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THE DYNAMIC BEHAVIOR OF THE SRI LANKAN EXCHANGE RATES: EVIDENCE FROM FIVE CURRENCIES OF MAIN TRADING PARTNERS.

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INTRODUCTION

Basic understanding of the dynamic behavior of exchange rates is important for policy makers and investors. Given the small, open and import dependent nature of the Sri Lankan economy, the exchange rate is probably the most important asset price. It has been an important element in the monetary transmission process in Sri Lanka. Against this background, a good understanding of the dynamic behavior of the exchange rate changes is important in many aspects. An in depth empirical analysis of the dynamic behavior of the exchange rate of Sri Lanka might also provide useful implications for the direction of future research. Sri Lankan exchange rates have not received much attention in the finance literature. A few studies have attempted to study about the features of exchange rates dynamics. However, their focus has been mainly on how the exchange rate affects other macro variables. However, there exists no in-depth technical analysis on statistical properties and dynamic behavior of the Sri Lankan exchange rate changes. This study intends to fill this gap in the finance literature and provide an in-depth analysis. Results of this study provide relevant implications for investors and policy makers. Therefore, a thorough understanding of the dynamic behavior of the Sri Lankan exchange rate will enable the planning of the exchange rate policy. The Main objective of this study is to identify underlying patterns and investigate dynamic behavior of the Sri Lankan nominal exchange rate changes of LKR against five major currencies, namely Euro, (LKR/EURO), U.S. Dollar(LKR/USD), the British pound,(LKR/GBP), Indian rupee (LKR/ INR), and the Japanese yen(LKR/JPY).

METHODOLOGY

The empirical study is carried out using the Sri Lankan exchange rates against five main trading partners' currencies, namely Euro, U.S. dollar, the British pound, Indian rupee, and the Japanese yen. These data were collected from the Central Bank, Sri Lanka. The study covers a time period from May 2006 to April 2011. Exchange rate is denoted by ER_t. The Natural log of ER_t is defined as $e_t = \ln(ER_t)$. Exchange rate return is defined as $r_t=e_t-e_{t-1}$. Numerical descriptive statistics and graphical displays- Line graphs, Histograms, and correlograms, kernel density estimate, Confidence Ellipse,- are used to explore the dynamic behavior of the exchange rate. Autoregressive model and Generalized autoregressive conditional heteroscedasticity model are used to study the types of dynamic behavior of the exchange rate. The augmented Dickey- Fuller and the Phillips- Perron tests were implemented on logarithm of the spot exchange rate series to investigate the random walk nature of the series. GARCH(1,1) model is used to capture ARCH and GARCH effect in exchange rate returns. Johansen multivariate co-integration method is employed to analyse the dynamic linkages among these exchange rates.

RESULTS AND DISCUSSION

The estimated sample moments- mean, variance, skewness, and kurtosis, provide a preliminary description of the properties of the distribution of weekly changes in exchange rate for Sri Lanka. The mean of the return series is very close to zero in each period. They are not statistically significantly different from zero, H_0: $\mu = 0$ was not rejected in all four cases

except JPY. The standard assumption that the expected value of weekly returns equals zero is met. This indicates that the value of the currency has remained stable over the sampling periods. LKR value against JPY has depreciated continuously. The Jarque–Bera test statistics rejects the null hypothesis of normality of the exchange rate return series for sample periods. P values for the JB test is 0.0000 for all series. The line graph shows considerable randomness. One can clearly see two main trend patterns from the line graph, upward movement and downward movement. Upward movement indicates a depreciation of the rupee; Downward movement indicates an appreciation in the nominal exchange rate against the each foreign currency.

The estimated Kernel density distribution of exchange rate return are approximately symmetric and leptokurtic which indicates that there is large excess kurtosis RTUSD (14.18) and RTINR(14.14), and their heavy tailed character. Mean and variance of those distributions change over time. Variability of return series vary over time and appear in clusters.

Empirical results of ACF show that the level of exchange rate of all exchange rates behaves as a random variable which behaves as random walk, I(1). ADF test and PP test results also indicate that the series are non-stationary and follow a random walk.

Sample ACF decays slowly to zero at a polynomial rate as the lag increases. This type of process is referred to as *long– memory* time series. The sample autocorrelation coefficients for each exchange rates series in level form at various lags are very high even up to first 36 lags. The autocorrelation coefficient starts at a very high value (0.997) close to 1 and declines very slowly toward zero as the lag lengthens. Autocorrelations for the first 36 lags range between approximately 0.993 and 0.846, providing strong evidence of the presence of serial correlation. Results indicate that e_t series has a very *long memory* and is *largely persistent* with lagged coefficients that are clearly statistically significant. The nature of the trend of this variable is stochastic and tends to diverge. The impact of a shock ε_t on e_t does not diminish over time. Therefore, the shocks are persistent.

Sample autocorrelations of exchange rate returns (SACF) are generally very small and statistically insignificant. whereas the sample autocorrelations of the *absolute* and *squared* returns are significantly different from zero even for large lags. The autocorrelation function of absolute returns decays slowly as a function of time lag as a power law. This behavior suggests that there is some kind of *long-range dependence* in the weekly exchange rate return. r_t series has a very long memory. The serial dependence for the absolute and squared returns are positive and significant and decays slowly. In addition, the autocorrelation in the absolute returns is higher than the autocorrelation in the corresponding squared returns in all series.

Volatility clusters are observed in all the exchange return series. Volatility evolves over time in a continuous manner. Volatility varies within some fixed range. Statistically speaking, volatility is often stationary.

