

# The US won the global currency war against Europe and Japan: Their retaliation likely helped elect Trump

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## Key words

Currency War, the Euro, the Dollar, Quantitative Easing, 2008, the Great Recession, Monetary Policy

## Abstract

*The United States financial community, lax regulations and the Fed started a global currency war in 2002. The inadvertent cheapening of the US dollar was a by-product of what became the US subprime lending crisis and the financial collapse in 2008. From 2002-2008, the Fed created so much liquidity that the dollar fell 33% relative to the yen and 40% relative to the euro. In response to the 2008 crash, the Fed had to ramp up US money creation again, generating \$4 trillion in money creation by 2014. World interest rates fell and raw materials and commodity producers in emerging markets borrowed nearly \$5 trillion. Overproduction and the slowdown of China caused a Third World oil and commodity market collapse around 2015.*

*Beginning in 2014, other advanced countries retaliated and declared a global currency war of their own against United States. They created their money with a vengeance. Just as the US had done, this made the currencies of Europe, Japan and Britain 20 to 25% cheaper and their goods became more competitive relative to US goods.*

*As a result, the US became the importer of last resort for cheap foreign goods from 2014 until the election in November of 2016. Only time will tell whether the US currency war that we won from 2002-2014 and the retaliation war we lost from 2014-2016 helped Trump get elected.*

*The parallel is inescapable that the US also started the world tariff and trade war in 1930 with the passage of the Smoot Hawley tariff, which extended the length of the Great Depression. The US currency war pushed Japan even further into recession and weakened Europe. US quantitative easing became a beggar-thy-neighbor policy against our trading partners.*

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## 1. Introduction

The Great Recession after 2008 was the greatest global downturn since the Great Depression of the 1930s. This paper recounts the US and the European currency wars. It explains why US monetary quantitative easing (QE) was more successful than Europe's. Currency wars are like a track meet: start early and you win the race. Quantitative easing is country expansion of its money supply designed stimulate the home economy.

The US started "printing money" in 2002 which was the beginning of the subprime lending crisis. US money supply changes were more dramatic after 2008. There were sizable increases in the US money supply relative to Japan both post-2002 and post 2008 and significant effects on the yen to dollar exchange rate. Japan seems to be the biggest casualty of US quantitative easing.

Even though the dollar dropped a lot relative to both the euro and the yen, neither retaliated and began quantitative easing in earnest until 2014, five years after the United States. Because fiscal deficits were a constraint on most economies post 2008, monetary quantitative easing was the only feasible macro policy tool. Recovery was difficult everywhere because of drops in the velocity of money after 2008.

Thereafter, monetary authorities were pushing on a string -- borrowers were afraid to borrow and banks were scared to lend. Banks and the public became more risk-averse and were hoarding money. That explains the drop in the velocity of money and part of the ineffectiveness of QE.

The US currency war from 2008 to 2014 is a contemporary parallel to the beggar thy neighbour trade war that the United States started in 1930 with the Smoot-Hawley tariff (see Magee, Brock and Young, 1989, chp 13), Like the 1930s, retaliation against the US finally occurred and so it happened today. The dollar was very cheap compared to the yen, euro and the pound when the crisis occurred in 2008 and it stayed cheap until mid 2014. Then retaliation began in mid-2014 with aggressive quantitative easing by both Europe and Japan. Like the US from 2002-2008, these countries "printed money" with a vengeance.

As a result of currency war retaliation, the US dollar rose in value about 25% relative to both the euro and the yen from 2014 until the US election in November of 2016. Our statistical analysis indicates that increases of that magnitude the real dollar exchange rate has a significant negative effect on the US trade balance. And this was going on for two years before the US election. While trade, imports, immigration and "foreign currency manipulation" were all issues in the campaign, there is no definitive way to know how much the currency wars mattered.

