THESIS TITLE "CURRENCY WARS, WHAT DRIVES THE WILD FLUCTUATIONS IN EXCHANGE RATES?"

by

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Abstract

Currency wars or competitive devaluation has change dramatically throughout history. The meaning of currency wars is completely different in comparison with that before the change of currency rates system. Firstly, in my thesis, there will be a brief history of currency wars and a reference of quantitative easing in US, Europe and Japan. Then the factors which determine the currency exchange rates and the reasons for the wild fluctuation in currency rates during a currency war will be mentioned. Moreover, the possible means for a currency war will be discussed. Lastly, there will be answered questions such as why is this happening, why a country devaluates its currency, which fundamental of a country affect this fluctuation and what the difference between the impact of currency war in developed countries and in emerging countries after the crisis of 2008.

key words - quantitative easing, deflation, monetary policy, depreciation

Contents

List of graphs

List of abbreviations

BoJ - Bank of Japan

BR - Brazilian Real

ECB - European Central Bank

EEC- European Economy Community

FED - Federal Reserve System

GDP - Gross Domestic Product

GNP - Gross National Product

IMF -International Monetary Fund

OMT - Outright Money Transactions

QE - Quantitative Easing

UK - United Kingdom

WWI - Worldwide War I

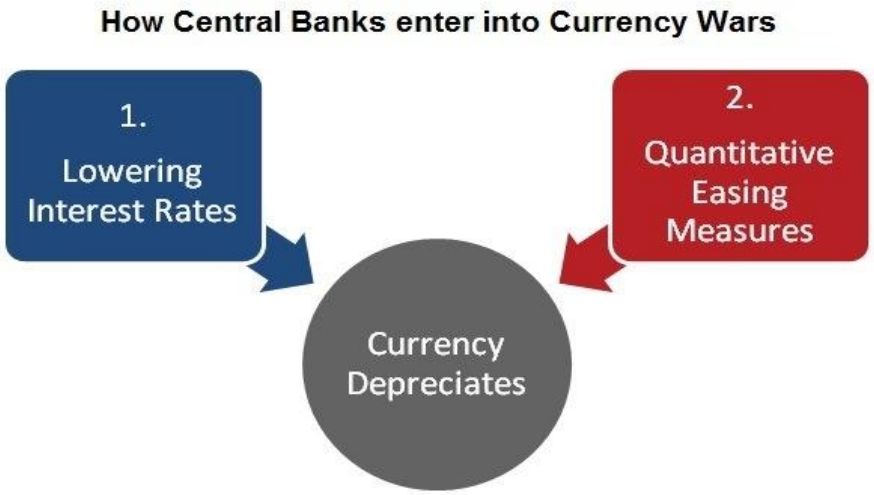
$GDP = C + I + G + (X - IM)$	GDP - gross domestic product
$DD = C + I + G$	DD - domestic demand C - personal consumption I - investments G - government consumption
$NX = X - IM$	NX - net exports X - exports IM - imports
$GDP (Y) = DD + NX$	
$CA = NX + NFI$	CA - current account NX - net exports NFI - net factor income
$BP = CA + CF$	BP - balance of payments CF - capital flows
$S_P + S_G = I + CA$	S_P - personal saving S_G - government saving

1. INTRODUCTION

Currency war, also known as competitive devaluation, is a condition in international affairs where countries compete against each other to achieve a relatively low exchange rate for their own currency. As the price to buy a country's currency falls so does the price of exports (X). However, cheap exports mean greater amount of exports. Imports (IM) to the country become more expensive. So domestic industry, and thus employment, receives a boost in demand from both domestic and foreign markets. However, the price increase for imports can harm citizens' purchasing power. The policy can also trigger retaliatory action by other countries which in turn can lead to a general decline in international trade, to the detriment of all countries.

Countries' central banks enter currency wars by depreciating their currency. In the past, countries mainly used two measures to stimulate growth in their economy.

Methods of currency wars figure 1



source : www.investopedia.com

Each of the measures has a depreciating effect on their currency in a different way. The first method is lowering interest rates by central bank. A central bank lowers interest rates in an economy to stimulate domestic demand and consumption. In effect, it does it to boost growth. An upsurge in demand gives an upward push to inflation. It helps an economy that's facing deflationary conditions. Over the past few years, the US, the United Kingdom, the Europe and Japan all sought this measure to cushion their respective inflation rates.

However, a lower interest rate pushes the currency exchange rate down in two ways:

1. A lower interest rate reduces a currency's relative expected return. Now, an investor would get less return for every unit of currency invested. In order for the lower expected return to match the investor's risk appetite, the currency has to depreciate. However, while currency depreciation boosts exports, it also depresses imports. This raises the trade balance. It reduces the intended impact of the interest rate cut in the first place.

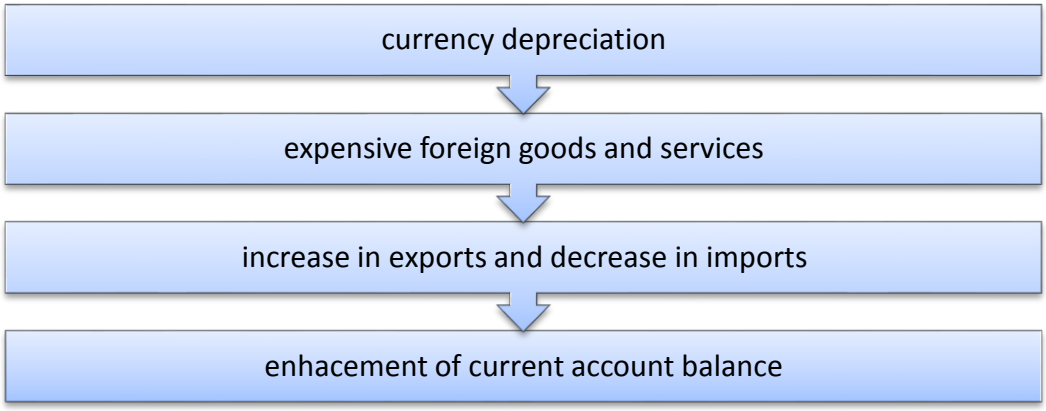
2. A reduction in interest rates leads to an increase in business and consumer demand. Money is available cheap. This boosts inflation. Higher inflation reduces a currency's real value. This leads to depreciation.

Higher inflation also erodes the lower exchange rate's competitive benefit. This offsets any positive impact on trade.

The second method and the most common nowadays is Quantitative easing, or QE, measures - like asset purchase or bond-buying programs - are used by central banks to increase the money supply in the market. By increasing the money supply, central bankers aim to promote increased lending and liquidity. This leads to overall growth. It also helps economies fight deflationary conditions by boosting consumer and business demand. QE measures tend to have a depreciating effect on an economy's currency. There is more money chasing fewer goods. The QE measures adopted in the US helped boost consumer demand, at least short-term.

In reality, it is very difficult to distinguish the effects of QE on prices, i.e. GDP, interest rates, and it is even more difficult to estimate its long-term effects. It is almost impossible to assess if the results in the real economy were owed to the expectations of the market or to QE. Sometimes the market has already discount the effects of a currency policy. As it results from the literature the size of the impact of a QE on the real economy varies across countries because each country has its own inflation, unemployment, exports, domestic demand and sizes like these.

Currency depreciation flowchart 1



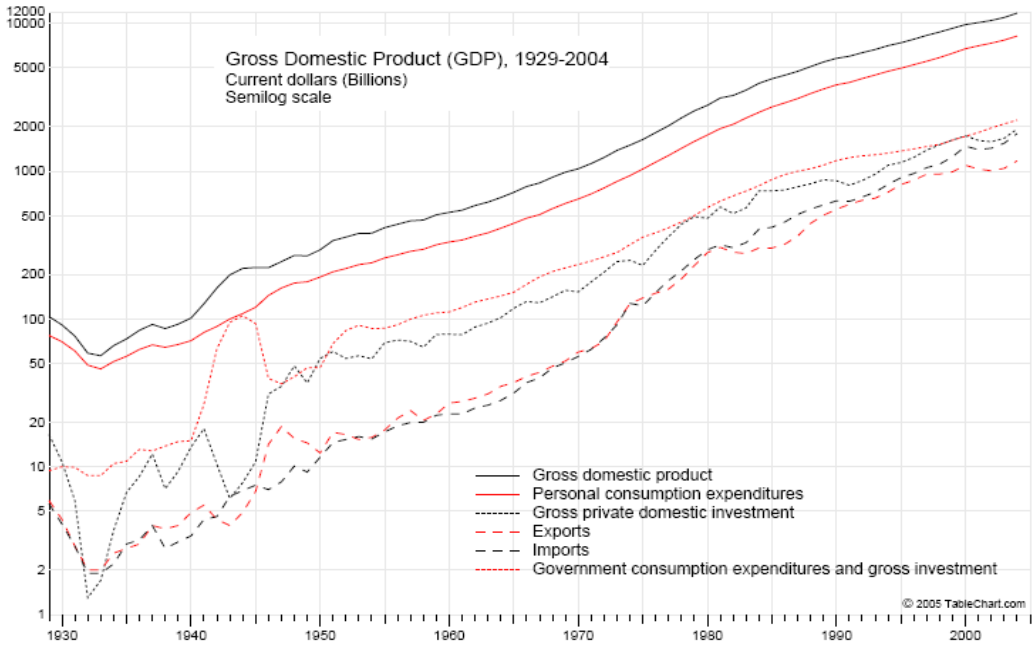
source : A.Antzoulatos - Governments and financial markets

Devaluation, with its adverse spillovers, has, historically, rarely been a preferred strategy. According to economist Richard N. Cooper, writing in 1971, a substantial devaluation is one of the most "traumatic" policies a government can adopt - it almost always results in cries of outrage and calls for the government to be replaced. Devaluation can lead to a reduction in citizens' standard of living as their purchasing power is reduced both when they buy imports and when they travel abroad. It can also add to inflationary pressure. Devaluation can make interest payments on international debt more expensive if those debts are denominated in a foreign currency, and it can discourage foreign investors. At least until the 21st century, a strong currency was commonly seen as a mark of prestige, while devaluation was associated with weak governments.

Nonetheless, when a country is suffering from high unemployment or wishes to pursue a policy of export-led growth, a lower exchange rate can be seen as advantageous. From the early 1980s the International Monetary Fund (IMF) has proposed devaluation as a potential solution for developing nations that are consistently spending more on imports than they earn on exports. A lower value for the home currency will raise the price for imports while making exports cheaper. This tends to encourage more domestic production, which raises employment and gross domestic product (GDP = C + I +G + (X - IM)) - though the effect may not be immediate due to the Marshall–Lerner condition. Marshall - Lerner condition claims

that a currency devaluation can lead to an improvement (reduction in deficit) in the current account, when the sum of price elasticity of exports and imports (in absolute value) must be greater than 1. Empirical evidence suggests the elasticity of demand for exports and imports tends to be inelastic in the short run, but more elastic in the long run. Therefore a devaluation, often worsens the current account in the short term, but improves it in the long term. Devaluation can be seen as an attractive solution to unemployment when other options, like increased public spending, are ruled out due to high public debt, or when a country has a balance of payments deficit which a devaluation would help correct. A reason for preferring devaluation common among emerging economies is that maintaining a relatively low exchange rate helps them build up foreign exchange reserves, which can protect against future financial crises.

US GDP 1929 - 2004 graph 1



source : economonic-charts

As we can see in the above graph, the biggest part of the gross domestic product in US is firstly reliant on personal consumption expenditures and secondly on government consumption expenditures and gross investment.

In my master thesis I will try to examine the factors which cause currency wars and the main question will be what causes the wild fluctuations in exchange rates. Firstly, there will be a brief historical flashback. Then, the factors that drove to currency wars in the past will be mentioned and it will also be examined whether there is any similarity with the ones experiencing nowadays. Some of the most significant questions that I will try to answer are the following: Is a reason for a currency war to export deflation or not? Why does a country want a currency devaluation? What about the volatility effect? How does the currency rate change in emerging markets change? Is currency policy affected by GDP or other factors?

Currency wars and their consequences is an issue of heated debate nowadays in every economic discussion. The main question is what drives the wild fluctuation in exchange rates. This is a very interesting question to which the answer has been constantly changing throughout history. A lot of sub-questions ensue from the main question. Currency wars aim to export deflation, but are they effective? Does currency depreciation help boost growth? Do they help solve low growth? Why do countries need to export deflation? Do they have long-term effect on a country economy? Firstly, there will be a brief history of currency wars and then some examples from three significant economies (USA, EUROZONE and JAPAN).

1.1. HISTORY OF CURRENCY WARS

1.1.1 Currency wars up to 1930

Going back to at least the Classical period, governments have often devalued their currency by reducing its intrinsic value. Methods have included reducing the percentage of gold in coins, or substituting less precious metals for gold. However, until the 19th century, the proportion of the world's trade that occurred between nations was very low, so exchange rates were not generally a matter of great concern. Rather than being seen as a means to help exporters, the debasement of currency was motivated by a desire to increase the domestic money supply and the ruling authorities' wealth through seignior age, especially when they needed to finance wars or pay debts. A notable example is the substantial devaluations which occurred during the Napoleonic wars. When nations wished to compete economically they typically practiced mercantilism. Mercantilism involved attempts to boost

exports while limiting imports, but rarely by means of devaluation. The most common methods for this theory were banning the export of gold and silver or subsidies on exports. Another favored method was to protect home industries using current account controls such as tariffs. From the late 18th century, and especially in Great Britain which for much of the 19th century was the world's largest economy, mercantilism became increasingly discredited by the rival theory of free trade, which held that the best way to encourage prosperity would be to allow trade to occur free of government imposed controls. The intrinsic value of money became formalized with a gold standard being widely adopted from about 1870–1914, so while the global economy was now becoming sufficiently integrated for competitive devaluation to occur there was little opportunity. Following the end of WWI, many countries other than the US experienced recession and few immediately returned to the gold standard, so several of the conditions for a currency war were in place. However, currency war did not occur as Great Britain was trying to raise the value of its currency back to its pre-war levels, effectively cooperating with the countries that wished to devalue against the market. By the mid-1920s many former members of the gold standard had rejoined, and while the standard did not work as successfully as it had pre war, there was no widespread competitive devaluation. So, we did not have any significant currency war until the Great Depression.

1.1.2 Currency War in the Great Depression

During the Great Depression of the 1930s, most countries abandoned the gold standard, resulting in currencies that no longer had intrinsic value. With widespread high unemployment, devaluations became common. Effectively, nations were competing to export unemployment, a policy that has frequently been described as "beggar thy neighbor ". However, since the effects of a devaluation would soon be offset by a corresponding devaluation by trading partners, few nations would gain an enduring advantage. On the other hand, resulting fluctuations in exchange rates were often harmful for international traders, causing global trade to decline sharply, hurting all economies.

The exact starting date of the 1930s currency war is open to debate. The three principal parties were Great Britain, France, and the United States. For most of the 1920s the three generally had coinciding interests; both the US and France supported

Britain's efforts to raise Sterling's value against market forces. Collaboration was aided by strong personal friendships among the nations' central bankers, especially between Britain's Montagu Norman and America's Benjamin Strong until the latter's early death in 1928. Soon after the Wall Street Crash of 1929, France lost faith in Sterling as a source of value and begun selling it heavily on the markets. From Britain's perspective both France and the US were no longer playing by the rules of the gold standard. Instead of allowing gold inflows to increase their money supplies (which would have expanded those economies but reduced their trade surpluses) France and the US began sterilizing the inflows, building up hoards of gold. These factors contributed to the Sterling crises of 1931; in September of that year Great Britain substantially devalued and took the pound off the gold standard. For several years after this global trade was disrupted by competitive devaluation and by retaliatory tariffs. The currency war of the 1930s is generally considered to have ended with the Tripartite agreement of 1936 which was an international monetary agreement entered into by the United States, France, and Great Britain to stabilize their nations' currencies.

1.1.3 Bretton Woods era

The Bretton Woods system was an exchange rate system where dollar convertibility to gold existed. Bretton wood system established in July 1944. Almost simultaneously, there will be the founding of IMF. IMF approval was necessary for any change in exchange rates in excess of 10%. It advised countries on policies affecting the monetary system and lent reserve currencies to nations that had incurred balance of payment debts. The maximum deviation from the fixed exchange rate that this system allowed was 1%. From the end of World War II until about 1971, the Bretton Woods system of semi-fixed exchange rates meant that competitive devaluation was not an option, which was one of the design objectives of the systems' architects. During the Bretton Woods era, countries were reluctant to alter exchange rates formally even in cases of structural disequilibria. Because such changes had a direct impact on certain domestic economic groups, they came to be seen as political risks for leaders. Additionally, global growth was generally very high in this period, so there was little incentive for currency war even if it had been possible.

However, as time went by ,the deficit in the balance of payments for the US was getting bigger. So, the change in the currency exchange system was inevitable in order for the US to reduce this deficit. Moreover, the U.S. was no longer the dominant economic power. E.E.C. and Japan had become international economic powers, as their total reserves exceeded those of the U.S.

The main disadvantage that this system had, was the existing of a free gold market apart from the Bretton Wood gold market. As a consequence, if there was a gap between these two gold prices, there were more opportunities for speculations

1.1.4 Currency wars from 1973 until 2000

After the Bretton Woods exchange system, a new system of floating exchange rates has been decided to be followed. Richard Nixon was the president of the United States who one-sidedly inhibit this system. President Nixon without the permission of IMF decided to make the dollar inconvertible to gold directly, except on the open market. This movement called Nixon Shock

In this floating system a country's currency depends on supply and demand for this currency against another one. For instance S_1 ($/€) = 1.08, this means that someone could buy 1,08$ for 1€. After three weeks, the demand for € (demand for € = American demand for Euroland goods, services and financial assets) has grown and now we have S_2 ($/€) = 1.09, with 1€ corresponding to 1.09$. From 1973 and on, most of the countries estimate their currencies with this exchange system. However, the current monetary regime has some disadvantages. For example, extreme fluctuation in currency rates could be catastrophic if the liabilities of a country are in foreign currency.

While some of the conditions to allow a currency war were in place at various points throughout this period, countries generally had contrasting priorities and at no point were there enough states simultaneously wanting to devalue for a currency war to break out. On several occasions countries were desperately attempting not to cause a devaluation but to prevent one. So states were striving not against other countries but against market forces that were exerting undesirable downwards pressure on their currencies. Examples include Great Britain during Black Wednesday and various tiger economies during the Asian crises of 1997. Asian crises begun in Thailand as the

government decided to no longer peg the local currency to the U.S. dollar and outspread in other Asian countries. George Soros took advantage of this crisis as he betted for depreciation of Thailand baht. During the mid-1980s the United States did desire to devalue significantly, but were able to secure the cooperation of other major economies with the Plaza Accord. It was the first time central bankers agreed to intervene in the currency markets, the first time the world set target rates, the first time for globalization of economies and the first time each nation agreed to adjust its own economies. As free market influences approached their zenith during the 1990s, advanced economies and increasingly transition and even emerging economies moved to the view that it was best to leave the running of their economies to the markets and not to intervene even to correct a substantial current account deficit. However the market maybe produce the wrong rate.

1.1.5 Currency wars from 2000 until 2008

During the 1997 Asian crisis several Asian economies ran critically low on foreign reserves, leaving them forced to accept harsh terms from the IMF, and often to accept low prices for the forced sale of their assets. This shattered faith in free market thinking among emerging economies, and from about 2000 they generally began intervening to keep the value of their currencies low. This enhanced their ability to pursue export led growth strategies while at the same time building up foreign reserves so they would be better protected against further crises. No currency war resulted because on the whole advanced economies accepted this strategy - in the short term it had some benefits for their citizens, who could buy cheap imports and thus enjoy a higher material standard of living. The current account deficit of the US grew substantially, but until about 2007, the consensus view among free market economists and policy makers like Alan Greenspan, then Chairman of the Federal Reserve, and Paul O'Neill, US Treasury secretary, was that the deficit was not a major reason for worry. [1]

By 2005 for example a chorus of US executives along with trade union and mid-ranking government officials had been speaking out about what they perceived to be unfair trade practices by China. These concerns were soon partially allayed. With the global economy doing well, China was able to abandon its dollar peg in 2005,

allowing a substantial appreciation of the Yuan up to 2007, while still increasing its exports. Until 2008 China accumulated large current account surpluses. The dollar peg was later re-established as the financial crisis began to reduce China's export orders.

Economists such as Michael P. Dooley, Peter M. Garber, and David Folkerts-Landau described the new economic relationship between emerging economies and the US as Bretton Woods II.

