Econometric modeling of exchange rate determinants by market classification: An empirical analysis of Japan and South Korea using the sticky-price monetary theory

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ECONOMETRIC MODELING OF EXCHANGE RATE DETERMINANTS BY MARKET CLASSIFICATION: AN EMPIRICAL ANALYSIS OF JAPAN AND SOUTH KOREA USING THE STICKY-PRICE MONETARY THEORY

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Abstract

Numerous researchers have studied the connection between exchange rate fluctuations and macroeconomic variables for various market economies. Few studies, however, have addressed whether these relationships may differ based on the market classification of the given economy. This study examined the impact on exchange rates for Japan (a proxy for developed economies) and South Korea (a proxy for emerging economies) yielding from the macroeconomic variables of the sticky-price monetary model between February 1, 1989 and February 1, 2015. The results show that money supply and inflation constituted a significant, but small, influence on South Korean exchange rate movements, whereas no macroeconomic variable within the model had a significant impact on Japanese exchange rates fluctuations. The results of the autoregressive error analyses suggest small variances in the affect that macroeconomic variables may have on developed versus emerging market economies. This may provide evidence that firms may use similar forecasting techniques for emerging market currencies as used with developed market currencies.

Dedication

This dissertation is dedicated to the Lord Jesus Christ and my family.

Acknowledgments

I thank God for his blessing on my educational endeavors. To Him be all the glory and honor. My sincere gratitude to dissertation committee for their dedication and support. I would like to acknowledge the entire faculty at Capella University, University of Wisconsin-Whitewater, and Tennessee State University for their encouragement throughout my studies. I would also like to give a special appreciation to Dr. Perry Haan for his guidance. A special recognition to the U.S. Bureau of Labor Statistics. I would also like to thank the First Baptist Church of Rockville, Maryland for their prayers and support.

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CHAPTER 1. INTRODUCTION

Introduction

Exchange rate fluctuations are an important risk that firms experience (Demirhan & Atis, 2013). A key component of a firm's aggregate demand is the import and export of its goods and services, which is affected by exchange rate fluctuation (Were, Kamau, & Kisinguh, 2013). As exchange rates increase and decrease, the prices that firms are able to charge for goods and services may become more or less attractive to their customers. Firms that are engaged in international business transactions expect and plan for exposure to exchange rate volatility; however, local firms not engaged might also be affected (Aggarwal & Harper, 2010). Therefore, the problem exists in that exchange rate volatility affects a firm's bottom line, thus influencing the financial performance of the firm.

Studies provide evidence that large costs occur when entering export markets (Bernard & Wagner, 2001; Roberts & Tybout, 1997; Bernard & Jensen, 2004). These costs derive from creating networks for distribution, modifying products to satisfy foreign tastes and regulations, and identifying potential target markets (Becker, Chen, & Greenberg, 2012). In addition, various risks may also increase the costs incurred by a firm. A firm's exposure to foreign currencies yield various types of risks, such as transaction risks, translation risks, and economic risks (Nazarboland, 2003).

Translation risks occurs from the process of translating a firm's financial statements from one currency to a different functional currency for reporting purposes (FASB, 1981). Converting

a firm's financial statements from a local currency to the currency of the home country affects the book value of the firm through the fluctuations in exchange rates (Nazarboland, 2003). Likewise, firms experience transaction risks when their monetary liabilities and assets are denominated in various currencies that result in gains or losses due to the movements of exchange rates (Gunter, 1992). Economic risk is the changes in currency values that affect a firm's competitive performance, and thus its market value (Gunter, 1992). Therefore, further knowledge of exchange rate behavior may assist in hedging risk and increasing financial performance.

A commonly held assessment in finance is that exchange rates are predictable (Austin & Dutt, 2014). According to Huber (2016), "forecasting exchange rates has been one of the major challenges in international economics since the early eighties, when Meese and Rogoff (1983) concluded that no structural model was able to improve upon a simple random walk benchmark in terms of short-term predictive capabilities" (p. 193). He, Wang, Zou, and Lai (2014) argued that exchange rate fluctuations affect firms because of the sensitivity that exchange rates have with many factors of global integration. Authors, such as Dornbusch and Fischer (1980), Solnik (1987), and Soyoung (2015) suggest that exchange rates affect firms engaged in the international financial market by affecting its capital flows in foreign currencies. Others such as Buch and Kleinert (2008) and Schmidt and Broll (2009), conclude that exchange rates have increasing importance for firms. Therefore, understanding their behavior is essential for financial success. This chapter presents the background, business problem, research purpose, research questions, rationale, theoretical framework, significance, definitions, assumptions, limitations, and the organization of the remainder of the study following this introduction.

Background

An extensive amount of research has explored various determinants of exchange rate movements (Were, Kamau, & Kisinguh, 2013). Evidence concerning the major determinants of fluctuations in rates of exchange suggest that monetary factors are most often responsible for influencing movements (Cuiabano & Divino, 2010). These macroeconomic variables include gross domestic product, inflation, interest, and money supply (Butt, Rehman, & Azeem, 2010; Hassan & Simione, 2013). Other literature has also provided support that exchange rates often fluctuate as monetary variables increase or decrease.

Khan and Qayyum (2011) examined how monetary fundamentals influenced exchange rates in Pakistan. Khan and Qayyum (2011) suggested that monetary variables were able to forecast movements in the exchange rate. Liew, Baharumshah, and Puah (2009) studied long-run relations among determinants of movements with rates of exchange and the Japanese yen. Liew, Baharumshah, and Puah (2009) found that movements within exchange rates might be forecasted using money supply, interest rates, and income as indicating variables. Additionally, Craigwell, Wright, and Ramjeesing (2011) found similar results studying exchange rate behaviors between the U.S. and Jamaica with respect to money supply, inflation, and the rate of interest.

No consensus has emerged regarding the general global effects that monetary variables may have on exchange rate volatility despite the volume of research that exists on issues dealing with exchange rate risks (Moslares & Ekanayake, 2015). Researchers have analyzed the effect that these macroeconomic factors have on exchange rate movements, but they have not investigated whether the effects differ based on a country's market classification. It is largely unknown whether monetary variables affect exchange rate movements differently between

developed and emerging market economies. Additional research examining how factors influence exchange rate movements is needed (Kehinde, 2014).

Business Problem

Among the risks firms experience are the volatility and difficulty in the prediction of exchange rates (Stockman, 1980). Research on exchange rate determinants has provided a significant volume of analyses for variables affecting various currency pairs. These studies have typically expressed how macroeconomic variables affect exchange rates in general. Little research has assessed whether those effects may differ depending on market classification (Kehinde, 2014). Scientific integrity expects research results to be replicable with few exceptions, but there is a lack of replication studies in economic research (Burman, Reed, & Alm, 2010). Replications of research on the correlation between monetary variables and movements within rates of exchange with respect to market classification may provide validity in establishing norms in forecasting the fluctuation differences between the exchange rates of emerging and developed economies.

Research Purpose

This study examined the sticky-price monetary theory in the context of developed and emerging market classifications. The sticky-price monetary model evaluates changes in movements within rates of exchange with respect to interest, money supply, productivity, and inflation. The theory suggest that fluctuations are consistent with rational expectations (Dornbusch, 1976). This theory explains the overshooting of currency exchange rates, and provides reasoning for the volatility and misalignment of currency exchange rates with purchasing power parity (Datta & Mukhopadhyay, 2014).

This study examined how the macroeconomic variables within the sticky-price monetary theory may affect exchange rates differently between market classifications. The study extended the work of Kim, An, and Kim (2015) on the comparison of developed versus developing market economies, and directly answered the call of Kehinde (2014) for additional research to address this gap in knowledge. The study built upon the numerous works on the sticky-price monetary theory including Hassan and Gharleghi (2015), Chin, Azali, and Matthews (2007), Frenkel (1976), Dornbusch (1976), and Frankel (1979). This study also addressed the need for replication studies in economic and financial research.

Research Questions

The study addressed the business problem by investigating the following generalized research question: To what extent do macroeconomic variables affect the exchange rates of developed economies differently from emerging economies (Kehinde, 2014)? To conduct the study, this research question expanded into multiple questions with respect to the specifications of the study as follows:

1. To what extent did money supply affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
2. To what extent did productivity affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
3. To what extent did interest rates affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
4. To what extent did inflation affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

5. To what extent did money supply affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
6. To what extent did productivity affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
7. To what extent did interest rates affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
8. To what extent did inflation affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

Regression analyses addressed these research questions by examining the results of the various models. Comparing and contrasting these results provided insight into the differing effects that each variable had with respect to the corresponding market classification. Answering the research questions directly met the purpose of this study, and provided context that added to the body of knowledge regarding exchange rate volatility under the sticky-price monetary theory. Answering these research questions provided knowledge for the practice of business administration. These analyses may guide financial decision-makers with respect to investing in developed and emerging market economies.

Rationale

The sticky-price monetary theory has been a leading, and widely used method of examining the extent that specific macroeconomic variables may affect exchange rate movements (Were, Kamau, & Kisinguh, 2013). Therefore, it was the rationale of the study that

the sticky-price monetary theory might provide insight into the differing effects of the macroeconomic variables with respect to market classification (Kehinde, 2014). The study inspected the usefulness of the sticky-price model in highlighting differences and analyzing macroeconomic effects on the study's sample to build upon prior research.

Theoretical Framework

This study examined how market classifications affect exchange rate fluctuations differently via productivity, money supply, inflation, and interest. This was a post-positivist quantitative study with a non-experimental, explanatory research design. It used a predictive model with an inferential analysis technique to test theory for deductive reasoning.

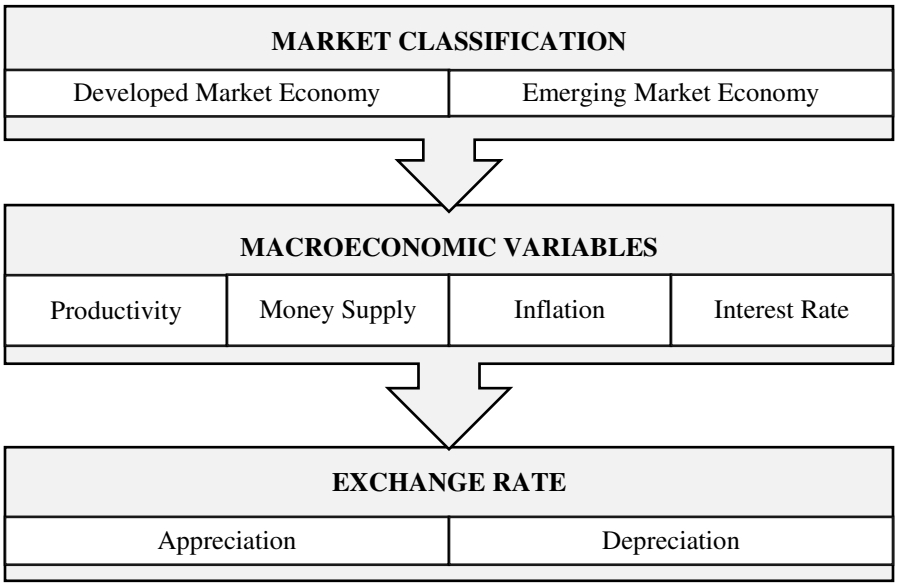

Figure 1. Theoretical framework of the study.

Figure 1 shows the theoretical framework that conceptualizes the study. This study built upon previous work concerning how macroeconomic variables affect exchange rates, and examined the additional influence that the market classifications, developed and emerging, had on the outcome. Chapter 2 provides the evolution of the theory and build of the model as part of the literature review surrounding the sticky-price monetary theory.

Significance

Replication studies serve an important part in the scientific process (Burman, Reed, & Alm, 2010). The absence thereof is a concern for empirical economic research, and thus theoretical conclusions may be inclined to inaccuracy (Dewald, Thursby, & Anderson, 1986; Anderson, Greene, McCullough, & Vinod, 2005). These errors may stem from careless mistakes, dishonesty, or programming issues (Lovell & Selover, 1994; McCullough & Vinod, 1999). This study addressed the call of Burman, Reed, and Alm (2010) for replication studies by replicating specific aspects of Kehinde (2014) to fill the gap in knowledge regarding the differing effects that macroeconomic variables may have on exchange rate movements with respect to market classification. The significance of this study was that it extended previous research on exchange rate determination using the Dornbusch (1976) sticky price monetary theory, and added to the body of knowledge by examining differences based on market classifications.

Definition of Terms

Researchers may use slightly differing meanings of specific terms, thus requiring the need for clarity. While this study makes an attempt to only use terms that are widely known in the field, specific indications of the exact terms used will strengthen the context of the outcomes produced by the study. Therefore, the following are select terms used throughout this study that may need specific clarification on their intent. The Mankiw (2010) and Dornbusch, Fischer, and Startz (2011) definitions are standard definitions found in textbooks widely used in the study of economics.

Business cycle. Dornbusch, Fischer, and Startz (2011) define business cycle as "the more or less regular pattern of expansion (recovery) and contraction (recession) in economic activity

around the path of trend growth" (p. 14). Mankiw (2011) defines the cycle as "fluctuations in economic activity, such as employment and production" (p. 833).

Developed economies. The term developed economies "typically refers to a country with a relatively high level of economic growth and security" (Investopedia, n.d.). Dow Jones (2011) describes developed economies as being "the most accessible to and supportive of foreign investors. Generally, there is high degree of consistency across these markets" (p. 2).

Developing or emerging economies. "An emerging market economy describes a nation's economy that is progressing toward becoming more advanced, usually by means of rapid growth and industrialization" (Investing Answers, n.d.). Dow Jones (2011) describes emerging markets as having "less accessibility relative to developed markets, but demonstrate some level of openness" (p. 2).

Economic contraction or recession. Dornbusch, Fischer, and Startz (2011) define this segment of the business cycle as the "period of diminishing economic activity, usually, but not always, marked by two quarters or more of declining real gross domestic product" (p. 611). Mankiw (2011) defines this as "a period of declining real incomes and rising unemployment" (p. 837).

Economic expansion or recovery. Dornbusch, Fischer, and Startz (2011) define this segment of the business cycle as "a sustained period of rising real income" (p. 611).

Economic peak. Dornbusch, Fischer, & Startz (2011) define this segment of the business cycle as a time in which "economic activity is high relative to trend" (p. 611). Mankiw (2010) describes this as "the starting date of each recession" (p. 258).

Economic trough. Dornbusch, Fischer, and Startz (2011) describe this segment of the business cycle as "the low point in economic activity" (p. 611). Mankiw (2010) describes this as "the ending date" of each recession (p. 548).

Efficient markets hypothesis. Mankiw (2010) defines efficient markets hypothesis as "the theory that asset prices reflect all publicly available information about the value of an asset" (p. 57), which concurs with Mankiw (2011) in a newer work (p. 834).

Exchange rate. Dornbusch, Fischer, and Startz (2011) define exchange rates as the "price of foreign currency per unit of domestic currency" (p. 600). Mankiw (2010) defines exchange rate as "the rate at which a country makes exchanges in world markets" (p. 577).

Gross domestic product. Dornbusch, Fischer, and Startz (2011) suggest gross domestic product is the "measure of all final goods and services produced within the country. Real GDP measured in constant dollars. Nominal GDP measured in current dollars" (p. 603). Mankiw (2010) defines it as "the total income earned domestically, including the income earned by foreign-owned factors of production; the total expenditure on domestically produced goods and services" (p. 578).

Inflation. Dornbusch, Fischer, and Startz (2011) define inflation as the "percentage rate of increase in the general price level" (p. 604). Mankiw (2010, 2011) defines inflation as "an increase in the overall level of prices" (p. 579; p. 835).

Interest. Mankiw (2010) defines interest as "the market price at which resources are transferred between the present and the future; the return to saving and the cost of borrowing" (p. 579). Dornbusch, Fischer, and Startz (2011) define nominal interest as the "expresses the payment in current dollars on a loan or other investment (over and above principal repayment) in terms of an annual percentage" (p. 608). Dornbusch, Fischer, and Startz (2011) suggest the real

rate of interest is the "return on an investment measured in dollars of constant value; roughly equal to the difference between the nominal interest rate and the rate of inflation" (p. 611).

Money supply: Dornbusch, Fischer, and Startz (2011) define money supply as the "assets that can be used for making immediate payment" (p. 607). Mankiw (2010) defines money supply as "the stock of assets used for transactions" (p. 580).

Purchasing power parity. Dornbusch, Fischer, and Startz (2011) define this parity as the "theory of exchange rate determination arguing that the exchange rate adjusts to maintain equal purchasing power of foreign and domestic currency" (p. 610). Mankiw (2010) defines the parity as "the doctrine according to which goods must sell for the same price in every country, implying that the nominal exchange rate reflects differences in price levels" (p. 582).

Assumptions and Limitations

This study assumed that the efficient market hypothesis holds true. This assumption rejects information asymmetry, suggesting that the changes in the macroeconomic variables reflect all known information. The study also assumed that the encompassing variables are the best fit based on the theory selected. Therefore, the study considered no additional variables. Chapter 2 addresses other assumptions specific to the model and theory that coincide with the history of the literature.

Possible limitations of the study include the size of the sample selected, the theory used for analysis, and the proxy variables used. The sample selected is the result of available and comparable high-frequency data. Examining additional samples and theories may provide results that differ from this study. In addition, analysis of various periods may also provide differing results. Future replication studies should consider investigating other sample countries

using the sticky-price monetary theory, as well as other theories and additional periods to establish generalization within the context.

The researcher that conducted this study expected differences between the two market classification groups. The researcher anticipated that macroeconomic variables would have a larger influence on the exchange rate fluctuations of emerging market economies when compared to developed market economies. The researcher expected greater volatility within emerging market economies when compared to developed market economies.

Organization for Remainder of Study

This study consists of five chapters. Chapter 1 presents the problem, purpose, significance, rationale, framework, limitations, and assumptions. Chapter 2 is a literature review covering international trade, finance, market influences, exchange rate forecasting, and the sticky-price monetary model. Chapter 3 lays out the methodology used in the study. Chapter 4 shows the collection results and regression analyses. Chapter 5 summarizes and interprets the discoveries and provides recommendations for additional study.