In response to the currency war started by the United States, the head of the European Bank, Europe's Mario Draghi and his counterpart at the Central Bank of Japan were understandably aggressive at employing quantitative easing in self-defence. They cheapened their currencies which pushed up the dollar, cheapening the prices of their exports to then to United States. This currency war by Europe and Japan was an additional US political burden top of China's historically cheap exports to the United States.

Another disadvantage to Europe and Japan of entering the currency war late is that if many countries are printing money, the stimulative exchange rate effects are cancelled out. E.g., if Europe and Japan both increase their money supplies by 20%, then the yen to euro exchange rate does not change so neither country gets an advantage in international trade vis-a-vis each other.

The post-2008 currency war by the US was successful only until mid-2014. A strong economy usually helps the incumbent party holding the White House, which in this case was the Democrat, Hillary Clinton. But Donald Trump successfully made the 2016 US election campaign about lost jobs to immigrants, globalization and ironically foreign currency manipulation. While the US won the war from 2009-2014. Europe and Japan achieved large decreases in their exchange rates relative to the dollar thereafter. It is ironic that the US won the currency war from 2009-2014 but after 2015, all three of our major trading partners succeeded in dropping the value of their currencies by 20 to 25 percent The result of that retaliation was the following increases in the value of the US dollar in the 2½ years before the US election:

In yen:	+25%
In UK pounds	+23%
In Euros	+20%

Those made US goods less competitive, hurting US exports and making US imports from those countries cheaper by roughly the same percentage points above. For the Europe and Japan, these currency retaliations were necessary because they had suffered the most since 2008 at the hands of the US dollar. But all three of those currencies were overvalued relative to the dollar in 2015 and needed to be cheaper irrespective of their history. Their depreciations pushed up the value of the dollar from 2014 to 2016.

The US clearly won the post 2008 currency war based on the macroeconomic results compared to Europe. The US had 8 quarters of positive real growth from 2009-2013 while Europe had 8 quarters of zero to negative growth. The United States was lucky in getting help from its high-tech sector expansion after the crash. In 2006, Microsoft was the only high-tech firm in the largest 5 US companies. By 2016, the 5 largest market cap firms in the United States were all high tech and fast growing: Amazon, Alphabet (owns Google), Amazon and Facebook along with Microsoft again. While high-tech was unrelated to the currency war, it gave an economic advantage to the United States over our other trading partners.

The United States financial community, lax regulations and the Fed started the large monetary expansion in 2002 that was directed domestically. From 2002-2008, the Fed created so much liquidity that the dollar fell 33% relative to the yen and nearly 40% relative to the euro. When things collapsed in 2008, the Fed ramped money creation up again to a new level, generating another \$4 trillion in M2 quantitative

easing by 2014. World interest rates then plummeted and raw materials and commodities in the emerging markets borrowed nearly \$5 trillion. Overproduction and the slowdown of China caused a Third World oil and commodity market collapse in 2015. At about the same time, other advanced countries retaliated and declared a currency war of their own against United States. As foreign advanced countries were doing their own QEs, just as the US had done earlier, the near bankrupt emerging markets now had to pay even 20% more to repay their dollar and euro-based loans. With the rest of the non-US world in dire financial straits and awash with cheap currencies, the importer of last resort became the United States with its strong currency. So, imports became very attractive in the United States in 2015 and 2016.

But with foreign retaliation, in 2015 and 2016, foreign central bankers gave Donald Trump a gift: cheap foreign imports. Trump ran a presidential campaign against foreign trade, immigration and foreign currency manipulators.

The United States won the currency war and Trump won the election.

## 2. US Domestic Quantitative Easing 1, 2002-2008

Academic studies have shown for decades that the number one determinant of a country's demand for money is domestic real gross domestic product, GDP. For the United States, for example the bulk of monetary transactions are in dollars. Thus, US money growth in excess than US GDP growth measures the net stimulation of the economy provided by domestic monetary policy above the demand for money.