1.1.6 Currency wars after 2009

When the financial crisis of 2008 began, it influenced first and foremost and to a great extent the developed countries. It is believed that the main reason for this crisis was the housing bubble in US.

By 2009 some of the conditions required for a currency war had returned, with a severe economic downturn seeing global trade in that year decline by about 12%. There was a widespread concern among advanced economies about the size of their deficits; they increasingly joined emerging economies in viewing export led growth as their ideal strategy. In March 2009, even before international co-operation reached its peak with the 2009 G-20 London Summit , economist Ted Truman became one of the first to warn of the dangers of competitive devaluation. He also coined the phrase competitive non-appreciation.

Now we are maybe witnesses of a global currency war. Central banks are afraid of the reinforcement of the deflationary spiral. The US and Eurozone have nominal interest rates close to zero. As a result, the main concern about deflation arises because nominal interest rates cannot fall below zero. Deflation worry is not temporary, deflation can be self-sustaining, pushing aggregate demand lower which causes further deflation. It is commonly known that deflation is more catastrophic than hyperinflation.

Ben Bernanke believes that central banks in cooperation with other agencies can deal with deflation by using a fiat money system, even when the short-term nominal interest rates is at zero. Intervention in such circumstances can prove both stabilizing and profitable. The authorities should be more capable than the market in

predicting the future course of their policies, and this is of relevance to the correct exchange rate.

It is not hap that after 2009, we became familiar with QE. US second QE was in November 2010 and the last one (3rd QE) took place in September 2012. As far as Europe is concerned, the first QE was established by the UK in October 2009 and after that the president of ECB Mario Draghi announced his intention to start an outright money transaction program in 2012 and at the beginning of 2015 a quantitative easing program followed. In this tangle of QEs, Japan entered the game in October 2010. It is explicit that the developed countries tried to boost the private investments through this expansive credit policy.

In contrast with the currency wars of 1930s, at 2008 crisis the emerging countries was in a uptrend and had current account surpluses, as a result investors preferred the emerging countries for their investments than the developed countries.

1.1.7 Currency wars now and then

In the great depression of the 1930s, there is evidence that shows that countries which abandon the gold standard and depreciate their currencies, recovered more quickly from the depression in comparison with the countries following the opposite policies. In order to this recovery be achieved, central banks committed to keeping interest rates lows, expanding supplies of money and credit, and raising the domestic currency price of gold for as long as it took for conditions to normalize.

The change in monetary policy had a positive impact on asset prices and therefore on investment and on competitiveness relative to countries remaining on gold. However, there is a lot of controversy about the cross - border spillover of the direct real exchange rate effect. It is believed that an international coordination will have been better solution because the deflationary monetary shock was symmetric and political or ideological factors prevented some countries to do what other countries have done (depreciate their currencies).

Nowadays, there is a lot of criticism against strong countries about their monetary policies. Despite the fact that there might be policies against the risk of global deflation, they seem to cause a strong upward pressure on emerging countries currencies. They unleashed a tremendous amount of capital flows towards emerging

markets, resulting in inflation, currency appreciation, loss of competitiveness and worrisome upward pressure on asset prices. This is a "beggar thy neighbor" policy. At the end of 2012, when BoJ committed to large-scale asset purchases, there were accusations, mainly from Japan's Asian neighbors, that the country was waging a immoral currency war.

The difference from the 1930s is that the pattern of shocks is more heavily asymmetric in recent episode. Where the advanced countries were hit by a deflationary shock which, in conjunction with the policy response, moved interest rates to the zero lower bound, emerging markets felt less deflationary pressure, experienced less deleveraging, and maintained healthier growth rates. Emerging markets were worried about inflation rather than deflation and about currencies, asset prices and, in some cases, growth rates that were too strong rather than too weak. Emerging market designed measures to limit capital inflows (capital controls). In contrast to the Great Depression controls, many of these controls were price-based rather than administrative, this means that they took the form of taxes on securities purchases by foreigners rather than outright prohibitions. “There are episodes where speculative market pressure is basically larger than the willingness, or ability, of the central bank to rule against it in terms of intervention,” said Ulrich Leuchtmann, head of currency strategy at Commerzbank AG in Frankfurt. “The pound was a good example.”

In principle, a superior outcome could have been attained through international coordination. Somewhat less quantitative easing by advanced-country central banks together with somewhat less fiscal tightening by emerging market governments, would have produced superior results for both parties. Advanced-country producers would have seen the same increase in demand for their products, the only difference being that more of it would have come from emerging markets. Emerging markets would have seen the same diminution of troublesome capital inflows, what with advanced-country central banks engaging in less quantitative easing, and emerging market governments would have been able to avoid the political costs of even larger fiscal adjustments.[2] So maybe it's time for countries to abandon this policy.

So far, we explained why countries engage in currency wars. We have also discussed how they attempt to boost growth through either lowering key interest rates or easing the credit availability in the economy to spur economic activity. Now, we will look at some economies that took these measures. We will analyze whether they have been effective in solving the low growth problem.

1.2 MONETARY POLICY IN DEVELOPED COUTRIES

1.2.1 Monetary policy in US

Between December 2008 and March 2010, the US Fed purchased more than $1.7 trillion in assets as part of the so-called QE1 program. The result was the reduction in the supply to the private sector of assets with long duration and increased the supply of assets (bank reserves) with zero duration. This affected the risk premium on the assets being purchased and triggered portfolio rebalancing effects. Moreover, it reduced the long-term interest rate. It is believed that the effect of QE1 on GDP growth and inflation increases significantly when combined with a commitment to keep interest rates low for some period of time.[3] This would suggest that the magnitude of program effects relies greatly on expectations for interest rate policy. They also add that these effects are weaker and more uncertain than the effects of conventional interest rate policy. This would imply that communication about future rates could have stronger effects than guidance about the exit from QE.

Right after US Federal Reserve announced it first QE program in late November 2008, the stock market reversed its declining trend. S&P 500 index were bullish. S&P 500 is the index which measures the performance of the US equity market's large capitalization sector. It is considered one of the best representations of the domestic economy. Its performance acts as a leading indicator of the US economy's health and growth. Fed during this period purchased more than twenty per cent of total stock of longer-term agency debt, fix-rate agency mortgage-backed securities and Treasury securities.

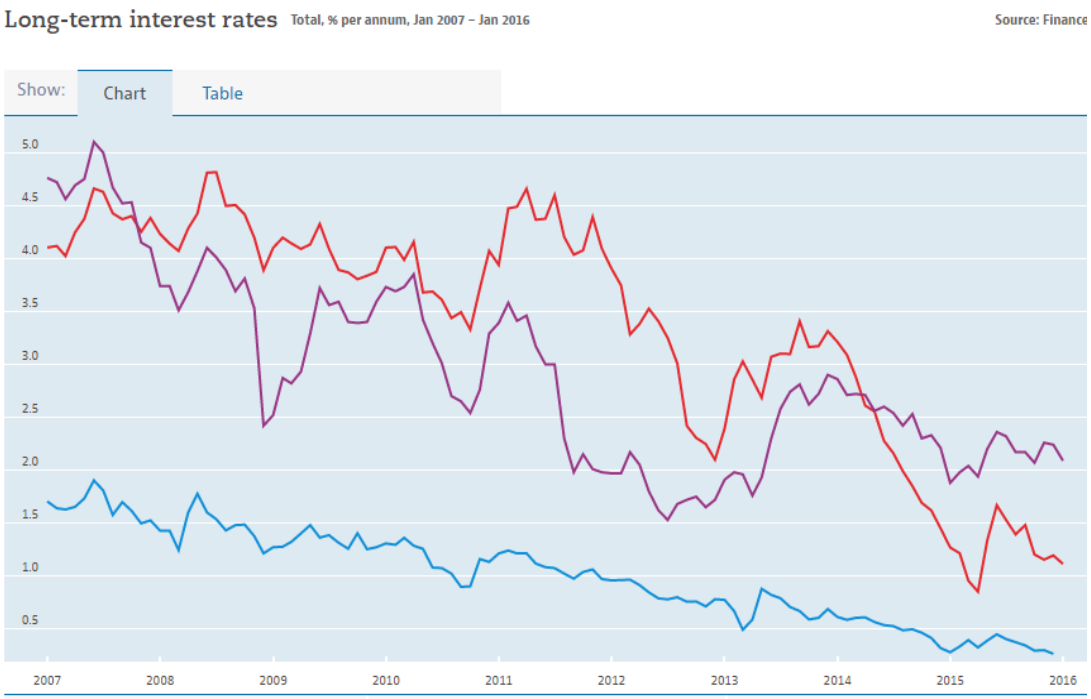
In November 2010, the Fed announced a program to purchase $600 billion of long-term Treasury securities. The program's goal was to boost economic growth and bring inflation to levels more consistent with the Fed's maximum employment and price stability mandate. S&P 500 index had started loosing strength. It found

more support. In the US, the third round of easing started in September 2012. Fed announced open-ended plan to buy $40 billion of mortgage-backed securities (MBS) each month until labor market improves. QE3 definitely outlined the US economy's recovery and growth. Over the last five years, S&P 500 gained almost 90% in price.

FED was expecting, these capital flows to enter in real economy in order to reduce the country's current account deficits. In reality, the biggest part of these capital flows moved to emerging countries and more specifically to the financial assets of them. The price of the emerging countries' financial assets was increased as a consequence of this enormous inflow. The emerging countries, on the other hand, consumed one small part of this inflow and the rest of it was invested in developed countries assets (US treasuries, T-bills, government bonds e.t.c.). Hence, part of this liquidity returned back to advanced countries.

Throughout literature, it is commonly believed that the first QE in US was the most effective. It improved unemployment as well as inflation and boosted the economic growth of the country. Immediately after the announcement of the first QE, we had a rally in American stock market. It is said that stock market is the best indicator of economic health. Maybe the good results of the first QE were due to suddenness of the market. There are articles which support that if it had not been for QE1, US economy would have been in deflation. According to more economist the long-term interest rate is the key variable which enables the linking of the QE policy to the real economy.

LONG-TERM INTEREST RATES USA JAPAN EUROPE graph 2



source : www.oecd.org

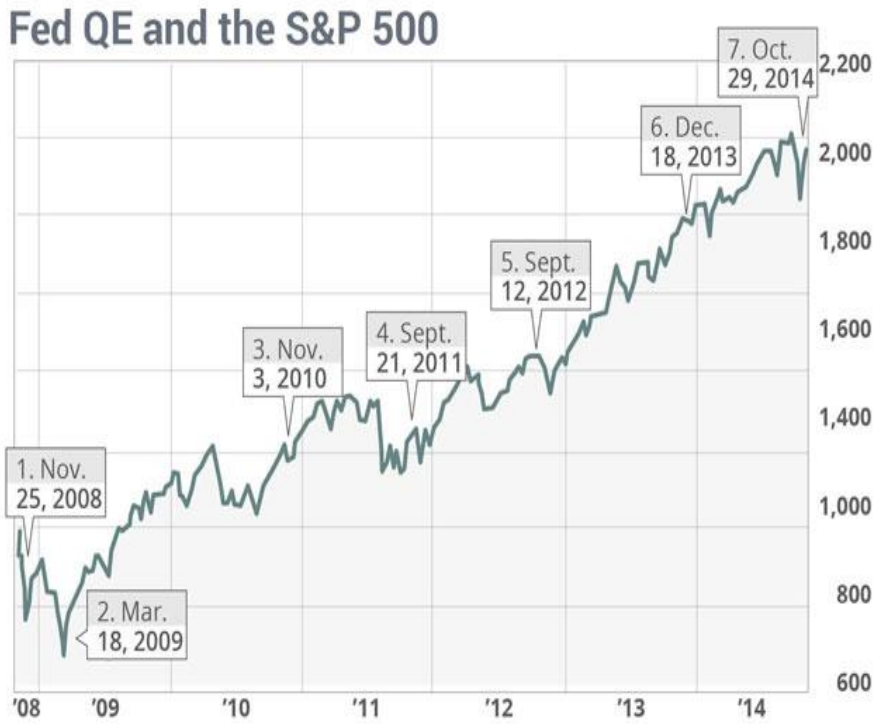
EUROPE US JAPAN

In the fall of 2014, US economy was considered the strongest economy in the world in comparison with Europe and Japan. As a consequence, the market expectations for an interest rate hike was so many that it was certain that it will happen. US dollar appreciated from 1.28 to 1.04 before the final announcement. Analysts believed that this appreciation was a signal that US economy could help the other developed economies which were in need of support. However, 1.04 was the point when the US dollar began to depreciate to 1.12 at this moment. Dollar was too strong as a currency for US economy and maybe this started again concerns for deflation in Europe.

Janet Jellen the FED new chairwoman, took the decision to stop the QE3 in October 2014 before the market expectations. At that point, the next step was to raise interest rates by 0.25% . The 16th of December 2015 is a historical moment for the US, it was the first rate hike after QEs

It's the first time that FED decide to rise their interest rates and as a results dollar has significantly appreciated against euro and yen. On the other hand, US economy is not so strong yet to be a deflation-importer of last resort. It is not prepared yet to absorb the problems of others countries because it still has its own problems

Fed QE and S&P 500 graph 3



1. Fed announces purchases of $100 billion of Fannie Mae and Freddie Mac debt and $500 billion agency mortgage-backed securities.

2. Fed announces purchases of $100 billion of Fannie Mae and Freddie Mac debt, $750 billion of mortgage-backed securities and $300 billion of long-term Treasurys.

3. Fed announces purchases of $600 billion of longer-term Treasury debt.

4. Fed unveils "Operation Twist," a plan to buy $400 billion of long-term debt but sell an equal amount of short-term debt.

5. Fed announces open-ended plan to buy $40 billion of mortgage-backed securities each month until labor market conditions improve "substantially." In December, Fed expands program to $85 billion: $45 billion in Treasurys and $40 billion in MBS.

6. Fed begins to reduce its $85 billion-per-month asset purchases by $10 billion at each Fed meeting.

7. Fed ends its so-called QE3 program.

source : market watch

1.2.2 Monetary policy in Europe

In August 2012, the ECB (European Central Bank) announced that it would undertake OMT (outright money transactions). OMT is a kind of quantitative easing, or QE, program where the central bank makes purchases in the secondary, sovereign bond markets. This increases the money supply. The increased demand for sovereign bonds drags down yields. It pushes up the prices for these bonds. Growth in the Eurozone was also bolstered by a 0.25% cut in the base rate in July 2012.

This OMT was not enough for Europe problems so Draghi announced on March 2015 the first QE by ECB. Draghi was intending to add almost 1 trillion € to the ECB's balance sheet. This program consists of 60 billion € purchase per month of public and private sector securities for at least nineteen months. Nonetheless, the announcement has been expected for some time so the surprise was not so substantial for the market.

The ECB's decision was taken under the threat of the outright deflation as the eurozone was suffering a prolonged weak recovery and very low inflation. The ideal inflation according to ECB and IMF is around 2%. Moreover, the interest rates were close to zero and maybe this was the last solution for Europe.

It is too early to make an assessment of the effect of the ECB's decision to undertake a QE program. The initial impact has apparently been successful in achieving the goals of reducing long-term interest rates and of an exchange rate depreciation. Nonetheless, it is not clear how much of it is a direct effect of QE as € began its slide against $ in the fall of 2014. The outcome is that the impact of ECB QE is ambiguous.

1.2.3 Monetary policy in Japan

Japan is the first country that introduce a QE program. This happened a long time ago in 2001. Before this, BoJ had followed a zero interest policy. However, when the dotcom bubble burst, the Japanese economy was hit by another negative shock and the risk of deflation made its reappearance. The BoJ exited QE in March 2006 amid signs that deflation risks were fading. It is interesting to note that during that period, the central bank directly purchased only a limited amount of government securities. The largest amount of these securities was bought by the postal offices,

which at that time were owned by the government. As a response to the global financial crisis, in 2008 the BoJ re-launched its government bond purchases and adopted a number of unconventional measures to promote financial stability. In October 2010, the BoJ introduced its comprehensive monetary easing policy, which differs from the typical QE programs of other central banks by including purchases of risky assets in an effort to reduce term and risk premium and to respond to the re-emergence of deflation and a slowing recovery. The most recent and largest asset purchase program was started in 2013 as the second arrow of "Abenomics" (which is the nickname for the multi-pronged economic program of Japanese prime minister Shinzō Abe) "Abenomics" have three arrows; the first one is printing money, the second is government spending programs and the third regulations in order to make Japanese companies more competitive (i.e. cutting corporate taxes, and increasing workforce diversity, fire ineffective workers)

Japan's deflationary Slump graph 4

source : market watch

In early October 2010, the Bank of Japan announced that it would examine the purchase of 5 trillion yen, or $60 billion, in assets as part of a monetary stimulus package. The attempt was to push down the value of the yen against the US dollar in order to stimulate the domestic economy by making Japanese exports cheaper. Growth did pick up, but not for long.

Japan is a classic case of how depreciating currency can boost economic growth. The major turnaround in Japan's story only occurred after December 2012—under Prime Minister Shinzo Abe's regime.

In the case of Japan, it emerges that the first QE was ineffective vis-a-vis the real economy and the second QE had just a very small effect on demand and none on inflation. Research on the effectiveness of Japan's quantitative easing experiences has yielded mixed results, and most of them point to very limited effects on economic activity.

2. FUNDAMENTAL CONCERNS AND EXAMPLE REFERENCES

2.1 Main exchange rates equations and fundamentals

Generally, in the interbank transactions all the currencies are quoted against the American dollar. The Cross-Exchange Rate Quotations states that the cross rate is given by the combination of the spot rates of two currencies against dollar. For instance : if 1€=1.08$ and 1€= £0.75 this means that 1$ = £0.69

The equation is S($/€) $= (S(€/£))/(S(\$/£))$ (1)

2.1.1 Interest Rate Parity (IRP)

IRP is a no-arbitrage condition representing an equilibrium state under which investors will be indifferent to interest rates available on bank deposits in two countries. The fact that this condition does not always hold allows for potential arbitrage.[4]

Suppose that an investor has 100€ in Germany and has two alternative ways to invest this amount in riskless asset for a year.

1st invest immediately in euro risk free interest rate $r_€$ getting in one year 100€ $(1 + r_€)$

2nd invest in dollar risk free interest rate $r_\$$. He will convert 100€ to $ with exchange rate S($/€) and getting in one year 100 × S($/€) × $(1 + r_\$)$. Finally, convert the outcome in € $[S(\$/€) \times (1 + r_\$)]/(F(\$/€)$

So if there is no arbitrage in €/$ exchange market, the above investor alternatives can be written as detailed below :

$(1 + r_{€}) = S(\$/€)/F_{12}\ (\$/€) \times (1 + r_{\$})$ where F_{12} is the future value of $S(\$/€)$ in 12 months

2.1.2 Purchasing Power Parity (PPP)

PPP states that the exchange rate between the domestic and a foreign currency will adjust to reflect changes in the price levels of the two countries.

$Sn\ (j/k) = S(j/k)\frac{1+i_j}{1+i_k}$ (2) where Sn (j/k) is the spot exchange rate after n months and i_j , i_k are the rates of inflation for the two currencies for n months else (PPP) can be written $e_n = \frac{i_j - i_k}{1+i_k}$ where, e_n is the change rate in the exchange rate in n months.[5]

However PPP does not take into account others factors such as country competitiveness and in reality is usually violated.

2.1.3 Fisher Effects

Fisher Effects states that an increase (decrease) in the expected inflation rate in a country will cause a proportionate increase (decrease) in the interest rate in the country.

Hence $1 + r = (1 + \rho\ ) \times (1 + E[i])$ or $r = \rho + E[i] + \rho \times E[i] \approx \rho + E[i]$

where ρ is the real (required) rate of return and E[i] is the expected inflation rate. Fisher Effect assume that between countries that there is no capital restrictions and risk differences the real interest rate should be equal $\rho_j = \rho_к$. Currencies with high inflation should bear high nominal interest rates.

if $\rho_j = \rho_к \leftrightarrow r_k - r_j \approx E[i_k] - E[i_j]$ (3)

when we apply the above equation into PPP we get the following relationship

E[Sn(j/k)] ≈ $S(j/k)(\frac{1+r_j}{1+r_k})^{n/12}$ this relationship is the International Fisher Effect (IFE) . Empirical evidence shows that IFE holds in long run.

2.2 Factors that affect currency rates

Aside from factors such as interest rates and inflation, the exchange rate is one of the most important determinants of a country's relative level of economic health. Exchange rates play a vital role in a country's level of trade, which is critical to most every free market economy in the world. For this reason, exchange rates are among the most watched, analyzed and governmentally manipulated economic measures. But exchange rates matter on a smaller scale as well: they impact the real return of an investor's portfolio. Here we look at some of the major forces behind exchange rate movements.