CHAPTER 2. LITERATURE REVIEW

Introduction

An extensive volume of research has explored the determinants of exchange rate fluctuations (Bhanja, Dar, & Tiwari, 2015; Were, Kamau, & Kisinguh, 2013). Studies have shown that exchange rates that are misaligned with macroeconomic fundamentals contribute to global imbalances (Chen, 2014). The Dornbusch (1976) sticky-price monetary theory suggests exchange rate movements are consistent with rational expectations. The sticky-price theory explains the overshooting of currency exchange rates, and provides reasoning for the volatility and misalignment of currency exchange rates with the purchasing power parity (Datta & Mukhopadhyay, 2014). Despite the volume of research that exists on issues dealing with exchange rate risks, no consensus has emerged regarding the overall global effects of monetary variables on exchange rate volatility (Moslares & Ekanayake, 2015).

This study built upon Kim, An, and Kim (2015) and Kehinde (2014) regarding the comparison between developed and emerging market economies, and added to recent literature, such as Hassan and Gharleghi (2015), utilizing the sticky-price monetary theory. This study used the model formulation of Dornbusch (1976) and Frankel (1979) as demonstrated in Were, Kamau, and Kisinguh (2013), Chin, Azali, and Matthews (2007), and Civcir (2003). This study assisted in filling the gap of differing effects based on market classification (Kehinde, 2014), and answered the call of Burman, Reed, and Alm (2010) for replication studies in finance. This

chapter provides an overview of relevant works and justifies the need for additional investigation into exchange rate fluctuations by market classification.

International Trade and Finance

The foreign exchange market is the largest liquid market consisting of a global network of sellers and buyers of currency (Chen, 2014; Shamah, 2009). The financial exchange market trades more than $5 trillion daily, surpassing any other financial market (Bank of International Settlement, 2013). Ever since the termination of Bretton Woods, understanding the effects of exchange rate policy and currency movements has been the dominant area in international financial research as the value of a currency affects households and businesses (Chen, 2014). Exchange rate instability increases uncertainty for the participants of foreign exchange markets, and influences flows of international trade (Peree & Steinherr, 1989; Cushman, 1986).

Post-Bretton Woods literature suggest an adverse effect on trade flow. Clark (1973) and Ethier (1973) demonstrated the uncertainty of a firm's trade revenue being the effect of exchange rate instability reducing the volume of trade. Literature supports the argument that uncertainty in exchange rate fluctuation affects trade (Hooper & Kohlhagen, 1978; Demers, 1991; Baron, 1976). On the other hand, later theoretical studies demonstrated positive effects on international trade flows from higher exchange rate volatility. Literature also supports the argument of a positive correlation between trade and exchange rate instability (Broll & Eckwert, 1999; Sercu & Uppal, 2003; Sercu & Vanhulle, 1992).

Sercu and Uppal (2003) investigated the relation between instability in rates of exchange concerning the size of trade, treating both variables as endogenous in a general-equilibrium stochastic-endowment economy with imperfect commodity markets. Sercu and Uppal (2003) found that the sign of the relation is contingent on the source for the variation in instability. For

example, additional instability of the endowments and greater costs to trade increase exchange risk while decreasing welfare. However, additional instability of the endowments increases the expected volume of trade, while greater costs to trade decreases trade. Sercu and Uppal (2003) noted an ambiguous inter-equilibria relation between welfare and trade.

Fluctuations in exchange rates alter the economic conditions and competitiveness of a firm, thus affecting the firm's cash flow (Prasad & Rajan, 1995). The seminal work of Aggarwal (1981) demonstrated a positive correlation between currency and stock prices. Adler and Dumar (1984) introduced a single-factor model that estimated exposure by calculating elasticity of exchange rate movements to a firm's equity returns. Jorion's (1990) alternate specification to that model controlled for market movements by regressing market returns and exchange rates against stock returns. However, Agyei-Ampomah (2012) suggested that the variable coefficient in Jorion's (1990) model measure more exposure than the market portfolio.

Stable exchange rates help firms evaluate the performance of investments, financing, and hedging of operational risks (Nieh & Wang, 2005; Rahman & Hossain, 2003). Dellas and Zilbergarb (1993) provided evidence for this effect using the asset-market approach, but Willett (1986) found inconclusive results, indicating that exchange rate instability may have positive, negative, or no effect on trade. De Grauwe (1998) demonstrated that the correlation among exchange rate instability and international trade is dependent upon how much risk a firm is willing to accept. De Grauwe (1998) concluded that exchange rate instability decreases exports if producers are slightly risk averse; however, exports increase if producers are highly risk averse.

Risk neutral exporting firms increase trade with higher exchange rate volatility (Franke, 1991; Sercu, 1992). Firms may be prepared to experience foreign exchange risk to reduce other

risk elements of cost funding (Galai & Wiener, 2012). Bodnar and Gentry (1993) studied exchange rate exposures at the industry-level and concluded that industries experience significant exposure; however, Amihud (1994) found no significant association among exchange rates and stock returns. Other empirical studies show insignificant correlation between exchange rates and share prices (Griffin & Stulz, 2001; Domingues & Tesar, 2006; Jorion, 1990), but the theoretical models indicate that for many firms foreign currency exposure should be greater than the exposure observed (Bodnar, Dumas, & Marston, 2002). Pricing policy, operational hedges, and financial activities may reduce the exposure to foreign currency risk (Galai & Wiener, 2012).

Empirical studies have examined the stability between trade and exchange rate volatility using econometric models. Some models illustrate an ambiguous effect that exchange rate volatility has on trade (Dhanani & Grover, 2001). Barkoulas, Baum, and Caglayan (2002) employed a partial equilibrium approach to show that the effect on trade from exchange rate volatility depends on the source of uncertainty, concluding that the relationship is indeterminable. Indeterminate effects were also shown by Bacchetta and Van Wincoop (2000) and Koren and Szeidl (2003). Other studies of relationships suggest adverse effects over long periods and diverse evidence over periods of less than one year (McKenzie, 1999; Pugh, Tyrrall, & Tarnawa, 1999).

Qill, Pinfold, and Rose (2011) found significant evidence that purchasing power parity determines exchange rates. Chang and Lee (2011) found that the parity holds and the adjustment toward the parity is nonlinear. Chang, Chang, Hung, and Su (2012) further added that the adjustment is asymmetric. However, neither empirical nor theoretical literature provides sufficient evidence on trade effects (Haile & Pugh, 2013).

Market Influences

Elections, terrorist activities, war, and political scandals have considerable influence on the foreign exchange market. Exchange rates react faster to geopolitical events than any other form of financial investment (McFarlin, 2011). Election outcomes have the potential to threaten asset prices and the economy as a whole (Webb, 2006). Chandiok (1996) argued that a political resignation could potentially cause abnormal returns in the field and affect currency markets. A geopolitical event will have a negative impact on the domestic currency when the event undermines the confidence of investors.

During political instability, investors seek safety by divesting their investments, which depreciates the exchange rate. According to Bernhard and Leblang (2002), the democratic processes contribute to the risk premiums that affect exchange rates as political events raise doubts and concern about the government. Presidential candidates often float policies that could strengthen or weaken domestic currency, therefore causing investors to anticipate uncertainties in which a premium will be required for a forward position, thus affecting spot and forward exchange rates (Bernhard & Leblang, 2002).

The risk of war has strong impacts on fluctuations of financial variables. Guidolin and La Ferrara (2005) examined how violence affects asset market reactions and found that conflicts have significant impact on prices of currency, oil, stock, commodities, and gold. Guidolin and La Ferrara (2005) concluded that markets are sensitive to news about future prospects. Likewise, Rigobon and Sack (2005) examined the impact that the Iraq war had on U.S. financial variables. Rigobon and Sack (2005) demonstrated that war increases oil prices while decreasing the U.S. dollar value, Treasury yields, and equity prices. To add, terrorist activities also have a negative

impact on financial markets as foreign investors divest their investments, which depreciates the domestic currency (Karolyi & Martell, 2010).

Edwards and Van Wijnbergen (1989) examined the connection concerning equilibrium real exchange rates, tariff changes, and deviations in the conditions of trade. Edwards and Van Wijnbergen (1989) investigated how import tariffs appreciate or depreciate real rates of exchange, and whether worsening terms of trade yield depreciation. Edwards and Van Wijnbergen (1989) demonstrated that a hike in tariffs cause the domestic real exchange rate to appreciate while worsening terms of trade results in an equilibrium real appreciation. Edwards and Van Wijnbergen (1989) did note, however, that these two incidents could not occur simultaneously.

Muller-Plantenberg (2010) examined how the imbalances in the balance of payments influence demand for different currencies over time. Muller-Plantenberg (2010) analyzed effects of trade and capital flows on exchange rate movements by looking at U.S. exchange rates and current account and data. The results indicated that balance of payments accounting led to fluctuations in the rates of exchange by affecting international payment flows.

Trade restrictions make the domestic economy better off by modifying terms of trade in favor to improve current account balances that appreciate the domestic currency (Ono, 2014). However, exports show to have a positive correlation with movements in the rates of exchange. Ali and Rahman (2012) found that the volume of exports had positive effects; therefore, regulations limiting exports would negatively affect movements of the domestic rate of exchange.

Natural disasters also provide significant effects on the market and infrastructure, and therefore the currency. Significant adverse impacts from these disasters slows down production

(Zylberberg, 2010). A disruption in export activities will yield a decrease in an economy if the economy is dependent upon exports. Less demand for a domestic currency will occur if the domestic economy is unable to meet foreign demand because of a natural disaster.

An aspect where a gap exists is concerning market classification. Empirical research on exchange rate volatility in developing markets is sparse because most existing models of monetary exchange rate movements have been tested for developed countries (Khan & Qayyum, 2011). The application of the monetary approach for developing markets include Lyons (1992), Fry (1976), Odedokun (1997), Edwards (1983), Chin (1998), Yunus (2001), and Kletzer and Kohli (2000). Empirical studies in countries with restricted cash flows in an underdeveloped or repressed financial sector may provide insight into the role that policies of monetary and exchange rates play in the developing world (Kletzer & Kohli, 2000).

Overseeing currency exchange for institutions engaged in currency trading, such as domestic firms that are in business with international corporations, is the primary function of the foreign exchange market (Iglesias, 2012). Firms functioning worldwide have the opportunity to funding capital investments in various markets (Galai & Wiener, 2012). The primary currency pairs are less volatile than lesser-known foreign currencies (Iglesias, 2012). The primary currencies include the British pound, Japanese Yen, Canadian dollar, U.S. dollar, New Zealand dollar, Swiss Franc, Australian dollar, and the Euro (Iglesias, 2012).

Nonindustrial nations that depend less on foreign investment incline to develop sooner (Prasad, Rajan, & Subramanian, 2007, p. 4). Rapetti, Skott, and Razmi (2012) argued that the positive correlation between exchange rates under-valuation and economic development is stronger in emerging market countries. Rapetti, Skott, and Razmi (2012) concluded that Rodrik's

(2009) findings conceals a non-monotonicity that the finding is only significant for least developed and most advanced countries.

The effect of macroeconomic data on asset returns connect financial markets. Friedman (1953) suggested that movements within the rates of exchange rate mirror a nation's financial conditions. These data cause adjustments in the prices of stocks, bonds, and exchange rates (Yamarone, 2012). Wongbango and Sharma (2002) found positive relationships between the level of financial transactions within a nation and stock prices, suggesting that increased productivity increases profits, expected future cash flow, and therefore increasing stock prices. However, Wongbango and Sharma (2002) found a negative relationship between price levels and stock prices, indicating that the increase in production costs due to inflation lowers profits, expected cash flow, and thus stock prices.

Fair (2003) found that economic data caused changes in stock markets, bond markets, and exchange rates, suggesting that changes in stock relative to changes in bonds were greater for monetary events than losses for price and real events. Similarly, Andersen, Bollerslev, Diebold, and Vega (2007) examined how stocks, bonds, and foreign exchange markets react to macroeconomic new releases and found stronger responses to surprises with negative impacts during contractions. Fixed-income markets experience a higher impact from economic data surprise when compared to the impact on equity markets (Huang, 2007).

Using an Ordinary Least Squares regression, such as used in this study as indicated in Chapter 3, Bartolini, Goldberg, and Sacarny (2008) examined financial market fluctuations with respect to released economic data. By monitoring changes in interest rates, equity prices, and exchange rates, Bartolini, Goldberg, and Sacarny (2008) revealed that payroll numbers, private sector manufacturing reports, and the gross domestic product releases generate significant impact

on prices. Markets show to react more strongly to surprises in the state of the economy (Anderson, Overby, & Sebestyen, 2009; Han, 2010).

The release of macroeconomic data affects exchange rate fluctuations (Laakkonen, 2004). Investors and currency traders affect the market through speculation where they use arbitrage to profit from anticipated increases or decreases in exchange rate. Anderson, Bollerslev, Diebold, and Vega (2003) and Dominguez and Panthaki (2006) used a regression analysis to show that economic data announcements result in rapid adjustments in exchange rates. Anderson, Bollerslev, Diebold, and Vega (2003) and Dominguez and Panthaki (2006) found evidence that bad economic announcements during an economic expansion had a greater impact than positive economic announcements, which shows that surprises to the market greatly affects the market (Bauwens, Ben, Omrane, & Giot, 2005). Therefore, the behavior of macroeconomic policies within the economy are influential on the behavior of exchange rate movements (Harada & Watanabe, 2009). However, other variables outside publically released economic announcements may be responsible for market volatility (Savaser, 2011; Rebitzky, 2010); therefore, further investigation is needed.

Existing studies on exchange rate determination have focused on the connection between macroeconomic fundamentals and exchange rates (Dabrowski, Papiez, & Smiech, 2015; MacDonald, Fidrmuc, & Crespo-Cuaresma, 2005; Uz & Ketenci, 2010). Khan and Qayyum's (2011) work found that monetary variables forecast exchange rate movements. A nation's economic statistics provides participants of the foreign exchange market with updated happenings of the domestic economy, and often provides an expected future direction. These data affect the supply and demand ratio for the domestic currency. Changes in these macroeconomic factors perform a dominant role for volatility in exchange rates. The efficient

market hypothesis suggests changes in the exchange rates will reflect all known economic data (Ito & Roley, 1987). Exchange rates serve as forward-looking prices of assets that respond to these factors.

Authors such as Lee (2007), Chiu (2008), and Olson (2010) established positive relationships between productivity and exchange rates. Others, such as Chen and Rogoff (2003), Stockman (1980), and Dong (2013), argue that price levels have negative impacts on exchange rates. Liew, Baharumshah, and Puah (2009) studied long-run relations among determinants of exchange rate movements with the Japanese yen, which found that movements within exchange rates might be forecasted using money supply, interest rates, and income as indicating variables. Craigwell, Wright, and Ramjeesing (2011) found similar results studying exchange rate behaviors between the US and Jamaica with respect to money supply, inflation, and interest rates. Therefore, evidence regarding the major determinants of exchange rate movements suggest that the monetary variables responsible for influencing exchange rate movements include gross domestic product, money supply, inflation, and interest (Cuiabano and Divino, 2010; Hassan & Simione, 2013; Butt, Rehman, & Azeem, 2010).

Money Supply and Productivity

Economic growth and trade are fundamental factors affecting the foreign exchange market (McFarlin, 2011). Economic output or productivity has shown to have an impact on exchange rate movements. Growth in economic output measures the output of a country with respect to a specific level of input (Carbaugh, 2005). The ability to produce goods at a lower cost than what competitors are able to achieve demonstrates higher productivity in the global marketplace. Therefore, an increase in productivity pushes prices lower for consumers, thus

influencing the volume of imports and exports, and therefore currency valuation through appreciation and depreciation.

According to Kuepper (2008), the gross domestic product is a comprehensive economic indicator and is an undeniable important fundamental for growth (Zhuk & Gharleghi, 2015; Gharleghi & Shaari, 2012). The per capita gross domestic product is a substantial driver of exchange rate fluctuations (Afzal & Hamid, 2013; Chen, Mancini-Griffoli, & Sahay, 2015), and study has shown that the growth in GDP has adverse effects on exchange rates as a result of decreasing prices (Cuiabano & Divino, 2010). Tille, Stoffels, and Gorbachev (2001) and Schnatz, Vijselaar, and Osbat (2004) studied links between exchange rate movements and output and found that changes in output can be utilized in determining exchange rate movements.

Bailey, Millard, and Wells (2001) examined the relationship between exchange rates and economic productivity. Bailey, Millard, and Wells (2001) found that an increase in productivity increases the expected profits, equity prices, and investment stimulation. As a result, this rise in the demand for investments increases the capital inflow from foreign investors. When productivity in a country increases, research shows the rate of return on capital increases to generate substantial foreign inflows of capital, therefore appreciating the domestic currency (Bailey, Millard, & Wells, 2001). Domestic productivity gains yield lower prices that increases domestic exports while decreasing foreign imports, thus resulting in an appreciation of domestic currency.

Tille, Stoffels, and Gorvachev (2001) used productivity and exchange rate data from the Euro, Japan, and U.S. to examine linkages between currency movements and productivity developments. Tille, Stoffels, and Gorvachev (2001) tracked the productivity gap to determine changes in exchange rates that are attributable to the gain in productivity. Results show that

productivity differentials between two countries had a significant influence on exchange rate fluctuations. Similarly, Schantz, Vijselaar, and Osbat (2004) found that the specific productivity measures used might cause a variance in the extent to which productivity may influence exchange rates. Schantz, Vijselaar, and Osbat (2004) demonstrated that the productivity shocks might generate an upsurge in the real interest rate differential along with capital inflows to cause the domestic currency to appreciate. This occurs because of productivity increasing future income, therefore increasing demand for goods and service, which affects relative price shifts that lead to the appreciation and depreciation of the currency (Schantz, Vijselaar, & Osbat, 2004).

Olson (2010) examined movements within rates of exchange pertaining to productivity differentials between the United States and Euro area. Olson (2010) found that productivity for the United States increased in the later part of the 20th century, appreciating the domestic currency. This occurred as productivity in the United States was increasing more rapidly than productivity in the Euro area. The decline of the U.S. dollar in the early 2000s correlates with an increase in productivity in the Euro area when compared to the slower rate of productivity in the United States. Olson (2010) found that the impact for each percentage point in the productivity differential between the United States and Euro area was three percentage points on the exchange rate. In a similar study, Alquist and Chinn (2002) found a five-point effect on rates of exchange.

