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# THE IMPACT OF REAL INTEREST RATE ON REAL EXCHANGE RATE: EMPIRICAL EVIDENCE FROM JAPAN

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# **THE IMPACT OF REAL INTEREST RATE ON REAL EXCHANGE RATE: EMPIRICAL EVIDENCE FROM JAPAN**

Shodipe, O. Tomiwa

## **ABSTRACT**

*This paper examines the impact of real interest rate on the real exchange rate in Japan using Two Stage Least Square econometric techniques. The two instruments used are money supply and gross domestic product growth rates. The result provides support for the theoretical and empirical evidences of positive relationship between real interest rate and real exchange rate in Japan. The estimation also shows that there is positive relation between trade and Japanese Yen over the period considered in the study. In light of these findings, the study suggests the adoption of fiscal macroeconomic policy instruments that are capable of achieving the inflation-economic growth target rather than monetary policy instrument which has consistently failed over the two decades. As the result indicates, continuous lowering of this monetary policy rate will cause Yen to lose its competitiveness by the time all economies (at the least, its competitors) fully adjust and agents are well sensitive to higher returns on their investments.*

## INTRODUCTION

The Japanese historical experience of the disturbance in the cross-border trade, that stemmed from the Second World War, to a large extent shows severe effects on its currency. Reports show Japanese Yen was instantaneously sent to lower rung in the currency exchange ladder vis-à-vis the world traded foreign currencies during the decade. At the later end of the 1940s, few years after the Bretton Woods Agreement<sup>1</sup> were signed; Japanese currency had already experienced an exponential depreciation with respect to U.S dollars and Sterling. The immediate effect was a sustained inflationary pressure that eventually plagued the economy.

In theory, for economy to attain external and internal balance, its exchange rate stability and its domestic absorptive capacity are paramount. The economic incapability through inconsistent trinity for most countries that makes it difficult to achieve monetary autonomy, exchange rate stability and freedom of capital flow at the same time always beckons for pragmatic steps from the policy makers. With these frequent crises of imbalances and the trilemma that cause headache for government economic actors, pragmatic policy instruments are always inevitable. Unlike other economies that experienced economic summersault in the past silver-jubilee, the decades-long economic crisis of Japan is still staggering and the economy has found it uneasy to maintain these balances. Also, its exchange rate has shown a wide fluctuation vis-à-vis major traded currencies.

The Asian Financial Crisis originating from Thailand in 1997 penetrating into neighboring countries caused rapid depreciation in currencies for the affected Asian nations, and the fluctuation in both stock and foreign exchange markets, Kyung (2008). The mild effect of Asian Crisis and the long-aged economic stagnancy in the system has created a center of attention for Japanese to making sure these secular economic slumps are rectified quickly<sup>2</sup>. As it is usual for policy makers to advocate aggressive monetary management “leaning

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<sup>1</sup> The collapse of Bretton Wood is briefly highlighted in the second section.

<sup>2</sup> The recovery is not in sight for Japanese economy as had earlier predicted. For more than two decades after the bubble and bust in Japan, the country is still battling with inflation target, weak interest rate and secular stagnation.

against the wind”<sup>3</sup> to correct any instability in the system, it is in this light, large scale of policy attempts was geared towards resuscitating the plunged economy. This was done by pressuring down the interest rates.

Also, the economic pursuit of boosting inflation rate towards achieving high economic growth motivates the Japanese economic actors to drive its energy towards lowering monetary interest rates. This was supposedly believed to encourage private investment. However, it is plausible to say, this can have grave economic implication on the economy; apparently, might constitute an open channel for capital flight that ultimately exacerbates the exchange rate. With wide inundated consensus in the literature of the ineffective expansionary monetary policies pursued by the Japanese economy, the study is then inspired to examine the impact of this aggressive monetary policy interest rate changes on the Japanese Yen.

Dissimilar views exist in the literature for universal reasons for movement in exchange rates, though, some are country-specific. Abou-zaid and Alabdulwahab (2013), in their study on sources of real exchange rate between US and Canadian dollars after North American Free Trade Agreement (NAFTA), opined that supply shocks are the major sources<sup>4</sup> of real exchange rate fluctuation. In their view, increase in Canada’s trade volume with US and its immediate neighbor (Mexico) allows more capital flow into the Canadian economy leading to its currency appreciation. While Dornbusch (1976) argues for monetary easing, Mussa (1986), Mundell (1962) and Fleming (1962) differently conceived that fluctuation in nominal exchange rate drives real the exchange rate movement.

These findings and several other drivers of exchange rate are discussed in second section of this paper. With international monetary implication in perspective, the Japanese expansionary monetary approach to speed up the crawling economy is believed to may have dilapidating effect on its currency. Yen is one of the major currencies traded in the world

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<sup>3</sup> Leaning against the wind or leaning into the wind, in economic parlance, refer to a countercyclical monetary policy where central banks take action to damp down inflationary booms or to boost growth when the economy is flagging.

<sup>4</sup> They also argued that there is an increasing role of demand shock as source of exchange rate fluctuation in the United State.

foreign exchange market and Japanese monetary authority is not expected to make any snap decision on changing its interest rate as large capital flight may be feared leading to the currency depreciation, at least in the short-run. It becomes more interesting to investigate the disposition of Japan towards its economic revival as the country has been more inward-looking since the crisis started in 1990s turning them to push the interest rate downward. This long term weird approach motivates current study to examine the theoretical splendor of the relationship between Japanese Yen and policy interest rates that have been continuously forced down by the country's monetary actors.

Moreover, though, diverse literature exist on secular stagnation of Japan – Arthur (2000), Takeo and Anil (2004), Tatsuyoshi and Yoshihiko (2004), Kalim (2009) Yoshino and Farhad (2015), Fukao et al.<sup>5</sup> (2015) - and its impact on the country's international economic presence but much attention has not been devoted to the effect of the country's reaction on the exchange rate movement in the international foreign exchange market. This also creates a desire to look at this relationship and provide policy suggestions.

Due to the data constraint, the scope of the study is limited to period between 1971 to 2015. The study adopts econometric technique Two-Stage Least Square as first worked on by Wright (1928) and Theil (1958) which was developed in early research on simultaneous equations estimation, Imbens and Angrist (1995). Also, bulk of the data used in the study is sourced from World Bank data bank.

The remainder of the study is in four sections. Second section contains brief history and literature review on both exchange rate and interest as applied to Japanese economy. Third section presents the method adopted for the current study. In the fourth section, data is analyzed while the study concludes, recommends and suggest for further studies in the last section.

## **BRIEF HISTORY**

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<sup>5</sup> Fukao, Kyoji, Kenta Ikeuchi, YoungGak Kim, HyeogUg Kwon, Tatsuji Makino and Miho Takizawa (2015)

As pointed out in the previous section on the International Monetary System of Bretton Woods, the fundamental long-run problem alluded to by Triffin (1960) in which central banks' international reserve needs outgrowing the U.S stock of gold, which dollar was directly pegged with and by which US was mandated to redeem on demand, would lead holders to concurrently want conversion of their dollars holdings to gold. This would eventually lead to serious speculative attack that might crumble 1944's International Monetary Agreement- Bretton Woods System.

The anticipated problems and the non-practicability of the system to mitigate external and internal imbalances for most economies at the time were beginning to send signals to countries of the world on international monetary rethink. Coupled with the excess monetary easing<sup>6</sup> of United State in early 1970s leading to break-down of the system<sup>7</sup>, countries gained freedom of currency exchange (dated March 1973) allowing nations to float their currencies in the foreign exchange markets. As a result, since the beginning of the floating system, Japanese Yen showed a continuous appreciation,<sup>8</sup> though with alternating sharp short-term real appreciation and depreciation against U.S dollar and sterling, Lothian (1990).

The freedom from fixed exchange regime for most countries was not without official intervention to keep track of the moderate movement in exchange rates. In line with the decries by the Japanese government and businesses of rising value of Yen, that caused the decline of export in international trade market, suggested the need to join the league of western countries as they intervened in the foreign exchange market. Japan's case was also in alignment to the overall main objective of the constant monitoring of the changes in its exchange rate rather than achieving a target level vis-à-vis other currencies like US dollar. According to Quirk (1977), the two major instruments at the disposal of Japanese policy makers for intervention in foreign exchange rate markets are changes in international

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<sup>6</sup> Under the presidency of Richard Nixon

<sup>7</sup> The failure of the Bretton Woods system was partly due to lopsided macroeconomic power of the United States, which allow it to generate global inflation- "International Economics, Theory and Policy", Krygman, Obstfeld and Melitz.