Before we look at these forces, we should sketch out how exchange rate movements affect a nation's trading relationships with other nations. A higher currency makes a country's exports more expensive and imports cheaper in foreign markets; a lower currency makes a country's exports cheaper and its imports more expensive in foreign markets. A higher exchange rate can be expected to lower the country's balance of trade, while a lower exchange rate would increase it.

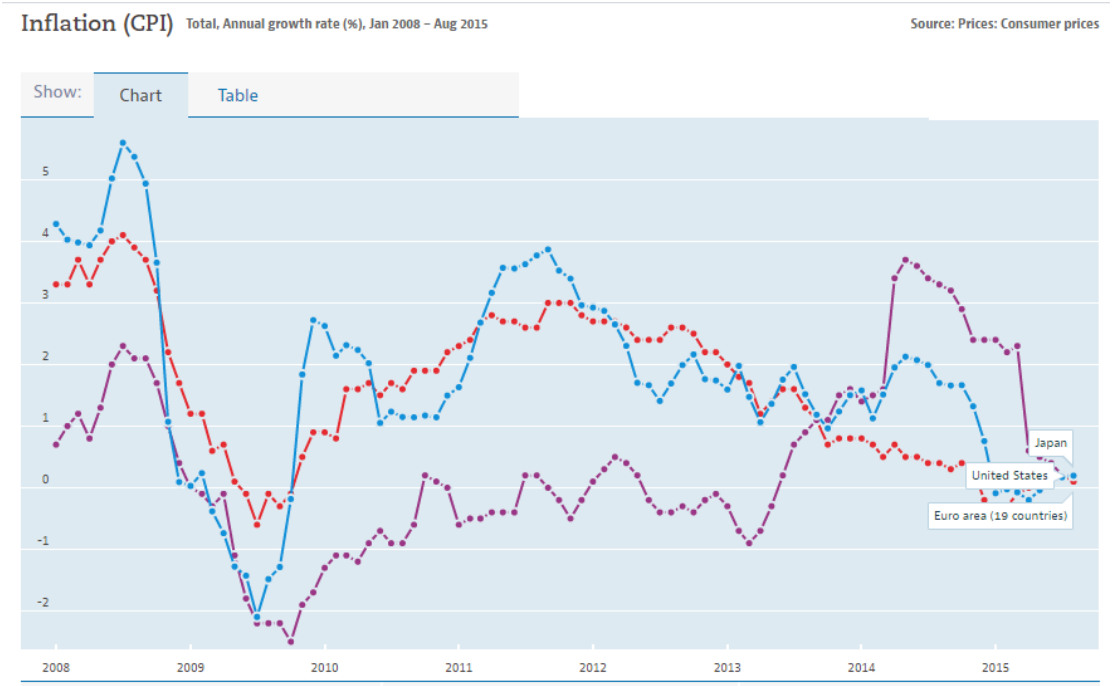
Numerous factors determine exchange rates, and all are related to the trading relationship between two countries. Remember, exchange rates are relative, and are expressed as a comparison of the currencies of two countries. The following are some of the principal determinants of the exchange rate between two countries. Note that these factors are in no particular order; like many aspects of economics, the relative importance of these factors is subject to much debate.

2.2.1 Differences in Inflation

As a general rule, a country with a consistently lower inflation rate exhibits a rising currency value, as its purchasing power increases relative to other currencies. During the last half of the twentieth century, the countries with low inflation included Japan, Germany and Switzerland, while the U.S. and Canada achieved low inflation only later. Those countries with higher inflation typically see depreciation in their currency in relation to the currencies of their trading partners. This is also usually accompanied by higher interest rates.

However this is not a rule if inflation is over 50% or below zero. In the first occasion we talk about the hyperinflation. Hyperinflation is the extreme increase of inflation which occurs when there is a large increase in the money supply not supported by gross domestic product (GDP) growth, resulting in an imbalance in the supply and demand for the money. Deflation is a general decline in prices, often caused by a reduction in the supply of money or credit. Deflation can also be caused also by a decrease in government, personal or investment spending. The opposite of inflation, deflation has the side effect of increased unemployment since there is a lower level of demand in the economy, which can lead to economic depression. Central banks attempt to stop severe deflation, along with severe inflation, in an attempt to keep the excessive drop in prices to a minimum.[6]

Inflation (CPI) US JAPAN EUROPE graph 5



source : www.oecd.org

JAPAN EUROPE US

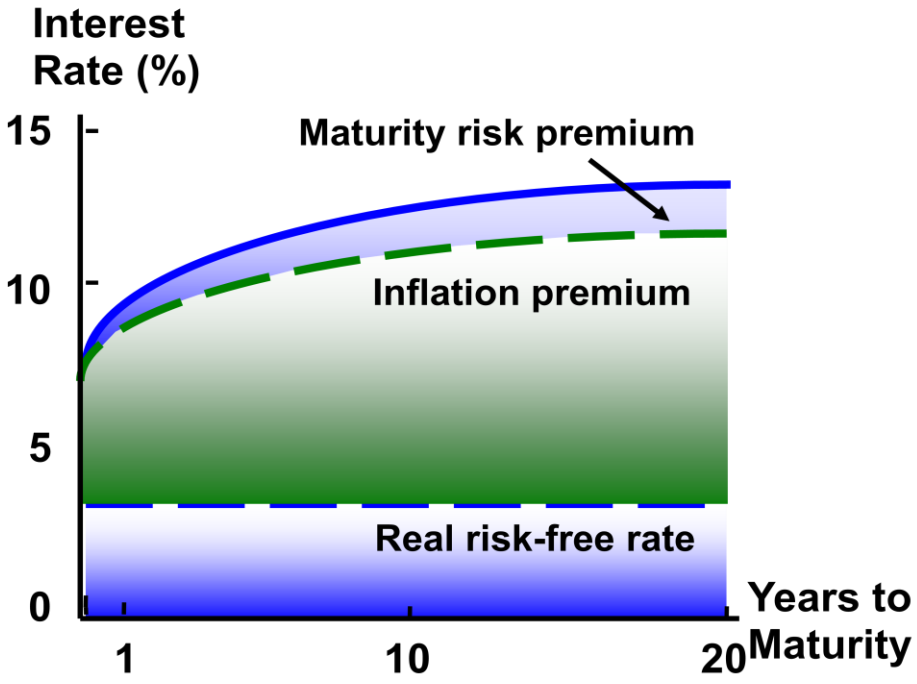
2.2.2 Differences in Interest Rates

The different between the interest rates that one country is giving, for example US 0,5% and another country, for example Japan 1.25% is the differentials in interest rates. the difference in interest rates is 1.25% - 0.5% = 0.75%. At a first glance, Japan is giving better interest for an investor but this it depend on the exchange currency rates between these two currencies. A principle that interest rates follows is the Purchasing Power Parity (PPP).

Interest rates, inflation and exchange rates are all highly correlated. By manipulating interest rates, central banks exert influence over both inflation and exchange rates, and changing interest rates impact inflation and currency values. Higher interest rates offer lenders in an economy a higher return relative to other countries. Therefore, higher interest rates attract foreign capital and cause the

exchange rate to rise. The impact of higher interest rates is mitigated, however, if inflation in the country is much higher than in others, or if additional factors serve to drive the currency down. The opposite relationship exists for decreasing interest rates - that is, lower interest rates tend to decrease exchange rates. The results of higher interest rates depend not only on inflation (deflation or hyperinflation) in the country but the market's expectation for this country.

Bond yield interest rate graph 6



source : Brigham - Ehrhardt

2.2.3 Current-Account Deficits

The current account is the balance of trade between a country and its trading partners, reflecting all payments between countries for goods, services, interest and dividends. A deficit in the current account shows the country is spending more on foreign trade than it is earning, and that it is borrowing capital from foreign sources to make up the deficit. In other words, the country requires more foreign currency than it receives through sales of exports, and it supplies more of its own currency than foreigners demand for its products. The excess demand for foreign currency lowers the country's exchange rate until domestic goods and services are cheap enough for

foreigners, and foreign assets are too expensive to generate sales for domestic interests. The graph below shows the Japan government deficit.

General government deficit graph 7

source : www.oecd.org

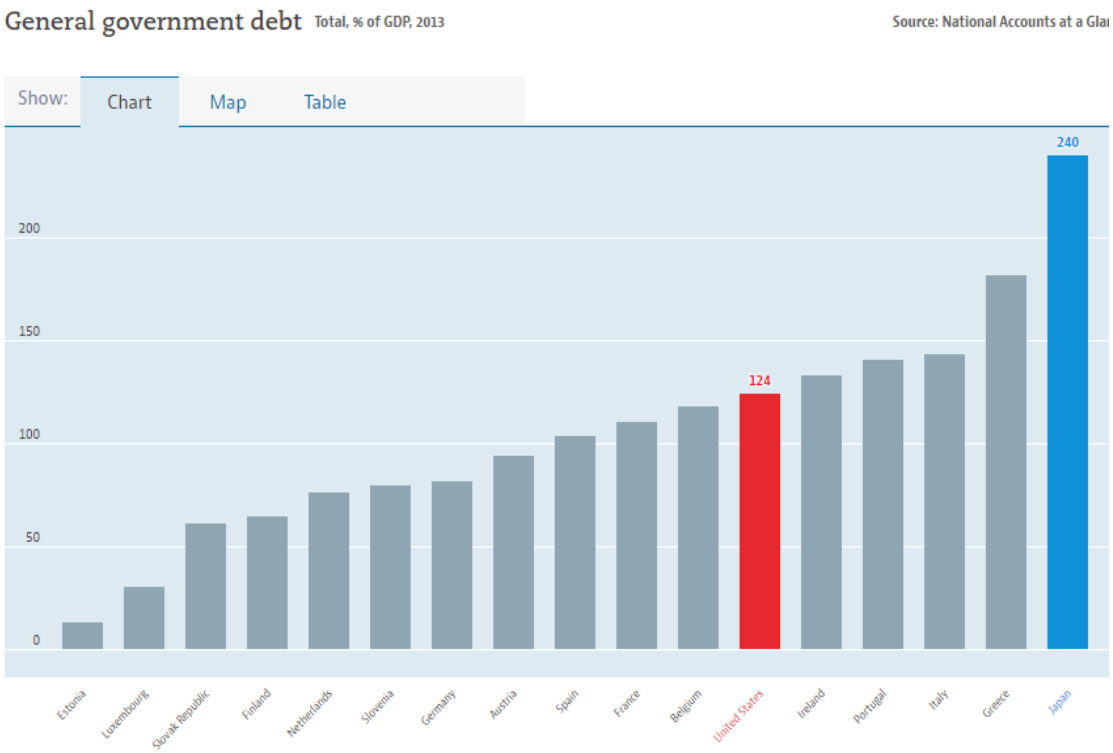
2.2.4 Public Debt

Countries will engage in large-scale deficit financing to pay for public sector projects and governmental funding. While such activity stimulates the domestic economy, nations with large public deficits and debts are less attractive to foreign investors. The reason for that is that a large debt encourages inflation, and if inflation is high, the debt will be serviced and ultimately paid off with cheaper real dollars in the future.

In the worst case scenario, a government may print money to pay part of a large debt, but increasing the money supply inevitably causes inflation. Moreover, if a government is not able to service its deficit through domestic means (selling domestic bonds, increasing the money supply), then it must increase the supply of

securities for sale to foreigners, thereby lowering their prices. Finally, a large debt may prove worrisome to foreigners if they believe the country risks defaulting on its obligations. Foreigners will be less willing to own securities denominated in that currency if the risk of default is great. For this reason, the country's debt rating (as determined by Moody's or Standard & Poor's, for example) is a crucial determinant of its exchange rate.

General government debt graph 8



source : www.oecd.org

2.2.5 Terms of Trade

A ratio comparing export prices to import prices, the terms of trade is related to current accounts and the balance of payments. If the price of a country's exports rises by a greater rate than that of its imports, its terms of trade have favorably improved. Increasing terms of trade shows greater demand for the country's exports. This, in turn, results in rising revenues from exports, which provides increased demand for the country's currency (and an increase in the currency's value). If the price of exports rises by a smaller rate than that of its imports, the currency's value will decrease in relation to its trading partners.

2.2.6 Political Stability and Economic Performance

Foreign investors inevitably seek out stable countries with strong economic performance in which to invest their capital. A country with such positive attributes will draw investment funds away from other countries perceived to have more political and economic risk. Political turmoil or elections, for example, can cause a loss of confidence in a currency and a movement of capital to the currencies of more stable countries. A country without turmoil and wealthy economy is a safe haven for investors.

All of these factors have some impact on exchange rates but the most important impact is the market's expectations on the above factors.

3. RELATIVE PROJECTS

Many surveys have been conducted on this matter so far because currency wars are something that we are experiencing right now in a very intense way. Historically, a currency war involves competitive devaluations by countries seeking to lower their cost structures, increase exports, create jobs and give their economies a boost at the expense of trading partners. This is not the only possible course for a currency war. The value of a nation’s currency is its Achilles’ heel. If the currency collapses, everything else goes with it. While markets today are linked through complex trading strategies, most still remain discrete to some extent. If you destroy the currency, you destroy all markets as well as the nation. This is why the currency itself is the ultimate target in any financial war.

There is an expanding literature relate to currency wars. Director of the Centre for European Policy Studies, Daniel Gross believes that what is called currency wars is ,thus, really a zero-sum game for the world’s export markets, a continuation of monetary policy by other means. In the long run ,the winners may be those who do not try to fight the markets and resist the strength of their currencies ,even if this may mean a painful adjustment to their export sector in the short run.

Another interest approach of currency wars is that of Barry Eichengreen. His model was an adaptation of the two-country Mundell-Fleming framework (appendix 2), with added emphasis on aggregate supply and the monetary links to gold. He

consider two symmetric economies, with identical coefficients in all equations. The first three components of the non dynamic model are familiar. Money demand is specified in standard transaction-balance form, $m - p = \varphi q - \lambda i$ where $\boldsymbol{m}$ is the log of nominal money balances, $\boldsymbol{p}$ the log of domestic output price, $\boldsymbol{q}$ the log of GNP and $\boldsymbol{i}$ the nominal interest rate. In his analysis indicates that the standard conclusions about competitive depreciation in a gold standard setting are not necessarily correct and devaluation under this setting may or may not be beggar-thy-neighbor, since it operates simultaneously through differential channels.

Keith Pilbeam has conducted a relevant research. Keith examined whether currency interventions was an effective policy tool or a shortsighted gamble in Switzerland. The result was that the Swiss franc is not yet a “big currency” in world markets, especially compared to the dollar, euro, yen and renminbi. Therefore, the chances of the Swiss franc destabilizing currency markets are slim.

Martin Wolf, an economics leader writer with the Financial Times, suggested there may be advantages in western economies taking a more confrontational approach against China, which in recent years has been by far the biggest practitioner of competitive devaluation. However, he advised that rather than using protectionist measures, which may spark a trade war, a better tactic would be to use targeted capital controls against China to prevent them from buying foreign assets in order to further devalue the yuan.

Formerly, Paul Krugman in a paper tried to compare the old currency crisis model (classical theory) with the new crisis model. The old currency-crisis models were essentially seigniorage-driven. In the new crisis model a government has no longer a simple mechanism like that in the classical model, but react as an agent trying to minimize a loss function. A government must decide whether or not to defend an exogenously specified exchange rate parity. New crisis theories have missed the possibility of a unique equilibrium despite policy optimization. In this model we have to take into account the uncertainty about the government's determination to defend the currency regime and the uncertainty about future fundamentals. In his approach Krugman consider M = EL(e), where E is the exchange rate (domestic money for foreign), L the real money demand, and e the expected rate of depreciation. The domestic money supply may be written as the sum of domestic

credit and foreign exchange reserves: M = D + R where R is the foreign exchange. Finally, he assume that the government is running a budget deficit, which must be covered by expanding domestic credit D.

In 2008, Eric Hillebrand and Gunther Schnabl studied the impact of Japanese foreign exchange intervention on the volatility of the yen/dollar exchange rate since the early 1990's in a GARCH framework with interventions as exogenous variables. Using daily intervention data provided by the Japanese Ministry of Finance, they show that the effect of interventions varies over time. From 1991 up to the late 1990's, Japanese foreign exchange intervention is associated with an increase in volatility of the yen/dollar exchange rate. After the year 1997, Japanese foreign exchange intervention correlates with reductions in exchange rate volatility. Their paper's name is " A structural break in the effects of Japanese foreign exchange intervention on yen/dollar exchange rate volatility

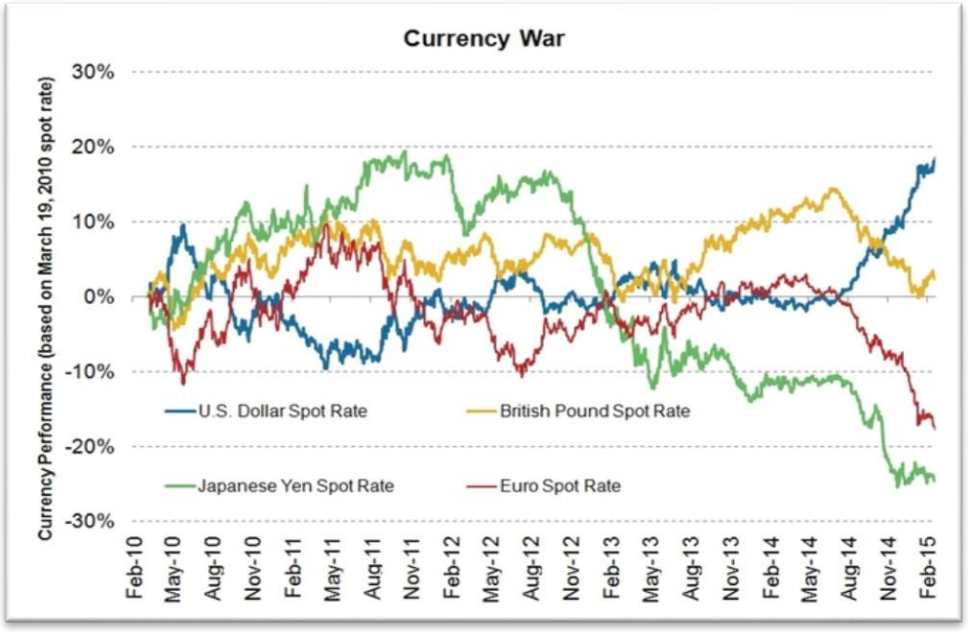
These references are some of the several references that exist

4. SOME INTEREST QUESTIONS FOR DISCUSSION

4.1 Currency wars aim to export deflation, but are they effective?

Originally, Guido Mantega, Brazilian Finance Minister coined the term "currency wars" in 2010 to signify currency depreciation by countries to maintain competitiveness and boost exports. However, it took on another meaning. With the advent of QE (quantitative easing) programs introduced by global central banks, the terms now includes those programs as well. QE programs had mixed results. The US had the best success utilizing QE.

Currency performance spot rate graph 9



source : investopedia

4.2 Does currency depreciation help countries?

First of all, we must cite a significant definition. There is a difference between devaluation and depreciation. A devaluation is a policy-driven decrease in the value of a currency whose exchange rate was previously held fixed. In contrast, a depreciation is a market-driven decrease in the value of a freely floating currency.[7]

The first country to depreciate its currency, generally does it, to pursue growth. Other countries join in simply to save their share of export demand. They also want to grab some extra share in the market. By lowering the value of their own currency, they make their goods cheaper. As a result, their goods are more competitive in foreign markets. Let's understand the effect of currency depreciation. It lures countries to enter into currency wars.

For instance, if an Japanese could buy a pair of US manufactured Polo t-shirt for 12,000 yen, or $100, when the exchange rate was $1=120yen, after the US dollar depreciates to $1=115yen, the same t-shirt could be bought for 11,500 yen, or $100. Since the price of the t-shirt effectively decreased in the export market, the US manufacturer would gain in terms of:

- ✓ increased demand for the product – more consumers will be able to afford the product
- ✓ increased competitiveness – the product became cheaper compared to certain other products

Such an increase in demand helps boosts sales and revenue for the country's domestic manufacturers. The country depreciates it currency. It also improves the competitiveness of exports. This opens up an opportunity to gain some extra market share.

4.3 How does a currency war help solve low growth?

Countries also want to attract foreign capital by depreciating their currency. A depreciated currency makes resources - like labor - cheap in the economy. This boosts profitability. It lures foreign investments into the country due to a decrease in the price of inputs and increased competitiveness for the country's goods in the global markets. The combination of increased competitiveness along with capital flows helps solve low growth in the country engaging in a currency war.