GARCH model results show the evidence of non-linearity in the exchange rate return series. *nonlinear dependence* is important in terms of model adequacy, market efficiency, and predictability. The sum of the ARCH and GARCH coefficients ($\alpha + \beta =$) is very close to one indicating that shocks to the conditional variance are highly persistent. Almost all series GARCH effects are more than 0.94. The results of Variance–Ratio methodology of Lo and MacKinlay shows that the p values larger than 0.05, indicating that the martingale hypothesis is rejected at 5 percent level. This indicates that Sri Lankan exchange rate, r_t, do not follow a martingale sequence. The results of this analysis provides a practical benefit in the field of exchange rate risk management.

CONCLUSIONS/RECOMMENDATIONS

This study shows that the expected value of exchange rate return has remained stable over the sampling period. Most of the exchange rates are not normally distributed. The variance of these distributions are time varying. The Kernel density distribution of the exchange rate return is leptokurtic. ACF analysis and Unit root tests show these series are non-stationary and have long memory. Volatility clusters are observed in all exchange rate returns. GARCH analysis show the evidence of nonlinearity of the series. The sum of ARCH and GARCH coefficients is very close to one indicating that shocks to the conditional variance are highly persistent. Most of the Sri Lankan exchange rate returns do not follow a martingale sequence. The results of this study provide valuable information to the policy makers and investors

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Appendix

Table 1: Summary statistics for returns

	RTEUR	RTGBP	RTUSD	RTJPY	RTINR
MEAN	0.000790	-0.000169	0.000276	0.001508	0.000280
MEDIAN	0.001021	0.000251	0.0000715	0.001728	0.000609
SD	0.012393	0.011853	0.003679	0.011652	0.010167
SK	0.358176	-0.602648	0.836519	0.263968	1.289431
KURT	7.067243	4.487145	14.85475	3.439080	14.14772
JB	0.0000	0.0000	0.0000	0.078	0.0000
CV	1568	7013	1332	772	3631

Table 2: Hypothesis testing results

Exchange rate (LKR vs f.currencies)	$H_0 : \mu = 0$
RTEUR	NS
RTGBP	NS
RTINR	NS
RTJPY	S
RTUSD	NS

Note: NS=not significant
S=statistically significant

Figure 1: ACF Plots of exchange rate returns

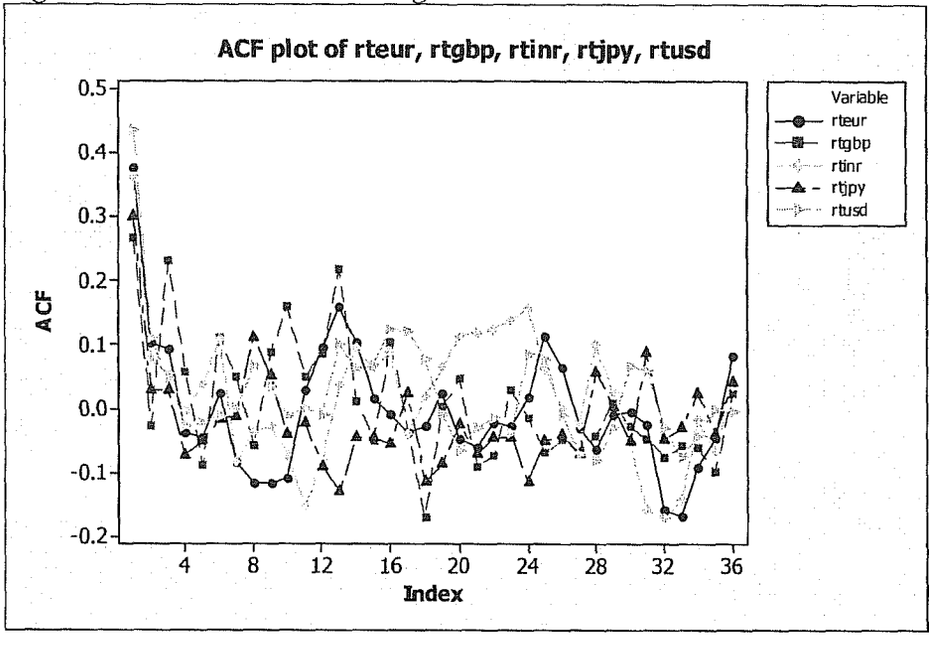

Figure 2: ACF of exchange rates

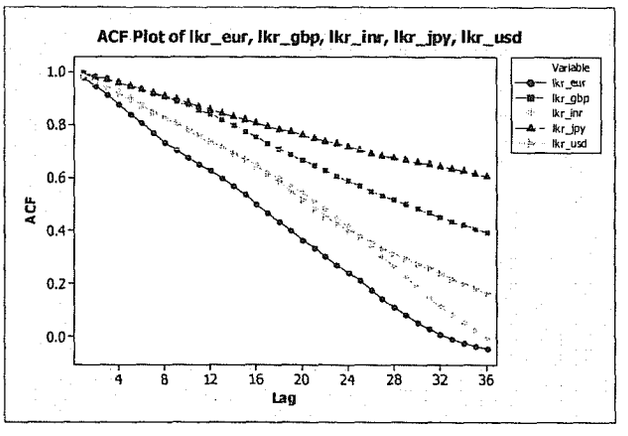

Table 3: ARCH and GARCH results

Exchange rates	ARCH	GARCH	Volatility

	effects (α)	effects (β)	persistence ($\alpha+\beta$)
RTEUR	0.1296 (0.009)	0.8167 (0.000)	0.9463
RTGBP	0.1175 (0.01)	0.8306 (0.000)	0.9481
RTINR	0.1600 (0.000)	0.8249 (0.000)	0.9849
RTJPY	0.0730 (0.076)	0.8946 (0.000)	0.9676