<sup>8</sup> The appreciation was between the breakdown of International Monetary Bretton Woods System and the beginning of Japanese economic slumps.

reserves and foreign exchange fund accounts kept by Bank of Japan. In recent years however, few years after Shinzo Abe - Prime Minister of Japan- was sworn into power, the aggressive monetary manipulation pursued by the Japanese monetary authority was roundly criticized as a beggar-thy-neighbor<sup>9</sup> policy by its trading partners<sup>10</sup>. In actual fact, this confrontation would only be justified if one would shy away from the dire need for Japanese economic revival.

For more than two decades now, the underperformance that plagued Japan economy has attracted large body of literature examining the stagnating economy of Japan. Leonard (2001), Reiko (2013) and Weiland and Hausman (2015) and several other studies supported the view that the sluggish Japan economy has sunk into slump because of several demographic changes<sup>11</sup> in the country. Another stream of studies blames the secular stagnation on low rate of return and most recent, by the reactions of Asian friends against the Abe's relation campaign. In any event, this long-term recession has launched the government in deep debt, Leonard (2001). While the policy interest rate has also gravitated towards zero for long period of time. Overcoming these economic quagmires, since the boom and bust of Japanese financial system and the economy, has proved difficult for policy makers.

The coming to power of Shimzo Abe in 2012, had initially given glimpse of hope for economic change with the Abe's aggressive policies (expansionary monetary and fiscal policies) that scholars referred to as "Abenomics"<sup>12</sup>. With the implementation of the first phase of these policies, the economy experienced oscillating growth for the following years, however, the Bank of Japan under the leadership of Haruhiko Kuroda pursuing only the

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<sup>9</sup> For countries experiencing external and internal imbalances, Beggar-thy-Neighbor policies are deliberate attempts to remove these imbalances that hurt the economic interest of its trading partners.

<sup>10</sup> United State trade deficit was \$261.7 billion in the year leading to marginal increase in unemployment in United State. Bank of Korea also called the attention of countries of Asia to fight against the Abenomic movement that hurt its international trading partners.

<sup>11</sup> Some studies argued that economic stagnation of the decades is a symptom of problems brought on by demographic Japan since the end of World War II, notably the population by low fertility.

<sup>12</sup> Abenomics refers to an aggressive set of monetary and fiscal policies with structural reforms, that was intended to pull Japan out of decades-long deflationary slump. This term was coined from the name of current Prime Minister of Japan and the word Economics.

monetary policy, with the failure to implement both fiscal policy and the structural reform as laid down by Abe, has made the 2 per cent inflation target difficult to reach.

The practical steps taken by the Japanese policy makers to combating its stagnating economy for decades could be said to have had grave implication on its exchange rates. Keisuke (1993) argues that its monetary relations have been characterized with turmoil and instability. Martin (2013) also emphasizes that Japan has lost its regional leadership standing in Asian continent, including its former strong currency ever since the end of the Japanese financial bubbles. With inflation target in mind; the Achilles heel of Bank of Japan in achieving its long pursued objective, the monetary arm of the government is ever flexing its economic muscles to pressure down the interest rates as a means to hit its target. The feedback of this Bank's revamping policy structure is that, it is noticeably seen on the nose-dive in the policy interest rate. The immediate effect of this monetary decision is perceivably causing Yen's depreciation against the traded currency in the foreign exchange markets in recent years.

### **Reviewed Literature**

Stream of studies have developed on the influential study of Obstfeld and Rogoff (1995) that views currency exchange as an asset, lending credence to the application of pricing models to its determination. Future market expectation having its basis on asset pricing models as considered by Engel, Mack and West (2007) was chiefly seen as determinant of the movement in exchange rate. In the previous study of Engel and West (2006), they presented evidence of macroeconomic fundamentals as determinants of exchange rate.

Large body of empirical studies has also viewed exchange rate movement as been determined by these macroeconomic fundamentals. Such studies as Renato (2009) Bhanumurthy (2006) Joscha, Ansgar and Michael (2011), Weiwei and Junye (2014), Ricardo and Jose (2014) and Fayyaz, Umar and Su-chang (2015) showed evidence of certain major macroeconomic fundamentals to exchange rate dynamics. These macroeconomic

fundamentals; price level, balance of payment, interest rates, inflation rate, changes in money supply, real output were viewed to account for such sizably recognizable dynamics in countries' exchange rate.

However, Goldberg and Frydman (2001) conclude that the different sets of macroeconomic fundamentals matter for exchange rate movement during different time periods. They further stressed, credible relationship exchange rate and macroeconomic fundamentals can only be established only if the belief of the rational expectation paradigm is severed, however, acknowledge that agents only acquire imperfect knowledge about the market.

Another spectrum of studies on the monetary policy innovations on the exchange rate volatility, contradicting the scholarship on fundamentals, has taken a wider recognition in literature. In leading papers of Koray and McMillin (1999), Chari, Patrick and Ellen (1997), Faust, Rogers, Swanson, and Wright (2003) Mehmet and Bulent (2010), Michhel, Quianying and Xuan (2010), Batbayar and Kim (2013) show that contractionary monetary policy shock pilot the upward direction of the exchange rate<sup>13</sup>. Even though, these research papers differ in explanation and the length to which their studies were able to prove the effect of monetary shocks on exchange rates dynamics, their findings are stylized facts in the large body of economics research.

In their recent paper that examined the impact of monetary, demand and supply shock on real exchange rate fluctuation, Abou-zaid et al. (2013) posited that greater part of the exchange rate variation can only be explained by the real shocks<sup>14</sup> (supply and demand innovations). While the effect of monetary shocks is found to be extraneous and diminutive to the exchange rate movement. This finding was consistent with the previous study of Annika (2000) and partly with Gauthier and David (2002).

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<sup>13</sup> These authors, however, differ in methods and submission. The review only considers the convergent point, that is the common ground of this stream of studies.

<sup>14</sup> They however, emphasized supply shocks are the major sources of real exchange rate fluctuation

In congruence to Balassa (1964), studies have revealed that exchange rate dynamics are substantial responses from the supply-side shocks of the economy. These strand of studies; Alexius (2005), Alexius ad Erik (2005), Tokuo and Hayata (2016), Bayoumi and Eichengreen (1998), Azcona (2014), Zhenbo, Keane, Kennan and Dirk (2015), found long-run relationship between real exchange rate movement and shocks that resulted from the supply side. For Alexius (2005), the conclusion reached by previous findings on the demand shock as the major factor to explain exchange rate fluctuation but with less consideration on the effect of supply shock should be thrust aside. He elucidates, macroeconomic fundamentals have not, in the past, shown any significant long-run equilibrium relationship with exchange rate movement. Therefore, these studies based their evidence on the impact of productivity shocks and oil price shocks, relative price level and relative real Gross Domestic Product on the real exchange rate fluctuation.

Another phase of studies summarily links the volatility in exchange rate to result from real or nominal shock - Rogers (1998), Philip (1992), Amalia (2006), Seiha, Makoto and Hiroaki (2010), Craighead and Tien (2015), Sarker, Hasan and Rahaman (2016). Philip (1992), simply posits that large portion of the temporary fluctuation in exchange rate can be linked to nominal shock while real shock causes a permanent volatility in exchange rate. While Sarker et al. (2016) stress in their studies that nominal shocks have no long-run effect on real exchange rate. However, Rogers (1998) reveal that approximately no significant difference on the effect of real and nominal shocks on exchange rate movement. Amalia (2003) argued that higher fluctuation in real exchange rate is mostly explained by real shocks rather than nominal shock in some economies<sup>15</sup> and vis-à-vis.

Studies on the determinants of exchange rate are inexhaustible in the literature. These determinants, as have been identified in the reviews, are major contending factors scholars perceive play active role in explaining variations in the exchange rate. However, some of these findings have often failed to take holistic view on the important factors that

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<sup>15</sup>These economies are in the process of transitioning. He also explained that this finding was a result of diverse monetary and fiscal policies in these economies.

interact to push exchange rate upward (appreciation) or downward (depreciation). Whether, on purpose or oversight, the neglect of certain choice of macroeconomic variables that go into the modeling of exchange rate volatility may be devastating to any conclusion reached. Another important thing to note here is that different shocks are characteristic to different economies and any conclusion ascertained for certain country(s) may be inapplicable to others. The approach adopted by Rogers (1998) and several others in his group lend some credence to the current study. The empirical evidence of these influential scholastic works is fascinating and can be directly linked to the crisis development in Japan.