Quantitative easing is colloquially called printing money. For the United States, we call QE 1 "domestic quantitative easing" It was large-scale creation of liquidity by Fed Chairman Alan Greenspan to stimulate the domestic US economy. Technically, quantitative easing is large-scale asset purchases by the central bank that generate both liquidity and reduce interest rates on government bills and bonds. This places more cash and purchasing power into the economy. The theoretical foundation of quantitative easing is the quantity theory of money equation popularized at the University of Chicago by Milton Friedman and others in the 1970s. The equation is

$$\text{Money Supply} * \text{Velocity} = \text{Price Level} * \text{Real GDP}$$

Where GDP is real gross domestic product. Studies had shown that velocity and prices had been historically stable in the US before 2008, except for the late 1970s. In periods in which velocity and prices are relatively constant, then a hypothetical doubling of the supply of dollars M by the US central bank would double spending on real goods, Q in the medium run. That is called the "domestic effect" of monetary quantitative easing, because it jump starts domestic real spending and equivalently, real gross domestic product. Greater liquidity in the economy increases bank lending which increases economic growth and investment. One study found that QE was eventually effective in the US after 2008, moderating the decline in US output and slowing the declines in prices (Martin and Costas, 2012).

Figure 1 presents evidence from 1971 through 2006 supporting the efficacy of domestically targeted quantitative easing, which we call QE 1 and the empirical validity of the quantity theory equation above. The figure shows that growth in the United States money supply M2 (the lighter line) precedes (Granger causes) growth in US real gross domestic product (the darker line). Historically this chart affirms that printing money can successfully increase real GDP in the domestic economy.

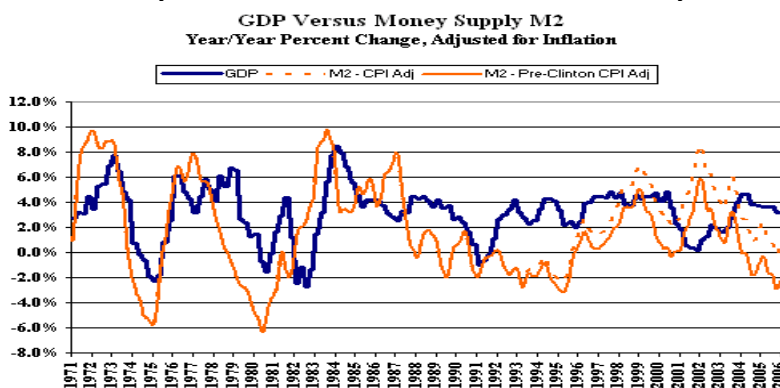


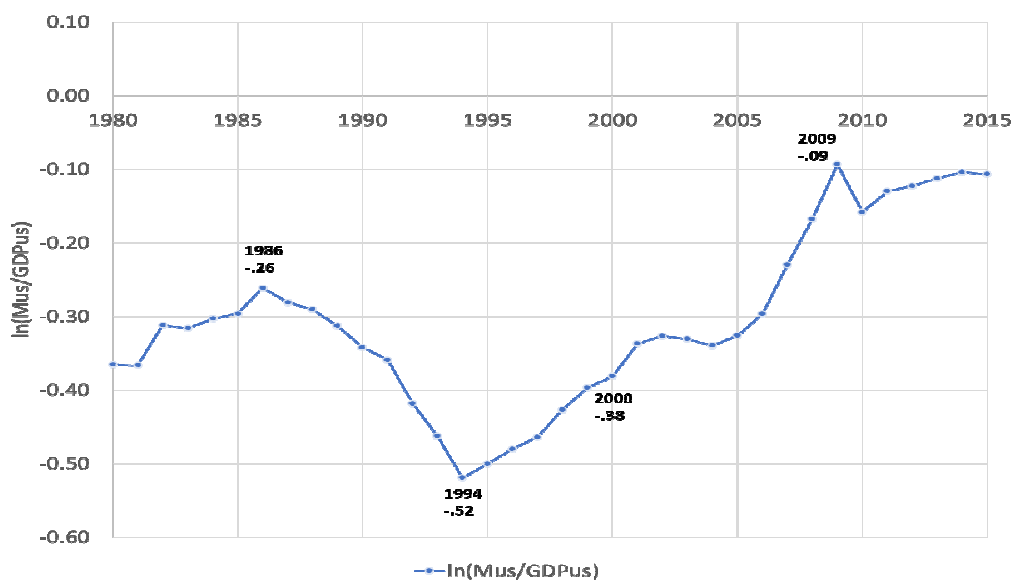
Figure 1: Money Supply Increases Precede US Real Economic Growth, 1971-2006