4.4 A "beggar-thy-neighbor" situation leads to currency warfare?

"Beggar-thy-neighbor" is an economic concept where one country attempts to remedy its economic problems by means that tend to worsen other countries' economic problems. In the context of a currency war, the "beggar-thy-neighbor" strategy is about increasing the demand for your nation's exports at the expense of other countries' export share.

Depreciation in the currency of say, country A, would make the currency of neighboring country B stronger. This would divert demand from country B to country A - as the good becomes cheaper from country A. It would hamper exports, manufacturing, and eventually the growth of country B.

This leads to a currency war between countries. Each country seeks to devalue or depreciate their currency compared to the other currencies. Each country boosts its own exports and economic growth at the expense of the other countries' growth.

Beggar thy neighbor situation flowchart 2

source : www.investing.com

4.5 Why countries need to export deflation ?

When one country weakens its exchange rate, another country's exchange rate gets stronger. This makes imports cheaper for the country with the strengthening currency. A flood of cheap imports in its markets hampers inflation. Inflation is boosted by increasing domestic demand. The increasing domestic demand is backed by price competitiveness.

Now, the availability of cheap imports is detrimental to domestic producers. The producers are forced to reduce their prices in order to maintain their market share. Lower prices weigh down inflation. A persistent reduction in the general price level, also known as "deflation," creeps into the economy.

The worry for deflation is not temporary, the most significant concern about deflation is when it becomes self-sustaining, pushing aggregate demand lower which in turn causes further deflation(called as deflation spiral).

Deflation spiral figure 3

Source : www.investopedia.com

As you can see in the above graph, deflation's economic spiral is the main reason why exporting deflation is desirable for any economy.

As a result, when one country depreciates its currency, its major trading partners also follow suit to depreciate their own currencies. They do this to save their economy from entering into a deflationary phase. In a way, they export the deflation back to where it came from. Deflation is a consequence of and contributor to the global economic slowdown.

For instance, it has been leading the Eurozone closer to a recession. At the same time, it has been reducing demand for exports from countries like China. China is one of its major trading partners. Bilateral trade between the two regions grew tremendously over the years. China and Europe now trade well over 1 billion euro a day.

However, why would China suffer at the expense of a depreciating euro? It depreciates its own currency as well. Since the Eurozone is also a major trading partner to China the effect will be muted. Essentially, currency depreciation in both the trading economies will have no net effect on boosting growth in either of the economies. It's plain currency warfare. It is not solving the problem of slow growth.

Many countries actively entered the ongoing currency war to fight the low growth deflationary environment prevailing around the world. Each country is using different means entering a currency war according to its needs and economy status.[8]

The world economy suffocates from the debts and all worries for the possibility of new irregular landing of world economy because debt. The world continued be lent after the economic crisis, adding almost 60 trillion from and increasing world charge of debt in 200 trillion dollar. Almost three times the size of total of world economy. In the dues of his decade 1990, the debt in Indonesia, Thailand and the South Korea, in combination with the bankruptcy of Russia caused crisis in the emerging economies and was required rescue. At 2008, on the occasion subprime mortgages in the USA befell the worst economic recession afterwards 1929, polluting Europe causing crises of government owned debt and recession in the economies.

After the economic crisis of 2008, investors have been spending their money in China, Brazil and other emerging markets in order to take profit from the rise of prices of basic commodities and the more rapidly developing economies. The banks in these countries opened market liquidity and started a wave of new credits to the households and the local enterprises. From 2009, medium level of private debt in the emerging economies went up from 75% of the GNP to 125%, according to the Bank of International Settlements. The private levels of debt in China and Brazil is double today from the size of national economy. The concerns are focused on the debt of China, which has tripled from 2009, from 10 trillion dollar to 30 trillion. dollars, according to last estimates. The most major increases occurred in the corporate sector of China, where big government owned enterprises borrowed a lot of loans from big government owned banks.

Analysts regard that the national banks of China can have losses 3.5 trillion dollar. This amount is four times more from what the banks of the USA have lost at the duration of the economic crisis of 2008. Despite that, the lending in China continues increasing itself. The problem is that however much credit is added , the economy continues to slow down. The question is if the Chinese crisis is contagious. However, the biggest part of debt in China is in local currency, and the risk of transmission is small. Also, the biggest lending of China is realised via the traditional

banking loans, and not via the market of bonds. In reality, what will happen is the loss of a lot of money in China. Something which we have learnt from crisis of 2008 is that the financial system of the USA was so much powerful as weak. There was high leverage in the banks and in the actuarial companies as AIG. the complete opposite is in effect in China, where the only that is of importance is the will of state to offer support. "From the moment where a bank or an enterprise faces danger, the government will dash to help them. The problem is that China ends up throwing money in something worthless, instead of investing in development. Increase of debt and the deceleration of growth in China has also cut the appetite for the American government bonds. For years now, the country has been placing its surpluses in the safety of USA debt. Now that these surpluses are not so big, China decreases her exposure to the government bonds.

5. PROPOSAL EMPIRICAL RESEARCH

Our main question will be if USA economy can handle a deflation import. Until now most, of the countries have been fighting to export deflation. FED, ECB and Bank of Japan were trying to export deflation to other countries by quantitative easing. US QE was a useful policy against the risk of global deflation. Since 2015 there is a divergence of central banks policies. For example FED abandon QE and rise the interest rates for first time after the crisis. No one can be sure about what can be done in the future about deflation. The bet will be whether the USA economy is strong enough to import deflation by a continuous upward dollar. So ,what we have to investigate is the reaction of emerging countries exchange currency rates, in an appreciation of dollar.

So through this investigation ,we will gather data (interest exchange rates) from the USA, Europe and Japan economies for at least fifteen years. Our data will be compared with the same data for some of the emerging countries for example China, Brazil and India. We suppose that this period is a sufficient period to understand the tension of the main economic sizes. Here we have taken weekly data since the beginning of 2000 (almost 850 observations). The econometric technique which we will use is the Least Squares (NLS and ARMA). Our data will be in weekly frequency cause to slightest difference in daily data. Additionally, we will estimate the weekly

percentage differences. Then, we will estimate the square of this differences for each currency as an approximation of volatility. After that, we will check out if there is any structural break in volatility. Lastly, we will create Granger causality tests among volatilities series.

In our model the independent variable will be the exchange rate of the developed country for our model dollar and the dependent variable will be the exchange rate of the emerging country(Brazilian real 'R$', Chinese yuan '¥' and Indian rupee 'Rs').

$$dS(R\$/\$) = (S(R\$/\$) - S(R\$/\$)(-1)\ ) - 1$$

$$dS(¥/\$) = (S(¥/\$) - S(¥/\$)(-1)\ ) - 1$$

$$dS(Rs/\$) = (S(Rs/\$) - S(Rs/\$)(-1)\ ) - 1$$

$$dS(€/\$) = (S(€/\$) - S(€/\$)(-1)\ ) - 1$$

$$dS(yen/\$) = (S(yen/\$) - S(yen/\$)(-1)\ ) - 1$$

In order to smooth the volatility we estimate the squares of the difference percentages

$$vardS(R\$/\$) = (dS(R\$/\$))^2(b_1)$$

$$vardS(¥/\$) = (dS(¥/\$))^2\ (b_2)$$

$$vardS(Rs/\$) = (dS(Rs/\$))^2(b_3)$$

$$vardS(€/\$) = (dS(€/\$))^2(b_4)$$

$$vardS(yen/\$) = (dS(yen/\$))^2(b_5)$$

after that we check for breakpoint in volatility with Bai - Perron tests

c = coefficient

Maybe some of the many problems that we will be faced with are the interpretation of the central banks, the economic and political stability of each country or the expectations of the market for each country. Another major problem will be that indices are not always a good indicator of the real economy and we cannot ignore

people's happiness and level of prosperity. Furthermore, we do not know how rational are the expectations of investors.

In this section, we will examine the volatility among the currencies exchange rates from developed and emerging countries. The model that we are likely to use is the following : $Y = a + b_1Y_{t-1} + b_2Y_{t-2} + ...+b_pY_{t-p} + e_t$

First of all, we have to make some hypotheses $E(e_t) = 0$

$Ho = b_1 = b_2 = b_i = 0$

H_1 = at least one $b_i \neq 0$

we will reject the null hypothesis when is below 5%

For this analysis we will use programs such as E-views

6. EMPIRICAL ANALYSIS

Before that we will take a statistic approach at the elements of our data

As we can see from appendix 1 graph 1 the mean for the Brazilian real to $ exchange rate is 2.31 and the median is 2.18. As far as the maximum rate is concerned, is 4.12 and the minimum is 1.55. The standard deviation of this pair of currencies is 0.57

After estimating the difference percentage for R$ to $, we observe that there is no large fluctuation because the standard deviation is now around 0.02 and the maximum upward price is 0.12 and downward is -0.08 (appendix 1 graph 2)

Then in order to make our estimations more smooth we estimate the square of this percentage in order to receive an approximation of volatility.

We did the same estimation for some other pairs of currencies such as ¥ to $, rupee to $, € to $. For Chinese ¥ the mean is 7.30, the median 7.20, the standard deviation 0.87, maximum rate 8.28 and minimum rate 6.04. The most interest is that

until June 2006 the exchange rate was above 8.00 what's why we have almost 300 observations above this level. In appendix 1 graph 8 we can easily observe when China abandon dollar peg and ¥ start to be appreciated in 2005 as well as the recent large depreciation of ¥ in 2015.

For Indian rupee (Rs) our results are : mean 53.09, median 51.45, standard deviation 7.81, maximum value is 68.72 and the minimum value is 39.35. We observe that the biggest standard deviation among this currencies of emerging countries is in India rupee (7.81). (graph 11)

So then, we check the exchange currency rate between € and $ as well as yen and $ which are considered to be currencies of developed countries. Results for € : mean is 1.22, median 1.27 standard deviation 0.17, max 1.59, min 0.83. We notice that this pair of currencies has lower standard deviation in comparison with the emerging countries. We also point out that the largest fluctuation for $S(\$/€)$ is during 2008 until 2009. As far as the yen is concerned, the mean is 105.83 and the smallest rate was 134.83. On the other hand, the biggest rate was 75.76.

After that, we check if there is any breakpoint in volatility as we can see in appendix 1(Equation 1 - 5)

1. $vardS(R\$/\$)$ (b_1) no breakpoints
2. $vardS(¥/\$)$ (b_2) no breakpoints
3. $vardS(Rs/\$)$ (b_3) one breakpoint 2/5/2008
4. $vardS(€/\$)$ (b_4) three breakpoints 14/1/2005, 8/8/2008, 28/1/2011
5. $vardS(yen/\$)$ (b_5) one breakpoint 13/8/2010

Lastly, we will test if there is any causality in this breakpoint with Granger causality test only when we have breakpoint. Granger causality answer the question whether X causes Y is to see how much of the current Y can be explained by past values of Y and then to see whether adding lagged values of X can improve the explanation. Y is said to be Granger-caused by X if X helps in the prediction of Y, or equivalently if the coefficients on the lagged X's are statistically significant. Note that two-way causation is frequently the case; X Granger causes Y and Y Granger causes X. It is important to note that the statement "X Granger causes Y" does not imply that Y is the effect or the result of X. Granger causality measures precedence

and information content but does not by itself indicate causality in the more common use of the term.

In the last part of appendix 1(graphs 26 to 30), we point to some graphs for Chinese yuan to Japanese yen currency exchange rates if someone want to see the correlation between two Asian currencies.

7. SUMMARY AND FUTURE WORK

To sum up, there is no right answer about how to react in a currency war. There has been much debate in the literature concerning currency wars. Nonetheless, we can suppose that the recent currency war influenced to a great degree the developed countries in contrast with the emerging countries.

In this thesis we tried to find the most accurate answer to this interesting topic. Moreover, we found the correlation among the factors that drive to currency wars. The most fascinating part of this thesis was the examination of currency exchange rates of different countries, neither developed nor developing, in accordance with a strong currency, for our investigation US dollar. Lastly, quite interest was the Granger causality test which shows according to lags we choose if one variable is the cause for a another variable . For sure, you cannot explain the currency exchange rates only by comparing these rates against each other, you have to take into account more factors such as the deficits or the surpluses of a country, the inventories of foreign currency or the debt.

However, cause to luck of time we could not estimate others factors which are maybe responsible for the wild fluctuation in currency exchange rates. For example we did not take into account the GDP of a country or the current account. Moreover, we could use another method for estimation such as an ARCH and GARCH model.

Maybe our model is not enough to predict precisely the fluctuations in currency exchange rates. Despite that, it helped us to understand that emerging countries currency exchange rates are more flexible in currency wars.

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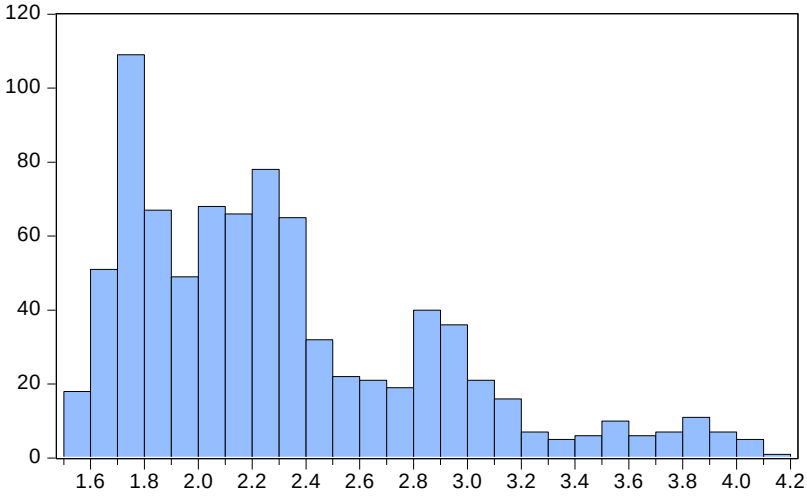
Appendix 1

8. Graphs and equations of the empirical session

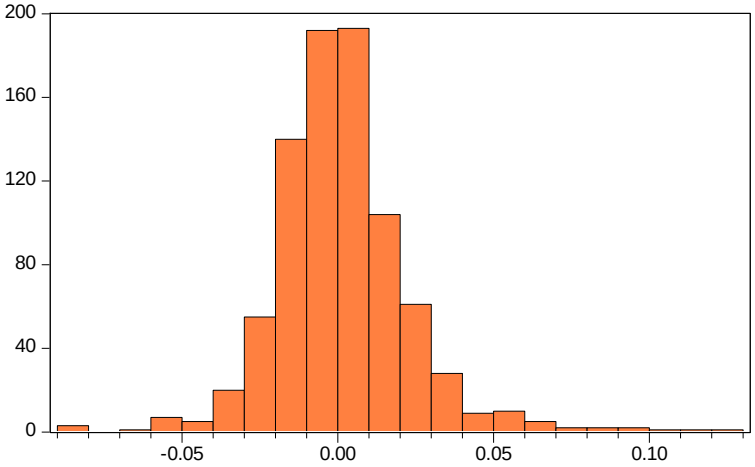
BRAZILIAN REAL TO USD HISTOGRAM AND STATS GRAPH 1



Series: BRAZILIAN_REAL_TO_US_$__
Sample 12/31/1999 2/19/2016
Observations 843

Mean	2.310311
Median	2.184500
Maximum	4.122900
Minimum	1.554300
Std. Dev.	0.570094
Skewness	1.036406
Kurtosis	3.537692
Jarque-Bera	161.0714
Probability	0.000000

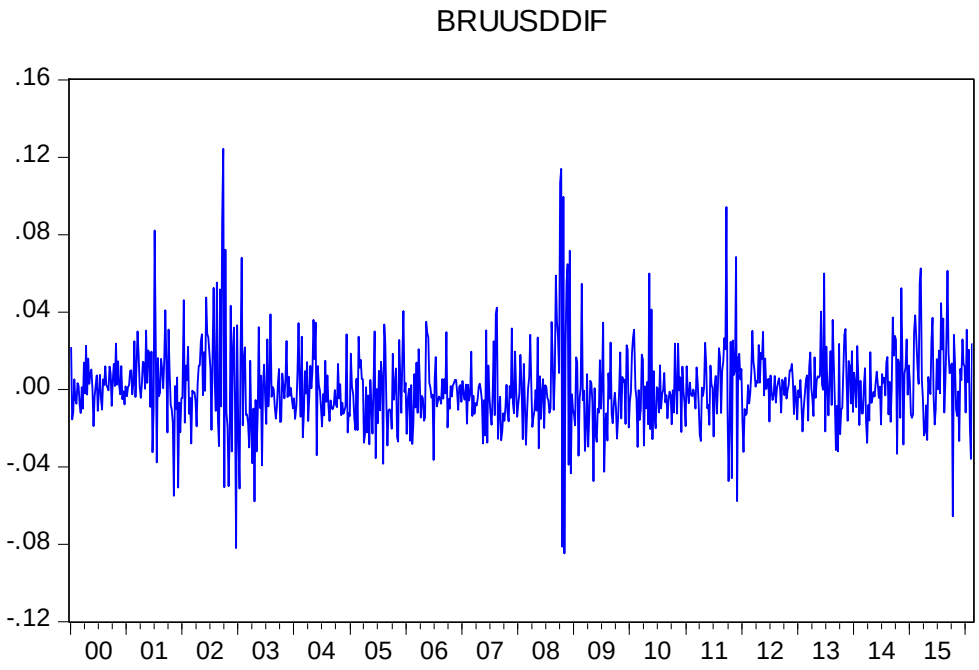
BRAZILIAN REAL TO USD DIFFERENCE PERCENTAGE HISTOGRAM AND STATS GRAPH 2



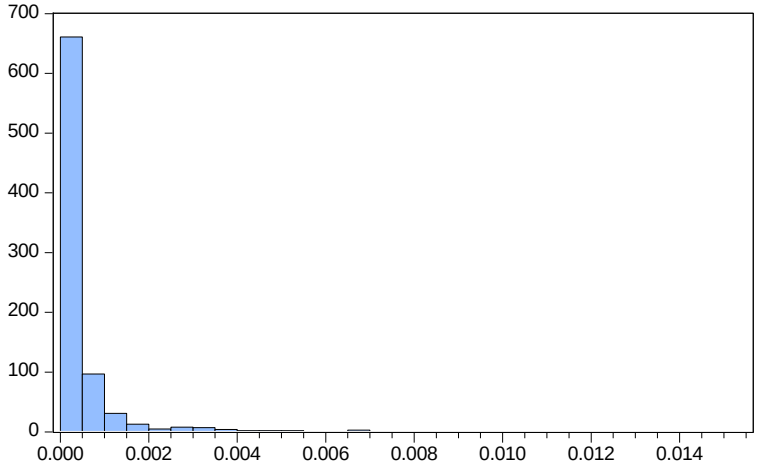
Series: BRUUSDDIF
Sample 12/31/1999 2/19/2016
Observations 842

Mean	0.001204
Median	-0.000184
Maximum	0.124413
Minimum	-0.084776
Std. Dev.	0.021724
Skewness	0.878632
Kurtosis	7.587656
Jarque-Bera	846.7211
Probability	0.000000

BRAZILIAN REAL TO USD DIFFERENCE LINE GRAPH 3



BRAZILIAN REAL TO USD SQUARE OF PERCENTAGE DIFFERENCE GRAPH 4



Series: BRUUSDDIFVAR
Sample 12/31/1999 2/19/2016
Observations 842

Mean	0.000473
Median	0.000124
Maximum	0.015479
Minimum	0.000000
Std. Dev.	0.001229
Skewness	6.632757
Kurtosis	59.97725
Jarque-Bera	120068.5
Probability	0.000000