### **Interest Rate Determination**

Interest rates in both command and market based economy are approximately determined by the demand and supply side of real money holdings. In Krugman, Obstfeld and Melitz (2015), theoretical based changes in domestic interest rates are directly linked to changes in output and money supply<sup>16</sup>. Increase in money supply lowers the interest rate (in the short-run when prices are relatively sticky) stimulates people to increase their real money holdings and vice versa. On the other hand, real output increases (decreases) cause people to increase (decrease) their real money demand causing upward (downward) shift in the money demand curve<sup>17</sup>. Since, the real money supply (nominal money supply divided by the price level) has remained the same; the upward (downward) shift in the real money demand equilibrates the former at the higher (lower) interest rate. This most plausible, as people perceive permanent increase (decrease) in income, they expand (contract) commodity basket of their consumption leading them to increase borrowing. Both (real) money supply and output are important sources of interest rate determination in any economy.

### **Interest Rate Parity Condition and Exchange Rate Determination**

Interest Rate Parity<sup>18</sup> (IRP) Condition allows interest to forecast the exchange rate fluctuation given the level of expected exchange rate in the future. This research investigation

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<sup>16</sup> While price level is held constant.

<sup>17</sup> On individual level, expected return on assets, riskiness of asset and liquidity also account for the shift the demand for money. On aggregate, price level and national output shift the aggregate demand for money.

<sup>18</sup> When domestic and foreign assets are perfectly substitutable in the foreign exchange markets

though has lost interest with scholars, still useful for making cross-border investment decisions by the people and financial institutions alike. Jyh-Lin and Show-Lin (1998), Dornbusch (1987)<sup>19</sup>, Erdey and Foldvari (2009), Antonio and Enrique (2011) provide little support for IRP in countries of investigation. When IRP holds, the effect of arbitrage opportunity is diminutive or totally absent. The IRP equation:<sup>20</sup>

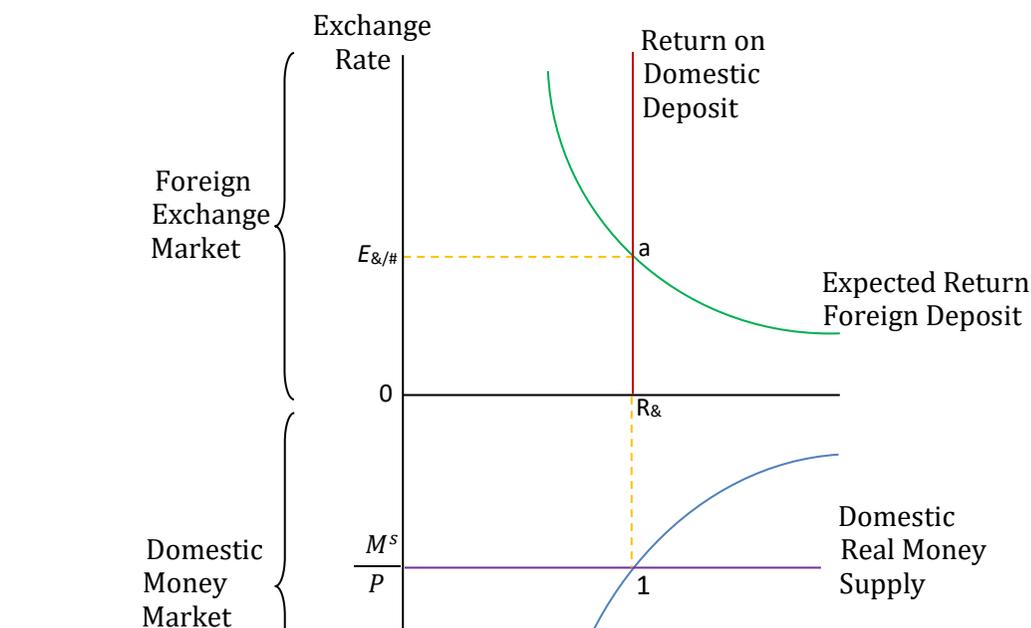
$$\text{Interest Rate Parity : } R_{\&} = R_{\#} + \frac{(E^* - E)}{E} \quad 1$$

2

$$\text{No Interest Rate Parity : } R_{\&} \neq R_{\#} + \frac{(E^* - E)}{E}$$

It was established above that certain domestic aggregates (money supply and output) are essential for the determination of interest rate equilibrium, therefore, means these two channels are fundamental to exchange rate determination through interest rate.

To demonstrate the linkage between money supply and output through exchange rate in the short-run, while we hold price level constant, both domestic money market and foreign exchange market are combined to derive the equilibrium exchange rate.



<sup>19</sup> One empirical evidence shows that interest parity does not hold for Mexican economy

<sup>20</sup>  $R_{\&}$  = domestic interest rate,  $R_{\#}$  = foreign interest rate,  $E^*$  = expected exchange rate and  $E$  = current exchange rate.

Fig. 2.1

In the fig. 2.1, the diagram shows the interaction between the domestic money market and foreign exchange market. The equilibrium interest rate, as determined by the interplay of real money balances, helps us to determine the exchange rate of a particular country. As the interest rate feeds into the international exchange rate market, given the expected exchange rate in the future, interest rate parity condition helps us determine the level of exchange rate at a particular time.

Looking at the fig. 2.2, the effect of increase in money supply, holding price constant, is connected to the exchange rate depreciation. The result of this monetary easing leads to downward movement of the domestic interest rate. This is theoretically credible, since this kind of expansionary monetary policy discourages the cross-border assets traders from holding the domestic currency and as they would be willing to flow their capital from low domestic interest yielding financial asset to high yielding foreign asset. This action taken by wide majority of investors forces down the value of the currency. As indicated on the

diagram, the new equilibrium is arrived at point  $b$  – exchange rate depreciation<sup>21</sup>- on the foreign exchange market.

The fig. 2.3 shows the impact of output on the exchange rate movement. It indicates that, as income increases, real money demand curve shifts upward putting pressure on the domestic interest rate. As interest is bid up in the money market, capital flows to the domestic economy putting another pressure on the exchange rate. Since, domestic financial assets give higher yields than what was obtainable in the world, domestic currency is on high demand to catch up with the domestic investment. This leads to domestic currency appreciation. These diagrams only indicate the domestic impact of both money and output on the exchange rate, external monetary policies affect the direction of the domestic exchange rate also<sup>22</sup>. With the case of Japan, it is expedient to investigate the impact of the two aggregates on the Japanese Yen.

The approximately three-decade economic stagnation of the Japanese economy has attracted different strategic policies to revive the economy from further drop and to restore price-stable economic growth. The most recent of these strategies is what scholars refer to the Abenomics. Whether these aggressive strategies are able to fulfill the 2% price stability is still in perspective. As some reports clearly point out, the quantitative easing adopted by the Bank of Japan has not really helped; many still advocate that government should still continue loosening its monetary policy to achieve its goals. However, some are skeptical about the potentiality of the monetary policy to accomplish the objective of the BOJ.

As it turned out to be, the complete effect of the quantitative and qualitative easing of the BOJ is on the policy rates. Loosing monetary policy is practically the same as to lowering the interest rate. To resuscitate the economy, Japanese policy actors have constantly applied negative interest rate on the new excess reserve. One could guess, with the diagram above,

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<sup>21</sup> In a fully employed economy, the effect of monetary has no effect on real macroeconomic variables; real output, interest rate and all relative prices, In Krugman, et. al (2015). In this case, the full proportion of the money supply bounces on the price.

<sup>22</sup> The monetary policies (expansionary or contractionary) and economic growth of the major trading partners also determine the level of the exchange rate. Sometimes, the beggar-thy-neighbor policies of the trading partner is has been indirectly linked to the movement of the exchange rate.

the direction (appreciation or depreciation) of the exchange rate of Japanese Yen with the relentless effort of BOJ to bring the economic to balance. It is surprising that the depreciation expected as a result of these monetary actions was not the case in recent years. The diagram shows the money supply growth, GDP growth, trade growth, interest rate and exchange rate in Japan from 1971 to 2015.

