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Causality Relationship between Foreign Exchange Rates and Stock Market Close: Evidence from Singapore

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Abstract:

This paper attempts to examine whether or not a causal relationship exists between exchange rates and stock market returns. By using the Granger Causality model, causality relationships were determined for four data sets created through the use of significant structural breaks between 1990 and 2006 in Singapore. The results suggest that over the course of 16 years there exists no relationship between exchange rates and stock market returns. However, from 1990 up until the Asian Financial Crisis exchange rates led stock prices as suggested by Granger et al. (2000). The other two time series, between the Asian Financial Crisis and September 11th, 2001 and September 11th to 2006, show the exact opposite results suggesting that stock prices granger cause exchange rates.

JEL Classification: G15, c32
Keywords: Exchange Rates, Stock Market Returns, Granger Causality, Singapore

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1.0 Introduction

The year 1973 marks a significant turning point in the world's global financial market; the creation of floating exchange rates. Floating exchange rates have allowed for investors, businessman, and stock market speculators to determine the currency's value. Typically economically stable countries and unions have allowed for their currency to float including the United States, Japan, and the European Union. Although some countries have kept quasi-floating or pegged exchanges rates, many countries have left the faith of the currency in the hand of the financial markets. In September, 1992 Gregory Soros (investopedia.com), a currency speculator, bet $10 billion on a speculation that the British pound would decline. In nearly a day time he generated a $1 billion dollar profit. Some argue that the overwhelming size of his trade instantaneously changed the mindset of investors indirectly forcing the value of the British pound and the stock market lower. It has also been argued that the effects of countries suffering from economic downturn are amplified by their floating exchange rates.

However, the question remains what exactly is the relationship between exchange rates and stock market? There are two explanations for which variable cause the other. The flow-oriented model approach as described in Dornbusch and Fischer (1980) research show that currency movements directly affect international competitiveness. In turn, currency has an effect on the balance of trade within the country. As a result, it affects the future cash flows or the stock prices of firms.

The counter argument suggests that taking a portfolio-balance approach (Dornbusch, 1976), where portfolio holders should diversify to eliminate firm specific risk, requires effective investments allocation including currencies. As with other financial instruments, currencies therefore are under the rules of supply and demand for assets. In order for investors to purchase

new assets they must sell off other less attractive asset in their portfolio. In other words buying and selling of domestic or foreign investments if less attractive. As countries assets become more valuable, interest rates begin to increase creating an appreciation of domestic currency.

Although two valid explanations, no consensus has been made between the two. This study looks to validate one of the explanations over the other by looking at Singapore's exchange rate to its stock market prices between 1990 and 2006.

2.0 Trends

The Singapore dollar (SGD) over the past five years has continued to appreciate over the United States Dollar (USD) as displayed in Chart (1). Although this can be the result of prior and current economic downturns in the United States, the Singapore still appreciated over the USD during the period between the internet bulb burst and the current credit crisis. The Singapore Exchange has shown a general upwards trend for the previous five years shown in the Chart (2). However, during the 1990's the market fluctuated from decade highs to decade lows as well as a plateau between 1993 and 1997. Looking at the both five year graphs, exchange rates have been strengthening as well as the Singapore markets.

Chart (1) SGD/USD Exchange Rate 2003-2008

(Chart provided by: Yahoo.com/finance)

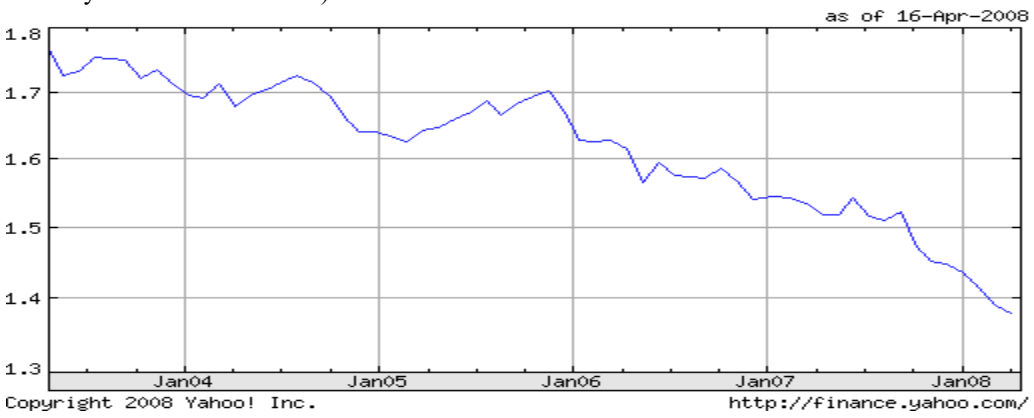


Chart (2) Straits Times Index 2001-2008
(Chart provided by: Yahoo.com/Finance)

