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A Proposed Statistical Model to Forecast the Exchange Rate of the Egyptian Pound per U.S. Dollar

A thesis submitted in partial fulfillment of the requirements for the Master Degree in Applied Statistics

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ABSTRACT

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A Proposed Statistical Model to Forecast the Exchange Rate of the Egyptian Pound per U.S. Dollar

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Forecasting of exchange rates has been an extremely challenging and important task for both academic and business researchers. These forecasts are essential for central banks, corporations, investors and even individuals to hedge exchange rate risks and to generate profits. This study aims to propose a statistical model to forecast the exchange rate of the Egyptian pound per U.S dollar (LE/$US) for both short-term and long-term periods. Several economic variables that were expected to have an impact on the LE/$US exchange rate were investigated. The study covered the period from February, 2003 to July, 2014 using monthly and daily LE/$US exchange rates.

Different statistical models were applied, for short-term forecasting, univariate autoregressive integrated moving average (ARIMA) model together with a hybrid model that combines the ARIMA model with the generalized autoregressive conditional heteroscedasticity (GARCH) model were applied using the daily exchange rate series. For long-term forecasting, univariate ARIMA model together with a dynamic regression model that combines the multiple regression analysis with the ARIMA model were applied using the monthly exchange rate series. Several

economic variables were included in the dynamic regression model. The forecasting performance of all models estimated were evaluated using different forecasting accuracy measures that were based on both in-sample and out-of-sample forecasts.

The results showed that for the short-term forecasting model, the hybrid ARIMA-GARCH model outperformed the univariate ARIMA model in terms of forecasting accuracy. As for the long-term forecasting model, the dynamic regression model outperformed the univariate ARIMA model.

These models may aid the Egyptian authorities to deal with the disequilibrium in the foreign exchange market. Policy makers, corporations, banks, individuals and foreign currency dealers, may also use these models to generate forecasts of the LE/$US exchange rate and to hedge against exchange rate risk.

Keywords: Exchange rate forecasting, Autoregressive integrated moving average, ARIMA, Dynamic regression, Regression with ARIMA errors, Generalized autoregressive conditional heteroscedasticity, GARCH, Hybrid ARIMA-GARCH, Technical analysis, Fundamental analysis.

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List of Abbreviations

ACF	Autocorrelation Function
ADF	Augmented Dickey-Fuller test
AIC	Akaike Information Criterion
AICc	Corrected Akaike Information Criterion
ANN	Artificial Neural Network
ANOVA	Analysis of Variance
AR	Autoregressive
ARCH	Autoregressive Conditional Heteroscedasticity
ARIMA	Autoregressive Integrated Moving Average
ARMA	Autoregressive Moving Average
BIC	Bayesian Information Criterion
BIS	Bank of International Settlements
BOP	Balance of Payments
CBE	Central Bank of Egypt
CPI	Consumer Price Index
DM test	Diebold and Mariano test
ER	Exchange Rate
FDI	Foreign Direct Investment
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
GDP	Gross Domestic Product
IMF	International Monetary Fund
KPSS test	Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test
LM	Lagrange Multiplier
MA	Moving Average

MAE	Mean Absolute Error
MAPE	Mean Absolute Prediction Error
MSPE	Mean Squared Prediction Error
OLS	Ordinary Least Squares
PACF	Partial Autocorrelation Function
PP test	Phillips Peron test
PPP	Purchasing Power Parity
Q-Q plot	Quantile-Quantile plot
RMSE	Root Mean Squared Error
S.E	Standard Error
T-GARCH	Threshold Generalized Autoregressive Conditional Heteroscedasticity
VAR	Vector Autoregressive
VEC	Vector Error Correction
VIF	Variance Inflation Factor

Chapter One: Introduction

1.1 Back ground

Since the development of foreign exchange market (currency market, Forex or FX), understanding and forecasting exchange rate movements has been an extremely challenging and important task for both academic and business researchers especially after the abolishment of fixed exchange rate system in most countries. With market globalization, multinational firms are in constant need of buying, selling or even borrowing foreign currency, thus exposing to exchange rate risk becomes an ever-growing challenge to more and more firms in the modern world (Cai & Qi, 2010). Profits or losses can become more dependent on exchange rate fluctuations than on the inherent profitability of the underlying trade in goods and services (Coyle, 2013).

In the past, foreign exchange market was limited to meet the demands of exporters and importers of goods and services but nowadays, these operations diversified to meet the demands of governments, financial sectors, companies, banks, investors and even individuals.

Exchange rate can be defined as the number of units of local currency paid to obtain one unit of foreign currency or in other words “the price of one money in terms of another” (Husted & Melvin, 2004). Every country has its own currency to be used in domestic payments, however, it appears necessary to use foreign currencies when commercial or financial relationships occur between different countries.

A major challenge in forecasting the movements of exchange rates is that the exchange rates varies and fluctuates continuously and are affected by