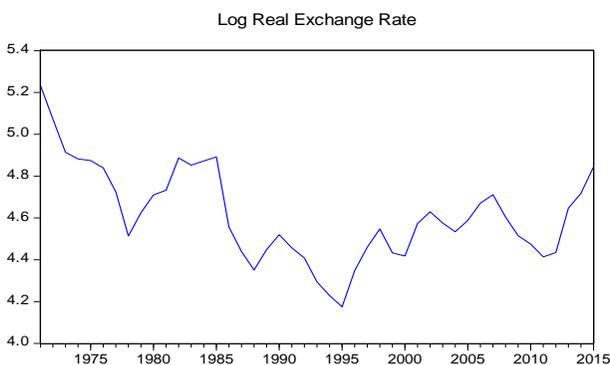


Fig. 2.4

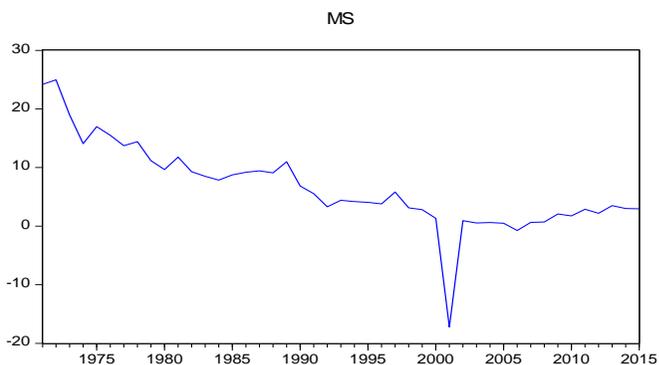
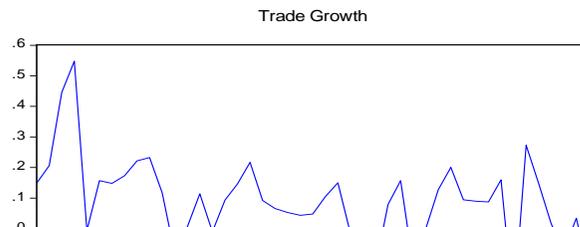
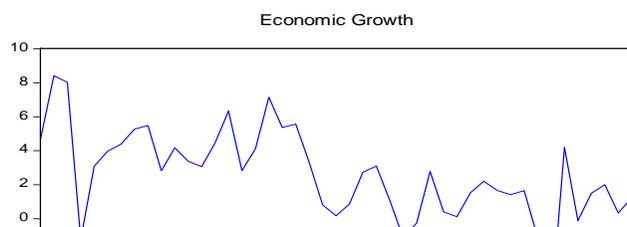


Fig. 2.5



The Fig. 2.4-8 show the real exchange rate, money supply growth, GDP growth, trade growth and real interest rate in Japan between 1971 to 2015. The Fig. 2.7 shows the combined graph of the real exchange rate, real interest rate and GDP growth in gross domestic product. The graphs reveal that money supply has grown over time at decreasing rate with sharp drop at the wake of the millennium and subsequently picked up; real interest rate dropped sharply in 1974 but quickly rose above zero in 1975. In 1995, periods between 1999 to 2005, and 2014 to 2015, Japanese real interest rate was below zero. Fitting a trend on real exchange rate time series plot, it clearly indicates the time-plot has continuously moved downward (appreciation) with less fluctuation. Important to pay attention is also the period Abe Shinzo with his the head of its monetary arm- Haruhiko Kuroda came into power. This period witnessed a slow trend of depreciation of the Japanese currency as a result of massive quantitative easing by his government.

## **METHODOLOGY**

The study adopts the econometric technique Two Stage Least Squares (2SLS) as first worked on by Wright (1928) and Theil (1958) followed by Basemann (1957) and Sagan

(1958). This technique was developed in early research on simultaneous equations estimation, Joshua and Guido (1994). Since its development, the 2SLS and Instrumental Variables technique are now widely used by researchers –Holland (1988), Angrist and Krueger (1991)- to tackle simultaneous causality bias, omitted –variables bias, sample selection bias, error-in-variables bias and multi-collinearity problems. The beauty of these powerful techniques is that it eliminates these time-series problems that Ordinary Least Square cannot get rid of.

It is important to note that the choice of instruments is very paramount and essential in the 2SLS or Instrumental variables techniques. To clean up the endogeneity problem or simultaneity causality bias completely in the model, the instrument is expected to satisfy two procedural conditions (instrument validity): Exogeneity and Relevance. It is relevant if the instrument correlates with the endogenous independent variables and it is exogenous if the instrument is uncorrelated with the error term in the structural model. To show if instrument validity holds;

*Given the original equation as:*

$$y_t = b_0 + b_1x_t + \varepsilon_t \quad 3$$

$y_t$  = dependent variable,  $b_1$  = parameter of the endogenous independent variable

$x_t$  = endogenous independent variable,  $\varepsilon_t$  = error term

*And given a variable instrument;  $w$*

$$Cov(y_t, w_t) = b_1Cov(x_t, w_t) + Cov(w_t, \varepsilon_t) \quad 4$$

$Cov(w_t, \varepsilon_t) = 0$ , *if the instrument is exogenous*

$$Cov(y_t, w_t) = b_1Cov(x_t, w_t) \quad 5$$

$$b_1 = \frac{Cov(y_t, w_t)}{Cov(x_t, w_t)}$$

Then, the sample Instrument estimator is given as:

$$\hat{b}_1^{2SLS} = \frac{S_{yw}}{S_{xw}} \rightarrow \frac{Cov(y_t, w_t)}{Cov(x_t, w_t)} = b_1$$

6

$Cov(x_t, w_t) \neq 0$ , if the instrument relevance condition holds

It follows that:  $\hat{b}_1^{2SLS} \sim N(b_1, \sigma_{2SLS}^2)$

This expression shows the instrument estimator follows a normal distribution with a population parameter and two stage population variance<sup>23</sup>.

The two instruments used in the study are growth in output and money supply. While the endogenous independent variable is the real interest rate. Also, the dependent variable,  $y$ , is real exchange rate.

Having established instrument validity, the endogenous independent variable is regressed on the instruments and several other exogenous variables in the first stage of the regression. In the current study, there are two instruments.

*First Stage:* 
$$x_t = \varphi_0 + \varphi_i w_{it} + \rho_i z_{it} + \mu_t$$

$x_t$  = endogenous independent variable,  $w_{it}$  = set of valid instruments  
 $z_{it}$  = set of other exogenous variables in the original model  
 $\varphi_i$  = set of instruments' coefficients  
 $\rho_i$  = set of coefficients of exogenous variables in the model

*Second Stage:* 
$$y_t = b_0 + \varphi_i \hat{x}_t + \rho_i w_{it} + \rho_i z_{it} + \epsilon_t$$

$y_t$  = dependent variable,  $\hat{x}_t$  = estimated  $x_t$ ,  $w_{it}$  = set of valid instruments  
 $z_{it}$  = set of other exogenous variables in the structural model  
 $\varphi_i$  = set of instruments' coefficients  
 $\rho_i$  = set of coefficients of exogenous variables in the model

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<sup>23</sup> Variance of the instrument estimator was derived by decomposing equation 6;  $\frac{S_{yw}}{S_{xw}}$

In the model, the number of instruments is more than the number of the endogenous independent variable. That is, multiple instruments. Therefore, there is over-identification of parameters. In the light of this, it is useful to test for over-identifying restrictions. This is taken care of by Hausman test of exogeneity. This is carried out by regressing generated residual from the 2SLS on the instruments and variables exogenous to the model. Multiply the sample size with the adjusted R-Squared ( $n \times R^2$ ) which follows Chi-Squared distribution with degree of freedom equal to number endogenous independent variables deducted from the number of instruments used to predict them. If  $n \times R^2$  is bigger than the chi-squared critical value, the instrument validity of exogeneity is rejected.

### *Test for Overidentifying Restriction*

$$\hat{\epsilon}_t = \varphi_i w_{it} + \rho_i z_{it}$$

$\hat{\epsilon}_t = \text{estimated residuals}$  ,  $w_{it} = \text{set of valid instruments}$

$z_{it} = \text{set of other exogenous variables in the structural model}$

Given , Coefficient of Determination;  $R^2$  of the estimation and Number of the observation; N

$$NR^2 \sim \text{Chi - Square}(k, 1)$$

And  $k$  is defined as difference between instruments and the endogenous independent variable

### **3.1 Data**

The data used in the study are sourced from World Bank data bank. Lack of data for years before 1971 reduced the scope to the period between 1971 and 2015. The data collected are real exchange rate, real interest rate, money supply growth and gross domestic product growth, trade volume and consumer price index. These data are checked for pre-estimation diagnostics before the above discussed Two-Stage Least Squared technique is used for the estimation of the result.