BRAZIL REAL TO USD BREAKPOINT EQUATION 1

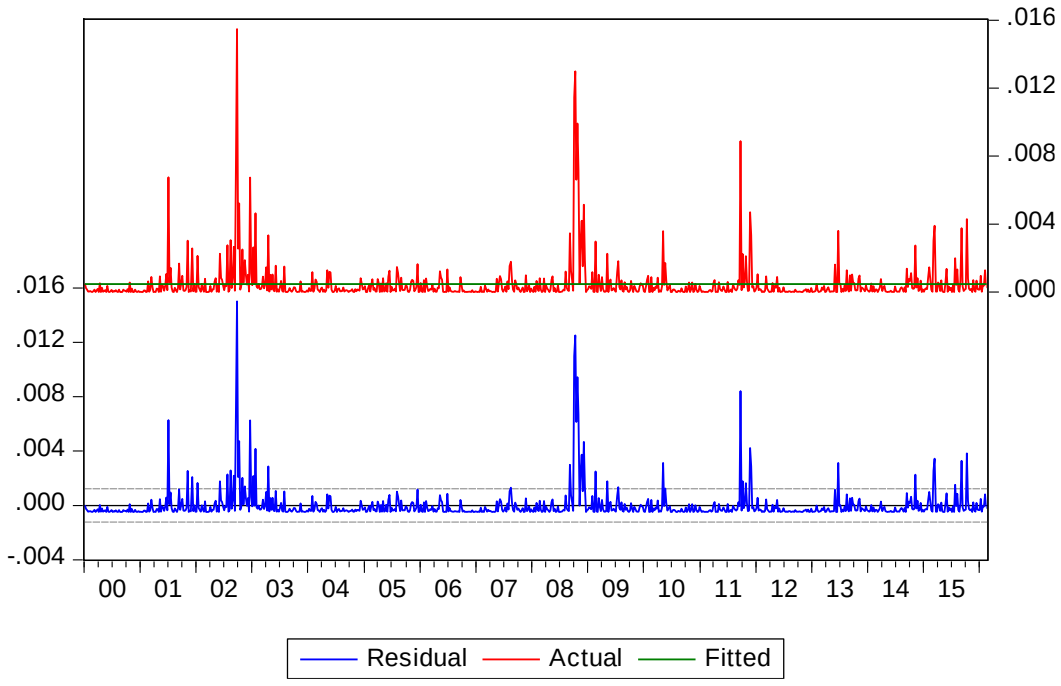
Dependent Variable: BRUUSDDIFVAR
Method: Least Squares with Breaks
Date: 02/29/16 Time: 11:10
Sample (adjusted): 1/07/2000 2/19/2016
Included observations: 842 after adjustments
Break type: Bai-Perron tests of 1 to M globally determined breaks
Break selection: Unweighted max-F (UDmax), Trimming 0.15, Max. breaks

5, Sig. level 0.05
No breakpoints selected
HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth)
Allow heterogeneous error distributions across breaks

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000473	7.98E-05	5.923021	0.0000

R-squared	0.000000	Mean dependent var	0.000473
Adjusted R-squared	0.000000	S.D. dependent var	0.001229
S.E. of regression	0.001229	Akaike info criterion	-10.56331
Sum squared resid	0.001271	Schwarz criterion	-10.55768
Log likelihood	4448.153	Hannan-Quinn criter.	-10.56115
Durbin-Watson stat	1.140309		

RESIDUAL VS ACTUAL BR TO USD GRAPH 5



BRAZILIAN REAL TO USD BREAKPOINT SPECIFICATION 1

Breakpoint Specification
Description of the breakpoint specification used in estimation
Equation: BRAZILREALUSDDIFVARBREAK
Date: 02/29/16 Time: 11:14

Summary

Estimated number of breaks: 0

Method: Bai-Perron tests of 1 to M globally determined breaks
Maximum number of breaks: 5

Current breakpoint calculations:

Multiple breakpoint tests
Bai-Perron tests of 1 to M globally determined breaks
Date: 02/29/16 Time: 11:14
Sample: 1/07/2000 2/19/2016
Included observations: 842
Breakpoint variables: C
Break test options: Trimming 0.15, Max. breaks 5, Sig. level 0.05
Test statistics employ HAC covariances (Quadratic-Spectral kernel, Andrews bandwidth)
Allow heterogeneous error distributions across breaks

Sequential F-statistic determined breaks:	0
Significant F-statistic largest breaks:	0
UDmax determined breaks:	0
WDmax determined breaks:	0

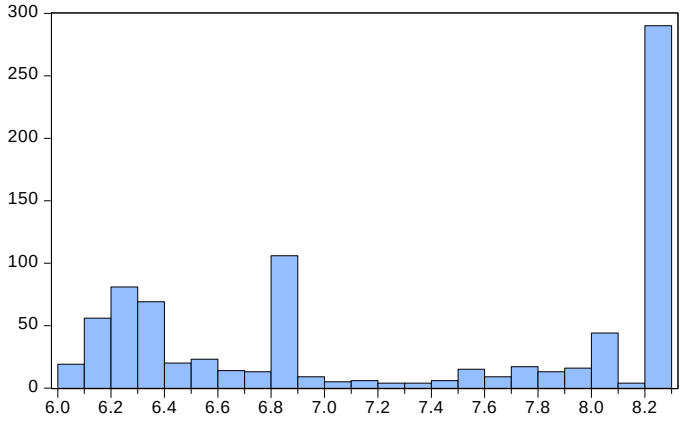
Breaks	F-statistic	Scaled F-statistic	Weighted F-statistic	Critical Value
1	1.585456	1.585456	1.585456	8.58
2	0.907437	0.907437	1.078367	7.22
3	3.712921	3.712921	5.345111	5.96
4	2.118716	2.118716	3.643003	4.99
5	2.438069	2.438069	5.350034	3.91

UDMax statistic	3.712921	UDMax critical value**	8.88
WDMax statistic	5.350034	WDMax critical value**	9.91

* Significant at the 0.05 level.
** Bai-Perron (Econometric Journal, 2003) critical values.

Estimated break dates:
1: 6/13/2003
2: 1/25/2008, 6/25/2010
3: 6/13/2003, 2/01/2008, 7/02/2010
4: 6/07/2002, 11/05/2004, 2/01/2008, 7/02/2010
5: 6/07/2002, 11/05/2004, 1/25/2008, 6/25/2010, 5/31/2013

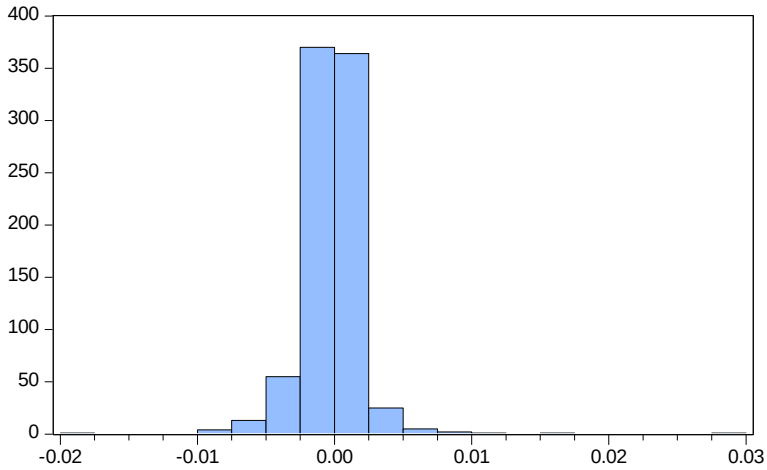
YUAN TO USD HISTOGRAM AND STATS GRAPH 6



Series: CHINESE_YUAN_TO_US_$___E
Sample 12/31/1999 2/19/2016
Observations 843

Mean	7.309774
Median	7.205000
Maximum	8.279900
Minimum	6.047000
Std. Dev.	0.871764
Skewness	-0.064322
Kurtosis	1.272462
Jarque-Bera	105.4079
Probability	0.000000

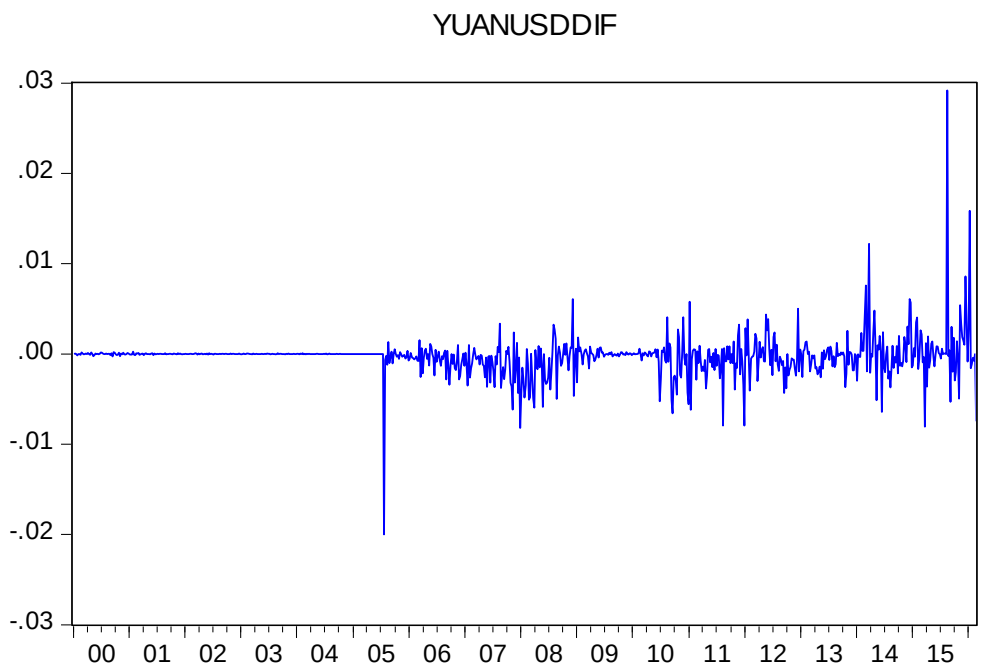
YUAN TO USD DIFFERENCE PERCENTAGE HISTOGRAM AND STATS GRAPH 7



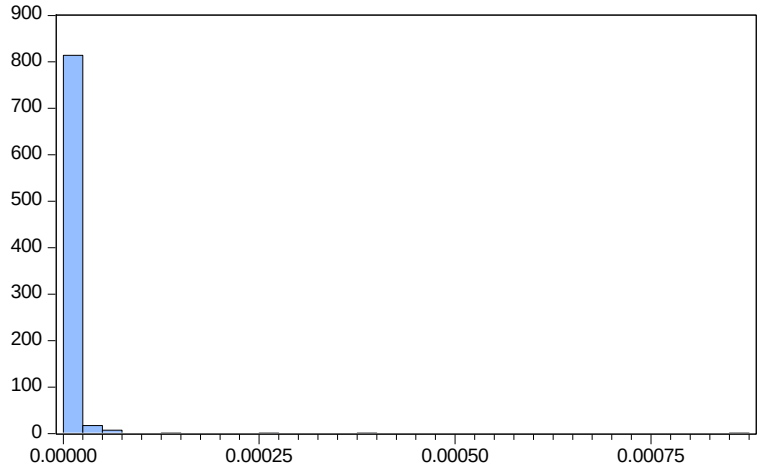
Series: YUANUSDDIF
Sample 12/31/1999 2/19/2016
Observations 842

Mean	-0.000281
Median	-1.21e-05
Maximum	0.029184
Minimum	-0.019984
Std. Dev.	0.002195
Skewness	2.439665
Kurtosis	54.15744
Jarque-Bera	92651.26
Probability	0.000000

YUAN TO USD DIFFERENCE PERCENTAGE LINE GRAPH 8



YUAN TO USD SQUARE OF DIFFERENCE PERCENTAGE GRAPH 9



Series: YUANUSDDIFVAR
Sample 12/31/1999 2/19/2016
Observations 842

Mean	4.89e-06
Median	7.73e-08
Maximum	0.000852
Minimum	0.000000
Std. Dev.	3.47e-05
Skewness	19.56196
Kurtosis	444.2436
Jarque-Bera	6884284.
Probability	0.000000

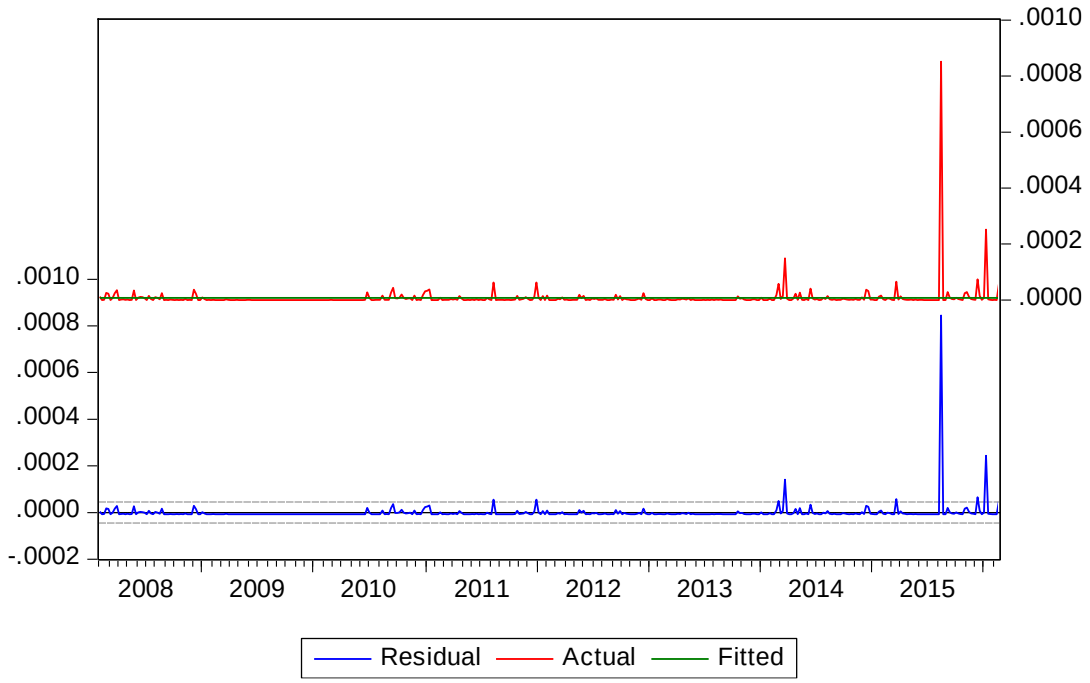
YUAN TO USD BREAKPOINT EQUATION 2

Dependent Variable: YUANUSDDIFVAR
Method: Least Squares
Date: 02/29/16 Time: 15:44
Sample (adjusted): 2/01/2008 2/19/2016
Included observations: 421 after adjustments
HAC standard errors & covariance (Prewhitening with lags = 1, Quadratic -Spectral kernel, Andrews bandwidth = 0.0685)

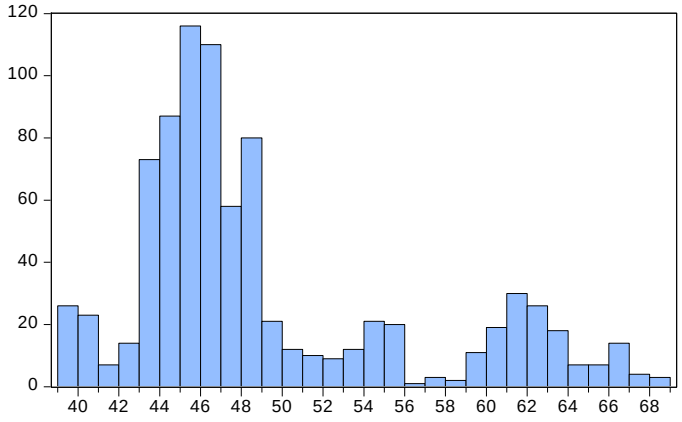
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.80E-06	2.17E-06	3.590879	0.0004

R-squared	0.000000	Mean dependent var	7.80E-06
Adjusted R-squared	0.000000	S.D. dependent var	4.47E-05
S.E. of regression	4.47E-05	Akaike info criterion	-17.19003
Sum squared resid	8.40E-07	Schwarz criterion	-17.18043
Log likelihood	3619.501	Hannan-Quinn criter.	-17.18624
Durbin-Watson stat	2.004071		

RESIDUAL VS ACTUAL YUAN TO USD GRAPH 10



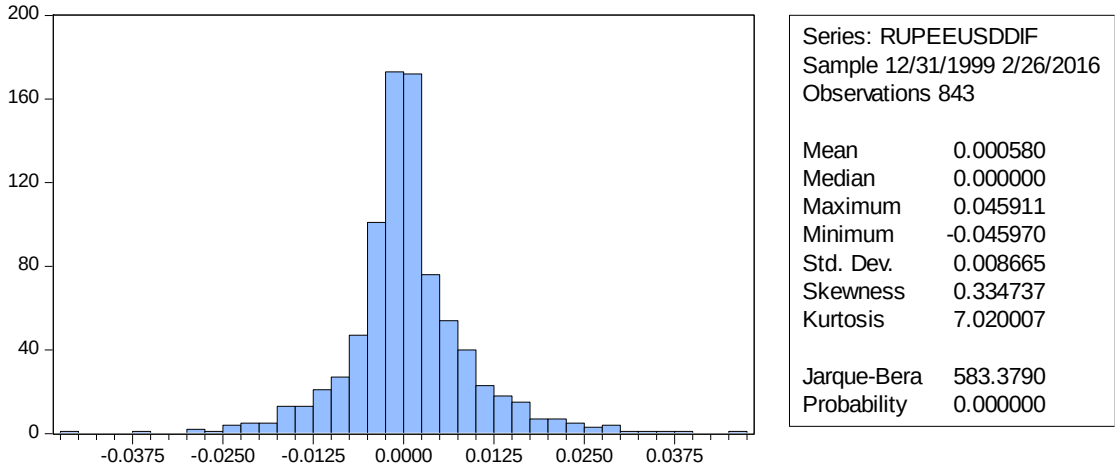
INDIAN RUPEE TO USD HISTOGRAM AND STATS GRAPH 11



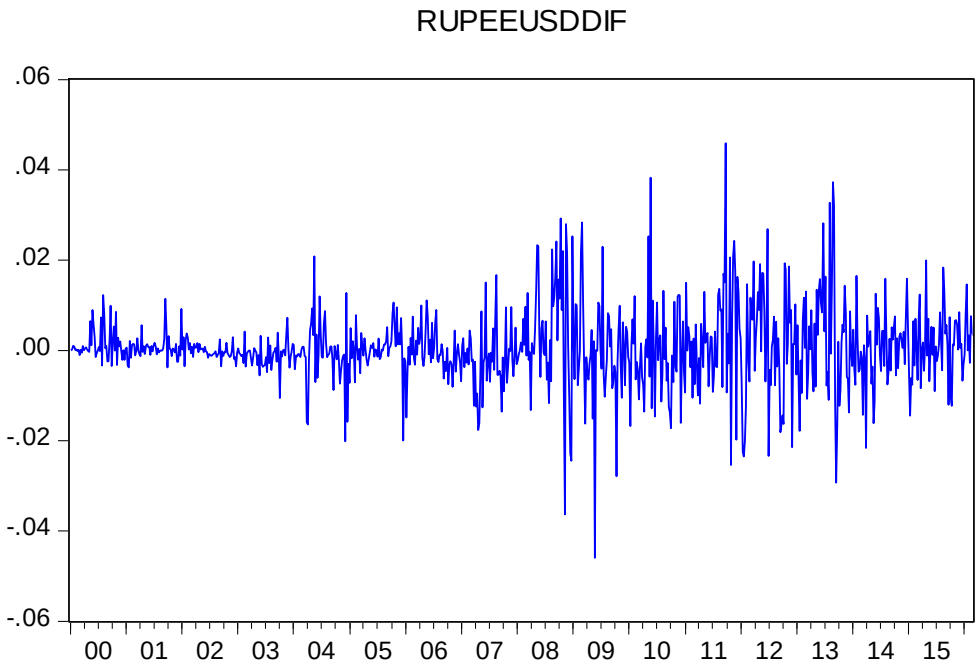
Series: INDIAN_RUPEE_TO_US_$__WM
Sample 12/31/1999 2/26/2016
Observations 844

Mean	49.21343
Median	46.67800
Maximum	68.72500
Minimum	39.30000
Std. Dev.	6.948100
Skewness	1.121851
Kurtosis	3.202512
Jarque-Bera	178.4781
Probability	0.000000

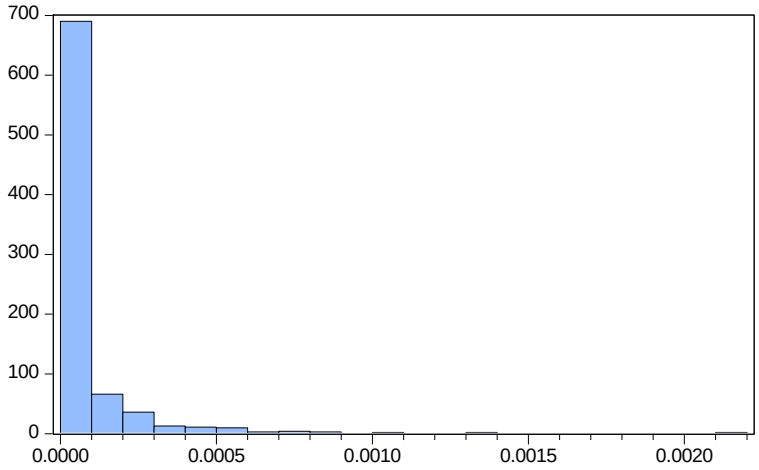
INDIAN RUPEE TO USD DIFFERENCE PERCENTAGE HISTOGRAM AND STATS GRAPH 12



INDIAN RUPEE TO USD DIFFERENCE PERCENTAGE LINE GRAPH 13



INDIAN RUPEE TO USD SQUARE OF DIFFERENCE PERCENTAGE GRAPH 14



Series: RUPEEUSDDIFVAR
Sample 12/31/1999 2/26/2016
Observations 843

Mean	7.53e-05
Median	1.11e-05
Maximum	0.002113
Minimum	0.000000
Std. Dev.	0.000186
Skewness	5.715807
Kurtosis	48.33097
Jarque-Bera	76768.45
Probability	0.000000