Lee (2007) examined the long-term association between productivity and real rates of exchange for 12 OECD nations using a regression analysis to evaluate the extent to which productivity may affect the exchange rate. Lee (2007) indicated differing effects on exchange rate movements being dependent upon which measure of production used: labor versus factor productivity. However, from those two measures of productivity, only labor productivity

demonstrated a significant positive relationship. Domestic relative price levels will be lower because higher domestic productivity decreases production costs if the domestic economy is more productive than the foreign economy of comparison (Chiu, 2008).

Relationships between stock returns and exchange rates vary over time (Inci & Lee, 2014). Equity markets in Europe demonstrated differing characteristics of volatility during expansions and recessions (Kearney & Poti, 2008). According to Rapetti, Skott, and Razmi (2012), a large amount of research has studied the relationship among rates of exchange and economic development. Studies have used different empirical strategies and data sets, but nearly all share a systematic outcome: undervalued exchange rates have a positive correlation with economic growth.

One explanation proposes that underestimated rates of exchange favor the restructuring of assets to the tradable sector. This approach defines an equilibrium real rate of exchange as the level of purchasing power parity adjusted for the Balassa-Samuelson effect (PPP-based). Rodrik (2009) and Eichengreen (2007) suggest that this is mostly the case with emerging market economies where financial issues are more noticeable.

Another reason stresses the role of exchange rates in easing the constraints on growth (Porcile & Lima, 2010; Rapetti, Skott, & Razmi, 2012). This method depends on single equation or general equilibrium macroeconmetric models (fundamentals-based). Growth accelerates using policies that organize unemployed assets in emerging markets; however, the acceleration may affect the balance of payments if the dependency on foreign capital goods is great such as in emerging market economies. In such case, competitive exchange rates would ease bottlenecks in the foreign exchange market that otherwise restrain growth.

Evidence suggest foreign direct investment activities respond to macroeconomic fluctuations over business cycles. Theoretically, two channels had identified the reasons why business cycles might affect foreign investments (Cavallari & Addona, 2013). Bernanke, Gertler, and Gilchrist (2000) show positive correlation between output and investment because a rise in cost for borrowing depresses investment in cyclical downturns. However, business cycles may affect a firm's cost to entry with potential contrasting effects on whether to access foreign markets, in addition to investment revenues. If a firm has a productivity drop in the country of their foreign direct investment, then the prospective returns from those investment deteriorates and discourages new firms from entering. However, the decreasing productivity may also reduce entry costs for multinational firms because of the depreciation of the host currency, therefore reversing the effect on entry (Russ, 2007).

Monetary policies allow central banks to control a country's money supply to stabilize inflation and interest rates within the economies (The Economic Times, 2015). This stimulates economic activity and influences the currency value (Filardo, Ma, & Mihaljek, 2011). Money supply and exchange rates have the ability to influence one another (Tervala, 2012), and therefore are crucial in policy choices for emerging market economies.

Yin and Li (2014) examined relationships among short-run nominal rates of exchange, macroeconomic inflation, interest rates. Yin and Li (2014) demonstrated a strong connection between the variables. Likewise, Chang and Su (2014) studied dynamic relationships between exchange rate movements, the industrial production index, and money supply, suggesting that macroeconomic variables may be useful in forecasting the variances of exchange rate values. According to Friedman (1987), the stability of the demand for money implies that macroeconomic variables predict the quantity of money. Kumari and Mahakud (2012) found

that the elasticity of demand in the long run for money demonstrates that the function for money demand is sensitive to economic activity, inflation, and stock prices

Interest and Inflation

According to Afzal and Hamid (2013), data show that the variances in interest rates may influence exchange rates greatly in emerging economies. Some literature suggest that real interest rate shocks in foreign currencies have little effect on labor, output, and consumption (Hoffmaister & Roldos, 1997; Mendoza, 1991; Schmitt-Grohe, 2000), while other literature suggest these shocks play a role in explaining cyclical variations (Blankenau, Kose, & Yi, 2001). Few studies connect the effect that these shocks have on exchange rate volatility, with the exception of di Giovanni and Shambaugh (2008) and Hoffmann (2007). Significant differences found in studies suggest that various macroeconomic variables responded differently to exchange rate regimes (Hoffmann, 2007). Interest rate shocks do not affect floating currencies as they do with pegged currencies (di Giovanni & Shanbaugh, 2008). Recently, Zhang, Li, and Chia (2014) found trade-offs between exchange rate volatility and real output to interest rate shocks.

Pearce (1960) contended that an escalation in a country's interest rate would result in domestic assets becoming more attractive to investors worldwide. The higher returns gained through higher interest rates would stimulate capital inflow from abroad and appreciate the domestic exchange rate. Camarero (2008) examined the effects that productivity and interest rate differentials had on exchange rate movements, and found that those variables only provided a partial explanation. Interest rates have an effect on the inflow of foreign capital; therefore, domestic currency appreciates as interest rates increase (Batten & Thornton, 1985; Alquist & Chinn, 2002; Byrne & Nagayasu, 2010; Engel, 2011).

Inflows of foreign capital and international trade affect interest rate differentials as investors seek high returns (Carbaugh, 2005). Increased domestic interest rates appreciates domestic currency by attracting foreign investors to domestic assets. These higher rates of return yield foreign inflows of capital that have a positive effect on the currency through the capital account (Alquist & Chinn, 2002). If domestic rates of interest are substantially greater than foreign rates of interest, the increase in foreign demand for domestic financial assets will appreciate domestic currency relative to foreign currencies. However, if domestic interest rates are lower than foreign interest rates, local investors will increase their demand for foreign financial resources to benefit from the higher rate of return, which results in domestic depreciation relative to foreign currencies.

Batten and Thornton (1985) found that changes in interest rate differentials significantly affect daily exchange rate movements, such that increased interest rate differentials yield domestic appreciation. Likewise, Kanas (2005), Wada (2012), and Byrne and Nagyasu (2010) found linkages among differentials of the real rates of interest and the real rate of exchange for the United States and United Kingdom. Hoffmann and MacDonald (2009) further investigated real rates of exchange concerning real interest rates and found that shocks of positive interest rates resulted in temporary fluctuations of the exchange rate, indicating that differentials in real interest rates are the sum of expected period-to-period exchange rate changes. According to Engel (2011), real exchange rates are overly sensitive to real interest rate differentials such that domestic currency appreciates given relatively high domestic rates of interest.

Increased rates of inflation in a competitive economy increases production costs, thus leading to an increase of imported foreign goods and depreciating the domestic currency. Korhonen and Junttila (2012) and Butt, Rehman, and Azeem (2010) found inflation influencing

fluctuations in the rates of exchange. In addition, Ozsoz and Akinkunmi (2012) and Kia (2013) examined exchange rate determinants and found exchange rates appreciate because of interest rate shocks with a negative impact.

The Consumer Price Index is an indicator of inflation published by the U.S. Bureau of Labor Statistics. This index is an important factor in evaluating costs of living (Mankiw, 2015). Traders in the market for foreign exchange consider the index a fundamental element affecting currency value and foreign business. According to Gharleghi, Shaari, & Sarmidi (2014), the index is a clear picture to firms as to whether goods and services are yielding profits or losses. Mozes and Cooks (2011) found that inflation has an adverse effect on domestic currency performance, and Bashir and Luqman (2014) concluded that prices levels and terms of trade yield appreciation or depreciation to a currency. Aligning a non-U.S. dollar to the U.S. dollar can become pervasive within countries with high inflation (Chan-Lau & Santos, 2006; Armas, Ize, & Weston, 2006; Havrylyshyn & Beddies, 2003).

Coes (1981) and Thursby and Thursby (1987) found that the volatility in exchange rate movements can depress exports. However, Rodrik (1994) and Elbadawi (1998) found that equilibrium exchange rates and exchange rate depreciation are not significant predictors of exports. In addition, Rose and Yellen (1989) and Rose (1991) did not find a substantial connection between trade and rates of exchange, but Wang (1993) and Gosh, Thomas, Zaldueno, Catao, Joshi, Ramakrishnan, and Rahman (2008) found that exchange rate depreciation makes trade better. Nevertheless, studies show that the value of domestic currency and relative prices determines the bulk of trade among nations (Tandon, 2014).

The differences between the price level of services and goods found domestically and the price levels of the same found abroad affect the supply and demand ratios of currency exchange

between the domestic and foreign currencies (Pearce, 1960). Changes in foreign prices relative to domestic prices will affect the value of the domestic currency such that an increase in prices in one nation relative to another will decrease the demand for that nation's product and increase demand for products of other countries (Pearce, 1960). According to Chiu (2008), relative prices between countries affect exchange rate movements. Under the theory of purchasing power parity, identical goods in two nations will have equal prices when expressed in equivalent currencies. Therefore, the rate of exchange is relational to the percentage of the foreign and domestic prices.

According to Stockman (1980), the ratio of the demand and supply for the currency is affected when price differentials exists for identical goods in two countries. Changes in relative price levels due to shifts in demand and supply induce change in the rates of exchange, thus causing them to deviate from the purchasing power parity (Stockman, 1980). Higher relative domestic prices yield a decreased demand for the domestic currency, therefore increasing demand for foreign goods and money. Consumers are encouraged to import goods when foreign market have lower prices, and this increase in imports depreciates the exchange rate of domestic currency.

Groen and Lombardelli (2004) found a long-run association among bilateral real exchange rates with relative prices in the United Kingdom. Groen and Lombardelli (2004) argue that long run movements of exchange rates correlate with movements of the price ratio between countries. Groen and Lombardelli (2004) provided evidence that show an integrating correlation among real rates of exchange and relative price levels. Similarly, Betts and Kehoe (2006) showed a positive connection between real rates of exchange and relative price levels by examining relationships of associated bilateral relative prices and bilateral real rates of exchange

in the United States and five main trading partners. The traditional concept attributing variations in real rates of exchange to variations in relative price served as the base of this study. Betts and Kehoe (2006) indicated that cross-country variations in relative levels of price were a prominent factor that influenced aggregate real exchange rate fluctuations.

Dong (2013) used regression analyses to examine how prices that deviate from the purchasing power parity theory explain movements in the nominal rate of exchange. Dong (2013) examined whether price misalignments influence future fluctuations in exchange rates between Japan, United Kingdom, and U.S. Findings indicate price deviations have predictive power for fluctuations in future exchange rates. Differences in domestic prices relative to foreign prices can help predict domestic appreciation and depreciation. An overvalued domestic currency yields higher domestic prices temporarily, and when it depreciates, the differentials between foreign and domestic prices influence the depreciation of the domestic currency.

Relative changes in commodity prices have shown to be a causal factor in exchange rate determination. Cayen, Coletti, Lalonde, and Maier (2010) found that commodity prices have a central role in shaping rates of exchange for commodity importers and exporters. Chen and Rogoff (2003) found that world prices of commodities from major exporters were key determinants of respective exchange rates. Cayen, Coletti, Lalonde, and Maier (2010) argue that currencies of exporters appreciate when commodity prices increase, therefore benefiting their economy, whereas importers experience a depreciation from rising prices. For example, a decrease in world commodity prices depreciates the Canadian dollar due to commodities representing a relatively larger portion of Canada's domestic production. An escalation in demand for Canadian oil exports increases the demand for the Canadian dollar, thus strengthening their exchange rate. Therefore, movements in the global prices of oil would

directly affect the Canadian dollar. A higher global price will affect Canada's exports and the demand for their currency.

Changes in price due to shifts in supply and demand yields deviance from the purchasing power parity, and therefore affects rates of exchange (Stockman, 1980). Groen and Lombardelli (2004) showed that exchange rates have a long-term relationship with relative prices. In the same effect, Betts and Kehoe (2006) demonstrated that relative price levels have a positive influence on fluctuations in the rates of exchange. A regression analysis conducted by Dong (2013) examined how fluctuations from the purchasing power parity affects changes within the rate of exchange. Dong (2013) showed that difference in relative prices might be helpful in predicting appreciation or depreciation in domestic currency. Chen and Rogoff (2003) and Cayen, Coletti, Lalonde, and Maier (2010) found relative prices had an influence on exchange rate movements between the currencies examined.

Forecasting Exchange Rates

Quantitative methods with a positivist perspective that tests theory with hypotheses are the most common approach for finance research (Robson, 2002). Experimental designs include random sampling and treatment. These designs control some variables while manipulating others. Quasi-experimental designs are similar to experimental designs, except they randomly assigned treatments. Non-experimental research designs study un-manipulated data that require explaining (Robson, 2002). Non-experimental research designs are the most pertinent to the study of finance and tend to use the approaches of survey research, archival research, and ex-post facto.

Survey research constitutes a non-experimental design by using questionnaires to test for linear relationships, statistical independence, and statistical differences. Archival research

analyzes records of secondary data to answer questions instead of collecting primary data. Ex-post facto examines the effects of naturally occurring treatment conditions. This study used the non-experimental, explanatory research design of a predictive linear regression model. This post-positivist method involved an inferential analysis technique that tested theory for deductive reasoning to establish possible causality among variables. This study used an archival research approach to collect data.

The two approaches used for forecasting exchange rates are the technical and fundamental approach (Hwang, 2001). Based on extrapolations of price trends, the technical approach does not rely on underlying economic determinants. These models rely on filters, momentum indicators, and moving averages for a chart analysis. Filter models examine the autocorrelation of asset prices to generate indications whether to buy or sell when exchange rates increase or decrease a set percentage (the filter) about a recent tough or peak. Momentum models determine an asset's strength by examining the speed in which asset prices change, and advise investors to buy when asset prices increase at an increasing rate (Schulmeister, 2008). Moving average models use erratic swings of prices to indicate trends. The indication to buy and sell using moving average models are generated when short-run moving averages of past rates intersect with long-run moving averages because the moving average in the long run is expected to lag short-run moving averages.

The fundamental approach uses structural equilibrium models based on economic variables (Hwang, 2001; Botha & Pretorius, 2009). Significant difference between observed and forecasted rates signal investors to buy or sell. The fundamental approach uses theoretical models, i.e. purchasing power parity, to generate forecasts; however, several issues exists that would benefit from further research. The issue of correct specification questions whether

forecasters are using the most appropriate model, which leads into the second issue of model estimation. Models strive to estimate coefficients for economic variables within the model, but poor estimates may mislead financial decision-making, which then goes back to the model. A third issue is that some explanatory variables are contemporaneous, which requires simultaneous equations models to estimate.

Fundamental models propose that macroeconomic variables affect exchange rates whereas technical models uses past fluctuation to predict new changes (Macerinskiene & Balciunas, 2013). Meese and Rogoff (1988) and Backus (1984) found that random walk models perform better at predicting exchange rates over theoretical models. However, Woo (1985), Boughton (1984), and Wolff (1988) found that theoretical models perform better. Subsequent studies used cointegration techniques, such as Johansen's (1988) maximum likelihood generation and Engel and Granger's (1987) two-step test, and others used Engle and Hamilton's (1990) non-linear techniques. Therefore, some techniques seem reasonable for short-run forecasts while others for longer horizons. Techniques for forecasting in the short-run include methods of advanced indicators, such as the ratio of nation's reserves to its imports, and the use forward rate as an indicator of future spot rate. Graphical techniques such as the curve of resistance, bar chart, rate-time curve, curve of support are also used. Techniques for forecasting in the medium and long-run use an economic approach, such as the balance of payments, reserves, interest, inflation, employment.

Since the seminal works of Poterba and Sumers (1988), and Fama and French (1988), the dominant assessment in finance is that predictability can occur. According to Cochrane (1999), returns are predictable but provide no guarantee; therefore, the strategy for foreign exchange returns is risky. Economists have formulated various theories to understand the behavior of

exchange rate movements, and provide explanations that determines their movements. These theories attempt to explain systemic patterns of the behavior that exchange rates exhibit. Unexpected shocks of underlying variables—the variables that guarantee efficient operations (Harvey, 2001)—limit the usefulness of the theories. The following details some of the theories concerning exchange rates.

Purchasing Power Parity

Essential theories to forecast exchange rates for longer horizons in excess of one year include the purchasing power parity and monetary theory. According to Abbasi and Safdar (2014), the purchasing power parity theory is the most controversial, but fundamental, hypothesis in international finance. This parity explains long run exchange rate equilibriums, thus making the theory an attractive tool for study (Abbasi & Safdar, 2014). Empirical testing of the purchasing power parity is extensive and spans decades, while supporting evidence is often weak (Were, Kamau, & Kisinguh, 2013). However, there exists a strand of literature concentrating on deviations from purchasing parity (Balassa, 1964; Samuelson, 1964; Marston, 1990). Balassa (1964) and Samuelson (1964) suggest deviation takes time to revert, and Edison and Klovland (1987) found evidence of an effect from productivity differential. However, some authors indicate the lack of support due to minimum innovations in econometrics techniques (Abuaf & Jorian, 1990). Nonetheless, advances in these techniques allow for the testing of weaker versions of the purchasing parity (Mark, 1990).

The purchasing power parity theory is a fundamental theory that explains the relation between expected domestic prices levels and the domestic exchange rate (Abbasi & Safdar, 2014). The theory explains movements between two currencies as being a direct result of the changes of prices levels between the countries (Krugman & Obstfeld, 2008). The theory

suggests that the rates of exchange between two currency pairs is the same as the prices levels of the countries. A single unit of domestic currency expects to purchase an equal basket of goods in the domestic economy and in a foreign economy at the given rate of exchange. A rise in domestic price levels causes a decline in the domestic purchasing power and a decline of the rate of exchange (Krugman & Obstfeld, 2008).

In the same effect, a decrease in domestic prices will increase the domestic purchasing power and appreciate the exchange rate (Abbasi & Safdar, 2014; Krugman & Obstfeld, 2008). If a market basket of goods cost $344 dollars in the United States and $250,000 pesos in Chile, then the purchasing power parity predicts the exchange rate will be $0.001376 ($344 USD /$250,000 CLP) United States' dollars for a single unit of Chilean peso. From Chile's point of view, the exchange rate would be 726.74 ($250,000 CLP / $344 USD) Chilean pesos for one United States dollar. If the U.S. dollar price level doubled to $688 and the Chilean peso remained unchanged, the exchange rate would increase to $0.002752 ($688 USD/$250,000 CLP) United States' dollars for a single unit of Chilean currency. Therefore, the prices of products or services in the United States become more expensive than in Chile, the demand for the U.S. products and services decrease along with the value of the dollar, therefore forcing the domestic prices and exchange rate back in line with the purchasing power parity (Abbasi & Safdar, 2014; Krugman & Obstfeld, 2008).