### **EMPIRICAL RESULT**

The pre-estimation test of unit root is conducted with the two (Augmented Dickey Fuller and Philipp-Perron) widely used stationarity test technique. The tests indicate that

only exchange rate need to be differenced once,  $I(d(=1))$ , for the time-series data to be stationary while other variables show mean reversion at level.

**Table 4.0 Test of Unit Root**

Variables	Level			First Difference		
	Order	Constant	Constant & Trend	Order	Constant	Constant & Trend
EXCH	I(0)	-2.752617*	-2.340274	I(1)	-4.642624***	-4.863049***
RINT	I(0)	-2.894027*	-4.191473***	I(1)	-	-
GDPG	I(0)	-4.086383***	-5.671693***	I(1)	-	-
MS	I(0)	-2.921569	-3.948740**	I(1)	-	-
TRADE	I(0)	-4.860555***	-5.855746***	I(1)	-	-
CPI	I(0)	-2.377023	-3.231208*	I(1)	-	-

Note: \*\*\*, \*\* and \* denote the rejection of the null hypothesis at 1 %, 5% and 10% significance level.

Source: Computed by the Author using E-views

### Tests for Instrument Validity

In the table 4.2, the test of instrument relevance shows that both money supply growth and GDP growth correlates with the real interest rate. These instruments alongside exogenous variable; trade growth, are used for the estimation of the structural model.

**Table 4.1 Instrument Relevance Test**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MS	-0.198313	0.064778	-3.061424	0.0038
GDPG	0.437964	0.175982	2.488688	0.0169
Constant	2.846424	0.542439	5.247453	0.0000

R-squared= 0.15 F-statistic = 5.016

Note: \*\*\*, \*\* and \* denote the rejection of the null hypothesis at 1 %, 5% and 10% significance level.

Source: Computed by the Author using E-views

### 4.2 Two-Stage Least Square Estimation of the Structural Model

The result of the research model is displayed in table 4.2. The table reports the autocorrelation corrected 2SLS parameters of the real interest rate on real exchange rate alongside the predetermined variables and the relevant instruments.

**Table 4.2 2SLS Estimation**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RINT	-0.045512***	0.0173946	-2.6165	0.00888
TRADEG	-0.748527***	0.227203	-3.2945	0.00099
MS	0.011940**	0.0049939	2.3910	0.01680
GDPG	-0.038397***	0.0135202	-2.8400	0.00451
Const (corrected)	0.116147**	0.0451066	2.5750	0.01003

R-squared= 0.257 F-statistic = 3.919, P-value= 0.009, DW= 1.931

**Hausman Test:**

Null hypothesis: OLS estimates are consistent  
Asymptotic test statistic: Chi-square(1) = 3.31516  
with p-value = 0.0686437  
Weak instrument test - First-stage F-statistic (1, 38) = 28.1992  
Instrument Exogeneity- F-Statistics (4,38) 1.53E-15

Note: \*\*\*, \*\* and \* denote the rejection of the null hypothesis at 1 %, 5% and 10% significance level.  
Source: Computed by the Author using GRET

The empirical evidence of this study is summarized in the table 4.2. These results show the evidence of predictability of Japanese real exchange rate by the real interest rate. The table presents a robust autocorrelation corrected 2SLS with fulfillment of relevance and exogeneity validity of the chosen instruments. Hausman tests rejected consistency of Ordinary Least Square as estimation technique at 5% level of significance while the null hypothesis of weak instrument is rejected with *F-Stat of 28.19*. Also, the null hypothesis of instrument exogeneity cannot be rejected with *F-Stat of 1.53E-15*. The combined test of the estimates with the use of F-Stat (3.919), P-value = 0.009, reject hypothesis that all estimates are not different from zero. Beyond reasonable doubt, the rejection of the desirability of this model cannot be ascertained.

### **Result Discussion**

This robust analysis markedly finds that real interest rate significantly affects Japanese Yen<sup>24</sup> for the year considered in the study supporting the previous empirical evidence that higher real interest rate (relative to the World) causes appreciation of real exchange rate vis-à-vis. On the defensive mode, Taha and Kadir (2016) once argued that there was no evidence of weakening of exchange rate as a result of higher interest rate. The result shows that higher real interest rate has positive impact on the Japanese Yen rate of exchange vis-à-vis U.S dollars. That is, higher real interest rate causes Yen to appreciate. This result widely contradicts the recent development in the financial and exchange markets of Japan.

In recent times, with several rounds of quantitative easing that forced interest rate to negative, Yen has not really worsened against other traded currencies in the foreign exchange market. Studies show that the recent global turbulence in the financial markets and less

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<sup>24</sup> 1% increase in interest rate causes exchange rate to move down by 0.04%. This is positive relationship as exchange rate is measured price of dollars in terms of yen.

performance of the United State economy has made Japan a secure haven<sup>25</sup> for investors causing the Yen to appreciate, even though, interest rate is gravitating negative.

In actual fact, Yen may not continue to enjoy this temporary privilege amongst other traded currencies such as US dollars and Euro, if BOJ continues to suppress its interest rate that leads to wide interest rate differentials with respect to the world. The stylized fact is clear, stable interest rate strengthens domestic currency but repressing the former would cause the latter to lose its competitive edge in the foreign exchange market.

One may say, the theoretical inconsistent trinity failed to hold in the current economic dispensation of the Japanese economy, but it is apparent, the most important economic target is not still met. As alluded “Despite a dramatic lowering of interest rates by the country’s central bank, the Bank of Japan (BOJ), the country’s economy has stagnated and suffered deflation since at least the mid-1990s” Krugman et al (2015, p.482). It is essentially important to state also; the monetary autonomy, financial flow freedom and non-depreciation of the Japanese currency enjoyed will not always continue if interest rate is continuously depressed. It is a known and proven fact that agents are very sensitive to interest rate differences on which they form expectations. When agents start to build up expectations for higher returns and fortune in overseas’ investments, the economy might have to wrestle with long-overcome Asian financial crisis.

Also, it clearly indicates that there is strong evidence of positive relationship<sup>26</sup> between the exogenous variable – trade – and real exchange rate. The more open the Japanese economy, the better the currency perform in the exchange market. This was because Japanese exports are fundamental in determining the value of its currency. This result supports the study of Muhammad and Ahmed (2011) and contradicts the evidence of Lee and Chee-Hong (2013). This contradiction is not surprising as countries are at different stage of development which clearly determines the level of their competitiveness in the international

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<sup>25</sup> This was because investors consider Japanese assets to be imperfectly substitutable. This what is Japan is leveraging on and not allowing its currency strong despite depressing its interest rates.

<sup>26</sup> 1% increase in trade growth causes real exchange rate to move down by 0.75%. This is also positive relationship as clearly indicated above that exchange rate is expressed in terms of Yen price of Dollar

trade market. Japanese economy is considerably large<sup>27</sup> whose exports compete healthily with developed and emerging economies of the world.

## **CONCLUSION**

This paper examines the impact of real interest rate on the real exchange rate using Two Stage Least Square econometric technique. The two instruments used are money supply and gross domestic product growth rate. While first stage model was controlled for with trade and inflation rate, only the trade figure went into the structural model. This was because inflation became insignificant in the structural model. The result provides support for the theoretical and some empirical evidences of positive relationship between real interest rate and real exchange rate in Japan. The estimation also shows that there is positive relation between trade and Japanese Yen over the period considered in the study. This is plausible as the health of the Japanese economy largely depends on its export values.

It is not yet clear if BOJ and the government target of 2% inflation is also meant to weaken its currency, but as it turned out to be, the opposite is what is seen in recent years. The fear is that by the time the formed expectation in oversea investment fortunes has fully matured; Yen may have to face strong depreciation if they continue to push the interest rate downward. In the light of this finding, the study suggests the adoption of fiscal macroeconomic policy instruments that are capable of achieving the inflation-economic growth target rather than monetary policy instrument which has consistently failed over the years. As the result indicates, continuous lowering of this monetary policy rate will cause Yen to lose its competitiveness by the time all economies (at the least, its competitors) fully adjust and agents are well sensitive to higher returns on their investments. It is plausible to mention that one of the ways to avert the reoccurrence of the similitude of Asian Crisis in the future is by withdrawing from this deliberate suppression of the interest rate.

For further studies, the paper desires more improvement, especially in the area of econometric technique used in the capturing the relationship of the research variables. The

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<sup>27</sup> In comparative term, Japanese economy is considerably larger than some nations where trade has been proved to have negative effect on domestic currency.

inclusion of the omitted exogenous -inflation rate- that is proven to be essential to determining long real exchange rate failed to be significant. This challenges the current study and desires further research with higher-power econometric technique to handle this complexity.