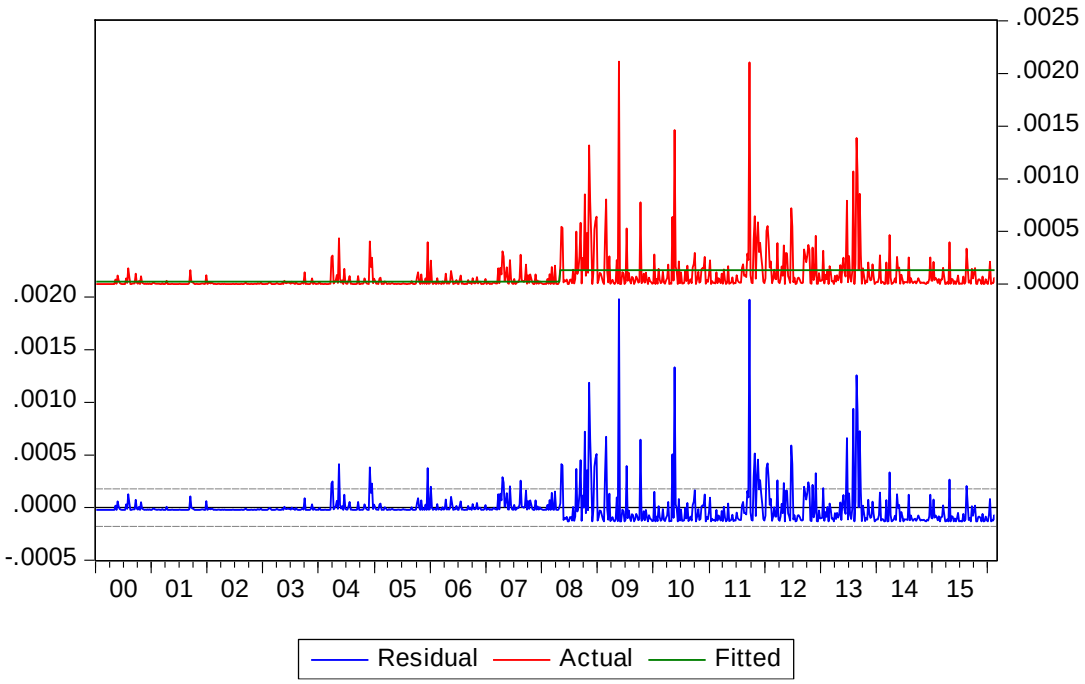
RUPEE TO USD BREAKPOINT EQUATION 3

Dependent Variable: RUPEEUSDDIFVAR
Method: Least Squares with Breaks
Date: 02/29/16 Time: 14:14
Sample (adjusted): 1/07/2000 2/26/2016
Included observations: 843 after adjustments
Break type: Bai-Perron tests of 1 to M globally determined breaks
Break selection: Unweighted max-F (UDmax), Trimming 0.15, Max. breaks 5, Sig. level 0.05
Breaks: 5/02/2008
HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth)
Allow heterogeneous error distributions across breaks

Variable	Coefficient	Std. Error	t-Statistic	Prob.
1/07/2000 - 4/25/2008 -- 434 obs				
C	2.25E-05	3.45E-06	6.514140	0.0000
5/02/2008 - 2/26/2016 -- 409 obs				
C	0.000131	1.46E-05	8.982885	0.0000

R-squared	0.085971	Mean dependent var	7.53E-05
Adjusted R-squared	0.084884	S.D. dependent var	0.000186
S.E. of regression	0.000178	Akaike info criterion	-14.43089
Sum squared resid	2.65E-05	Schwarz criterion	-14.41965
Log likelihood	6084.621	Hannan-Quinn criter.	-14.42659
F-statistic	79.10186	Durbin-Watson stat	1.682369
Prob(F-statistic)	0.000000		

RESIDUAL VS ACTUAL RUPEE TO USD GRAPH 15



INDIAN RUPEE TO USD BREAKPOINT SPECIFICATION 2

Breakpoint Specification
Description of the breakpoint specification used in estimation
Equation: RUPEEUSDDIFVARBREAK
Date: 04/21/16 Time: 13:01

Summary

Estimated number of breaks: 1
Method: Bai-Perron tests of 1 to M globally determined breaks
Maximum number of breaks: 5
Breaks: 5/02/2008

Current breakpoint calculations:

Multiple breakpoint tests
Bai-Perron tests of 1 to M globally determined breaks
Date: 04/21/16 Time: 13:01
Sample: 1/07/2000 2/26/2016
Included observations: 843
Breakpoint variables: C
Break test options: Trimming 0.15, Max. breaks 5, Sig. level 0.05
Test statistics employ HAC covariances (Quadratic-Spectral kernel, Andrews bandwidth)
Allow heterogeneous error distributions across breaks

Sequential F-statistic determined breaks: 5

Significant F-statistic largest breaks:	5
UDmax determined breaks:	1
WDmax determined breaks:	5

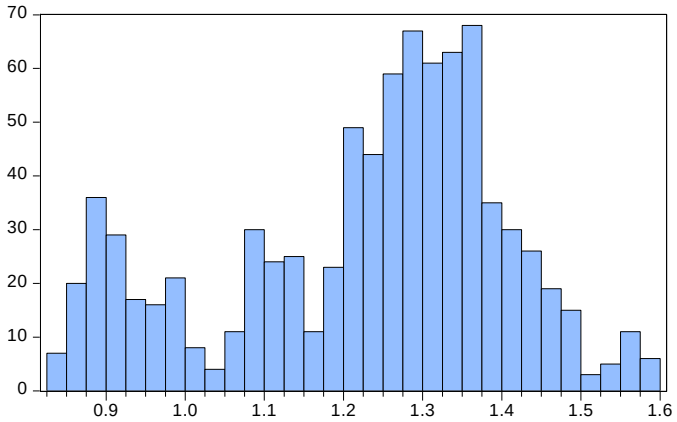
Breaks	F-statistic	Scaled F-statistic	Weighted F-statistic	Critical Value
1 *	52.50880	52.50880	52.50880	8.58
2 *	32.89777	32.89777	39.09458	7.22
3 *	22.81970	22.81970	32.85118	5.96
4 *	31.92956	31.92956	54.90093	4.99
5 *	25.42981	25.42981	55.80249	3.91

UDMax statistic*	52.50880	UDMax critical value**	8.88
WDMax statistic*	55.80249	WDMax critical value**	9.91

* Significant at the 0.05 level.
** Bai-Perron (Econometric Journal, 2003) critical values.

Estimated break dates:
1: 5/02/2008
2: 5/02/2008, 9/27/2013
3: 5/02/2008, 4/29/2011, 9/27/2013
4: 3/26/2004, 5/02/2008, 4/29/2011, 9/27/2013
5: 7/04/2003, 12/02/2005, 5/02/2008, 4/29/2011, 9/27/2013

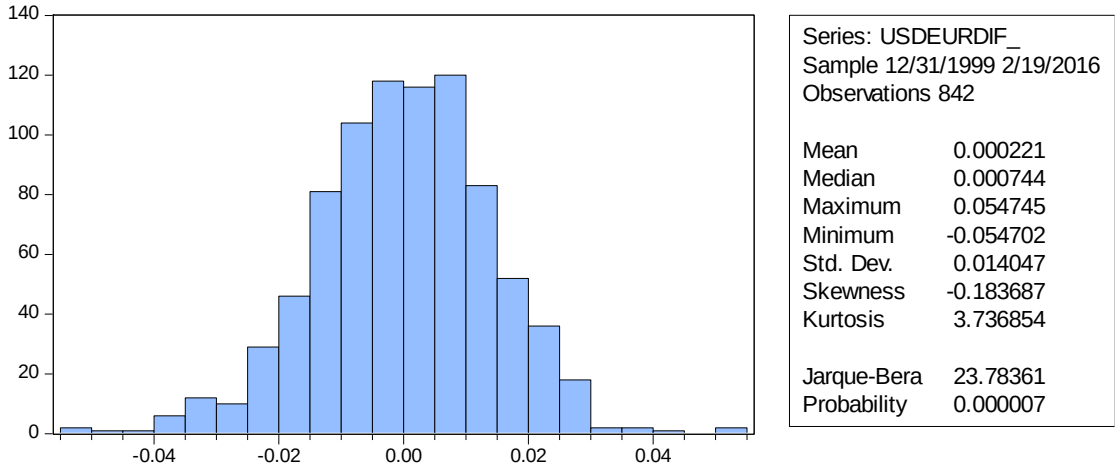
USDEUR HISTOGRAM AND STATS GRAPH 16



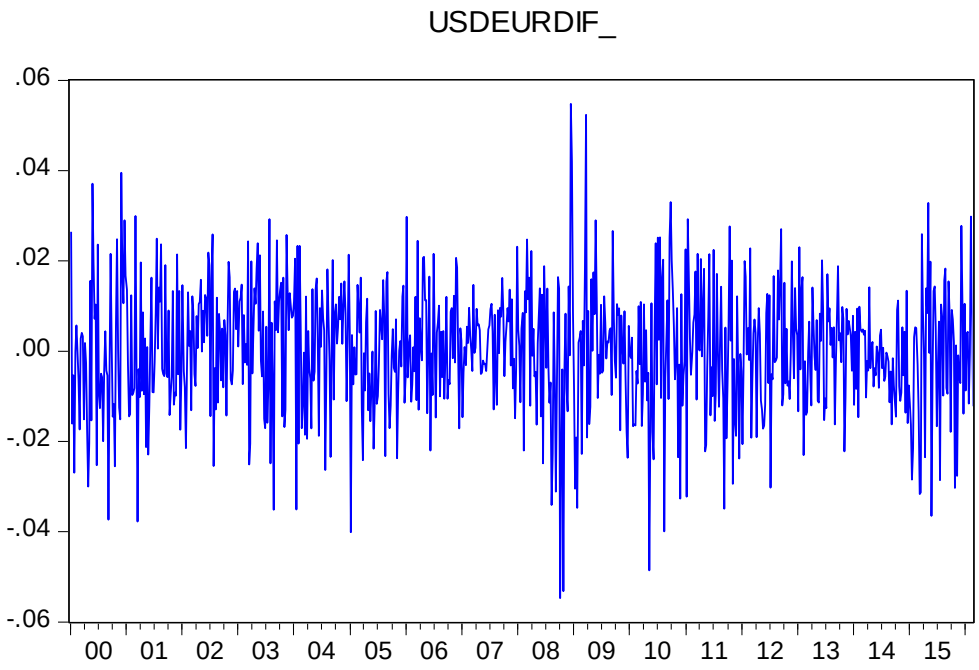
Series: US_$_TO_EURO__WMR_DS____
Sample 12/31/1999 2/19/2016
Observations 843

Mean	1.226792
Median	1.270550
Maximum	1.590950
Minimum	0.837600
Std. Dev.	0.179545
Skewness	-0.544290
Kurtosis	2.466730
Jarque-Bera	51.61208
Probability	0.000000

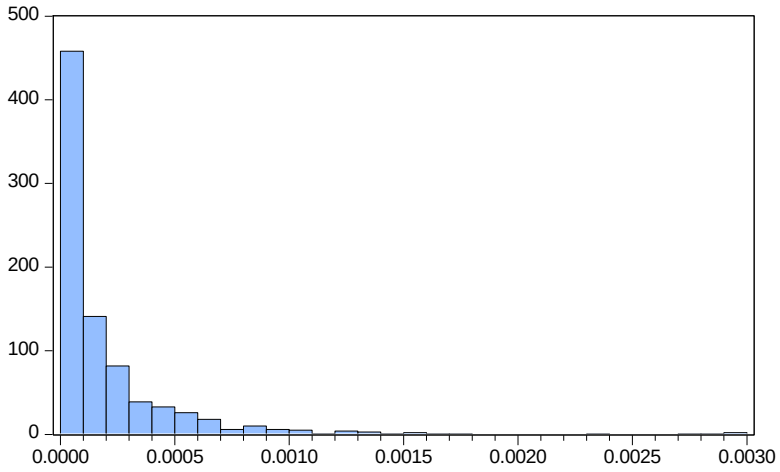
USDEUR DIFFERENCE PERCENTAGE HISTOGRAM AND STATS GRAPH 17



USDEUR DIFFERENCE PERCENTAGE LINE GRAPH 18



USDEUR SQUARE OF DIFFERENCE PERCENTAGE GRAPH 19



Series: USDEURDIFVAR
Sample 12/31/1999 2/19/2016
Observations 842

Mean	0.000197
Median	8.42e-05
Maximum	0.002997
Minimum	6.35e-09
Std. Dev.	0.000326
Skewness	4.239085
Kurtosis	28.92986
Jarque-Bera	26110.32
Probability	0.000000

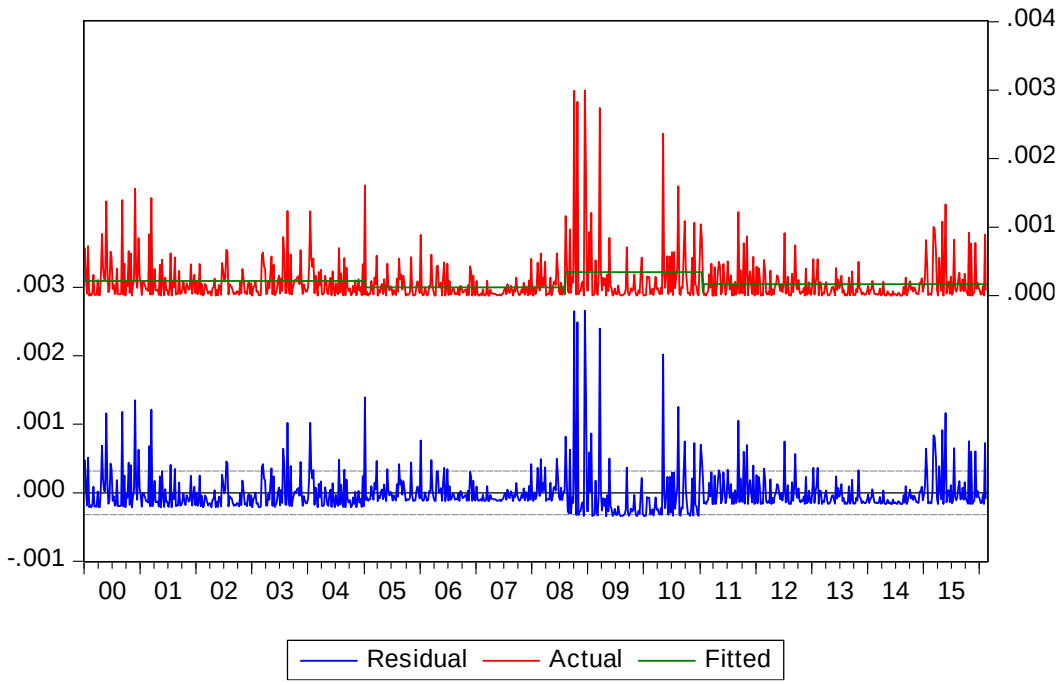
USD TO EUR BREAKPOINT EQUATION 4

Dependent Variable: USDEURDIFVAR
Method: Least Squares with Breaks
Date: 02/27/16 Time: 15:56
Sample (adjusted): 1/07/2000 2/19/2016
Included observations: 842 after adjustments
Break type: Bai-Perron tests of 1 to M globally determined breaks
Break selection: Unweighted max-F (UDmax), Trimming 0.15, Max. breaks 5, Sig. level 0.05
Breaks: 1/14/2005, 8/08/2008, 1/28/2011
HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth)
Allow heterogeneous error distributions across breaks

Variable	Coefficient	Std. Error	t-Statistic	Prob.
1/07/2000 - 1/07/2005 -- 262 obs				
C	0.000213	1.73E-05	12.30955	0.0000
1/14/2005 - 8/01/2008 -- 186 obs				
C	0.000120	1.15E-05	10.49649	0.0000
8/08/2008 - 1/21/2011 -- 129 obs				
C	0.000342	5.44E-05	6.281193	0.0000
1/28/2011 - 2/19/2016 -- 265 obs				
C	0.000166	1.46E-05	11.34588	0.0000

R-squared	0.045373	Mean dependent var	0.000197
Adjusted R-squared	0.041955	S.D. dependent var	0.000326
S.E. of regression	0.000319	Akaike info criterion	-13.25976
Sum squared resid	8.51E-05	Schwarz criterion	-13.23726
Log likelihood	5586.358	Hannan-Quinn criter.	-13.25114
F-statistic	13.27650	Durbin-Watson stat	1.926867
Prob(F-statistic)	0.000000		

RESIDUAL VS ACTUAL EUR TO USD GRAPH 20



EUR TO USD BREAKPOINT SPECIFICATION 4

Description of the breakpoint specification used in estimation
Equation: USDEURDIFVARBREAK
Date: 02/29/16 Time: 11:20

Summary

Estimated number of breaks: 3
Method: Bai-Perron tests of 1 to M globally determined breaks
Maximum number of breaks: 5
Breaks: 1/14/2005, 8/08/2008, 1/28/2011

Current breakpoint calculations:

Multiple breakpoint tests
Bai-Perron tests of 1 to M globally determined breaks
Date: 02/29/16 Time: 11:20
Sample: 1/07/2000 2/19/2016
Included observations: 842
Breakpoint variables: C
Break test options: Trimming 0.15, Max. breaks 5, Sig. level 0.05
Test statistics employ HAC covariances (Quadratic-Spectral kernel, Andrews bandwidth)
Allow heterogeneous error distributions across breaks

Sequential F-statistic determined breaks:	0
Significant F-statistic largest breaks:	5

UDmax determined breaks: 3
WDmax determined breaks: 3

Breaks	F-statistic	Scaled F-statistic	Weighted F-statistic	Critical Value
1	7.188323	7.188323	7.188323	8.58
2	4.872642	4.872642	5.790480	7.22
3 *	10.86734	10.86734	15.64460	5.96
4 *	8.194960	8.194960	14.09073	4.99
5 *	6.708190	6.708190	14.72027	3.91

UDMax statistic*	10.86734	UDMax critical value**	8.88
WDMax statistic*	15.64460	WDMax critical value**	9.91

* Significant at the 0.05 level.
** Bai-Perron (Econometric Journal, 2003) critical values.