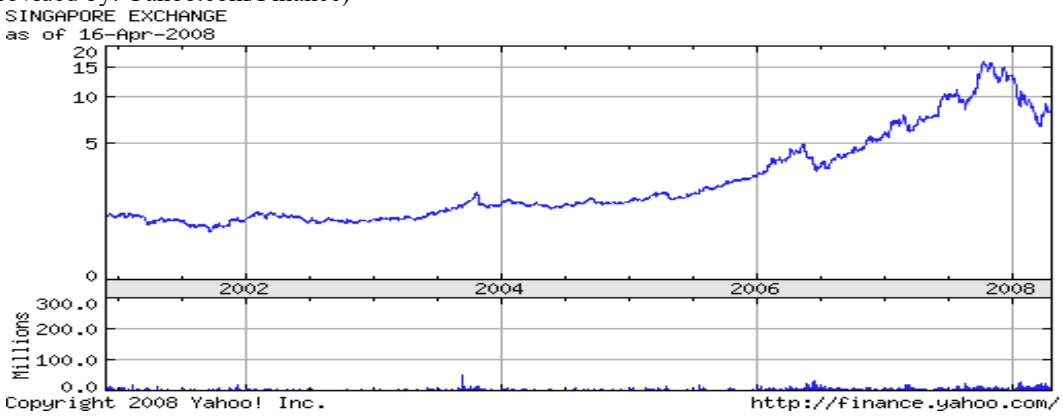
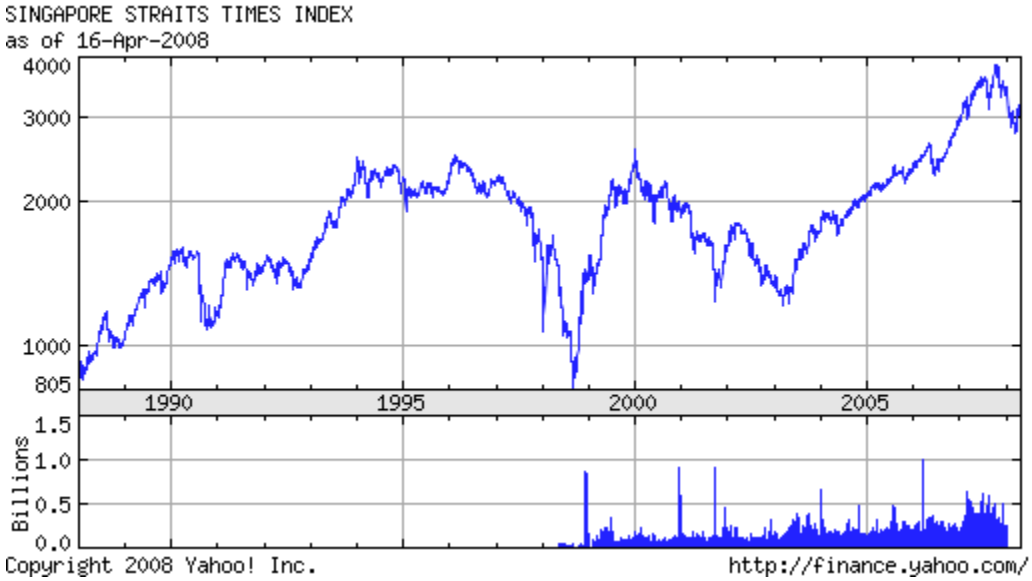


Chart (3) Straits Times Index 1988-2008
(Chart provided by: Yahoo.com/Finance)



3.0 Literature Review

Economic theory states that changes in exchange rates will directly affect a firm's net income through its foreign operation. This change in profits will impact the underlying value of the firm's stock. There has been much research in the past 30 years focusing on exchange rates and their relationship to stock prices. In the 1980's, researchers tested specifically the correlation between both exchange rates and stock prices. Aggarwal (1981) research suggested a

positive correlation between both variables where as Soenen and Hennigar (1988) tests appeared to show a stronger negative relationship.