Following the 2008 crash, QE 1 was engaged immediately by the United States a view other country. The FED increased the US money supply M2 by 50% from \$8 trillion to \$12 trillion in the first few years after 2008. Such an increase would have been large historically and would have had a substantially stimulated the US economy. However, the desired stimulation of the US economy was slow to take hold. Economists noticed that the US velocity of money was steadily declining. Velocity is simply the number of times a dollar bill changes hands every year in a transaction. Velocity has hovered historically around 2, meaning that the entire US money stock is spent twice a year. But the 2008 crash generated a great deal of fear so that people suddenly clutched their money, saving more and spending less. This drop-in velocity greatly weakened the initial domestic economic effects of QEs in the US, Europe and other major economies.

Figure 2 shows historical moves in the US money supply relative to money demand. In effect, this is excess monetary liquidity in the economy. Money demand is best proxied by real gross domestic product. Almost all the charts in this paper are plotted in natural logarithms. The virtue of that is that if you subtract any number from any other, you know the percentage change between the points. For example, the US money supply to GDP ratio is  $-.38$  in 2000 and  $-.09$  at its peak in 2009. That is a rise of  $.29$  which is a 29 percent in the excess supply of money above the demand for money. That number alone gives insight into why we had a subprime lending crisis. The Fed had created 29% more money than was demanded (GDP in the denominator representing demand). This gives some insight into what can happen when too much liquidity is available.

### 3. US Quantitative Easing I, 2002-2008: Unintended Exchange Rate Consequences

Domestic quantitative easing was in vogue in the 1960s and 1970s. But with the explosion of globalization in the 1980s, the economists realized that the closed economy model was out of date. The idea behind international quantitative easing or QE 2 is that printing money makes one's home currency cheaper which stimulates the country's exports. When the United States does a QE and prints dollars, then the price of dollars falls on global foreign exchange markets. It will require fewer euros to purchase a dollar hence it is easier for Europeans now to buy US goods.



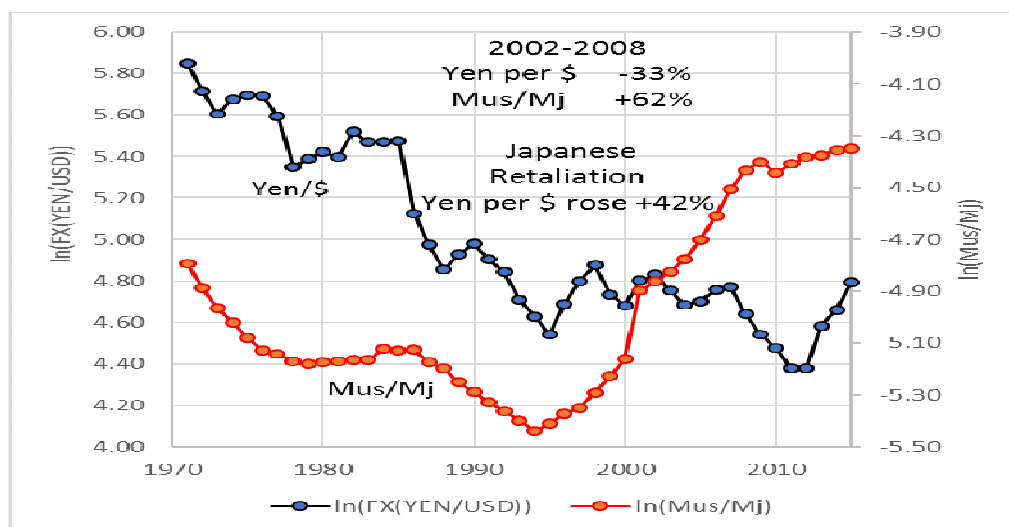
**Figure 2: The Ratio of US Money to Money Demand (GDP) Measures Net Domestic QE 1 Stimulation**