The *Economist* publishes the Big Mac Index to be a casual measure of the purchasing power parity. This index suggest that the price of a Big Mac is equal in two different nations given the exchange rate. According to *The Economist* (2015), the index "is based on the theory of purchasing power parity, the notion that in the long run exchange rates should be towards the rate that would equalize the prices of an identical basket of goods and services in any two

countries." The Big Mac index conveys the law of one price and the purchasing power parity (Schmidt, 2016). When exchange rates are misaligned (prices of a Big Mac in two countries are not the same given the rate of exchange), then spectators engage in arbitrage to earn a profit. This pressures supply and demand to depreciation one currency while appreciating another to return to an equilibrium.

Purchasing power parity holds because of the law of one price that relates to international goods arbitrage (Taylor & Taylor, 2004). This concept suggest that equal products sold in different nations would sell for an identical price in competitive markets free of barriers when stated in a common currency. Traders use this arbitrage to make riskless income by benefiting from price differentials: selling goods from a low-priced nation and shipping to a nation where prices are higher. The law of one price infers that rates of exchange should hold through the purchasing power parity if the goods are identical and hold the same weight for each country in question (Taylor & Taylor, 2004). Otherwise, arbitrage opportunities would occur if there were a price difference in the traded goods, and therefore riskless trading may occur by buying low and selling high.

Changes to the relative value of goods can occur because of fluctuations from the law of one price if all goods in the index have equal weights at home and abroad (Engel, 2000). Arbitrage transitions will force price difference to an equilibrium point by affecting the market supply and demand, thus reinstating the purchase power parity. The adjustment will result in the selling of goods at the same relevant prices. The law of one price and the purchasing power parity hold when trades are free from barriers and transportation costs (Engel, 2000). Therefore, arbitrage profit would not consider costs, such as sales tax, import duties, and transportation cost.

Purchasing power parity may not hold when trade barriers exists, if the market is no longer a free competition market, or when there is a difference in price level measurement and consumption patterns (Krugman & Obstfeld, 2008). Government trade restrictions and transportation costs affect profits and make goods too expensive for international travel, consequently violating the underlying 'law of one price' mechanism of the purchasing power parity. Transportation costs and trade restrictions allow for a greater span in which currency exchange rates can fluctuate (Krugman & Obstfeld, 2008). Differences in the patterns of consumption affect how governments consider price levels. Countries having different market baskets of goods and services drive the different price levels of measurement. Therefore, changes in relative prices of basket components lead to fluctuations from the purchasing power parity.

Random Walk

The short-run refers to daily, intra-day, or weekly periods. Exchange rates can experience dramatic fluctuations in the short-run; therefore, a random walk method may be appropriate. The random walk theory forecasts exchange rate movements by using logarithmic levels of nominal exchange rates. Fama (1965) suggested that successive values are independent of one another thus being random, and caused by a change in information. The random walk theory assumes identical distribution of successive changes; therefore, conditional marginal probability distributions of the random variables are identical (Nwidobie, 2014). Testing the random walk theory unadjusted in all economies may be unreliable because testing emerging economies should consider the level of development and institutional features of capital markets (Oprean, 2012).

After the seminal work of Meese and Rogoff (1983), studies have sought to find out if exchange rates follows a random walk (Almudhaf, 2014). Some studies suggest that no model outperforms the random walk method of forecasting changes, and that although rates are determined by fundamentals of the economy, changes trail a near-random walk (Cheung, Chinn, & Pascual, 2005; Engel & West, 2005). Since Meese and Rogoff (1983), it has become widely established that determination models for exchange rates are unable to outperform random walk models (Moosa & Burns, 2013).

In contrast, however, others suggest that models can outdo the random walk method over long horizons, but not for short horizons (Clark & West, 2006; Peel, & Sarno, 2001; Molodtsova & Papell, 2009; Mark & Sul, 2001; Taylor, Kilian & Taylor, 2003; Groen, 2000; Mark, 1995; Chinn & Meese, 1998; La Cour & MacDonald, 2000; Alquist & Chinn, 2007; Wang, 2012). These studies examined monthly or quarterly data due to the limited accessibility of comparable data. As sample intervals grew to monthly, quarterly, and yearly periods, there exist some foreseeable components of substantial magnitude (Cheong, Kim, & Yoon, 2012).

Equilibrium Approach

Iyke and Obhiambo (2016) state, "classically, the equilibrium exchange rate for a country could be established by setting up and simulating an empirical dynamic macroeconomic model—using parametric calibrations and data suitable for that country. This is the so-called general equilibrium approach in the literature" (p. 323). There are two views on the issue of the equilibrium theory. One suggests that rates are always at a market equilibrium, while the other suggests purchasing power parity influences prices equalization as a long-run benchmark (Benassy-Quere, Bereau, & Mignon, 2010). These two assessments (market equilibrium and the

parity) have limited practicality because they suggest unpredictable short-run movements or constant long-run movements without addressing medium-term concerns.

Montiel (1997) suggest that Monte Carlo simulations result in consistent values for exchange rates when building appropriate models for a country. Monte Carlo simulations evaluate deterministic models using random inputs. Research that have used this logic to analyze exchange rate equilibriums include Williamson (1994), Clark, Bartolimi, Bayoumi, Symansky (1994), and Stein, Allen, and Associates (1995). Other studies have used partial-equilibrium and single-equation models, such as Montiel (1999), Driver and Wren-Lewis (1997), and Ghei and Pritchett (1999). Some of the popular approaches employed by the International Monetary Fund (IMF, 2006) for valuation of rates of exchange include the Behavioral Equilibrium Exchange Rate (MacDonald, 1997; Faruqee, 1995; Clark & MacDonald, 1999, 2000), Fundamental Equilibrium Exchange Rate (Williamson, 1985), and Natural Equilibrium Exchange Rate (Stein, 1994).

Fundamental Equilibrium Exchange Rate. The fundamental equilibrium exchange rate (FEER) has several variants, such as found in Jeong, Mazier, and Saadaoui. (2010), Cline (2008), Carton and Herve (2012), and You and Sarantis (2011). With the FEER approach, long-term estimates of economic fundamentals that relate to full employment are used. According to Saadaoui (2015), these variations fluctuate on the size and type of modeling (general or partial equilibrium, and reduced form relation), on the determination of maintainable current account in the medium-run (critical valuation, arithmetic mean, econometric estimates), and on trade elasticity (econometric estimates ensuring consistency, and calibration to balance the model in value and volume).

Behavioral Equilibrium Exchange Rate. Clark and MacDonald (1999) and MacDonald (1997) introduced the behavioral equilibrium exchange rate (BEER) approach to connect fundamentals to exchange rates through interest parity. Instead of employment-related fundamentals, as with FEER, the BEER approach uses observable data currently prevailing in the market (Lebdaoui, 2013). This approach focuses on the impact of productivity and categorizes exchange rates to an equilibrium rate of exchange from the observable fundamentals (Driver, 2005).

Natural Equilibrium Exchange Rate. Stein (1994) developed the natural equilibrium exchange rate approach that uses economic fundamentals to produce and equilibrium exchange rate. According to Stein and Paladino (1998), this model allows for the generation of an equilibrium benchmark grounded on an implementable theory. This approach is a moving equilibrium exchange rate that considers government policies as given (Siregar & Har, 2001).

Monetary Theory

The monetary theory is an outgrowth of the purchasing power parity that emerged post Bretton Woods and revitalized long-run equilibrium interpretations (Beckmann, 2013). Many studies favor the relationship between macroeconomic fundamentals and exchange rates (Kim & Mo, 1995; MacDonald & Taylor, 1993; Choudhry & Lawler, 1997), while others indicate unclear results (Chinn & Meese, 1998; Goldberg & Frydman, 2007). Research using the monetary approach on advanced markets is widespread and covers co-integration and causality among monetary fundamentals and rates of exchange (Dabrowski, Papiez, & Smiech, 2015).

According to Khan and Qayyum (2011), the monetary exchange rate theory suggests that the demand for as well as the supply of money determines exchange rates. The contention of this approach is that monetary policy underlies exchange rate movements, thus joining the theory of

purchasing power parity with the quantity theory of money. This approach hypothesizes that a reduction in relative purchasing power will yield from increasing the domestic supply of money. Monetary models determining rates of exchange were the backbone of international finance in the 1970s (Neely & Sarno, 2002), and the recent resurgence of empirical work examine these models using new methods (Abbasi & Safdar, 2014). The premise of the monetary model is that a nation's monetary policy determines the exchange rates.

Monetary models of exchange rates assume that the demand and supply for money is the result of financial markets (Beckmann, 2013). A central building block for monetary models is the purchasing power parity (Dornbusch, 1976; Frenkel, 1976; Bilson, 1978; Neely & Sarno, 2002). The key of the monetary approach is that the relative development of the demand and supply for money determines the rate of exchange between two currencies (Beckmann, 2013). Increasing money supply or interest rate yields domestically excel money and therefore a surge in prices, thus restoring an equilibrium in the money market (Beckmann, 2013).

Pearce (1960) argued that changes in the supply and demand of currency between two countries affect the exchange rate between those two countries. Influencing factors under this theory include the nation's money supply, the growth rate of that money supply, and the expected levels of the future money supply. According to MacDonald and Taylor (1992), the monetary approach has produced a wide range of models to explain exchange rate flexibility. This approach as developed into the flexible-price monetary model (Bilson, 1978; Frenkel, 1976, 1979, 1993), which was extended by MacDonald and Taylor (1992, 1994), and the Dornbusch (1976) sticky-price monetary theory along with its modification from Frankel (1979). Frankel's (1976) variation of the model recognizes exchange rate deviations resulting from adjustments toward the purchasing power parity while including expected rates of inflation and depreciation.

The flexible-price model undertakes that the purchasing power parity holds and values are consistent and flexible with the equilibrium between the supply and demand of money (Isard, 1995).

The sticky-price model allows for slow adjustments in deviations from purchasing parity and domestic prices. Mankiw (2010) defines sticky prices as "prices that adjust sluggishly and, therefore, do not always equilibrate supply and demand," and the sticky-price model as "the model of aggregate supply emphasizing the slow adjustment of the prices of goods and services" (p. 583). Dornbusch's (1976) model overshoots to allow purchasing parity to hold in the long run, but not in the short-run. Frankel's (1979) formulation of the model assumes nominal output prices are sticky (adjust slowly over time), but asset markets respond continuously to new information.

Dornbusch, Fischer, and Startz (2011) states that "capital is perfectly mobile when it has the ability to move instantly, and with a minimum of transactions costs, across national borders in search of the highest return" (p. 609). This assumption of perfect capital mobility is the starting assumption for exchange rate determination monetary models. These models define equilibrium conditions through conditions of purchasing power and interest rate parity, therefore, assuming that foreign and domestic bonds are perfect substitutes.

The sticky-price model has been widely tested with mixed empirical support. The theory allows domestic prices and deviations from the parity to adjust slowly, holding the parity in long horizons but not in the shorter horizons (Were, Kamau, & Kisinguh, 2013). Therefore, evidence proposes that changes in the long run rates of exchange have predictability but not in the short run (Mark, 1995). Rapach and Wohar (2002) found evidence support the monetary model; however, the data failed the assumption of homogeneity. According to Pesaran, Shin, and Smith

(1999), this issue is not be a strong basis to dismiss the results. Civcir (2003) also found favorable evidence, where earlier studies, such as Meese and Rogoff (1982), and Alexander and Thomas (1987), did not. According to Were, Kamau, and Kisinguh (2013), the sticky-price monetary model is the "workhorse model in modelling exchange rate behavior" (p. 167). Research continues to investigate the usefulness of the sticky-price monetary model in a variety of aspects.

Other theories

The efficient market hypothesis assumes that the market is strong and exchange rates are unpredictable, thus favoring the random walk hypothesis. For an efficient market, this theory suggest that the current exchange rate reflects all known information (Macerinskiene & Balciunas, 2013). Following this logic, a change will only occur when new information is announced, which is unpredictable, thus future changes are independent from past fluctuations. However, Engel, Mark, and West (2007) and Moosa and Burns (2013) suggest better performing models over the random walk theory.

The interest rate parity advocates a discount or premium of a currency against a different currency should replicate differentials of interest. This theory indicates that the nation with a lesser rate of interest may be a forward premium with respect to the currency of the nation with the greater rate of interest (Macerinskiene & Balciunas, 2013). The theory of uncovered parity maintains that currencies with comparatively high interest should devalue the scale of the difference for the interest rates, therefore generating an equilibrium for anticipated returns (Hauner, 2014). The theory of uncovered parity regresses ex-post exchange rate movements on differences within the rates of interest. The theory of covered interest rate parity argues that a return on a hedged foreign investment might equate to the domestic interest rate on investment of

identical risk. The covered parity suggest that the difference between the hedged foreign rate and domestic interest rate is zero.

The balance of payments theory models the supply and demand (encompassing the purchasing power parity theory) as determined by the flow of currency, suggesting that exchange rates will fluctuate in response to an imbalance in the balance of payments to restore an equilibrium (Mussa, 1984). This approach tracks financial flows during a given period to equilibrate a final balance of zero. The current account is the country's balance of trade that includes cash flows paid and received on investments, transfers, imports, and exports. The financial and capital account comprises short-term and long-term transactions of capital excluding transactions made by the central bank. The official reserve account are the net changes in the government's international reserve, which includes the transactions made by the central bank.

The balance of payments theory suggests that exchange rates should be at an equilibrium level when the current account balance of a country is stable because payment flows determine the rate of exchange (Mussa, 1984). A country's current account includes the inflow and outflow of money for payments, and the net balance of payments affects the currency's supply and demand. A deficit will yield a reduction in foreign exchange reserves that depreciates the domestic currency. Cheaper domestic prices promote exports, which appreciates the domestic currency. The economic forces of the purchasing power parity theory assume to stabilize trade balance and currency to an equilibrium. The balance of payment theory considers the current account of a country, but ignores the country's capital account.

Conversely, the asset market theory only considers the capital account, ignoring the current account. The asset market theory suggests equilibrium circumstances in asset markets

govern rates of exchange. Pearce (1960) argues a rise in domestic interest rates will increase the attractiveness of domestic assets to foreign and domestic investors. This means that a rise in demand for foreign assets puts a surge in the demand of the respective foreign currency and depreciates the currency of the domestic economy. Likewise, a rise in foreign cash flows to purchase financial assets puts a surge in the demand for domestic currency and appreciates the exchange rate (Pearce, 1960). This approach suggest that shifts in supply and demand for a financial asset influences the changes in the exchange rates, and that monetary and fiscal policy also alter expected returns and risks, which influence exchange rate fluctuations. The asset approach was popular until the 1960 when economists challenged the view on short-term behavior of exchange rates.

The portfolio balance theory relaxes the assumption that countries are perfect substitutes by suggesting differing interest rates among countries due to varying risk premia (Macerinskiene & Balciunas, 2013). The microstructure model suggest that micro factors carrying information about macro fundamentals influence exchange rates (Lyons, 2001). The theory of chaos models suggest exchange rates have a non-linear relationship with determinant variables (Macerinskiene & Balciunas, 2013). However, Gilmore (2001) argues that exchange are not chaotic, while Hanias and Curtis (2008) argues for in support for chaotic behavior.

Sticky-Price Monetary Model

Dornbusch, Fischer, and Startz (2011) state that "capital is perfectly mobile when it has the ability to move instantly, and with a minimum of transactions costs, across national borders in search of the highest return" (p. 609). This provides the assumption that the purchasing power parity continuously holds

$$s_t = p_t - p_t^* + c \quad (1)$$

where the constant is represented by *c*, the log of the exchange rate is signified by *s*, and the foreign and domestic price levels are represented by *p* and *p** respectively. If the constant equals zero, then this equation implies that absolute purchasing power parity holds, and if the constant does not equal zero, the equation implies that relative purchasing power parity holds (Civcir, 2003).

We assume that all countries have a stable function for the demand of money; therefore, conditions for foreign and domestic money market equilibrium are dependent on the nominal interest rate (*i*), the price level (*p*), and the log of real income (*y*). The monetary equilibria displayed in equations (2) and (3) assumes identical relationships for both countries:

$$m_t = p_t + \beta_2 y_t - \beta_3 i_t \tag{2}$$

$$m_t^* = p_t^* + \beta_2^* y_t^* - \beta_3^* i_t^* \tag{3}$$

where *m* is the supply of money. Asterisks denotes foreign variables. The β_2 represents the income elasticity for the demand of money, and $\beta_3$represents semi-elasticity for interest rates. Reordering equations (2) and (3) for price and replacing them into equation (1) provides the flexible price model of Frankel (1978), Hodrick (1978), Bilson (1978):

$$s_t = c + \beta_1(m_t - m_t^*) - \beta_2(y_t - y_t^*) + \beta_3(i_t - i_t^*) + \varepsilon_t \tag{4}$$

where *c* is a constant, the βs are parameters, and the disturbance term is represented by ε_t. This assumes that relative excess money supplies drive the equilibrium exchange rate, meaning that opposite and equal sign on income, interest rates, and relative money are assumed, $\beta_i = -\beta_i^*$. The degrees of freedom assumes the validity of these restrictions (Civcir, 2003).

The nominal rate of interest is comprised of the rate of expected inflation and the real rate of interest:

$$i_t = r_t + \pi_t^e \tag{5}$$

$$i_t^* = r_t^* + \pi_t^{e^*} \quad (6)$$

where foreign and domestic real interest rates are represented by r_t^* and r_t respectively, and the expected rates of foreign and domestic inflation are represented by π_t^e and π_t respectively. Equalizing the real interest rates yields the equation

$$i_t - i_t^* = \pi_t^e - \pi_t^{e^*} \quad (7)$$

Therefore, equation (4) would become:

$$s_t = c + \beta_1(m_t - m_t^*) - \beta_2(y_t - y_t^*) + \beta_3\left(\pi_t^e - \pi_t^{e^*}\right) + \varepsilon_t \quad (8)$$

Grounded on the neutrality of money, the relative money supply coefficient is positive so that money supply increases prices at equal percentages. To restore equilibrium with continuous purchasing power parity, domestic currency would depreciate (s_t increases) by the same amount (Civcir, 2003).