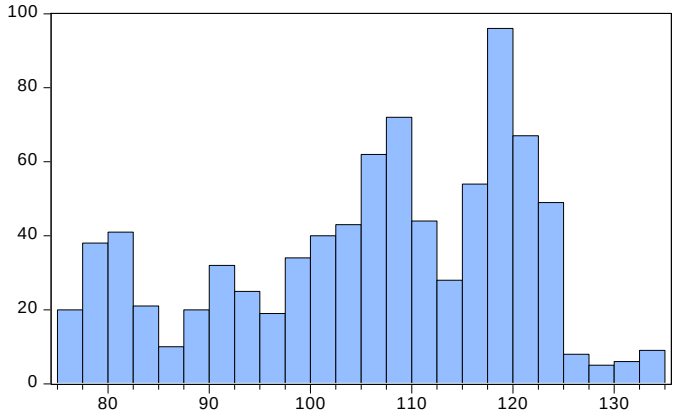
Estimated break dates:
1: 3/09/2012
2: 8/08/2008, 1/28/2011
3: 1/14/2005, 8/08/2008, 1/28/2011
4: 8/02/2002, 1/14/2005, 8/08/2008, 1/28/2011
5: 8/02/2002, 1/14/2005, 8/08/2008, 1/28/2011, 7/19/2013

GRANGER TEST RUPEEUSD USDEUR 1

Pairwise Granger Causality Tests
Date: 02/29/16 Time: 16:37
Sample: 2/01/2008 2/26/2016
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
RUPEEUSDDIFVAR does not Granger Cause USDEURDIFVAR	421	0.14879	0.8618
USDEURDIFVAR does not Granger Cause RUPEEUSDDIFVAR		7.82127	0.0005

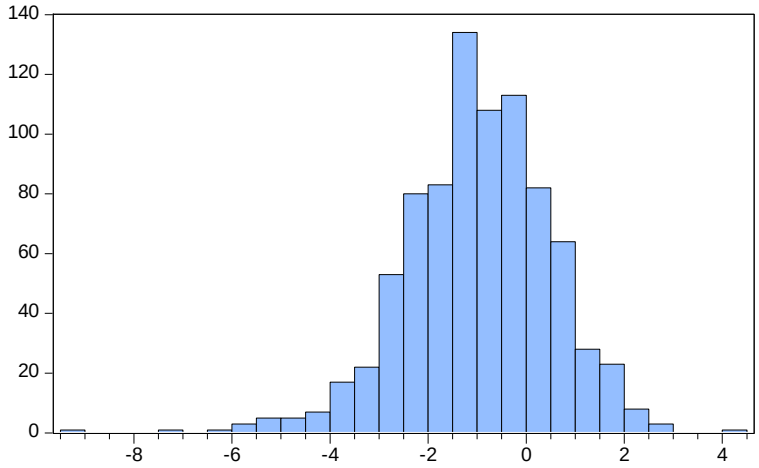
YENUSD HISTOGRAM AND STATS GRAPH 21



Series: JAPANESE_YEN_TO_US_$__WM
Sample 12/31/1999 2/19/2016
Observations 843

Mean	105.8321
Median	108.0000
Maximum	134.8300
Minimum	75.76000
Std. Dev.	14.51057
Skewness	-0.473535
Kurtosis	2.217099
Jarque-Bera	53.03436
Probability	0.000000

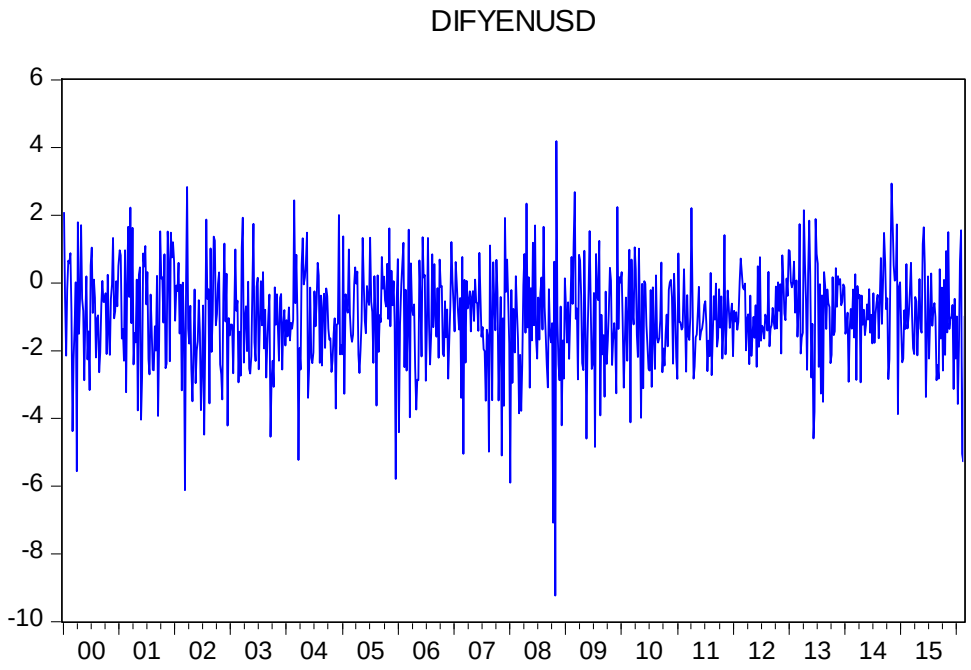
USDEUR DIFFERENCE PERCENTAGE HISTOGRAM AND STATS GRAPH 22



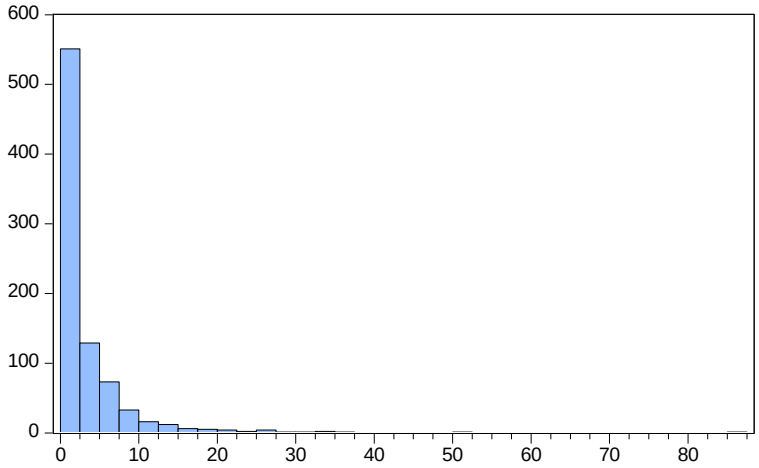
Series: DIFYENUSD
Sample 12/31/1999 2/19/2016
Observations 842

Mean	-0.987625
Median	-0.945000
Maximum	4.190000
Minimum	-9.230000
Std. Dev.	1.485361
Skewness	-0.495806
Kurtosis	4.595674
Jarque-Bera	123.8257
Probability	0.000000

YENUSD DIFFERENCE PERCENTAGE LINE GRAPH 23



YENUSD SQUARE OF DIFFERENCE PERCENTAGE GRAPH 24



Series: VARYENUSD
Sample 12/31/1999 2/19/2016
Observations 842

Mean	3.179081
Median	1.404225
Maximum	85.19290
Minimum	0.000000
Std. Dev.	5.701339
Skewness	5.969262
Kurtosis	64.06387
Jarque-Bera	135819.0
Probability	0.000000

YEN TO USD BREAKPOINT EQUATION 5

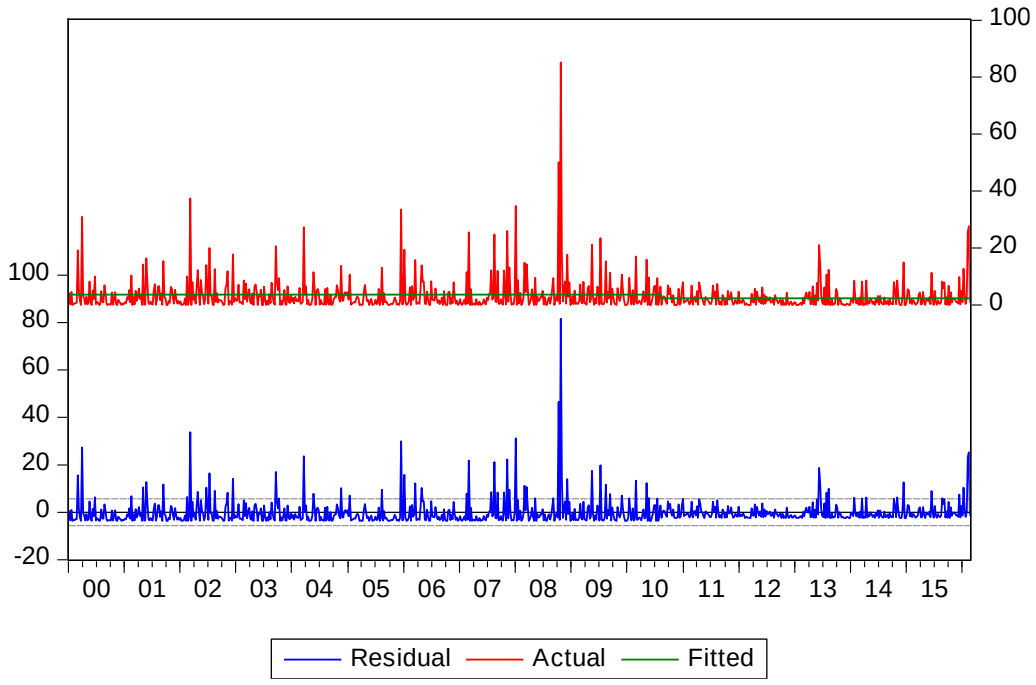
Dependent Variable: VARYENUSD
Method: Least Squares with Breaks
Date: 04/13/16 Time: 12:24
Sample (adjusted): 1/07/2000 2/19/2016
Included observations: 842 after adjustments
Break type: Bai-Perron tests of 1 to M globally determined breaks
Break selection: Sequential evaluation, Trimming 0.15, Max. breaks 5, Sig. level 0.05
Breaks: 8/13/2010
HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth)
Allow heterogeneous error distributions across breaks

Variable	Coefficient	Std. Error	t-Statistic	Prob.

1/07/2000 - 8/06/2010 -- 553 obs				
C	3.614873	0.271080	13.33509	0.0000
8/13/2010 - 2/19/2016 -- 289 obs				
C	2.345195	0.239658	9.785605	0.0000

R-squared	0.011193	Mean dependent var	3.179081
Adjusted R-squared	0.010016	S.D. dependent var	5.701339
S.E. of regression	5.672716	Akaike info criterion	6.311585
Sum squared resid	27030.95	Schwarz criterion	6.322834
Log likelihood	-2655.177	Hannan-Quinn criter.	6.315896
F-statistic	9.508585	Durbin-Watson stat	1.999990
Prob(F-statistic)	0.002112		

RESIDUAL VS ACTUAL YEN TO USD GRAPH 25



YEN TO USD BREAKPOINT SPECIFICATION 5

Breakpoint Specification
Description of the breakpoint specification used in estimation
Equation: YENUSDDIFVARBREAK
Date: 04/13/16 Time: 12:28

Summary
Estimated number of breaks: 1
Method: Bai-Perron tests of 1 to M globally determined breaks
Maximum number of breaks: 5
Breaks: 8/13/2010

Current breakpoint calculations:

Multiple breakpoint tests
Bai-Perron tests of 1 to M globally determined breaks
Date: 04/13/16 Time: 12:28
Sample: 1/07/2000 2/19/2016
Included observations: 842
Breakpoint variables: C
Break test options: Trimming 0.15, Max. breaks 5, Sig. level 0.05
Test statistics employ HAC covariances (Quadratic-Spectral kernel, Andrews bandwidth)
Allow heterogeneous error distributions across breaks

Sequential F-statistic determined breaks:	1
Significant F-statistic largest breaks:	5
UDmax determined breaks:	1
WDmax determined breaks:	1

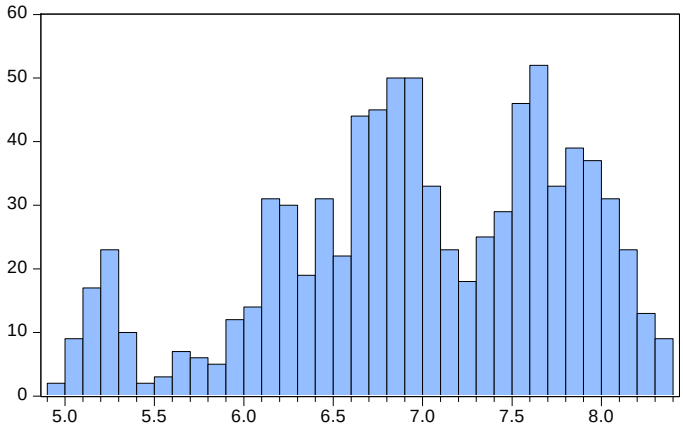
Breaks	F-statistic	Scaled F-statistic	Weighted F-statistic	Critical Value
1 *	12.31348	12.31348	12.31348	8.58
2	6.056994	6.056994	7.197924	7.22
3	4.929533	4.929533	7.096542	5.96
4 *	5.572324	5.572324	9.581271	4.99
5 *	4.446351	4.446351	9.756955	3.91

UDMax statistic*	12.31348	UDMax critical value**	8.88
WDMax statistic*	12.31348	WDMax critical value**	9.91

* Significant at the 0.05 level.
** Bai-Perron (Econometric Journal, 2003) critical values.

Estimated break dates:
1: 8/13/2010
2: 7/13/2007, 12/11/2009
3: 1/21/2005, 7/13/2007, 12/11/2009
4: 1/21/2005, 7/13/2007, 12/11/2009, 3/08/2013
5: 8/23/2002, 1/21/2005, 7/13/2007, 12/11/2009, 3/08/2013

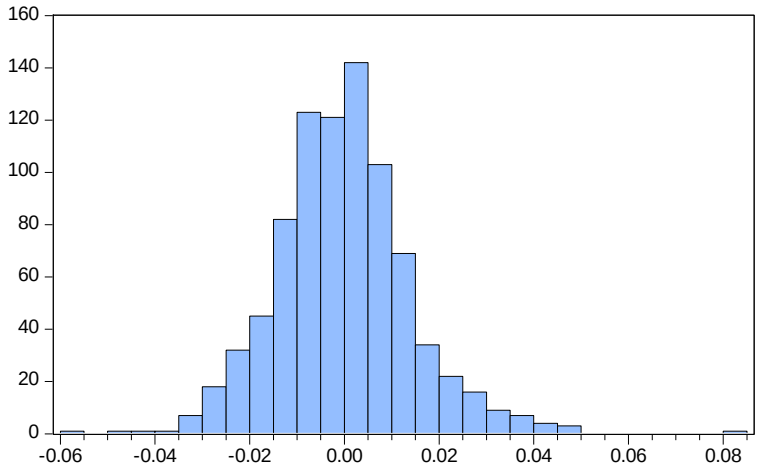
YUANYEN HISTOGRAM AND STATS GRAPH 26



Series: CHINESE_YUAN_TO_100_JAPA
Sample 12/31/1999 2/19/2016
Observations 843

Mean	6.977268
Median	6.981550
Maximum	8.381450
Minimum	4.943700
Std. Dev.	0.818397
Skewness	-0.509119
Kurtosis	2.608871
Jarque-Bera	41.79137
Probability	0.000000

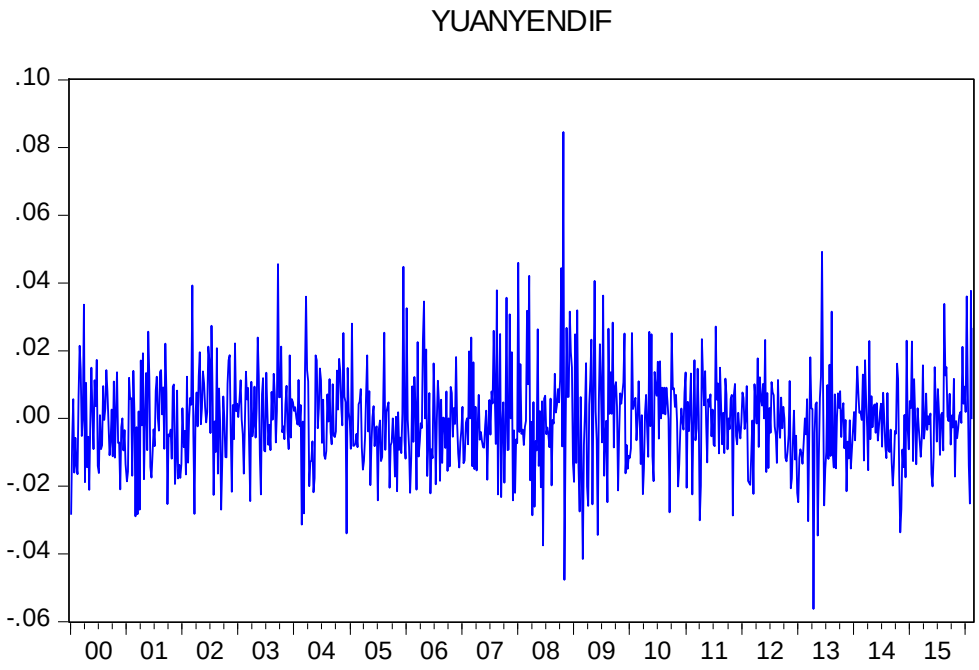
YUANYEN DIFFERENCE PERCENTAGE HISTOGRAM AND STATS GRAPH 27



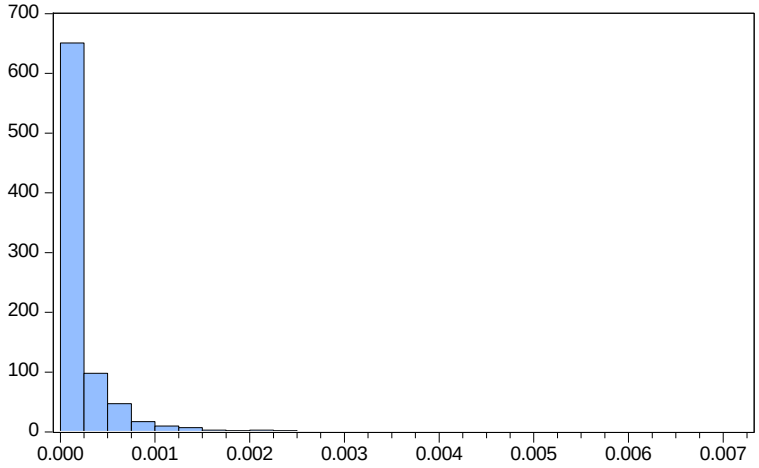
Series: YUANYENDIF
Sample 12/31/1999 2/19/2016
Observations 842

Mean	-0.000302
Median	-0.000469
Maximum	0.084589
Minimum	-0.056240
Std. Dev.	0.014209
Skewness	0.468237
Kurtosis	5.128266
Jarque-Bera	189.6780
Probability	0.000000

YUANYEN DIFFERENCE LINE GRAPH 28



YUAN TO YEN SQUARE OF DIFFERENCE PERCENTAGE GRAPH 29



Series: YUANYANDIFVAR	
Sample 12/31/1999 2/19/2016	
Observations 842	
Mean	0.000202
Median	6.74e-05
Maximum	0.007155
Minimum	0.000000
Std. Dev.	0.000408
Skewness	7.788723
Kurtosis	109.3971
Jarque-Bera	405668.6
Probability	0.000000

YUANYEN BREAKPOINT EQUATION 6

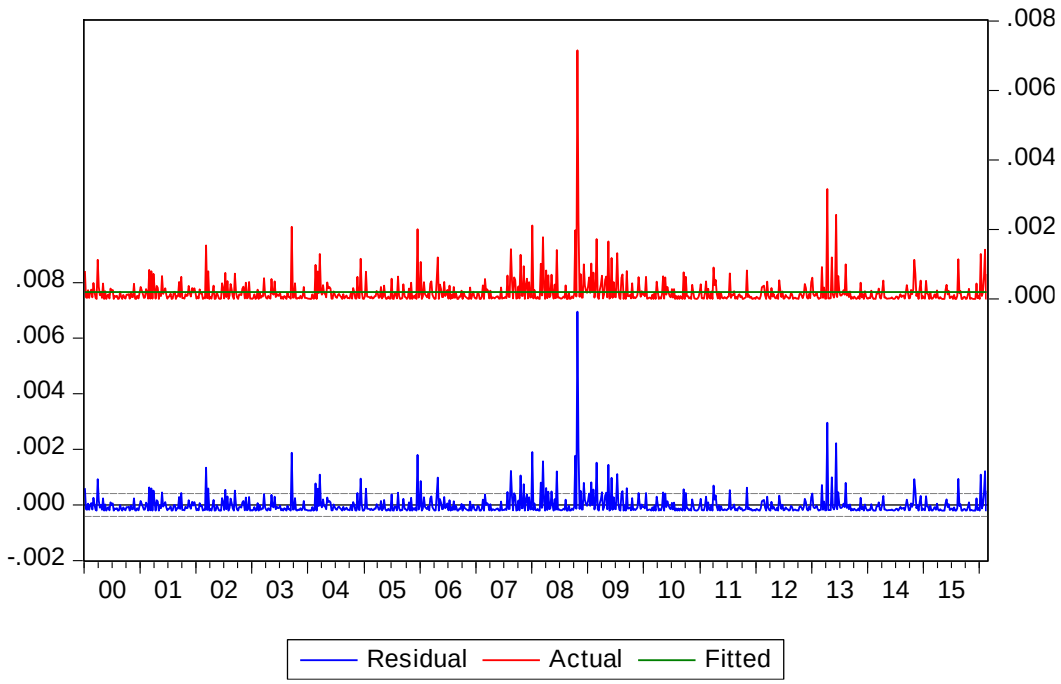
Dependent Variable: YUANYANDIFVAR
Method: Least Squares with Breaks
Date: 02/29/16 Time: 17:39
Sample (adjusted): 1/07/2000 2/19/2016
Included observations: 842 after adjustments
Break type: Bai-Perron tests of 1 to M globally determined breaks
Break selection: Unweighted max-F (UDmax), Trimming 0.15, Max. breaks 5, Sig. level 0.05
No breakpoints selected

HAC standard errors & covariance (Quadratic-Spectral kernel, Andrews bandwidth)
Allow heterogeneous error distributions across breaks

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000202	1.48E-05	13.63894	0.0000

R-squared	0.000000	Mean dependent var	0.000202
Adjusted R-squared	0.000000	S.D. dependent var	0.000408
S.E. of regression	0.000408	Akaike info criterion	-12.76913
Sum squared resid	0.000140	Schwarz criterion	-12.76350
Log likelihood	5376.802	Hannan-Quinn criter.	-12.76697
Durbin-Watson stat	1.893376		

RESIDUAL VS ACTUAL YUAN TO YEN GRAPH 30



YUAN TO YEN BREAKPOINT SPECIFICATION 6

Breakpoint Specification
Description of the breakpoint specification used in estimation
Equation: YUANYENBREAKPOINT
Date: 02/29/16 Time: 17:43

Summary

Estimated number of breaks: 0

Method: Bai-Perron tests of 1 to M globally determined breaks
Maximum number of breaks: 5

Current breakpoint calculations:

Multiple breakpoint tests
Bai-Perron tests of 1 to M globally determined breaks
Date: 02/29/16 Time: 17:43
Sample: 1/07/2000 2/19/2016
Included observations: 842
Breakpoint variables: C
Break test options: Trimming 0.15, Max. breaks 5, Sig. level 0.05
Test statistics employ HAC covariances (Quadratic-Spectral kernel, Andrews bandwidth)
Allow heterogeneous error distributions across breaks

Sequential F-statistic determined breaks:	0
Significant F-statistic largest breaks:	0
UDmax determined breaks:	0
WDmax determined breaks:	0

Breaks	F-statistic	Scaled F-statistic	Weighted F-statistic	Critical Value
1	5.533579	5.533579	5.533579	8.58
2	5.619134	5.619134	6.677586	7.22
3	5.657175	5.657175	8.144054	5.96
4	4.629864	4.629864	7.960769	4.99
5	3.661654	3.661654	8.035035	3.91

UDMax statistic	5.657175	UDMax critical value**	8.88
WDMax statistic	8.144054	WDMax critical value**	9.91

* Significant at the 0.05 level.
** Bai-Perron (Econometric Journal, 2003) critical values.