Figure 3 shows the most extreme consequence QE I occurred with respect to Japan because the US is large compared to Japan. Notice in Figure 3 that the ratio of the US money supply to Japan's money supply increased by 62%. That flooding of dollars onto the market caused the yen price of the US dollar to

fall by 33%. This strong increase in the competitive position of the United States against Japan could not have happened at a worse time. Japan was still struggling in the second decade of its long recession that began in 1990. This also made the United States globally stronger and Japan weaker entering 2008 when the great global stock crash occurred.

Figure 4 shows that US QE1 had less extreme monetary consequences with respect to Europe. Notice in the figure that the logarithm of the US to European money supply dropped from .33 in 2001 to .29 in 2008. That is a 4% drop (the fractions are percentages). While the United States did not cause the exchange rate to drop using the money supply, it did drop dramatically for other reasons; we believe counterintuitive changes in relative velocity.

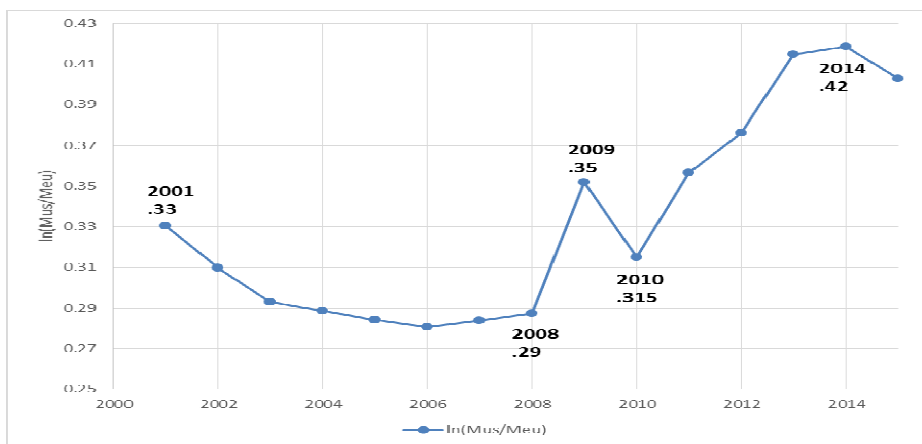
Figure 5 shows this paradoxical 40% decline in the value of the dollar in terms of the euro (euros per dollar).