Frankel (1979) developed a model that captured liquidity effects by incorporating short-run interest. The model assumes a positive function of the opening between the long-run equilibrium rate and the current exchange rate for the expected depreciation rate of the exchange rate, and the anticipated long-run inflation differential between the two nations, yielding

$$E(\dot{s_t}) = -\lambda(s_t - \overline{s_t}) + \pi_t^e - \pi_t^{e^*} \quad (9)$$

where the speed of adjustment to the equilibrium is represented by λ. This equation indicates the current rate of exchange expects to return to the long-run equilibrium at λ rate. The expected currency depreciation rate will equal the difference between foreign and domestic inflation in the long run due to $s_t - \overline{s_t}$. Thus combining (5), (6), and (9) produces:

$$s_t - \overline{s_t} = -\frac{1}{\lambda}[(i_t - \pi_t^e) - \left(i_t^* - \pi_t^{e^*}\right)] \quad (10)$$

This equation indicates the difference between the long-run equilibrium rate of exchange and the current rate of exchange is proportional to the differentials of the real interest between the countries, therefore, expecting domestic capital outflows when foreign interest rates are higher and unequaled. Equation (11) displays this purchasing power parity.

$$\overline{s_t} = \overline{p_t} - \overline{p_t^*} \tag{11}$$

The interest differential in the long run equates to the long-run projected inflation differential,

$$\overline{r_t} - \overline{r_t^*} = \pi_t^e - \pi_t^{e^*} \tag{12}$$

and therefore equation (10) can be written as:

$$s_t - \overline{s_t} = -\frac{1}{\lambda}[(\overline{\iota_t} - i_t) - (\overline{\iota_t^*} - i_t^{e^*})] \tag{13}$$

This equation indicates that rate of exchange will overshoot their long-run equilibrium when interest differentials rise above their particular equilibrium. Merging equations (4), (12), and (13) yields,

$$s_t = \beta_1(\overline{m_t} - \overline{m_t^*}) - \beta_2(\overline{y_t} - \overline{y_t^*}) + \beta_3(\pi_t^e - \pi_t^{e^*}) + c + \varepsilon_t \tag{14}$$

and therefore the short-run dynamics are obtained by replacing equation (14) into equation (13), thus producing the Sticky-Price Monetary Model of Dornbusch (1976) and Frankel (1979):

$$s_t = \beta_1(m_t - m_t^*) + \beta_2(y_t - y_t^*) + \beta_3(i_t - i_t^*) + \beta_4(\pi_t^e - \pi_t^{e^*}) + c + \varepsilon_t \tag{15}$$

The model assumes that the purchasing power parity holds between the countries in question for broad prices indices (Civcir, 2003). To stay pure to the sticky price monetary theory and previous published works using the model, the assumptions Gujarati (2003) relates to the classical linear regression model assumed in this study as follows:

1. "The regression model is linear in the parameters" (p. 66).
2. "Values taken by the regressor *X* are considered fixed in repeated samples. More technically, *X* is assumed to be nonstochastic" (p. 66).
3. "Given the value of *X*, the mean, or expected, value of the random disturbance term u_i is zero. Technically, the conditional mean value of u_i is zero" (p. 67).
4. "Given the value of *X*, the variance of u_i is the same for all observations. That is, the conditional variances of u_i are identical." (p. 68).
5. "Given any two *X* values, X_i and $X_j (i \neq j)$ the correlation between any two u_i and $u_j (i \neq j)$ is zero" (p. 70).
6. "Zero covariance between u_i and X_i "(p. 71).
7. "The number of observations *n* must be greater than the number of parameters to best estimated. Alternatively, the number of observations *n* must be greater than the number of explanatory variables" (p. 72).
8. "The *X* values in a given sample must not all be the same" (p. 72).
9. "The regression model is correctly specified. Alternatively, there is no specification bias or error in the model used in empirical analysis" (p. 73).
10. "There is no perfect multicollinearity. That is, there are no perfect linear relationships among the explanatory variables" (p. 75).

In addition, the sticky price monetary theory uses log values of specific variables. Logarithms and exponentials serve an important function in finance and economics because they are favorite means of executing positive monotonic transformations. Logarithmic treatment of the Y-axis differs from linear treatments in that a logarithmic chart provides an equal percentage change along the axis whereas a linear chart provides an equal distance along the axis. An

increase of three spaces on a linear chart may indicate an increase from, i.e. $10 to $13, but an increase of three spaces on a log chart would indicate, i.e. a 15% increase.

Absolute changes in a firm's financials would appear small in the beginning and larger later on, if looking at a linear chart, but a log chart would show a steady percentage increase. This results in an upward-sloping line that is straight instead of a sharp curving line. A decrease in growth would show a taper of the upward slope, and an increase in growth would provide a sharp upward slop. A dramatic increase in a logarithmic curve indicates a true dramatic increase.

Summary

A vast amount of academic literature has modeled exchange rate behavior, making it the most researched puzzle in macroeconomics (Paya, Nobay, & Peel, 2009; Evans & Lyons, 2004; Beckmann, 2013). Numerous empirical studies for predicting exchange rate fluctuations have occurred since the seminal work of Meese and Rogoff (1983). Poor explanatory powers in existing models may weaken international macroeconomics (Baccetta & van Wincoop, 2006). However, the last decade has seen theoretical and empirical econometric developments in the support of exchange rate determination (Neely & Sarno, 2002). Frankel and Rose (1995) suggest a pessimistic effect from negative results in international finance and exchange rate modelling.

Studies provide evidence that large costs occur when entering export markets (Roberts & Tybout, 1997; Bernard & Jensen, 2004; Bernard & Wagner, 2001). These costs derive from developing distribution networks, detecting potential target markets, and modifying products to meet foreign tastes and regulations (Becker, Chen, & Greenberg, 2012). According to Austin and Dutt (2014), "a widely held view in finance is that there is predictability in stock returns, bond returns, and exchange rates and that this predictability increases with the forecast horizon"

(p. 147). Therefore, the problem exists in that exchange rate volatility affects a firm's bottom line, thus influencing the financial performance of the company.

Despite the volume of research that exists on issues dealing with exchange rate risks, no consensus has emerged regarding the general global effects of monetary variables on exchange rate volatility (Moslares & Ekanayake, 2015). Studies have examined the effect that these macroeconomic variables have on exchange rates movements, but they have not investigated whether the variables have differing effects on the exchange rates of emerging market economies than that of developed market economies. Therefore, it is largely unknown if monetary variables might affect differently the exchange rates between countries depending upon the classification of the economy within those countries. Additional research to examine how factors influence exchange rate movements differently for developed economies than for emerging economies is needed (Kehinde, 2014).

CHAPTER 3. METHODOLOGY

Introduction

This study investigated the sticky-price monetary theory in the context of developed and emerging market classifications. This study extended the research of Kim, An, and Kim (2015) on the comparison of developed versus emerging market economies, and directly answered the call of Kehinde (2014) for additional research to address the gap in knowledge regarding the effects. This study built on various work, including Hassan and Gharleghi (2015), Frenkel (1976), Chin, Azali, and Matthews (2007), Dornbusch (1976), and Frankel (1979).

This chapter details the specifics of completing this study. Following the introduction is the design and methodology section, followed by population and sampling. Afterwards, provided are the details of the setting, data collection, and instrumentation. Then given are the details of the data analysis and hypotheses, followed by sections for validity, reliability, and ethical considerations.

Design and Methodology

This explanatory quantitative study used the regression technique found within the sticky-price monetary theory as discussed in Chapter 2 and shown below. In the model below, *r* represents the exchange rate, *c* represents the constant, *m* represents log money supply, *y* represents gross domestic product (a production index is used in this study), *i* represents interest, π represents inflation, and ε represents the error term. The asterisks represents non-U.S. data.

$$r = c + \beta_1(m - m^*) + \beta_2(y - y^*) + \beta_3(i - i^*) + \beta_4(\pi - \pi^*) + \varepsilon \quad (1)$$

The sticky-price monetary theory has been a leading, and widely used method of examining to what extent specific macroeconomic variables affect exchange rates movements (Were, Kamau, & Kisinguh, 2013). The differentials serve as the predictor variables that affect the dependent variable. The specific variables selected for this study include Money Supply (M1), Consumer Price Index (an inflation proxy), Production Index of Total Industry (gross domestic product proxy), Rates of Exchange, and Interest Rates for Government Securities Treasury Bills (interest rate proxy).

This model will answer the following research questions:

1. To what extent did money supply affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
2. To what extent did productivity affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
3. To what extent did interest rates affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
4. To what extent did inflation affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
5. To what extent did money supply affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
6. To what extent did productivity affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

7. To what extent did interest rates affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?
8. To what extent did inflation affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

Population and Sampling

The five developed and eight emerging market economies of Asia-Pacific found within the All Country World Index (ACWI) from Morgan Stanley Capital International (MSCI) were the population of this study. Selected countries were Japan and South Korea due to the availability of comparable monthly data listed on the Federal Reserve Economic Data (FRED) database. These two countries are top trading partners with the United States. Also considered were other countries, but ultimately excluded due to the lack of comparable data available at the frequency needed to maximize the results of the study. The study also used macroeconomic data from the United States to compute the differentials required for the model.

Setting

The setting of this study was by a personal computer. Microsoft Excel organized the data. The data was freely available from a secondary source (government database). The Statistical Analysis Software (SAS) provided the computations and analyses results.

Data Collection

The study used data collected through the Federal Reserve Economic Data (FRED) database. Table 1 provides the identification codes for the specific variables selected for this study. These data are monthly data series of comparable type.

Table 1

Identification codes for monthly data series used in the study

Data series	Identification code
United States M1 Money Supply	MYAGM1USM052N
United States Discount Interest Rate	INTDSRUSM193N
United States Consumer Price Index	CPIAUCNS
United States Production of Total Industry	USAPROINDMISMEI
Japan M1 Money Supply	MYAGM1JPM189N
Japan Discount Interest Rate	INTDSRJPM193N
Japan Consumer Price Index	JPNCPIALLMINMEI
Japan Production of Total Industry	JPNPROINDMISMEI
U.S./Japan Spot Exchange Rate	CCUSSP01JPM650N
South Korea M1 Money Supply	MYAGM1KRM189N
South Korea Discount Interest Rate	INTDSRKRM193N
South Korea Consumer Price Index	KORCPIALLMINMEI
South Korea Production of Total Industry	KORPROINDMISMEI
U.S./South Korea Spot Exchange Rate	CCUSSP01KRM650N

Note. Data collected from the Federal Reserve Economic Data (FRED) database

To stay true to the study of replication, the researcher collected the production of total industry index to use as a proxy for gross domestic product. According to Cuche and Hess (2000), "economists are sometimes forced to use variables that proxy GDP and that are available at a higher frequency. In many countries, a common proxy is industrial production which is often recorded at monthly frequency" (p. 153). The production index is widely used for as a monthly indicator assessing the current situation and the short-term position for GDP (Runstler & Sedillot, 2003; Sedillot & Pain, 2003; Mitchell, Smith, Weale, Wright, & Salazar, 2005). The Organisation for Economic Co-operation and Development is on record using a monthly

production index as a reference series because of its "strong co-movement with GDP" (Fulop & Gyomai, 2012, p. 1).

The percentage change in the index was be used as a measure for calculating the change in growth of the economy. Likewise, the researcher collected the consumer price index and computed the percentage change to account for inflation. Microsoft Excel computed the calculations to produce the differential values needed for the analysis. Microsoft Excel also calculated the log values for money supply, as required by the analysis. This study did not use log values for gross domestic product since a proxy index number replaced the raw gross domestic product. The percent change for the production in total industry index measured growth in the economy.

Instrumentation

This study did not use a survey nor a questionnaire for instrumentation. Microsoft Excel stored the collected data publically available from FRED. The Microsoft Excel file had columns for the date as well as for each variable of each country within the sample, including macroeconomic data for the United States. Microsoft Excel manipulated the data according to the model: calculate differentials and log values for money supply. The Statistical Analysis System (SAS) calculated the output for the regression analyses.

Data collected from the FRED database was the raw available data. The researcher then calculated the percentage change for the consumer price index and the production of total industry index. The researcher also calculated the natural log of money supply, and performed the computations for the differentials required for the model. These calculations where completed using Microsoft Excel.

Hypotheses

Listed separately with respect to the research questions, the hypotheses are as follows:

1. To what extent did money supply affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

   $H1_0$: There is no significant relationship between money supply and the exchange rate for Japan.

   $H1_a$: There is a significant relationship between money supply and the exchange rate for Japan.

2. To what extent did productivity affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

   $H2_0$: There is no significant relationship between productivity and the exchange rate for Japan.

   $H2_a$: There is a significant relationship between productivity and the exchange rate for Japan.

3. To what extent did interest rates affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

   $H3_0$: There is no significant relationship between interest rate and the exchange rate for Japan.

   $H3_a$: There is a significant relationship between interest rate and the exchange rate for Japan.

4. To what extent did inflation affect monthly Japanese exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

$H4_0$: There is no significant relationship between inflation and the exchange rate for Japan.

$H4_a$: There is a significant relationship between inflation and the exchange rate for Japan.

5. To what extent did money supply affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

   $H5_0$: There is no significant relationship between money supply and the exchange rate for South Korea.

   $H5_a$: There is a significant relationship between money supply and the exchange rate for South Korea.

6. To what extent did productivity affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

   $H6_0$: There is no significant relationship between productivity and the exchange rate for South Korea.

   $H6_a$: There is a significant relationship between productivity and the exchange rate for South Korea.

7. To what extent did interest rates affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

   $H7_0$: There is no significant relationship between interest rate and the exchange rate for South Korea.

$H7_a$: There is a significant relationship between interest rate and the exchange rate for South Korea.

8. To what extent did inflation affect monthly South Korean exchange rate movements relative to the U.S. dollar between February 1, 1989 and February 1, 2015?

   $H8_0$: There is no significant relationship between inflation and the exchange rate for South Korea.

   $H8_a$: There is a significant relationship between inflation and the exchange rate for South Korea.

Data Analysis

The researcher evaluated statistical hypotheses using multiple regression analyses at the 95 percent confidence interval (alpha = 0.05). The researcher assumed the normality of the populations and sample selected. The model for this analysis was a least squares regression model that identified the relation among the dependent and independent factors. The least squares method is the most commonly used econometric tool (Hansen, 2000), and may be used to evaluate the significance of individual predictors, analyze effects of variable changes, and forecast response variables for given predictors.

The analysis addressed the research questions with respect to the hypotheses traditional notated as

$$H_0: \beta_j = 0$$

$$H_a: \beta_j \neq 0$$

where the β_j indicates each individual variable coefficient in the model. The null hypothesis indicates that there is no statistically significant relation among the independent factors and the

dependent factor. The alternate hypothesis indicates there is a statistically significant relation among the independent factors and the dependent factor.

```
proc import OUT= work.sk DATAFILE= "X:\data_sk.xlsx"; run;
proc import OUT= work.jp DATAFILE= "X:\data_jp.xlsx"; run;

/*-- Regression --*/
proc autoreg data=work.sk;
model exchange = interest money inflation productivity /
                 dw=1 dwProb nlag=1 method=ml;
run;
proc autoreg data=work.jp;
model exchange = interest money inflation productivity /
                 dw=1 dwProb nlag=1 method=ml;
run;
```

Figure 2. SAS program for running the analysis

Figure 2 shows the SAS programing needed to run the auto regression analyses (SAS, n.d.). The coded model used the exchange rate variables as the dependent variable and the log money supply, productivity, interest rate, and inflation as the independent variables. In addition to a regression output, the analysis provided an output for the Durbin-Watson test and estimates for a corrected model, if one was required.

The study produced corrected estimates in the event that the Durbin-Watson test suggest correlation, which would violate an assumption of the least squares regression. This test is a commonly used technique for detecting autocorrelation. The tests uses an order equal to the order of possible seasonality to check for autocorrelation since seasonality produces autocorrelation at a seasonal lag.

Validity and Reliability

The design for this study will replicate a similar type of analysis as found in previous research by Chin, Azali, and Matthews (2007), Civcir (2003), and Kehinde (2014). These studies relied on the context of the sticky-price monetary theory as employed in this study. The changes made by this study will be the examination of a different sample, period, and selected

proxy data. Therefore, grounded theory and established literature will underline the validity and reliability for the framework utilized in this study.

Ethical Considerations

This study used secondary data extracted from a publically available source. Collected data came from a government database of the United States Federal Reserve System. No permission was required to access the data.

CHAPTER 4. RESULTS

Introduction

Among the risks firms experience are the volatility and difficulty in the prediction of exchange rates (Stockman, 1980). Research on exchange rate determinants has provided a significant volume of analyses for variables affecting various currency pairs. These studies have typically expressed how macroeconomic variables affect exchange rates in general. Little research has assessed whether those effects may differ depending on a country's market classification (Kehinde, 2014). Scientific integrity expects research results to be replicable with few exceptions, but there is a lack of replication studies in economic research (Burman, Reed, & Alm, 2010). Replications of research concerning the correlation between monetary factors and movements in rates of exchange with respect to market classification may provide validity in establishing norms in forecasting the fluctuation differences between the exchange rates of emerging economies and developed economies.

This study examined the sticky-price monetary theory in the context of developed and emerging market classifications. The sticky-price model evaluates changes in exchange rate movements in relation to gross domestic product, money supply, interest, and inflation. The theory suggest that fluctuations are consistent with rational expectations (Dornbusch, 1976). This theory explains the overshooting of currency exchange rates, and provides reasoning for the volatility and misalignment of currency exchange rates with purchasing power parity (Datta & Mukhopadhyay, 2014).

The study examined how the macroeconomic variables within the sticky-price monetary theory affected exchange rates differently between market classifications. This study extended the research of Kim, An, and Kim (2015) on the comparison of developed versus developing market economies, and directly answered the call of Kehinde (2014) for additional research to address the gap in this knowledge. The study built on the work of the sticky-price monetary theory by Hassan and Gharleghi (2015), Chin, Azali, and Matthews (2007), Dornbusch (1976), Frenkel (1976), and Frankel (1979). This study also addressed the need for replication studies in economic and finance research, and added to the body of knowledge regarding exchange rate determination using the sticky-price monetary theory.