## REFERENCE

- Ahmad, Fayyaz, Draz, Muhammad Umar and Yang, Su-Chang."Impact of Macroeconomic Fundamentals on Exchange Rates" Empirical Evidence from Developing Asian Countries (Dec. 21, 2015). Available at SSRN: <https://ssrn.com/abstract=2707089>.
- Alexius, Annika. Productivity Shocks and Real Exchange Rates. *Journal of Monetary Economics*, 52(3), 555-566.
- Alexius, Annika and Erik, Post. "Exchange Rates and Asymmetric Shocks in Small Open Economies." *Empirical Economics* (Nov. 2008), Vol. 35, Issue 3, pp. 527-541.
- Amalia, Morales-Zumaquero."Explaining Real Exchange Rate Fluctuations." *Journal of Applied Economics*, Vol.11, No. 2 (Nov., 2006), 345-360.
- Angrist, J. and Krueger, A. "Does Compulsory School Attendance Affect Schooling and Earnings?." *Quarterly Journal of Economics*, 106, pp.979-1014.
- Ahmed, S. Abou-Zaid and Sami, Zaki Alabdulwahab. "NAFTA and Sources of Real Exchange Rate Fluctuations in North America.", *International Journal of Sustainable Economy*, (Jan., 2013), 5(3).
- Balassa, Bela. "The Purchasing Power Parity Doctrine: A Reappraisal", *Journal of Political Economy*, 72(Dec., 1964), pp. 584-96.
- Batbayar, Buyangerel and Won Joong, Kim. "The Effect of Macroeconomic Shock on Exchange Rate and Trade Balance in Korea." *Korea and the World Economy*, Vol. 14, No.1 (April, 2013) pp. 91-119.
- Bhanumurthy, N. R." Macroeconomic Fundamentals and Exchange Rate Dynamics in India." *Economic and Political Week*, Mar. 18, 2006, 41(1), pp. 1101-1107.
- Binder, Michael, Chen, Quianying and Zhang, Xuan. "On the effects of Money Policy Shocks on Exchange Rates, CESifo Working Paper: Monetary Policy and International Finance, No. 3162, 2010.
- Chari, V. V., Patrick J. Kehoe, and Ellen T. McGrattan. "Sticky Price Models of the Business Cycle: Can the Contract Multiplier Solve the Persistence Problem?" *Econometrica* 68:1151-1179, 2000.
- Chin, Lee and Chee-Hong Law."The Effects of the Openness on Malaysian Exchange Rate." *International Economic and Finance* 1.8(2013): pp. 25-39.
- Craighead, William D. and Tien, Pao-Lin."Nominal Shocks and Real Exchange Rates. Evidence from Two Counties." *Journal of International Money and Finance*, Elsevier, Vol. 56(C), pp.135-157, 2015.
- Dornbusch, Rudiger." Expectations and Exchange Rate Dynamics.", *Journal of Political Economy* (December, 1976), 84, pp.1161 – 1196.
- Diez de los Rios, Antonio and Sentana, Enrique. "Testing Uncovered Interest Parity: A Continuous-Time Approach." *International Economic Review*, Vol. 52, No.4, pp.1215-1251(37), Nov., 2011.
- Engle, Charles, Nelson C. Mark, and Kenneth D. West." Exchange Rate Models Are Not As Bad As You Think." *NBER Macroeconomics Annual 2007*, University of Chicago Press, 2008, pp. 381-441.
- Engel, Charles and Kenneth D. West. "Taylor Rules and the Deutschmark-Dollar Real Exchange Rates." *Journal of Money, Credit, and Banking* 38, 2006, pp. 1175-1194.
- Erdey, L. and Foldvari, P. "Do Purchasing Power and Interest Rate Parities Hold for the EUR/HUF Exchange Rate? A time-Series Analysis" *Acta Oeconomica: Periodical of the Hungarian Academy of Sciences*, Vol. 59, 2009, pp.289-306.
- Faust, Jon, John Rogers, Eric Swason, and Jonathan, Wright. "Identifying the Effects of Monetary Policy Shocks on Exchange Rates Using High-Frequency Data." *Journal of the European Economic Association* 1 (2003), pp. 1031-57.
- Fleming, J.M."Domestic Financial Policies Under Fixed and Under Floating Exchange Rates." *Staff Paper*, International Monetary Fund, (1962), 9: 369-379.

- Frydman, R, and M.D. Goldberg. "Macroeconomic Fundamentals and the DM/USD Exchange Rate: Temporal Instability and the Monetary Model." *International Journal of Finance and Economics*, 6(4), pp. 421-435, 2001.
- Fukao, Kyoji, Kenta Ikeuchi, YoungGak Kim, HyeogUg Kwon, Tatsuji Makino and Miho Takizawa. "The Structural Causes of Japan's Lost Decades." Paper Presented at the Third World KLEMS Conference, Tokyo, Japan, May 19-20.
- Hausman, J and Wienland, J. "Abenomics: Preliminary Analysis and Outlook. *Brookings Papers on Economic Activities*, 2014(1), pp.1-63.
- Holland, P. "Statistics and Causal Inference." *Journal of the American Statistical Association*, 81, 945-979, 1986.
- Imbens, Guido W. and Angrist, Joshua D. "Two Stage Least Squares Estimation of Average Causal Effects in Models with Variable Treatment Intensity." *Journal of the American Statistician Association*, 1995; 90(430)-442.
- Joscha, Beckmann, Ansgar, Belke and Michael, Kuhl. "The Dollar-Euro Exchange Rate and Macroeconomic Fundamentals: A time-Varying Coefficient Approach." *Review of World Economics (Weltwirtschaftliches Archiv)*, 2011, Vol. 147, Issue. 1, pp. 11-40.
- Jyh-Lin, Wu and Show-Lin, Chen. "A re-examination of Real Interest Parity." *Canadian Journal of Economics*, 1998, Vol. 31, Issue 4, pp.837-851
- Kalim, Siddiqui. "Japan's Economic Recession." *Research in Applied Economics*, Vol. 1, No. 1 (2009).
- Koray, Faik and W. Dougblas McMillin. "Monetary Policy Shocks, the Exchange Rate, and the Trade Balance." *Journal of International Money and Finance*, 18(6):925-940, 1999.
- Krugman, Obstfeld and Melitx. "International Economics: Theory and Policy", Tenth Edition, Addison-Wesley Publishers: 2015.
- Kyung, Chun Mun. "Effects of Exchange Rate Fluctuation on Equity Market Volatility and Correction: Evidence from the Asian Financial Crisis.", University of Nebraska Lincoln, 2008.
- Lida, Keisuke. "Analytical Uncertainty and International Cooperation: Theory and Application to International Economic Policy Coordination." *International Studies Quarterly* 37: 431-57.
- Lothian, J.R."A Century Plus of Yen Exchange Rate Behaviour." *Japan and the World Economy* (1990), Vol.2, pp.47-70.
- Lowe, Philip. "The Impact of Real and Nominal Shocks on Australian Real Exchange Rate." Discussion Paper No. 9201, Reserve Bank of Australia, Canberra, 1992.
- Mehmet, Ivrendi and Bulent, Guloglu. "Monetary Shocks, Exchange Rates and Trade Balances: Evidence from Inflation Targeting Countries." *Economic Modelling*, 2010, Vol. 27, Issue 5, pp. 1144-1155.
- Mohammed, B. Yusoff and Ahmed, Hossain Sabit. "The Effect of Exchange Rate Volatility on ASEAN-China Bilateral Exports." *Journal of Economics, Business and Management*, Vol. 3, No. 5, May, 2015.
- Mundell, Robert A. "The Appropriate Use of Monetary and Fiscal Policy Under Fixed Exchange Rates." Staff Paper, International Monetary Fund, (1962), 9:70-79.
- Mussa, Michael."Nominal Exchange Rate Regimes and the Behavior of Real Exchange Rates, Evidence and Implication." *Carnegie-Rochester Conference Series on Public Policy*, Vol. 25, pp.117-213.
- Nazimul, Arif Sarkar, Sadrul, Hasan, Aatur, Rahaman."Real or Nominal Shocks: What Drives Exchange Rate Movements in Bangladesh?" Research Department and SME and Special Programmes Department; Bangladesh Bank, 2016, Working Paper Series:WP No. 166.
- Nestor, Azcona."Supply Shocks and Real Exchange Rate Volatility in a Small Open Economy." *The Journal of Business and Economic Studies*, Vol. 20, No. 1 (Dec., 2014).
- Obstfeld, Maurice and Rogoff, Kenneth. "The Mirage of Fixed Exchange Rates." *Journal of Economic Perspectives*, Fall 1995, 9(4), pp.73-96.