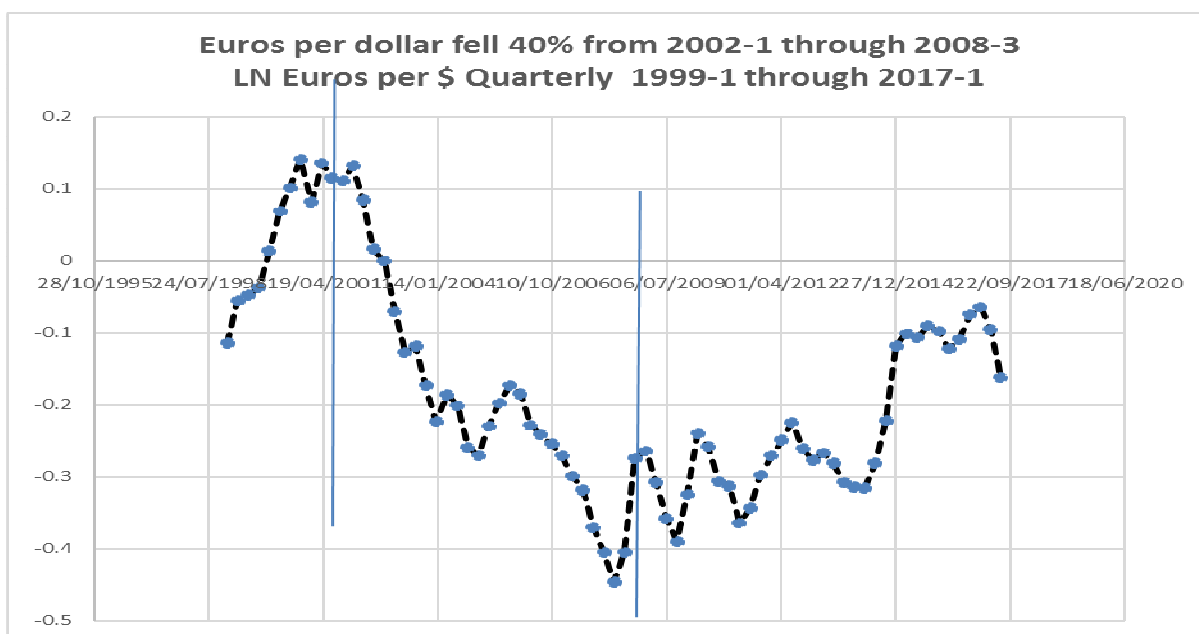
**Figure 3: The FED’s Aggressive QE1 in 2002-2008 Caused the US Money Supply to Rise 62% Compared to Japan’s, Resulting in a 33% Decline in the Price of the Dollar**

Consider now Figure 6. We focus there on whether changes in foreign exchange rates have real impacts on the economy. Remember that if euros per dollar decline, the other side of the coin is that euros necessarily become more expensive. The number of dollars required to purchase a euro is now higher which discourages Americans from buying European goods. Notice that there are two simulative benefits to having the Fed produced more dollars through quantitative easing: the US can export more products and at the same time the US will not have to compete with as many imports into the United States. Should. We saw strong empirical evidence above that domestic quantitative easing was effective in stimulating the domestic US economy. European retaliation caused the \$ to rise 23% from 2014-1 to 2016-3

Figure 6 shows changes in the dollar through US quantitative easing have effects on the economy. Printing dollars cheapens the real foreign currency cost of the US dollar, meaning that the United States will export more and import less. Tests using the data in that figure show that there is a statistically significant positive effect of a cheaper dollar increasing US net exports. That is illustrated on the left side of the diagram where the ratio of net exports to gross domestic product is high and the real dollar is cheap.



**Figure 4: The International Consequences of the US QEs Are Measured by Changes in the Ratio of the US Money Supply to Each Foreign Country's Money Supply**



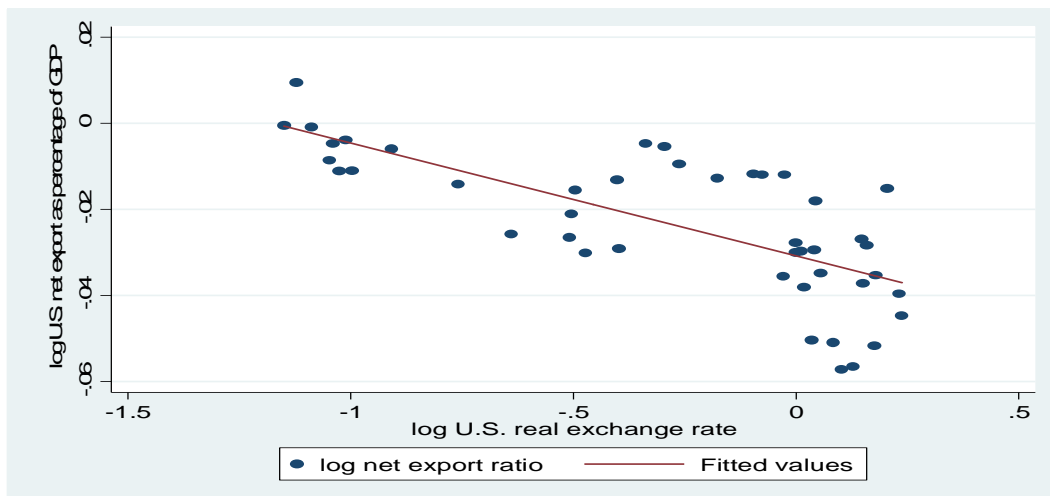
**Figure 5: US Money Growth Was Modest Relative to Europe But Other Factors Caused a 40% Drop in the Euro Price of the Dollar**