Estimated break dates:
1: 9/18/2009
2: 7/27/2007, 12/25/2009
3: 7/27/2007, 12/25/2009, 12/28/2012
4: 6/04/2004, 7/27/2007, 12/25/2009, 12/28/2012
5: 8/02/2002, 1/21/2005, 7/27/2007, 12/25/2009, 12/28/2012

Appendix 2

In this part we will see changes which occur by monetary or fiscal policies (depreciation or appreciation of a currency) through Mundell - Flemming model.

9. Mundell-Fleming model

The IS-LM-BP model (also known as IS-LM-Balance of Payments or Mundell-Fleming model) is an extension of the IS-LM model, which was formulated by the economists Robert Mundell and Marcus Fleming, who made almost simultaneously an analysis of open economies in the 60s. Basically, we could say that the Mundell-Fleming model is a version of the IS-LM model for an open economy. In addition to the balance in goods and financial markets, the model incorporates an analysis of the balance of payments.

In order to understand how this model works, we will first see how the IS curve, which represents the equilibrium in the goods market, is defined. Secondly, the LM curve, which represents the equilibrium in the money market. Thirdly, the BP curve, which represents the equilibrium of the balance of payments. Finally, we will analyze how the equilibrium is reached.

IS curve represent the market for goods and services. In an open economy, the equilibrium condition in the market for goods is that production (Y), is equal to the demand for goods, which is the sum of consumption, investment, public spending and net exports. This relationship is called IS. If we define consumption (C) as C = C(Y-T) where T corresponds to taxes, the equilibrium would be given by:

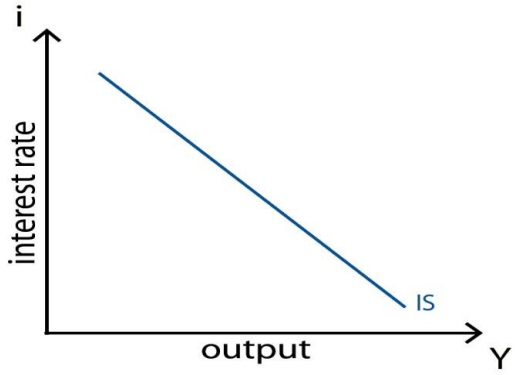
$$Y = C (Y- T) + I + G + NX$$

We consider that investment is not constant, and we see that it depends mainly on two factors: the level of sales and interest rates. If the sales of a firm increase, it will need to invest in new production plants to raise production; it is a positive

relation. With regard to interest rates, the higher they are, the more expensive investments are, so that the relationship between interest rates and investment is negative. Now, in addition to what we have in the IS-LM model, since we have net exports, we also have to take into account the exchange rates, which directly affect net exports. Let's say e is the domestic price of foreign currency or, in other words, how many units of our own currency have to be given up to receive 1 unit of the foreign currency. The new relationship is expressed as follows (where i is the interest rate):

$$Y = C(Y - T) + I(Y, i) + G + NX(e)$$

IS CURVE THE MARKET FOR GOODS AND SERVICES



If we keep in mind the equivalence between production and demand, which determines the equilibrium in the market for goods, and observe the effect of interest rates, we obtain the IS curve. This curve represents the value of equilibrium for any interest rate.

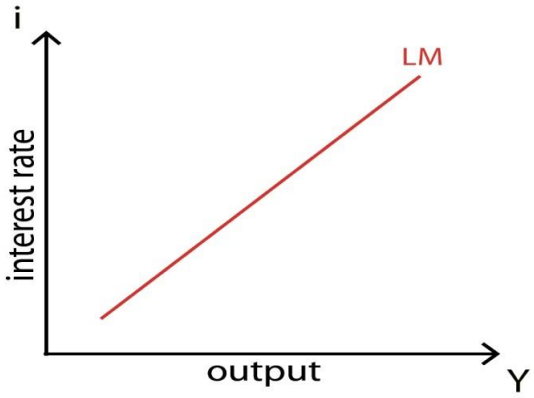
An increasing interest rate will cause a reduction in production through its effect on investment. Therefore, the curve has a negative slope. The adjacent graph shows this relationship.

As stated before, we also need to analyze changes in exchange rates (here, e). If e decreases, then we'll be able to buy more foreign currency with less of our own currency. On the other hand, foreigners we'll need to pay more of their currency to buy our own. Therefore, when e decreases, also called an appreciation under flexible exchange rates or a revaluation under fixed exchange rates, domestic residents have more purchasing power, thus being able to buy the same amount of goods using less domestic currency. The opposite works in the same way: if e increases (also called an

depreciation under flexible exchange rates or a devaluation under fixed exchange rates), domestic residents will pay more for the same goods. To sum up, an increase in e causes net exports to increase (IS curve shifts to the right) and a decrease in e causes net export to decrease (IS curve shifts to the left).

The LM curve represents the relationship between liquidity and money. In an open economy, the interest rate is determined by the equilibrium of supply and demand for money: M/P=L(i,Y) considering M the amount of money offered, Y real income and i real interest rate, being L the demand for money, which is function of i and Y. Also, the exchange rate must be analyzed since it affects money demand (investors may decide buy or sell bonds in a country depending on the exchange rate).

LM CURVE THE MARKET FOR MONEY



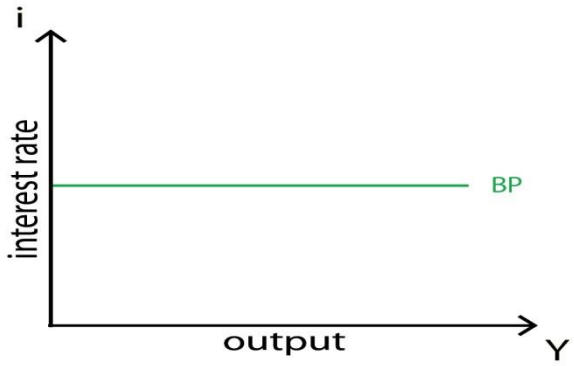
The equilibrium of the money market implies that, given the amount of money, the interest rate is an increasing function of the output level. When output increases, the demand for money raises, but, as we have said, the money supply is given. Therefore, the interest rate should rise until the opposite effects acting on the demand for money are cancelled, people will demand more money because of higher income and less due to rising interest rates.

The slope of the curve is positive, contrary to what happened in the IS curve. This is because the slope reflects the positive relationship between output and interest rates.

The BP curve shows at which points the balance of payments is at equilibrium. In other words, it shows combinations of production and interest rates that guarantee that the balance of payments is viably financed, which means that the volume of net exports that affect total production must be consistent with the volume of net capital outflows. It will usually slope up since the higher the production, the higher the imports, which will disturb the equilibrium of the balance of payments, unless interest rates rise (which would cause capital inflows to maintain the equilibrium). However, depending in how great the mobility of capital is, it will have a greater or smaller slope: the higher the mobility, the flatter the curve.

Once the BP curve is derived, there is an important thing to know about how to use it. Any point above the BP curve will mean a balance of payments surplus. Any points below the BP curve will mean a balance of payments deficit. This is important since depending where we are, different things may affect the interest rates.

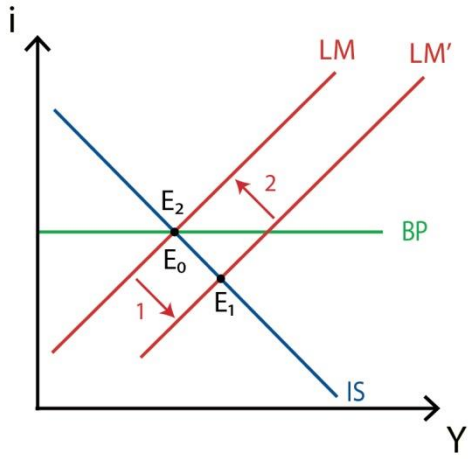
BP CURVE BALANCE OF PAYMENTS



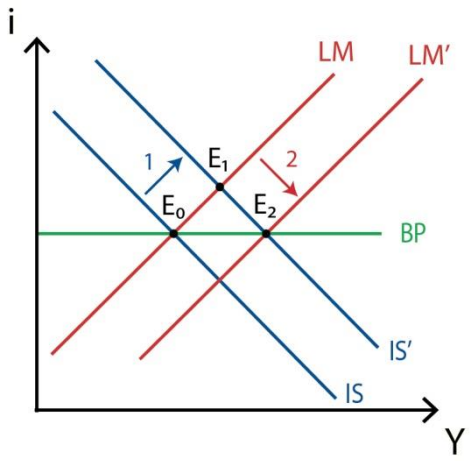
In the model we distinguish between perfect and imperfect capital mobility, but also between fixed and flexible exchange rates. For each of these cases, we will see what happens when both an expansionary monetary and fiscal policy are applied to the economy. We will first review model, which deals with perfect mobility. Then, we will analyze imperfect mobility model.

9.1. Perfect capital mobility

Fixed exchange rate



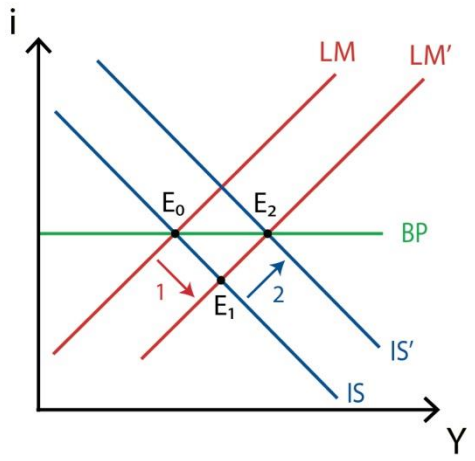
An expansionary monetary policy will shift the LM curve to LM', which makes the equilibrium go from point E_0 to E_1. However, since we are below the BP curve, we know the economy has a balance of payments deficit. Since exchange rates are fixed, government intervention is required: the government will purchase domestic currency and sell foreign currency, which will drop the money supply and therefore shift the LM' curve to its original position (which makes the equilibrium go to E_2). Monetary policy has therefore no effect under these circumstances.



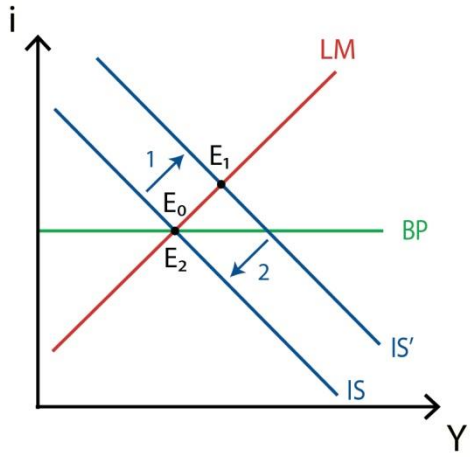
An expansionary fiscal policy will shift the IS curve to IS', moving the equilibrium form point E_0 to point E_1. Since the economy has now a balance of

payments surplus, and because the exchange rate is fixed, government will intervene in the exact opposite way: they'll purchase foreign currency and sell domestic currency. This will increase the money supply, shifting the LM curve to the right. The final equilibrium is reached at point E_2 where, at the same interest rate, production has increased greatly: fiscal policy works perfectly under these circumstances.

Flexible exchange rate



An expansionary monetary policy will shift the LM curve to LM', which makes the equilibrium go from point E_0 to E_1. However, since now exchange rates are flexible, we have a different situation: the balance of payments deficit will depreciate the domestic currency. This will increase net exports (since foreigners can now buy more of our products with the same amount of money), which will shift the IS curve to the right (to IS'). The final equilibrium is reached at point E_2 where, at the same interest rate, production has increased greatly: monetary policy works perfectly under these circumstances.

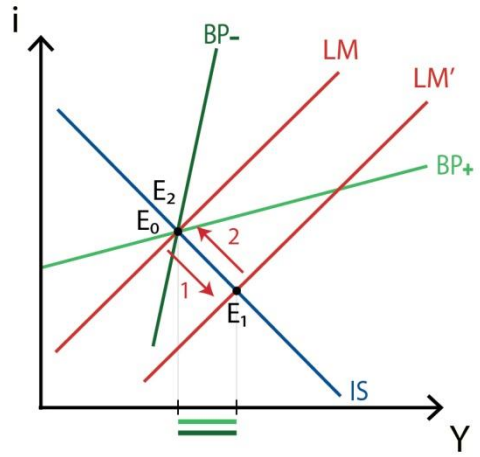


An expansionary fiscal policy will shift the IS curve to IS', moving the equilibrium form point E_0 to point E_1. The economy will therefore have a balance of payments surplus, which in this case of flexible exchange rate will appreciate the domestic currency. This will decrease net exports, since we are able to import more goods and services with less money, while foreigners will import less of our products because of our appreciated domestic currency. This drop in net exports will shift the IS' curve back to its original position. Since now the final equilibrium E_2 corresponds to the initial equilibrium, we know fiscal policy is no good in this case.

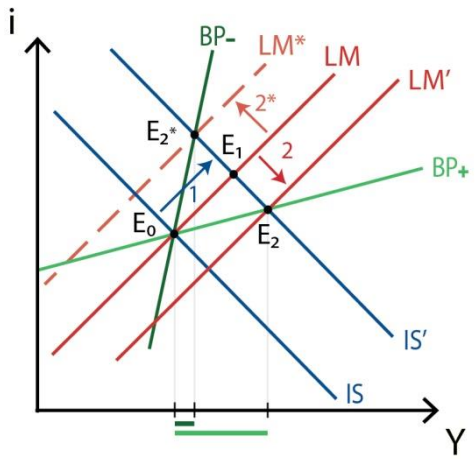
It is easy to see why Mundell devised what is known as the impossible trinity. In a few words, no economy can have the following three: perfect capital mobility, fixed exchange rates and an independent and efficient monetary policy. Under the perfect capital mobility assumption, and in order to have an efficient monetary policy, exchange rates must be flexible. Or have fixed exchange rates but assume that monetary policy won't be efficient.

9.2 Imperfect capital mobility

Fixed exchange rate

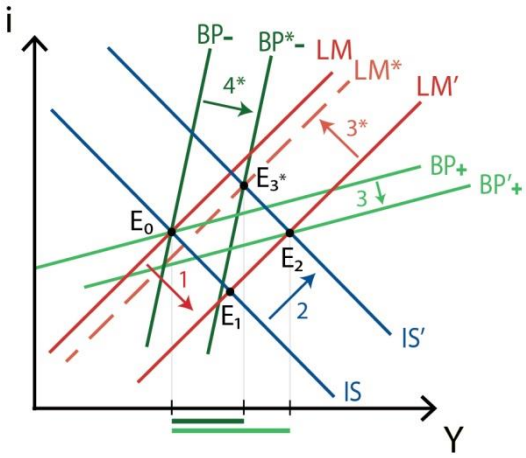


Here we have the exact same situation as before: an expansionary monetary policy will shift the LM curve to LM', which makes the equilibrium go from point E_0 to E_1. However, since we are below the BP curve, we know the economy has a balance of payments deficit. Since exchange rates are fixed, the government will purchase domestic currency and sell foreign currency, which will drop the money supply and therefore shift the LM' curve to its original position (which makes the equilibrium go to E_2). Monetary policy has again no effect, no matter how great or small capital mobility is.

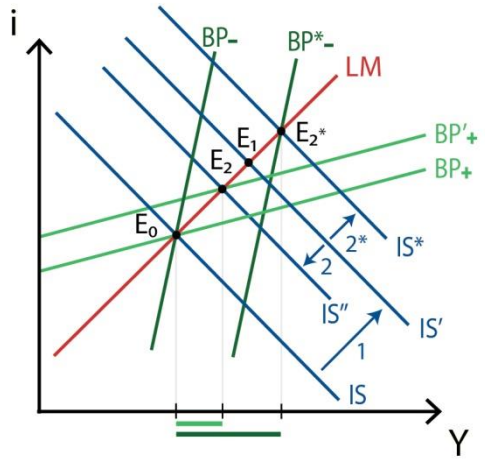


An expansionary fiscal policy will shift the IS curve to IS', moving the equilibrium form point E_0 to point E_1. Now, depending on capital mobility, we'll either have a balance of payments surplus (high capital mobility, BP+ curve) or a balance of payments deficit (small capital mobility, BP- curve). Since exchange rates are fixed, government will need to intervene: its acquisitions and disposals of both domestic and foreign currency will shift the LM curve to either LM' or to LM* (you can review what happens above: a balance of payments surplus is the same scenario as in a fiscal policy with perfect capital mobility and fixed exchange rates, while the balance of payments deficit corresponds to the monetary policy scenario). Under these circumstances, fiscal policy is completely efficient. It's actually the more efficient the higher capital mobility is.

Flexible exchange rate



An expansionary monetary policy will shift the LM curve to LM', which makes the equilibrium go from point E_0 to E_1. However, since now exchange rates are flexible, the balance of payments deficit will depreciate the domestic currency. This will increase net exports, shifting the IS curve to IS'. Also, since domestic assets are less expensive, the BP curve will shift to the right (to either BP'+ or BP'-). Therefore, with high capital mobility, final equilibrium will be at point E_2. Monetary policy works well under these assumptions. It's actually the more efficient the higher capital mobility is.



An expansionary fiscal policy will shift the IS curve to IS', moving the equilibrium form point E_0 to point E_1. Now, depending on capital mobility, we'll either have a balance of payments surplus (high capital mobility, BP+ curve) or a balance of payments deficit (small capital mobility, BP- curve). In the case of a balance of payments surplus, and considering flexible exchange rates, there will be an appreciation of the domestic currency. This will decrease net exports, which will shift the IS' curve to the left. Also, since domestic assets are more expensive, the BP+ curve will shift to the left. The final equilibrium will therefore be at point E_2. If there is a balance of payments deficit (the case for the BP- curve), the result will be the same one as in the monetary policy case (being E_2* the final equilibrium). In this scenario, fiscal policy will be more efficient the smaller capital mobility is.

To sum up, under perfect capital mobility, monetary policy will only work with flexible exchange rates, while fiscal policy will only work with fixed exchange rates.[9]

[1] www.wikipedia.org
[2] 'Currency wars or international policy coordination' B. Eichengreen
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[4] www.wikipedia.org
[5] Capital markets Michail Anthropelos
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