This purpose of this chapter is to provide the results of the data collection and analyses. The organization of this chapter includes the data collection results, descriptive analysis, analysis of hypotheses, and ends with a summary. The data collection section provides visuals of that data with respect to time. Graphics for each variable used within the analysis provides visual representation. The descriptive analysis section provides tables of descriptive statistics, such as the mean, median, and standard deviation. This section also provide tables that include a correlation and the Durbin-Watson statistic for serial correlation. The analysis of hypotheses section provides tables with the regression results, including the coefficients, standard error, t-value, and the p-value.

Data Collection Results

This section provides details about the data collected from the Federal Reserve Economic Data (FRED) database. Data collected were monthly releases of data from January 1, 1989 through February 1, 2015. This provided one data point for each variable for each month (i.e., February 1989, March 1989…February 2015). However, the analysis did not include data points

from January 1, 1989. The study solely used the data collected for January 1989 to calculate the percentage change for the consumer price index (inflation) and the production of total industry (productivity). This would show the percent change between January and February 1989 such that the data used in the study will all have data points for February 1989. The data used in the analysis of this study were from February 1, 1989 and February 1, 2015. This constitutes 313 observations of each variable.

Collected variables include the spot exchange rates for the U.S/Japan and U.S./South Korea. Collection also included M1 money supply for Japan, South Korea, and the United States. Collection also included production of total industry in Japan, South Korea, and the United States. The production index is widely used for as a monthly indicator assessing the current situation and the short-term position for GDP (Runstler & Sedillot, 2003; Sedillot & Pain, 2003; Mitchell, Smith, Weale, Wright, & Salazar, 2005). Collection also included the discount interest rates for Japan, South Korea, and the United States. Collection included the consumer price index for Japan, South Korea, and the United States.

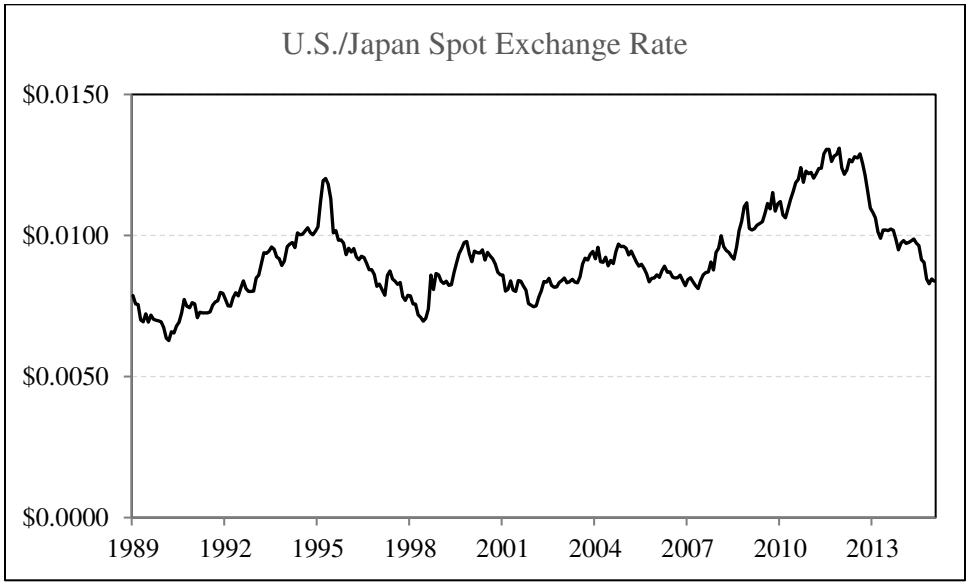

Figure 3. U.S./Japan Spot Exchange Rate.

Figure 3 shows the U.S./Japanese spot exchange rate from February 1, 1989 through February 1, 2015. This exchange rate is the amount of U.S. dollars received for one Japanese yen. Data show that the exchange rate appreciated (the U.S. dollar lost value while the Japanese yen gained value) between April 1990 and May 1995 and the exchange rate increased from $0.006 to $0.012. This suggests the Japanese yen gained value as it increased the quantity of U.S. dollars required to purchase one yen. Between May 1995 and August 1998, the exchange rate depreciated (the U.S. dollar gained value while the Japanese yen lost value). From August 1998 to June 2007, the exchange rate experienced volatility. From June 2007 to January 2012, the exchange rate had a tendency (overall picture) to appreciate. However, a drastic depreciation occurred between October 2012 and February 2015.

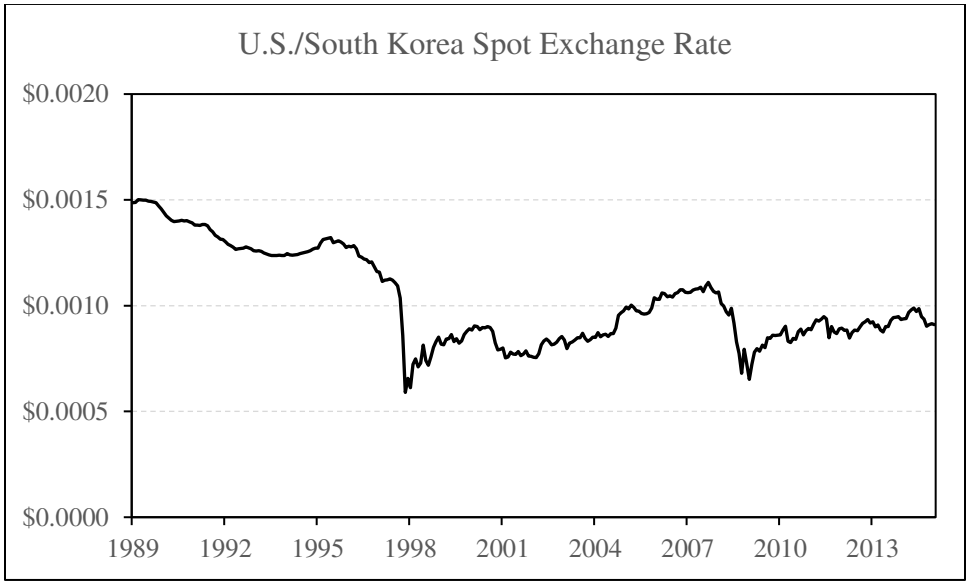

Figure 4. U.S./South Korea Spot Exchange Rate.

Figure 4 shows the U.S./South Korea spot exchange rate from February 1, 1989 through February 1, 2015. Data show that the South Korean exchange rate had a tendency to decline between March 1989 and April 1996, but then experienced a drastic decrease through February 1998. Since that time until September 2007, the exchange rate had a tendency to appreciate,

with little volatility occurring. As the value of the exchange rate increased, this suggest the value of the U.S. dollar was losing value since a single unit of foreign currency was able to purchase more domestic currency. However, the exchange rate experienced a drastic decrease between November 2007 and February 2009. Since that time through February 2015, the exchange rate had a tendency to increase, but with volatility. In addition, the rate of the increase (slope) appears to be lower than previous cycles.

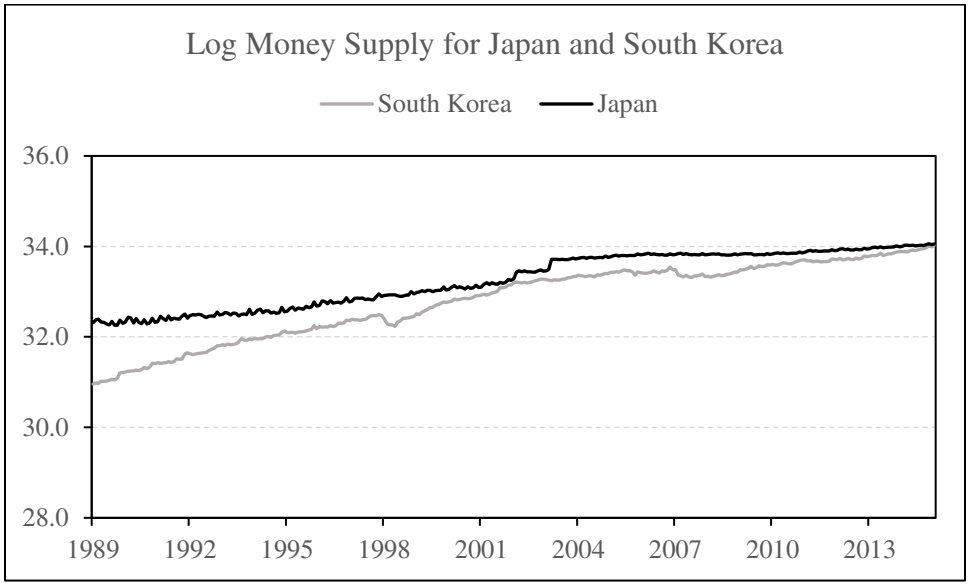

Figure 5. Log Money Supply for Japan and South Korea.

Figure 5 shows the log money supply for Japan and South Korea. Data shows that the percent change in money supply for both Japan and South Korea has increased between 1989 and 2015. However, South Korea experienced a greater rate of increase. Logarithms execute positive monotonic transformations. Logarithmic treatment of the y-axis differs from linear treatments in that a logarithmic chart provides an equal percentage change along the axis whereas a linear chart provides an equal distance along the axis. A dramatic increase in a logarithmic curve indicates a true dramatic increase. Small changes in natural logarithms are directly interpretable as percent changes to a very close approximation.

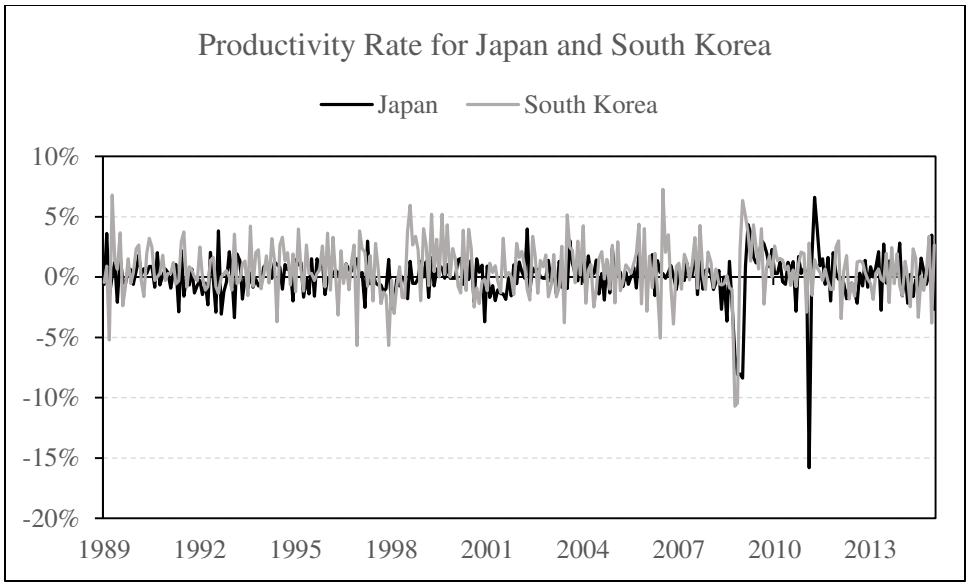

Figure 6. Productivity Rate for Japan and South Korea.

Figure 6 shows the productivity rate for Japan and South Korea. This is the percentage change for the production index. Gross domestic product is a measure of productivity in a country. However, gross domestic product is a quarterly release; therefore, the study used a proxy variable in the place of gross domestic product. To stay true to the study being replicated (Kehinde, 2014), the variable selected to proxy GDP is the production in total industry index, which is a monthly release. Similar to the calculation of inflation (using a percentage change of the consumer price index), taking the percentage change of the production in total industry index will provide a measure of productivity growth on a monthly basis. The production index is widely used for as a monthly indicator assessing the current situation and the short-term position for GDP (Runstler & Sedillot, 2003; Sedillot & Pain, 2003; Mitchell, Smith, Weale, Wright, & Salazar, 2005).

Between 1989 and September 2008, Japan experienced relatively stable fluctuations in productivity. However, between September 2008 and December 2008, a drastic decrease occurred. However, from that time through September 2009, productivity greatly increased.

They experienced another major decrease in March 2011, which increased a few months later. Since then through February 2015, Japan appears to have resumed the relatively stable fluctuations as experienced between 1989 and 2008.

On the other hand, South Korea show to have had higher volatility in productivity. Data show that South Korea had a relatively high level of growth in productivity in May 1989. Productivity in South Korea appears to have declined in January 1997 and 1998, followed by higher levels of productivity until October 2000. As with Japan, South Korea also experienced a drastic decrease in 2008. Their productivity fell lower than Japan's productivity in November 2008. However, they appear to have experienced an increase in productivity slightly faster than Japan in February 2009.

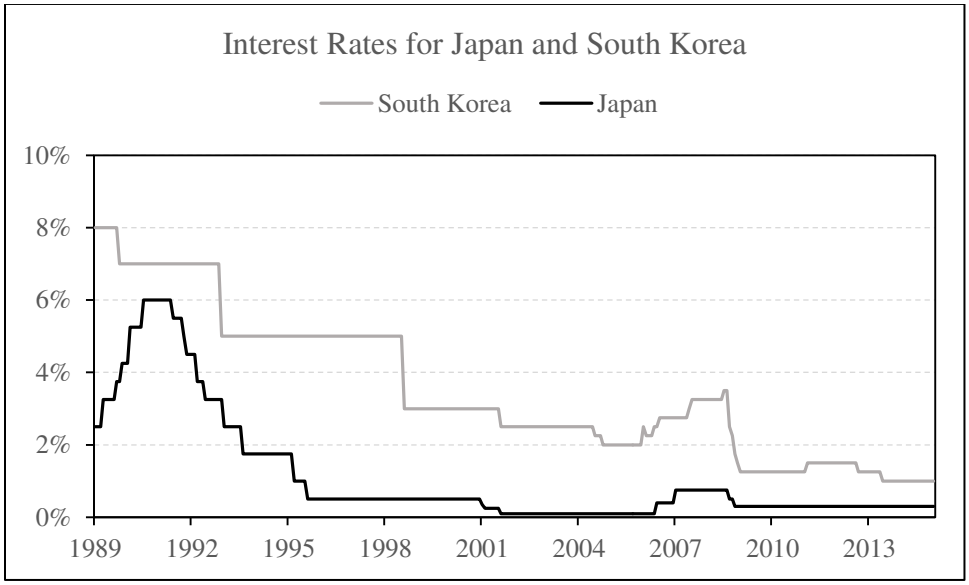

Figure 7. Interest rates for Japan and South Korea.

Figure 7 shows the interest rates for Japan and South Korea. Data shows that South Korea has had a higher interest rate from February 1989 through February 2015 when compared to Japan. From 1989 through January 2006, the interest rate in South Korea had a tendency to decline. However, from 2006 through August 2008, South Korea experienced an increase in

interest rates. The interest rate appears to have returned to the trended decline since 2012. From 1989 through June 1991, Japan had an increasing rate of interest. Since that time through December 1995, they experienced a drastic decrease. However, from December 1995 through February 2015, interest rates in Japan have stayed relatively steady and low. They did experience an increase in the 2007-2008 financial crisis.

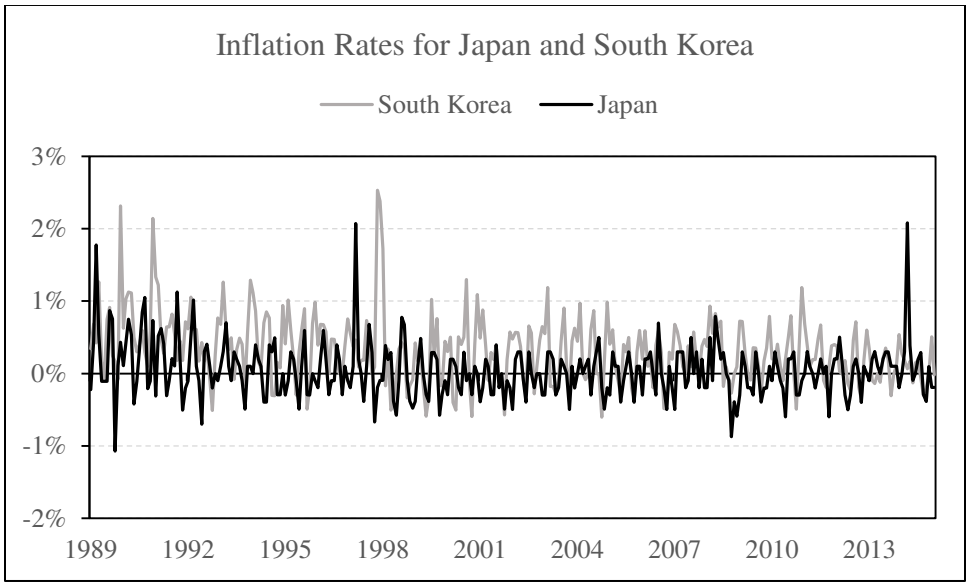

Figure 8. Inflation rates for Japan and South Korea.

Figure 8 shows the inflation rates for Japan and South Korea. The percent change of the consumer price index is the measure of inflation for Japan and South Korea. The U.S. Bureau of Labor Statistics calculates the rate of inflation as the percentage change in the consumer price index. Therefore, the study used the percentage change for the consumer price index values. Figure 8 displays the percentage change of the consumer price index values, therefore representing comparable inflation measures.

Data shows that South Korea appears to experience greater inflation when compared to Japan. From 1990 through 1995, South Korea had a higher rate of inflation. However, in April 1997, Japan's rate of inflation drastically increased, and South Korea followed suit nine months

later. Since then until January 2013, South Korea continued experiencing greater inflation compared to Japan. However, Japan incurred another drastic increase in April 2014.

Descriptive Analysis

Table 2 provides the descriptive statistics for Japan. Data shows that the average exchange rate between February 1, 1989 and February 1, 2015 was $0.0092 U.S. dollars for one Japanese yen. The average money supply between the same periods was 329 trillion yens; however, the range between the lowest and highest levels of money supply was 516 trillion yens. The average rate of productivity was 0.03 percent. The average rate of interest was 1.1 percent. The average rate of inflation was 0.04 percent. The standard deviation for the exchange rate, productivity, interest, and inflation was below one standard deviation.

