 1: Japan and The United States

Coefficient	Least-Square Value	Standard Error	Z-score	p-value	Region of Acceptance: Lower Limit	Region of Acceptance: Upper Limit
α	**-0.0004**	0.0069	-0.0554	0.9558	-0.0142871	0.0135180
β	**-0.2832**	0.3445	-3.7249	0.0002	-0.9727464	0.4063852
R-squared Value				0.0115		
Durbin-Watson Statistic				1.3982		

ISSN: 2455-8834

Volume:02, Issue:11 "November 2017"

Table 2: Japan and The United Kingdom

Coefficient	Least-Square Value	Standard Error	Z-score	p-value	Region of Acceptance: Lower Limit	Region of Acceptance: Upper Limit
α	**-0.0033**	0.0125	-0.2658	0.7904	-0.028317	0.021678
β	**-0.4526**	0.4340	-3.3468	0.0008	-1.321379	0.416190
R-squared Value				0.0184		
Durbin-Watson Statistic				1.3704		

Table 3: Japan and The Eurozone

Coefficient	Least-Square Value	Standard Error	Z-score	p-value	Region of Acceptance: Lower Limit	Region of Acceptance: Upper Limit
α	**-0.0108**	0.0159	-0.6821	0.4951	-0.0426457	0.02096175
β	**-1.4952**	0.8345	-2.9902	0.0028	-3.1650044	0.17457028
R-squared Value				0.0525		
Durbin-Watson Statistic				1.4049		

Table 4: Japan and Australia

Coefficient	Least-Square Value	Standard Error	Z-score	p-value	Region of Acceptance: Lower Limit	Region of Acceptance: Upper Limit
α	**-0.0108**	0.0159	-0.6821	0.4951	-0.0426457	0.02096175
β	**-1.4952**	0.8345	-2.9902	0.0028	-3.1650044	0.17457028
R-squared Value				0.0525		
Durbin-Watson Statistic				1.4049		

By contrast, the analysis failed to reject the null hypothesis for the case of Canada, as both coefficients' p-values exceeded the significance level of 0.05, implying that the International Fisher Effect is likely to have held in the case of the Japanese Yen and Canadian Dollar, and that nominal interest rate differentials may appropriately predict exchange rate changes.

ISSN: 2455-8834

Volume:02, Issue:11 "November 2017"

Table 5: Japan and Canada

Coefficient	Least-Square Value	Standard Error	Z-score	p-value	Region of Acceptance: Lower Limit	Region of Acceptance: Upper Limit
α	**0.0001**	0.0133	-0.0105	0.9916	-0.02642041	0.02669949
β	**-0.0756**	0.6488	1.6577	0.0974	-1.37438046	1.22322826
R-squared Value				0.0002		
Durbin-Watson Statistic				1.7143		

In South Korea, however, the p-test concludes that, while the Null Hypothesis cannot be rejected for coefficient β, it must be rejected for α. This supports the validity of The International Fisher Effect in the case of Japan and South Korea by suggesting that a unit percentage rise in interest differential does lead to a unit percentage rise in exchange rates, but contradicts it by suggesting that a zero interest differential does lead to some change in exchange rates. Thus, while the Null Hypothesis must be rejected, it can be deduced that the International Fisher Effect holds only partially for the case of Japan versus South Korea, and that there must exist many other factors that are responsible for changes in exchange rates between the Japanese Yen and the South Korean Won.

Table 6: Japan and South Korea

Coefficient	Least-Square Value	Standard Error	Z-score	p-value	Region of Acceptance: Lower Limit	Region of Acceptance: Upper Limit
α	**0.0479**	0.0237	2.0229	0.0431	0.0005184	0.0952208
β	**1.5350**	0.7447	0.7184	0.4725	0.04491225	3.0250388
R-squared Value				0.0683		
Durbin-Watson Statistic				1.5104		

4. CONCLUSION

The results suggest, at a 5% significance level, that, between 2002 (Q2) to 2017 (Q2), The International Fisher Effect did not hold for Japan versus The United States, The United Kingdom, The Eurozone, and Australia. It did, however, hold for the case of Japan versus Canada, and can be inferred to have played a role in the case of Japan versus South Korea. They also allowed the inference that a zero interest differential likely corresponds to a zero change in exchange rates (in

ISSN: 2455-8834

Volume:02, Issue:11 "November 2017"

all cases but South Korea), reflective of the fact that low-to-zero interest rate differentials are not enough for investors to prefer investing in foreign rather than domestic capital markets. Additionally, it is also possible that the decrease in interest rates in developing countries worldwide (the only circumstances in which the differential is near zero) has led to a decrease in all investment worldwide.

However, given the extremely low correlation identified in all the tests, the analysis allows the conclusion that differences in Nominal Interest rates are not a significant predictor of exchange rates, if valid at all. Possible failed assumptions causing this difference may include immobility of capital in and out of Japan that violates the theory's assumption of Capital Account Convertibility, or possible differences in risk characteristics between Japanese and Foreign bonds. Further analysis of the cause behind why the International Fisher Effect did not hold with the enumerated countries could test the validity of the assumption that real interest rates equalize between Japan and other countries in the long run, as well as hurdles to Purchasing Power Parity in Japan's International Trade.

REFERENCES

OECD (2017), Short-term interest rates (indicator). doi: 10.1787/2cc37d77-en (Accessed on 22 October 2017)

OECD (2017), Exchange rates (indicator). doi: 10.1787/037ed317-en (Accessed on 22 October 2017)

Sundqvist, E. (2002) *An empirical investigation of the International Fisher Effect*. *Examensarbete*.

Booth, G & Ciner, C. (2001) *The relationship between nominal interest rates and inflation: international evidence*. Journal of Multinational Financial Management, 11.

Coppock, L.,Poitras, M. (2000). *Evaluating the Fisher Effect in the long-term cross country averages*, International Review of Economics and Finance pp. 181-192.

Demirag, I & Goddard, S. (1994*) Financial Management for International Business.* McGraw-Hill Book Company Europe. Berkshire.

Eichengreen, B. (1996). *Globalizing Capital*. Princeton University Press. New Jersey.

Gailliot, H. J. (1971). *PPP as an explanation of long-term changes in exchange rates*. Journal of Money, Credit and Banking, August.

ISSN: 2455-8834

Volume:02, Issue:11 "November 2017"

Kane, E. & Rosenthal, L. (1982) *International Interest Rates and Inflationary Expectations.* Journal of International Money and Finance, April. Short Term Interest Rates — *Data and Methods*, stats.oecd.org (1990-2017)

Krugman, R. P. & Obstfeld, M. (1997) *"International economics".* Addison Wesley Longman, Inc. Harlow, England.

Shapiro, A. C. (1998). "*Foundations of Multinational Financial Management"*. Prentice-Hall, Inc. London.

Solnik, B. (2000). *International Investments.* Addison Wesley Longman, Inc. New York.

Webster, A. (1987). "*Purchasing Power Parity as a theory of international arbitrage"* Applied Economics.

Mishkin, Frederic S. (1984) "*Are real interest rates equal across countries? An empirical investigation of international parity conditions."* The Journal of Finance 39.5, 1345-1357

Evans, M, and Lewis, K, 1995, "*Do Expected Shifts in Inflation Affect Estimates of the Long-Run Fisher Relation?"* Journal of Finance, pp. 225-253.

Mundell, R, 1963, "*Inflation and Real Interest,"* Journal of Political Economy, Vol. 71, pp. 280-83.