- Quirk, Peter J. "Exchange Rate Policy in Japan: Leaning Against the Wind." Staff Papers No. 24 (International Monetary Fund, Washington, DC) Nov. 1977, pp.642-664 .
- Reiko, Aoki. "A Demographic Perspective on Japan's Lost Decades." Population and Development Review, 38 (supplement), 2013, pp. 103-112.
- Renato, E. Resdide. "Global Determinants of Stress and Risk in Public –Private Partnerships (PPP) in Infrastructure." (Marc., 2009), ADBI Working Paper No. 133.
- Ricardo, Laborda and Jose, Olmo. "Exchange Rates, Macroeconomic Fundamentals and Risk Aversion." Journal of Theoretical Economics Letter, 2014, 4, pp.363-370.
- Rogers, J. H. "Monetary Shocks and Real Exchange Rates." Journals of International Economics 1998, 49, 269-288.
- Rudiger, Dornbusch."Exchange Rate and Prices." American Economic Review, Vol. 77, No. 1, (Mar., 1987), pp.93-106.
- Sagan, J.D."The Estimation of Economic Relationships Using Instrumental Variables." Econometrica 1958, 26:393-415.
- Seiha, Ok, Makoto, Kakinaka and Hiroaki Miyamoto. "Real Shock or Nominal Shocks? Exchange Rate Movements in Cambodia Laos PDR." The Singapore Economics Review, Vol. 55, No. 4, pp.685-703.
- Taha, Bahadir Sarac and Kadir, Karagoz."Impact of Short-Term Interest Rate on Exchange Rate: The Case of Turkey."Procedia Economics and Finance, 38(2016), 195-202.
- Takeo, Hoshi and Anil, Kashyap H. "Japan's Financial Crisis and Economcis Stagnation." , Journal of Economic Perspectives, (Winter, 2004), Vol. 18, No. 1 , pp. 3-26.
- Tamim, Bayoumi and Barry, Eichengreen."Exchange Rate Volatility and Intervention: Implication of the Theory of Optimum Currency Crisis." Journal of International Economics 45 (1998) pp.191-209.
- Tatsuyoshi, Miyakoshi and Yoshihiko, Tsukuda. "The Causes of the Stagnation in Japan.", Applied Financial Economics,, Vol. 14, (2004), pp. 113-120.
- Theil,H. "Economic Forecasts and Policy." Amsterdam: North-Holland (1958).
- Triffin, R. "Gold and the Dollar Crisis: The Future of Convertibility.", New Haven, CT: Yale University Press.
- Weiwei, Yin and Junye, Li. "Macroeconomic Fundamentals and Exchange Rate Dynamics: A No-Arbitrage Macro-finance Approach." Journal of International Money and Finance, 41(2014), pp.46-64.
- Wright, S."Appendix to the Tariff on Animal and Vegetable Oils, by P.G Wright, New York: Macmilland (1928).
- Yoshino, Naoyuki and Taghizadeh Hesary, Ferhad."Japan's Lost Decade: Lessons for Other Economics." (April 13, 2015). ADBI Working Paper 521. Available at SSRN: <https://ssrn.com/abstract=2593714>.
- Zhenbo, Hou, Jodie Keane, Jane Kenna and Dirk William te Velde. "The Oil Price Shock of 2014: Drivers, Impact and Policy Implication." ODI Working Paper 415.

## Annotated Bibliography

Most of the papers used in my study are sourced from the JSTOR ([jstor.org](http://jstor.org)).

The data used in the study are sourced from World Bank data bank (<http://databank.worldbank.org/data/home.aspx>). Lack of data for years before 1971 reduced the scope to the period between 1971 and 2015. The data collected are real exchange rate, real interest rate, money supply growth and gross domestic product growth, trade volume and consumer price index

Ahmad, Fayyaz, Draz, Muhammad Umar and Yang, Su-Chang. "Impact of Macroeconomic Fundamentals on Exchange Rates" Empirical Evidence from Developing Asian Countries [Dec. 21, 2015]. Available at SSRN: <https://ssrn.com/abstract=2707089>.

The study was reviewed to gain insight on fundamental economic variables that affect exchange rates.

Alexius, Annika. Productivity Shocks and Real Exchange Rates. *Journal of Monetary Economics*, 52(3), 555-566.

It helped the current study to understand the exogenous factors affecting exchange rate in open economies.

Alexius, Annika and Erik, Post. "Exchange Rates and Asymmetric Shocks in Small Open Economies." *Empirical Economics* (Nov. 2008), Vol. 35, Issue 3, pp. 527-541.

The study helped to understand the impact of shocks on the real exchange rate free trade economy.

Amalia, Morales-Zumaquero. "Explaining Real Exchange Rate Fluctuations." *Journal of Applied Economics*, Vol. II, No. 2 (Nov., 2006), 345-360.

The study helped me to understand fundamental factors affecting volatility of exchange rate

Ahmed, S. Abou-Zaid and Sami, Zaki Alabdulwahab. "NAFTA and Sources of Real Exchange Rate Fluctuations in North America.", *International Journal of Sustainable Economy, Qan.*, 2013), 5(3).

This paper was written by two lecturers in my department and helped me to understand the impact of the real interest rate and real exchange. It lent credence to theoretic framework of economic fundamentals affecting real exchange rate which my research findings found support for.

Balassa, Bela. "The Purchasing Power Parity Doctrine: A Reappraisal", *Journal of Political Economy*, 72[Dec., 1964), pp. 584-96.

This influential study helped to understand the theory on PPP and Law of one price. The study does not really support my work but reviewed to gain insight on PPP and exchange rate

Batbayar, Buyangerel and Won Joong, Kim. "The Effect of Macroeconomic Shock on Exchange Rate and Trade Balance in Korea." *Korea and the World Economy*, Vol. 14, No. 1 [April, 2013) pp. 91-119.

The study helped to understand the impact of fundamental shocks on exchange rate and trade. My research used Trade figures as control variables in the model. This study was influential to the my research.

Taha, Bahadir Sarac and Kadir, Karagoz."Impact of Short-Term Interest Rate on Exchange Rate: The Case of Turkey." *Procedia Economics and Finance*, 38(2016), 195-202.

The study was reviewed to examine the impact of policy rate on the exchange which was relevant to the current study.

Takeo, Hoshi and Ani!, Kashyap H. "Japan's Financial Crisis and Economics Stagnation.", *Journal of Economic Perspectives*, (Winter, 2004), Vol. 18, No.1, pp. 3-26.

The Asian Financial Crisis and the impact of these economies were reviewed and helped the current study to provide analytical implication on financial market on the economy.

Tamim, Bayoumi and Barry, Eichengreen."Exchange Rate Volatility and Intervention: Implication of the Theory of Optimum Currency Crisis." *Journal of International Economics* 45 (1998) pp.191-209.

The study helped to understand the impact of exchange rate management on the exchange rate fluctuation. This was useful to the study as my research tried to criticize the monetary policy of the BOJ.

Tatsuyoshi, Miyakoshi and Yoshihiko, Tsukuda. "The Causes of the Stagnation in Japan.", *Applied Financial Economics*, Vol.14, (2004), pp. 113-120.

Past study on economic slump of Japan is significantly dealt in details. It helped the study to understand the historical economic growth on Japan.

Theil, H. "Economic Forecasts and Policy." Amsterdam: North-Holland (1958).

Triffin, R. "Gold and the Dollar Crisis: The Future of Convertibility.", New Haven, CT: Yale University Press.

The real exchange regime and their implication are dealt with in the study and helped the study juxtapose the theoretical explanations and empirical findings of each exchange rate regime,

Weiwei, Yin and Junye, Li. "Macroeconomic Fundamentals and Exchange Rate Dynamics: A No-Arbitrage Macro-finance Approach." *Journal of International Money and Finance*, 41(2014), pp.46-64.

The impact of fundamental factors on the volatility in exchange rate is reviewed in the paper. It helped my research to find out the stand of body of literature on economic fundamentals

Yoshino, Naoyuki and Taghizadeh Hesary, Ferhad."Japan's Lost Decade: Lessons for Other Economies." (April 13, 2015). ADBI Working Paper 521. Available at SSRN: <https://jssrn.com/abstract=2593714>.

Past study on economic slump of Japan is significantly dealt in details. It helped the study to understand the historical economic growth on Japan.