Table # 2

Descriptive statistics for Japan

Statistic	Exchange Rate	Money Supply	Productivity	Interest	Inflation
Mean	0.009203	329,966,826,517,572	0.000261	0.011260	0.000439
Median	0.009011	285,435,300,000,000	0.002045	0.005000	0.000000
Standard Deviation	0.001504	173,557,058,977,097	0.019003	0.015789	0.003811
Minimum	0.006275	101,835,200,000,000	-0.158049	0.001000	-0.010707
Maximum	0.013096	618,725,300,000,000	0.065984	0.060000	0.020792
Standard Error	0.000085	9,810,024,982,753	0.001074	0.000892	0.000215
Kurtosis	0.111715	-1.6760	17.990875	2.639415	5.662001
Skew	0.731211	0.0759	-2.521337	1.940940	1.341361
Range	0.006820	516,890,100,000,000	0.224033	0.059000	0.031499

Note: Statistics were ran on the raw data collected from the Federal Reserve Economic Data (FRED) database.

Table 3 provides the descriptive statistics for South Korea. Data show that the average exchange rate between February 1, 1989 and February 1, 2015 was $0.001026 U.S. dollars for one South Korean won. The average money supply during the same periods was 237 trillion won; however, the range between the lowest and highest levels of money supply was 574 trillion wons. The average rate of productivity growth was 0.5 percent. The average rate of interest was 3.5 percent. The average rate of inflation was 0.3 percent. The standard deviation for the exchange rate, productivity, interest, and inflation was below one standard deviation.

Table # 3

Descriptive statistics for South Korea

Statistic	Exchange Rate	Money Supply	Productivity	Interest	Inflation
Mean	0.001026	237,155,585,917,938	0.005637	0.035232	0.003238
Median	0.000948	259,465,714,000,000	0.004690	0.030000	0.003043
Standard Deviation	0.000220	153,971,495,292,926	0.022709	0.020260	0.004690
Minimum	0.000590	27,794,600,000,000	-0.107143	0.010000	-0.006031
Maximum	0.001501	602,450,300,000,000	0.072702	0.080000	0.025292
Standard Error	0.000012	8,702,983,470,437	0.001284	0.001145	0.000265
Kurtosis	-0.912078	-1.0710	3.278551	-0.759364	3.335171
Skew	0.518935	0.3065	-0.631566	0.625289	1.078730
Range	0.000911	574,655,700,000,000	0.179845	0.070000	0.031323

Note: Statistics were ran on the raw data collected from the Federal Reserve Economic Data (FRED) database.

Table 4 provides the descriptive statistics for the United States. Data shows that the average money supply in the United States between February 1, 1989 and February 1, 2015 was 1.3 trillion dollars. However, the range between the lowest and highest levels of money supply was 2 trillion dollars. The average rate of productivity growth was 0.17 percent. The average rate of interest between these periods was 3.48 percent. The average rate of inflation was 0.2 percent. The standard deviation for productivity, interest, and inflation was below one standard deviation. The researcher collected data for the United States because the Sticky-Price Monetary Theory uses differentials (the difference between the data point for the U.S. and the foreign country) as the independent variables.

Table 4

Descriptive statistics for the United States

Statistic	Money Supply	Productivity	Interest	Inflation
Mean	1,389,249,201,278	0.001729	0.034820	0.002122
Median	1,185,600,000,000	0.002152	0.035000	0.002102
Standard Deviation	524,497,605,780	0.006411	0.021306	0.003371
Minimum	766,100,000,000	-0.042078	0.005000	-0.019153
Maximum	2,985,200,000,000	0.020804	0.070000	0.012220
Standard Error	29,646,357,494	0.000362	0.001204	0.000191
Kurtosis	1.3165	8.391767	-1.368916	5.682139
Skew	1.4489	-1.628065	-0.005103	-1.013010
Range	2,219,100,000,000	0.062883	0.065000	0.031373

Note: Statistics were ran on the raw data collected from the Federal Reserve Economic Data (FRED) database.

Table 5 shows the Pearson correlation matrix for Japan. The exchange rate has relatively high correlation with money supply and interest. Money supply has a positive correlation with

exchange rate, while the rate of interest as an inverse correlation. In the same affect, money supply also had a high negative correlation with interest rate. The rate of productivity does not appear to have a correlation with any other variable used within the study. The rates of interest and inflation have low correlation. These levels of correlation may potentially affect the analysis by violating an assumption of the least squares regression procedure. The study used an additional test for verification.

Table 5

Pearson correlation matrix for Japan

Variable	Exchange Rate	Money Supply	Productivity	Interest	Inflation
Exchange Rate	1.0000	0.54663	-0.01211	-0.47487	-0.13447
Money Supply	0.54663	1.0000	-0.00203	-0.61861	-0.09270
Productivity	-0.01211	-0.00203	1.0000	-0.00328	-0.00140
Interest	-0.47487	-0.61861	-0.00328	1.0000	0.20348
Inflation	-0.13447	-0.09270	-0.00140	0.20348	1.0000

Note: Data from February 1, 1989 through February 1, 2015.

Table 6 shows the Pearson correlation matrix for South Korea. The exchange rate has relatively high correlation with money supply and interest rate. Money supply for South Korea has a negative correlation with the exchange rate, while the rate of interest as a positive correlation. Likewise, money supply has a high negative correlation with interest. No correlation exists between the productivity rate and any other variable within the study. The rates of inflation and interest have a slight correlation. In addition, the rate of inflation also has a small correlation with the exchange rate and money supply. The Durbin-Watson statistic tested the various correlations found within the data for Japan and South Korea.

Table 6

Pearson correlation matrix for South Korea

Variable	Exchange Rate	Money Supply	Productivity	Interest	Inflation
Exchange Rate	1.0000	-0.62134	0.04567	0.80119	0.19944
Money Supply	-0.62134	1.0000	-0.06352	-0.90663	-0.27139
Productivity	0.04567	-0.06352	1.0000	0.00092	0.00326
Interest	0.80119	-0.90663	0.00092	1.0000	0.30366
Inflation	0.19944	-0.27139	0.00326	0.30366	1.0000

Note: Data from February 1, 1989 through February 1, 2015.

The study used corrected estimates because the Durbin-Watson test suggest correlation, which would violate an assumption of the least squares regression technique. This test is a commonly used technique for detecting autocorrelation. Table 7 provides the Durbin-Watson statistic with the R-squared of 0.1768 for Japan and 0.6912 for South Korea. Table 7 also provides the F-statistics for the regression model, showing significance (alpha = 0.05; p-value = <0.0001). Data show the Durbin-Watson test is highly significant ($p < .0001$) and suggest correlation (statistic much lower than 2); therefore, the regression requires a correction for serial correlation (see Table 7).

Table 7
Preliminary regression key statistics with Durbin-Watson

Variable	Japan		South Korea	
	Estimate	Significance	Estimate	Significance
Durbin-Watson	0.0532	<.0001*	0.1308	<.0001*
R-Squared	0.1768		0.6912	
F-statistic	16.54	<.0001*	172.32	<.0001*

Note: The asterisk (*) indicates significance at alpha level 0.05.

The study use a first-order autoregressive, otherwise known as AR(1), error model to correct for serial correlation. The remainder of this study will use the estimates from the autoregressive error model that accounts for serial correlation among the variables. Provided are the coefficient estimates, along with their respective standard error, t-value, and significance value. The regression analyses used the 95 percent confidence interval (alpha = 0.05).

Analysis of Hypotheses

The first hypothesis (H1) was analyzed using regression (Table 8). The test results showed that Japanese money supply did not have a significant effect on the U.S.-Japan exchange rate between February 1, 1989 and February 1, 2015 (alpha = 0.05; p-value = 0.3152). Therefore, we fail to reject the null hypothesis ($H1_0$) thus rejecting the alternate hypothesis

($H1_a$). According to statistical practice, researchers are unable to accept null hypotheses; however, evidence might fail to reject the null hypothesis.

Table 8
Regression estimates from the autoregressive error model for Japan

Variable	Estimate	Standard Error	t-value	p-value
Intercept	0.0112	0.002410	4.66	<.0001*
Money Supply	0.000433	0.00431	1.01	0.3152
Productivity	0.000163	0.00595	0.27	0.7848
Interest	-0.002554	0.006749	-0.38	0.7054
Inflation	0.002258	0.003020	0.75	0.4552
AR1	-0.9821	0.0101	-97.69	<.0001*
Durbin-Watson	1.7429		R-Squared	0.9648

Note: The asterisk (*) indicates significance at alpha level 0.05.

The second hypothesis (H2) was analyzed using regression (Table 8). The test results showed that Japanese productivity (a proxy for gross domestic supply) did not have a significant effect on the U.S.-Japan exchange rate between February 1, 1989 and February 1, 2015 (alpha = 0.05; p-value = 0.7848). Therefore, we fail to reject the null hypothesis ($H2_0$) and reject the alternate hypothesis ($H2_a$).

The third hypothesis (H3) was analyzed using regression (Table 8). The test results showed that Japanese interest rates did not have a significant impact on the U.S.-Japan exchange rate between February 1, 1989 and February 1, 2015 (alpha = 0.05; p-value = 0.7054). Therefore, we fail to reject the null hypothesis ($H3_0$) and reject the alternate hypothesis ($H3_a$).

The fourth hypothesis (H4) was analyzed using regression (Table 8). The test results showed that Japanese inflation did not have a significant effect on the U.S.-Japan exchange rate between February 1, 1989 and February 1, 2015 (alpha = 0.05; p-value = 0.4552). Therefore, we fail to reject the null hypothesis ($H4_0$) and reject the alternate hypothesis ($H4_a$).

Table 8 shows that the Durbin-Watson is closer to two (1.7429), meaning that serial correlation has substantially decreased. The R-squared improved from 17 percent in the preliminary estimates to 96 percent in the autoregressive error model. The analysis indicates that

the first-order autoregressive model was found to be significant (alpha = 0.05; p-value = <.0001) for recent effects. Implementing these findings into the sticky-price monetary theory produces the following first-order autoregressive error model for Japan.

$$Exchange\ Rate = 0.0112 + v_t \quad (1)$$

$$v_t = -0.9821 v_{t-1} + \varepsilon_t \quad (2)$$

$$Est.Var(\varepsilon_t) = 0.0000000810324 \quad (3)$$

The model shown in equation (1) indicates that the variables within the sticky-price monetary theory did not have significant predictive abilities for the Japanese exchange rate. Equation (2) provides the coefficient for the first-order autoregressive error model. This suggests that one lag period is significant for recent effects. Since the analyzed data is monthly data, it may take one lag period for recent effects to affect exchange rate fluctuations. Equation (3) provides the expected variance of the error term within equation (2).

The fifth hypothesis (H5) was analyzed using regression (Table 9). The test results showed that South Korean money supply had a significant effect on the U.S.-South Korea exchange rate between February 1, 1989 and February 1, 2015 (alpha = 0.05; p-value = <0.0001). Therefore, we reject the null hypothesis ($H5_0$) and accept the alternate hypothesis ($H5_a$).

Table 9

Regression estimates from the autoregressive error model for South Korea

Variable	Estimate	Standard Error	t-value	p-value
Intercept	0.002273	0.000250	9.09	<.0001*
Money Supply	0.000263	0.0000507	5.19	<.0001*
Productivity	0.0000300	0.0000750	0.40	0.6889
Interest	0.000118	0.000876	0.13	0.8931
Inflation	0.001724	0.000471	3.66	0.0003*
AR1	-0.9414	0.0191	-49.19	<.0001*
Durbin-Watson	2.1704		R-Squared	0.9634

Note: The asterisk (*) indicates significance at alpha level 0.05.

The sixth hypothesis (H6) was analyzed using regression (Table 9). The test results showed that South Korean productivity (a proxy for gross domestic product) did not have a significant effect on the U.S.-South Korea exchange rate between February 1, 1989 and February 1, 2015 (alpha = 0.05; p-value = 0.6889). Therefore, we fail to reject the null hypothesis ($H6_0$) and reject the alternate hypothesis ($H6_a$).

The seventh hypothesis (H7) was analyzed using regression (Table 9). The test results showed that South Korean interest rates did not have a significant effect on the U.S.-South Korea exchange rate between February 1, 1989 and February 1, 2015 (alpha = 0.05; p-value = 0.8931). Therefore, we fail to reject the null hypothesis ($H7_0$) and reject the alternate hypothesis ($H7_a$).

The eighth hypothesis (H8) was analyzed using regression (Table 9). The test results showed that South Korean inflation had a significant effect on the U.S.-South Korea exchange rate between February 1, 1989 and February 1, 2015 (alpha = 0.05; p-value = 0.0003). Therefore, we reject the null hypothesis ($H8_0$) and accept the alternate hypothesis ($H8_a$).

Table 9 shows that the Durbin-Watson is closer to two (2.1704), meaning that serial correlation has substantially decreased. The R-squared improved from 69 percent in the preliminary estimates to 96 percent in the autoregressive error model. This suggest that the proposed model explains 96 percent of the variation in the exchange rate. The first-order autoregressive model was found to be significant (alpha = 0.05; p-value = <.0001) for recent effects.

$$Exchange\ Rate = 0.002273 + 0.000263(m - m^*) + 0.001724(\pi - \pi^*) + v_t \quad (4)$$

$$v_t = -0.9414 v_{t-1} + \varepsilon_t \quad (5)$$

$$Est.Var(\varepsilon_t) = 0.00000000181573 \quad (6)$$

The model shown in equation (4) indicates that as the log money supply differential increases one percent, the exchange rate will increase 0.000263 percent. Likewise, a one percent increase in the inflation differential will increase the exchange rate 0.00172 percent. Equation (5) provides the coefficient for the autoregressive lag. Lag effects may take one period to influence the exchange rates. Equation (6) provides the expected variance of the error term in equation (5).

Tables 8 and 9 also displays the t-statistic. The t-statistic tests that the true value of the coefficient is zero and should not be included in the model). According to Rabbi and Batsos (2012), "the hypothesized value is reasonable when the t-statistic is close to zero, the hypothesized value is not large enough when the t-statistic is large positive and finally the hypothesized value is too large when the t-statistic is large and negative" (p. 97). If a t-statistics is not greater than two in magnitude and corresponding to p-values less than 0.05, then the model is to be refitted with the least significant variable excluded. If the p-value is greater than 0.05, which occurs when the t-statistic is less than two in absolute value, then the coefficient may be accidentally significant (Nau, n.d.). A t-statistic with an absolute value greater than or equal to 1.96 indicates that the estimate is statistically significant at the 95 percent confidence level.

Summary

The analysis indicated that the macroeconomic variables did not have a significant impact on the Japanese exchange rate, while inflation and money supply had a significant impact on the South Korean exchange rate. The model suggests that a one-unit increase in the money supply differential would yield a percent change increase in the exchange rate by 0.000263 percent, and a one-unit increase in inflation will increase the exchange rate by 0.001724 units. The models

for both Japan and South Korea suggest one lag period to correct for serial correlation. The estimated variance of the error term for both models was low.

CHAPTER 5. CONCLUSIONS

Introduction

Numerous researchers have investigated the connection between exchange rate fluctuations and macroeconomic variables for developed and emerging market economics. Few studies, however, have addressed whether these relationships differ based on the market classification of the given economy. This study examined the impact on exchange rates for Japan (a proxy for developed economies) and South Korea (a proxy for emerging economies) yielding from the macroeconomic variables of the sticky-price monetary model between February 1, 1989 and February 1, 2015.

The purpose of this chapter is to provide an evaluation of the research questions, which will lead into a discussion of implications. The organization of this chapter includes an evaluation of the research questions, fulfillment of the research purpose, contribution to the business problem, recommendations for future research, and will end with a conclusion. The section for the evaluation of the research questions will detail the test results, organized by macroeconomic variable, with respect to the literature as well as the study of replication. The section for the fulfillment of the research purpose will simply describe how the research performed within this paper met the expectations and requirements of the study. The section for the contribution to the business problem will provide implications as how the results might influence business practice. The section for future research will provide areas for other researchers to consider. The conclusions will wrap up the study.

Evaluation of Research Questions

This section is an evaluation of the research questions. Chapter 4 detailed the test results along with the model formulated by the autoregressive procedure. Below is an overview and

interpretation of the test results. Separated by variable, the evaluation below provides an analysis and comparison of how each variable affected their respective rates of exchange differently during the sample period of the study.

Money Supply

To what extent did money supply affect Japanese and South Korean exchange rate movements relative to the U.S. dollar? The first hypothesis test showed that Japanese money supply had no significant effect on the U.S.-Japan exchange rate; therefore, failing to reject the null hypothesis of no relation and rejecting the alternate hypothesis of an existing relation. In comparison, the fifth hypothesis test showed that South Korean money supply did have a significant effect on the U.S.-South Korea exchange rate; therefore, rejecting the null hypothesis of no relation and accepting the alternate hypothesis of an existing relation.

The test results suggest money supply had an effect on the South Korean exchange rate but not the Japanese exchange rate. Given that the variable used within the analysis was a differential of the log money supply between the foreign nation and the U.S., the data shows that differentials in log money supply between the United States and the foreign country affected rates of exchange differently between Japan and South Korea. The analysis indicates that a one-unit increase in the log money supply differential between the United States and South Korea causes the respective percent change in the exchange rate to increase by a small percentage.

The findings agree with the study of replication. Kehinde (2014) did not find a significant effect for Japan at the 95 percent confidence interval. In addition, the effects for the emerging economies varied with no consensus (Kehinde, 2014). Similarly, the estimate for money supply in this study suggest an impact so small, that the failure to find a consensus in the study of Kehinde (2014) is within range for the results of this analysis. For the purpose of the

study, this variable may be a causal factor in a potential difference between market classifications.

Monetary policies allow central banks to control a country's money supply to stabilize inflation and interest rates within the economies (The Economic Times, 2015). This stimulates economic activity and influences the currency value (Filardo, Ma, & Mihaljek, 2011). Money supply and exchange rates have the ability to influence one another (Tervala, 2012), and therefore are crucial in policy choices for emerging market economies.