It was not until the early 1990's that Granger Causality Testing to explain the relationship between equity markets and exchange rates. Bahmani-Oskooee and Sohrabian (1992), one of the first studies to use the GC testing, found bidirectional causality between the returns of the S&P 500 index and the effective exchange rate of the dollar. Since then, research on the topic continues to grow. Different variations have been attempted, including different samples and time series, giving various explanations to whether exchange rates Granger cause stock price or vice versa. Although results diverge, the traditional theory described above tends to explain the majority. In their 2003 study, Smyth and Nadha (2003) found a uni-directional causality from exchange rates to stock price in both India and Sri Lanke, however Bangladesh and Pakistan show that both variables independent from one another. In respect to Brazilian markets, Benjamin Tabak's work, *The Dynamic Relationship between Stock Prices and Exchange Rates: Evidence for Brazil*, discovered Granger causality from exchange rates to stock prices (Tabak 2006). Among other countries in Granger et al. (2000) study, Singapore's data suggested a relationship flowing exchange rates to stock prices prior to the Asian Financial Crisis.

Amongst those whom studied the effects of short term or long term relationships between the two variables, Muhammad and Rasheed (2002) discovered in Pakistan and India there was no long run relationship between stock prices and exchange rates.

4.1 Methodologies and Results

To measure causality between the Singapore stock market closes and exchange rates, the Granger Causality Model was used. This test is used to determine whether or not one variable is the cause of the other, vice versa, or neither. After eliminating serial correlation, Granger's

(1969) GC test provides four possible outcomes to a regression of variables x and y: No causality, X granger causes Y only, Y granger causes X only, and bi-directional causality.

The following summarizes the step necessary to complete the GC test:

i. Test for Unit Root between stock markets and exchange rates using the Augmented Dickey-Fuller Test(ADF)
ii. If a Unit Root is present, difference the data and execute a ADF test again
iii. Estimate co-integration using the same order of integrated variables
iv. Use a VAR to test Causality

The Granger Causality Test estimates the results of two regressions:

$$MKT = \sum_{i=1}^{n} \alpha_i \, XRATE_{t-1} + \sum_{j=1}^{n} B_j \, MKT_{t-1} + \varepsilon_{1t} \qquad (1)$$

$$XRATE = \sum_{i=1}^{m} \lambda_i \, MKT_{t-1} + \sum_{j=1}^{m} \delta_j \, XRATE_{t-1} + \varepsilon_{2t} \qquad (2)$$

Where: *MKT*= the Singapore market close for the day

XRATE= the Singapore Dollar to USD exchange rate for the day

Equation (1) regress the dependant variable, *MKT*, to how it relates to lagged variables of XRATE and *MKT*. Equation (2) is similar to Equation (1), it regress *XRATE* to lagged variables of *XRATE* and *MKT*. Both equations assume that the disturbance terms, ε, are uncorrelated. The null hypothesis for equation (1) and (2) state no evidence of causation from *MKT* to *XRATE* and no causation form *XRATE* to *MKT* respectfully. Based on these results one of the four possible outcomes, as described above, will become evident.

The goal of this study was to expand on the Granger et al. (2000) study which observed the time up to the Asian Financial Crisis and shortly after. This study focused primarily on the

period after the crisis to the present time period, which to the author's knowledge has not be studied in depth. Base on the Granger Causality Model procedure, four different time series were tested. One tested the Granger causality between stock market closes and exchange rates for the time period from 1990-2006. The other three use the same test however different data sets. Two structural breaks were used on the overall data set at the July 1st, 1997(time of the Asian Financial Crisis) and September 11th, 2001(Terrorist Attack on the USA). There are a few explanations for this. The structural break at the financial crisis allows for comparison to previous studies using GC test on exchange rates and stock market closes insuring valid results and data selection. It also allows us to examine the larger test (1990-2006) in different sections to see if the is some causation between exchange rates and the stock market in shorter spans of time appose to fifteen years.