Zhenbo, Hou, Jodie Keane, Jane Kenna and Dirk William te Velde. "The Oil Price Shock of 2014: Drivers, Impact and Policy Implication." ODI Working Paper 415.  
**The impact of oil shocks on the macroeconomic performances are reviewed in the paper**

**Other Materials from JSTOR used in the study are:**

- Bhanumurthy, N. R. "Macroeconomic Fundamentals and Exchange Rate Dynamics in India." *Economic and Political Week*, Mar. 18, 2006, 41(1), pp. 1101-1107.
- Binder, Michael, Chen, Quianying and Zhang, Xuan. "On the effects of Money Policy Shocks on Exchange Rates, CESifo Working Paper: Monetary Policy and International Finance, No. 3162, 2010.
- Chari, V. V., Patrick J., Kehoe, and Ellen T. McGrattan. "Sticky Price Models of the Business Cycle: Can the Contract Multiplier Solve the Persistence Problem?" *Econometrica* 68:1151-1179, 2000.
- Chin, Lee and Chee-Hong Law. "The Effects of the Openness on Malaysian Exchange Rate." *International Economic and Finance* 1.8(2013): pp. 25-39.
- Craighead, William D. and Tien, Pao-Lin. "Nominal Shocks and Real Exchange Rates. Evidence from Two Countries." *Journal of International Money and Finance*, Elsevier, Vol. 56(C), pp. 135-157, 2015.
- Dornbusch, Rudiger. "Expectations and Exchange Rate Dynamics.", *Journal of Political Economy* (December, 1976), 84, pp. 1161-1196.
- Diez de los Rios, Antonio and Sentana, Enrique. "Testing Uncovered Interest Parity: A Continuous-Time Approach." *International Economic Review*, Vol. 52, No. 4, pp. 1215-1251(37), Nov., 2011.
- Engle, Charles, Nelson C. Mark, and Kenneth D. West. "Exchange Rate Models Are Not As Bad As You Think." *NBER Macroeconomics Annual 2007*, University of Chicago Press, 2008, pp. 381-441.
- Engel, Charles and Kenneth D. West. "Taylor Rules and the Deutschmark-Dollar Real Exchange Rates." *Journal of Money, Credit, and Banking* 38, 2006, pp. 1175-1194.
- Erdey, L. and Foldvari, P. "Do Purchasing Power and Interest Rate Parities Hold for the EUR/HUF Exchange Rate? A Time-Series Analysis" *Acta Oeconomica: Periodical of the Hungarian Academy of Sciences*, Vol. 59, 2009, pp. 289-306.
- Faust, Jon, John Rogers, Eric Swanson, and Jonathan Wright. "Identifying the Effects of Monetary Policy Shocks on Exchange Rates Using High-Frequency Data." *Journal of the European Economic Association* 1 (2003), pp. 1031-57.
- Fleming, J.M. "Domestic Financial Policies Under Fixed and Under Floating Exchange Rates." *Staff Paper*, International Monetary Fund, (1962), 9: 369-379.
- Frydman, R. and M.D. Goldberg. "Macroeconomic Fundamentals and the DM/USD Exchange Rate: Temporal Instability and the Monetary Model." *International Journal of Finance and Economics*, 6(4), pp. 421-435, 2001.
- Fukao, Kyoji, Kenta Ikeuchi, YoungGak Kim, HyeogUg Kwon, Tatsuji Makino and Miho Takizawa. "The Structural Causes of Japan's Lost Decades." Paper Presented at the Third World KLEMS Conference, Tokyo, Japan, May 19-20.
- Hausman, J and Wienland, J. "Abenomics: Preliminary Analysis and Outlook." *Brookings Papers on Economic Activities*, 2014(1), pp. 1-63.
- Holland, P. "Statistics and Causal Inference." *Journal of the American Statistical Association*, 81, 945-979, 1986.
- Imbens, Guido W. and Angrist, Joshua D. "Two Stage Least Squares Estimation of Average Causal Effects in Models with Variable Treatment Intensity." *Journal of the American Statistician Association*, 1995; 90(430)-442.

- joscha, Beckmann, Ansgar, Belke and Michael, Kuhl. "The Dollar-Euro Exchange Rate and Macroeconomic Fundamentals: A time-Varying Coefficient Approach." *Review of World Economics (Weltwirtschaftliches Archiv)*, 2011, Vol. 147, Issue.1, pp. 11-40.
- jyh Lin, Wu and Show-Lin, Chen.** "A re-examination of Real Interest Parity." *Canadian Journal of Economics*, 1998, Vol. 31, Issue 4, pp.837-851
- Kalim, Siddiqui. "japan's Economic Recession." *Research in Applied Economics*, Vol. 1, No. 1 (2009).
- Koray, Faik and W. Douglas McMillin. "Monetary Policy Shocks, the Exchange Rate, and the Trade Balance." *Journal of International Money and Finance*, 18(6):925-940, 1999. Krugman, Obstfeld and Melitz. "International Economics: Theory and Policy", Tenth Edition, Addison-Wesley Publishers: 2015.
- Kyung, Chun Mun. "Effects of Exchange Rate Fluctuation on Equity Market Volatility and Correction: Evidence from the Asian Financial Crisis.", University of Nebraska Lincoln, 2008.
- Lida, Keisuke. "Analytical Uncertainty and International Cooperation: Theory and Application to International Economic Policy Coordination." *International Studies Quarterly* 37: 431-57.
- Lothian, J.R. "A Century Plus of Yen Exchange Rate Behaviour." *Japan and the World Economy* (1990), Vol.2, pp.47-70.
- Lowe, Philip. "The Impact of Real and Nominal Shocks on Australian Real Exchange Rate." Discussion Paper No. 9201, Reserve Bank of Australia, Canberra, 1992.
- Mehmet, Ivrendi and Bulent, Guloglu. "Monetary Shocks, Exchange Rates and Trade Balances: Evidence from Inflation Targeting Countries." *Economic Modelling*, 2010, Vol. 27, Issue 5, pp. 1144-1155.
- Mohammed, B. Yusoff and Ahmed, Hossain Sabit. "The Effect of Exchange Rate Volatility on ASEAN-China Bilateral Exports." *Journal of Economics, Business and Management*, Vol. 3, No.5, May, 2015.
- Mundell, Robert A. "The Appropriate Use of Monetary and Fiscal Policy Under Fixed Exchange Rates." Staff Paper, International Monetary Fund, (1962), 9:70-79.
- Mussa, Michael. "Nominal Exchange Rate Regimes and the Behavior of Real Exchange Rates, Evidence and Implication." *Carnegie-Rochester Conference Series on Public Policy*, Vol. 25, pp.117-213.
- Nazimul, Arif Sarkar, Sadrul, Hasan, Aatur, Rahaman. "Real or Nominal Shocks: What Drives Exchange Rate Movements in Bangladesh?" Research Department and SME and Special Programmes Department; Bangladesh Bank, 2016, Working Paper Series:WP No. 166.
- Nestor, Azcona. "Supply Shocks and Real Exchange Rate Volatility in a Small Open Economy." *The Journal of Business and Economic Studies*, Vol. 20, No.1 (Dec., 2014).
- Obstfeld, Maurice and Rogoff, Kenneth. "The Mirage of Fixed Exchange Rates." *Journal of Economic Perspectives*, Fall 1995, 9(4), pp.73-96.
- Quirk, Peter J. "Exchange Rate Policy in Japan: Leaning Against the Wind." Staff Papers No. 24 (International Monetary Fund, Washington, DC) Nov. 1977, pp.642-664.
- Reiko, Aoki. "A Demographic Perspective on Japan's Lost Decades." *Population and Development Review*, 38 (supplement), 2013, pp. 103-112.
- Renata, E. Resdide. "Global Determinants of Stress and Risk in Public-Private Partnerships (PPP) in Infrastructure." (Marc., 2009), ADBI Working Paper No. 133.
- Ricardo, Laborda and Jose, Olmo. "Exchange Rates, Macroeconomic Fundamentals and Risk Aversion." *Journal of Theoretical Economics Letters*, 2014,4, pp.363-370.
- Rogers, J. H. "Monetary Shocks and Real Exchange Rates." *Journals of International Economics* 1998, 49, 269-288.
- Rudiger, Dornbusch. "Exchange Rate and Prices." *American Economic Review*, Vol. 77, No. 1, (Mar., 1987), pp.93-106.
- Sagan, J.D. "The Estimation of Economic Relationships Using Instrumental Variables." *Econometrica* 1958, 26:393-415.