The suggested impact of this study that money supply has on the South Korean exchange rate agrees with prior literature. An increase in the money supply stimulates economic activity and influences the currency value (Filardo, Ma, & Mihaljek, 2011). The results of this study showed a significant relation between money supply and the exchange rate for South Korea. This study further adds evidence to the body of knowledge supporting the fact that money supply affects currency value.

Productivity

To what extent did productivity affect Japanese and South Korean exchange rate movements relative to the U.S. dollar? The second hypothesis test showed that the Japanese productivity index did not have a significant impact on the U.S.-Japan exchange rate; therefore, failing to reject the null hypothesis of no relation and rejecting the alternate hypothesis. In comparison, the sixth hypothesis test also showed that the South Korean productivity index did not have a significant effect on the U.S.-South Korea exchange rate; therefore, failing to reject the null hypothesis and rejecting the alternate.

The test results suggest that the productivity index did not influence the Japanese nor South Korean exchange rates. Given that the variable used within the analysis was a differential

of the productivity index between the foreign nation and the U.S., the data show that differentials in the index between the U.S. and the foreign nation do not significantly affect rates of exchange. The finding agrees with Kehinde (2014) in that the proxy for gross domestic product coefficients were not significant for Japan nor the emerging economies of the study. For the purpose of the study, this variable did not show to be a causal factor in a potential difference between market classifications.

These findings differ from the literature using the pure gross domestic product. The per capita gross domestic product is a substantial driver of exchange rate fluctuations (Afzal & Hamid, 2013; Chen, Mancini-Griffoli, & Sahay, 2015), and studies have shown that the growth in domestic GDP has adverse effects on exchange rates as a result of decreasing prices in domestic countries (Cuiabano & Divino, 2010). Economic growth and trade are fundamental factors affecting the foreign exchange market (McFarlin, 2011). Economic output or productivity has shown to have an impact on exchange rate movements. Growth in economic output measures the output of a country with respect to a specific level of input (Carbaugh, 2005). Bailey, Millard, and Wells (2001) found that an increase in productivity increases the expected profits, equity prices, and investment stimulation. As a result, this rise in the demand for investments increases the capital inflow from foreign investors. When productivity in a country increases, research shows the rate of return on capital increases to generate substantial foreign inflows of capital, therefore appreciating the domestic currency (Bailey, Millard, & Wells, 2001).

Tille, Stoffels, and Gorbachev (2001) and Schnatz, Vijselaar, and Osbat (2004) studied links between exchange rate movements and output and found that changes in output can be utilized in determining exchange rate movements. The results of Tille, Stoffels, and Gorbachev

(2001) show that productivity differentials between two countries had a significant influence on exchange rate fluctuations. Similarly, Schantz, Vijselaar, and Osbat (2004) found that the specific productivity measures used might cause a variance in the extent to which productivity may influence exchange rates. However, the results of this study did not implement the pure gross domestic product, but rather a productivity index due to the index being a monthly release as compared to a quarterly release of the gross domestic product. Therefore, although literature suggests the gross domestic product affects exchange rates, the results of this study confirms the study of replication in that that the percent change of the productivity index would not affect exchange rates at a significant level.

The research found in this current study adds to the body of knowledge that the percent change in the production index (a measure of productivity) did not have an effect on the exchange rate of Japan and South Korea with respect to the United States dollar. The study of replication did not use the percent change as a measure of productivity, but instead used the production index itself. However, to differentiate the current study, the percent change in the production index measured productivity in a similar method used by the U.S. Bureau of Labor Statistics to measure inflation as the percent change of the Consumer Price Index. Therefore, although the production index is a widely used proxy for gross domestic product, this specific variable may not be useful within the sticky-price monetary model for Japan and South Korea.

Interest Rates

To what extent did interest rates affect Japanese and South Korean exchange rate movements relative to the U.S. dollar? The third hypothesis test showed that Japanese interest rates had no significant effect on the U.S.-Japan exchange rate; therefore, failing to reject the null hypothesis of no relation and rejecting the alternate. In comparison, the seventh hypothesis test

showed that South Korean interest rates also had no significant effect on the U.S.-South Korea exchange rate; therefore, accepting the null and rejecting the alternate. Given that the variable used within the analysis was a differential of interest rates between the foreign country and the U.S., the data show that differentials in interest between the U.S. and the foreign nation do not significantly affect rates of exchange. For the purpose of the study, this variable did not show to be a causal factor in a potential difference between market classifications.

Increased domestic interest rates appreciates domestic currency by attracting foreign investors to domestic assets. These higher rates of return yield foreign inflows of capital that have a positive effect on the currency through the capital account (Alquist & Chinn, 2002). If domestic rates of interest are substantially greater than foreign rates of interest, the increase in foreign demand for domestic financial assets will appreciate domestic currency relative to foreign currencies. However, if domestic interest rates are lower than foreign interest rates, local investors will increase their demand for foreign financial resources to benefit from the higher rate of return, which results in domestic depreciation relative to foreign currencies.

Batten and Thornton (1985) found that changes in interest rate differentials significantly affect daily exchange rate movements, such that increased interest rate differentials yield domestic appreciation. Likewise, Kanas (2005), Wada (2012), and Byrne and Nagyasu (2010) found linkages among differentials of the real rates of interest and the real rate of exchange for the United Kingdom and United States. Hoffmann and MacDonald (2009) further investigated real rates of exchange concerning real interest rates and found that shocks of positive interest rates resulted in temporary fluctuations of the exchange rate, indicating that differentials in real interest rates are the sum of expected period-to-period exchange rate changes. According to

Engel (2011), real exchange rates are overly sensitive to real interest rate differentials such that domestic currency appreciates given relatively high domestic rates of interest.

The specific variable used in this study was the discount interest rate. Other measures of interest rates may show a different result. The study of replication used 90-day rates and yields (Kehinde, 2014). Those results found different effects on the developed economies, as well as differing effects on the emerging market economies. To differentiate the research found in the current study, the analysis used the discount interest rates. Data show that the discount interest rate differentials of Japan and South Korea did not significantly affect their respective exchange rate with the United States dollar. Therefore, the discount interest rate would not be a useful variable to use in the sticky-price monetary model for Japan or South Korea. This is an addition to knowledge provided by the results of this specific study.

Inflation Rates

To what extent did the rate of inflation affect Japanese and South Korean exchange rate movements relative to the U.S. dollar? The fourth hypothesis test showed that Japanese inflation did not have a significant impact on the U.S.-Japan exchange rate; therefore, failing to reject the null and rejecting the alternate. In comparison, the eighth hypothesis test showed that South Korean inflation did have a significant effect on the U.S.-South Korea rate of exchange; therefore, rejecting the null and accepting the alternate.

The test results suggest inflation did not influence Japanese, but did influence the South Korean exchange rates. Given that the variable used within the analysis was a differential of inflation between the foreign nation and the U.S., the data shows that differentials in inflation between the U.S. and Japan do not significantly affect rates of exchange, but the inflation differential between the U.S. and South Korea do significantly affect exchange rates. This

agrees to Kehinde (2014) in that inflation did not have a significant effect on Japan; however, no consensus was determined for the emerging economies. For the purpose of the study, this variable did show to be a causal factor in a potential difference between market classifications.

Increased rates of inflation in a competitive economy increases production costs, thus leading to an increase of imported foreign goods and depreciating the domestic currency. Korhonen and Junttila (2012) and Butt, Rehman, and Azeem (2010) found inflation influencing fluctuations in the rates of exchange. In addition, Ozsoz and Akinkunmi (2012) and Kia (2013) examined exchange rate determinants and found exchange rates appreciate because of interest rate shocks with a negative impact. Changes in price due to shifts in supply and demand yields deviance from the purchasing power parity, and therefore affects rates of exchange (Stockman, 1980).

Groen and Lombardelli (2004) showed that exchange rates have a long-term relationship with relative prices. In the same effect, Betts and Kehoe (2006) demonstrated that relative price levels have a positive influence on fluctuations in the rates of exchange. A regression analysis conducted by Dong (2013) examined how fluctuations from the purchasing power parity affects changes within the rate of exchange. Dong (2013) showed that difference in relative prices might be helpful in predicting appreciation or depreciation in domestic currency. Chen and Rogoff (2003) and Cayen, Coletti, Lalonde, and Maier (2010) found relative prices had an influence on exchange rate movements between the currencies examined.

Some studies show that inflation affects exchange rates while other studies show varying significances. Therefore, the results of this study show that inflation has differing effects depending on other factors, such as the specific country and period. This study adds to the body of knowledge that the percent change in the consumer price index (inflation) did not have a

statistically significant effect on Japanese and only a small impact on South Korean exchange rates with the United States between February 1989 and February 2015. While studies may show differing results, the significance of this current study is that the variable did not substantially affect these particular exchange rates during this particular point of time.

Fulfillment of Research Purpose

The study examined the sticky-price monetary theory in the context of developed and emerging market classifications. This study extended the work of Kim, An, and Kim (2015) on the comparison of developed versus developing market economies, and directly answered the call of Kehinde (2014) for additional research to address this gap in knowledge. The study built upon various works of the sticky-price monetary theory, some of which include Hassan and Gharleghi (2015), Frenkel (1976), Chin, Azali, and Matthews (2007), Dornbusch (1976), and Frankel (1979).

The study found that money supply and inflation affected the South Korean exchange rate. In addition, the study found no significant impact on the Japanese exchange rate with respect to any macroeconomic variable within the sticky-price monetary model. Results of the analysis also added to the body of knowledge of specific variables that may not be useful candidates for the sticky-price monetary model as related to Japan or South Korea. The analysis found within this study directly fulfilled the purpose of its intended research.

The research found in this current study is a replication study aimed at replication aspects of Kehinde (2014) using a different sample and slight differing selection of variables (i.e., discount interest rate in this study verses the 90-day interest rate in the study of replication). These are results are significant in that they add to the body of knowledge regarding how these different variable affect the sticky-price monetary theory with respect to Japan and South Korea.

Contribution to Business Problem

The analysis indicated that some economic variables may have a significant influence on the rates of exchange for emerging market and developed market economies. However, the variables have varying significance and impacts. The study contributed to addressing the business problem by confirming the results of a prior studying using a different sample. The direct implication for applied business practice is that the findings suggest firms engaging in foreign direct investment within emerging markets and traders of emerging market currencies can deploy existing or similar strategies used for developed economies.

It is common knowledge that the random walk theory is preferred for shorter horizons; however, forecast models are appropriate for longer horizons. Taking into consideration the seasonal lag period and minimal impact, using the sticky-price monetary model may not be the most useful method of advising currency exchange strategies concerning emerging markets. Literature has shown, however, that this theory has been useful in establishing relationships with macroeconomic fundamentals and exchange rates of other developed currencies.

Transaction risk is the possibility of a loss resulting from adverse exchange rate fluctuations while transferring revenues dominated in a foreign currency to the currency of the home country. The forward market provides an avenue to hedge against transaction risk by entering into a contract providing profits when losses incur (Bekaert & Hodrick, 2012). When a transaction requires a transfer from foreign funds, the firm experiencing transaction risk may buy or sell the non-domestic currency forward. Today's rate determines the cost; therefore, the forward contract reduces transaction risk.

Hedging transaction risks requires quantifying degrees of uncertainty of future spot rates by observing ranges of current data. A common technique to achieve this task is forecasting

probability distributions. A probabilistic forecast uses a normal distribution to summarize volatility with a mean and standard deviation. Probability distributions constructed for exchange rate forecasting provide the probability that an exchange rate will reach a specific value given a certain level of confidence. Therefore, among the risks firms experience are the volatility and difficulty in the prediction of exchange rates (Stockman, 1980).

Little research has assessed whether macroeconomic effects on exchange rates differ with respect to market classification (Kehinde, 2014). The results of this study show that money supply and inflation had a small impact on the South Korean exchange rate, which was a proxy for emerging market economies. These results provide a statistically sound method to evaluate the effect of monetary variables by market classification for projecting rates of exchange used in probability distributions to hedge transaction risk through forward contracts.

The study contributed by extending the similar work of Kehinde (2014) and demonstrated that the sticky-price monetary theory may consist of variables with serial correlation. The findings show that the autoregressive correction models suggest one lag period to correct for correlation. Therefore, movements of significant macroeconomic variables may not substantially affect exchange rate fluctuations for Japan, however, the findings showed a significant influence from money supply and inflation on the South Korea exchange rate with an appropriate level of significance for an expected period in the forecast models based on the sticky-price theory.

Another contribution this study made to the business problem is that discount interest rate and the percent change of the production index may not be appropriate variables for the sticky-price monetary theory. However, a significant contribution made by this study is that money supply and inflation had differing effects between Japan and South Korea, but these effects were small. Further research would be useful considering additional variables and situations to

investigate significant results that provide evidence for a generalized answer as to whether emerging and developed economies experience differing influences of their exchange rates based on fluctuations of macroeconomic variables. However, this study as contributed knowledge to the research of this business problem.

Recommendations for Further Research

The lack of high frequency data is a limitation of this study; therefore, the researcher recommends additional investigation when more data become available. In addition, another method for determining an exact impact of market classification would be to incorporate a control (dummy) variable for market classification. However, to perform this analysis, one would have to research an economy that has transitioned from being an emerging market economy to a developed market economy, with available data ranging throughout the periods. A second recommendation for future research would be to expand the analysis with respect to business cycle. It may be interesting to investigate how monetary variables influence differently the rates of exchange by market classification contingent on whether the economy is in a recession or expansion.

Future research may also investigate other exchange rate forecasting methods with respect to market classification and business cycle. A final recommendation for future study would be to analyze sensitivity for the variations of the sticky-price monetary model. This study used the model as demonstrated in Civcir (2003); however, the variation shown in Hassan and Gharleghi (2015) does not use differentials and log values. Examining the sensitivity of the this theory's variations may provide future insight on to which variation provides better measurement with respect to market classification and business cycle. Likewise, examining various periods,

proxy data, and varying data frequencies may also extend the body of knowledge concerning this area.

Conclusions

Exchange rate fluctuations are an important risk that firms experience (Demirhan & Atis, 2013). Firms that are engaged in international business transactions expect and plan for exposure to exchange rate volatility; however, local firms not engaged might also be affected (Aggarwal & Harper, 2010). Therefore, the problem exists in that exchange rate volatility affects a firm's bottom line. A commonly held assessment in finance is that exchange rates are predictable (Austin & Dutt, 2014). Therefore, understanding their behavior is essential for financial success.

This study extended knowledge found in literature to deepen the understanding between macroeconomic fundamentals and emerging market exchange rates. The study used an autoregressive error model of the sticky-price monetary theory to examine differing effects the variables may have on Japan and South Korea based on their market classification. Given the coefficient estimates, lag time, and error variance, the study suggests that emerging market economies may experience volatility in their exchange rate as the level of money supply and inflation fluctuates. The findings indicate forecasting techniques using macroeconomic variables of the sticky-price monetary theory may not be an appropriate method to predict exchange rate fluctuations of emerging market economies.

This study built on the foundation of the multiple regression analysis of the sticky-price monetary model. A contribution to knowledge echoes Kehinde (2014) in that the sticky-price monetary theory may consist of serial correlation that requires correction for an appropriate analysis. Therefore, studies that blindly perform an analysis of the theory without verifying

correlations (and simply use the assumption that the theory holds) will yield poor analyses of their results. This study provides further evidence that the assumptions of the multiple regression analysis need verifying before performing a significant evaluation. The evidence of serial correlation suggest required lag periods for the effects of the independent variables to influence the dependent variable.

The study adds to the body of literature regarding the sticky-price monetary theory. The study provides evidence that specific variables may not be useful representations of generalized variables. For example, the theory analyzes interest rates, but various studies uses different measures of interest rates. Some studies use a 90-day interest rate while others use discount interest rates. The research in this current study used discount interest rates, and the analysis found no significant influence on exchange rates. The study also added to literature in that inflation and money supply may affect developing and emerging market economies differently. The results showed differing effects between Japan and South Korea; however, these effects were small. Additional research would be beneficial for further investigation.

This study has demonstrated that exchange rates are important factors for firms to consider hedging. Traders often use technical methods (moving average periods) whereas economist traditionally evaluate macroeconomic variables. Since the 1970s, the sticky-price monetary theory has been a primary model of evaluating exchange rates with respect to macroeconomic variables. Prior studies demonstrate varying results, but few have investigated potential differences between market classifications. This study served as a replication study and found similar results across a different sample and slightly different variable proxies. The findings of this study added to the body of knowledge for significant results. Data show that the sticky-price model may not be most appropriate for determining exchange rate fluctuations

between Japan and South Korea. The same model with different countries may provide differing results. The author recommends additional research.

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Capella University's Academic Honesty Policy (3.01.01) holds learners accountable for the integrity of work they submit, which includes but is not limited to discussion postings, assignments, comprehensive exams, and the dissertation or capstone project.

Established in the Policy are the expectations for original work, rationale for the policy, definition of terms that pertain to academic honesty and original work, and disciplinary consequences of academic dishonesty. Also stated in the Policy is the expectation that learners will follow APA rules for citing another person's ideas or works.

The following standards for original work and definition of *plagiarism* are discussed in the Policy:

> Learners are expected to be the sole authors of their work and to acknowledge the authorship of others' work through proper citation and reference. Use of another person's ideas, including another learner's, without proper reference or citation constitutes plagiarism and academic dishonesty and is prohibited conduct. (p. 1)
>
> Plagiarism is one example of academic dishonesty. Plagiarism is presenting someone else's ideas or work as your own. Plagiarism also includes copying verbatim or rephrasing ideas without properly acknowledging the source by author, date, and publication medium. (p. 2)

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> Research misconduct includes but is not limited to falsification, fabrication, plagiarism, misappropriation, or other practices that seriously deviate from those that are commonly accepted within the academic community for proposing, conducting, or reviewing research, or in reporting research results. (p. 1)

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Statement of Original Work and Signature

I have read, understood, and abided by Capella University's Academic Honesty Policy (3.01.01) and Research Misconduct Policy (3.03.06), including Policy Statements, Rationale, and Definitions.

I attest that this dissertation or capstone project is my own work. Where I have used the ideas or words of others, I have paraphrased, summarized, or used direct quotes following the guidelines set forth in the APA *Publication Manual*.

Learner name and date: Richard F. Works, 10/10/2016