4.2 Data

The data selected for this research was acquired from internet historical data logs. To measure the changes to the stock market, the day's closes were used based on the Singapore Index. Exchange rates were based on the daily close of the Singapore dollar to the US dollar exchange rate. Yahoo.com was used to collect Singapore Index historical closes and oanda.com, a provider of foreign exchange data and services, to collect the daily foreign exchange rates. The accumulated data spans over 16 years from January 01, 1990 to December 31, 2006 for a total of 4,167 observations. Although stock markets close during weekends and specific holidays, exchange rates are calculated on a daily basis. To account for this discrepancy, all exchange rate closes during the weekend and these holidays were excluded to allow for one exchange rate and one stock market close on any specific trading day.

5.0 Empirical Analysis

The hypothesis in the introduction suggested that there are two possible explanations for the directions of causality between stock market returns and exchange rates. The results suggested by the Augmented Dickey Fuller required that the unit root data be differenced. By differencing the data, it allowed for the time series to become stationary and eliminated misspecification in the causality test. Table 1 and 2 show the results from both the ADF and co-integration tests.

The empirical results from the study show over the entire period from 1990 to 2006, there is no relationship between stock prices and exchanges rates in Singapore. This conclusion supports the results found by Muhammad and Rasheed (2002) where they found that there is no long-run relationship between both variables in Pakistan and India. Granger et al. (2000) results suggested that up until the Asian Financial Crisis, Singapore's exchange rates lead the price of stocks. To insure the correct methodology, the period between 1990 and up until the financial crisis was tested. The results from this study suggest that exchange rates indeed lead the price of stocks. These results were consistent with previous studies as suggested above. The empirical results for both the time periods between the structural break (the Financial Crisis in 1997 to September 11, 2001) and from September 11th until 2006 suggest, with statistical significance, that stock prices lead exchange rates in Singapore. The results from this time series explain the portfolio balance approach, an alternative explanation for the relationship between both variables. These results contradict a majority of previous studies conducted on this topic. A possible reason for the discrepancy could be the economic conditions follow both time series. After 1997, financial markets were experiencing the side-effects from the Financial Crisis and a

combination of the internet bubble bursting and the terrorist attacks on the United States. These events could have forced skewed results for the time series after 1997.

6.0 Conclusion

This study looked at the causal relationship between stock market prices and exchange rates in Singapore between 1990 and 2006. By using two structural breaks at the Asian Financial Crisis and September 11th 2001, four different time series were tested for Granger Causality. After making the data stationary through differencing the data and testing for co-integration, the results from the four time series complemented prior research. In the long run, neither variable Granger caused the other. The data before the first structural break, the Asian Financial Crisis, showed that exchange rates lead the prices in equity markets. However this was not the case for both the time periods between the structural break (the Financial Crisis in 1997 to September 11, 2001) and from September 11th until 2006 where stock prices Granger cause exchange rates. The extreme conditions that followed 1997, including the Asian Financial Crisis and the terrorist attacks on the US, may have caused skewed results for both time series.

In summary, based on results, the study favors neither explanation for the relationship between both variables. Depending on the time series tested in Singapore, the relationship between stock prices and exchange rates differs.

Table 1: Results of the ADF Test									
		1/1/90-12/31/06		**1/1/06-7/1/97**		**7/1/97-9/11/01**		**9/11/01-12/31/06**	
		ADF		ADF		ADF		ADF	
UR(Level)	Fisher Chi-squared	2.04535		2.58535		11.7223	***	0.09612	
	Choi Z-stat	0.4612		0.13692		-1.73176	**	3.08412	
UR(1st Difference)	Fisher Chi-squared	36.8414	***	173.798	***	371.522	***	190.557	***
	Choi Z-stat	-5.25948	***	-12.6694	***	-18.9056	***	-13.3309	***

** Denotes Significant at 5% Critical Value

*** Denotes Significant at 1% Critical Value

Table 2: Co-integration Results		
Time Period	λ Trance	λ Max
1/1/90- 12/31/06	3.158116	2.237945
1/1/90- 7/1/97	9.381953	6.993401
7/1/97-9/11/01	15.91005**	14.22739**
9/11/01-12/31/06	10.12588	8.251146

** denotes significant at 5% Critical Value

Table 3: Granger Causality Test Results		
Time Period	Stock Market to Exchange Rate	Exchange Rate to Stock Market
January 1, 1990- December 31,2006	No	No
January 1, 1990- July 1, 1997	No	Yes
July 1, 1997- September 11, 2001	Yes	No
September 11,2001-December 31,2006	Yes	No

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