The yen moved counter intuitively until 1995 and then the 130% rise in the US money supply relative to Japanese yen supply drove the yen per dollar down from 2002-2008 (the subprime US QE period)<sup>1</sup>

International quantitative easing operates through a country's foreign exchange rate. Printing money makes the country's currency cheaper and easier for the country to sell its goods globally. Foreign exchange markets are sizable: there is nearly \$5 trillion a day transacted on global foreign exchange markets. This compares to an annual US gross domestic product of \$19 trillion. So how effective are foreign exchange rates in affecting the real economy?

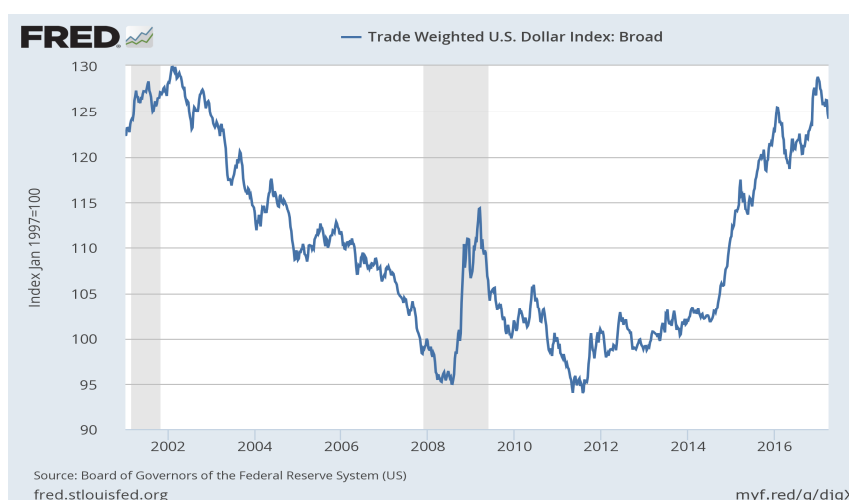
Figure 6 is consistent with a negative relationship between the real US dollar and United States net exports (exports minus imports) as a percent of US GDP. We found that there was a strong statistically significant relationship in the expected direction. That is, as the US real exchange rate got it more expensive (to the right in the figure) the US net exports declined. When the real US dollar was cheap, US net exports increased as shown in the top left northwest corner of the diagram.

<sup>1</sup> The chart data source is @Magee Data v5 (10-02) Japan final chart 1B1 chart (Y and a).



**Figure 6 The Cheaper the Real Dollar, the Larger the US Export Surplus<sup>2</sup>**

Figure 7 showing the trade weighted US dollar indicates that monetary expansion was well underway by 2002. Even though Alan Greenspan meant for that to stimulate the domestic US economy after the 2001 recession, it actually had the unintended consequence of cheapening the trade weighted US dollar which fell by 25% from 2002 until 2008. This had to have a negative impact on most of our trading partners.



**Figure 7 The Subprime Lending Prelude Caused the Trade-Weighted Dollar (foreign currency/dollar) to Fall 25% From 2002 to 2008. Unintended but Turned Globally into US QE 2**

#### 4. US Currency War 2 From 2009-2014 and European and Japanese Retaliation War 2015-2017

The US monetary expansion stimulated US exports and retarded imports, including with Europe. Monetary expansion plus fiscal expansion and spending for the Iraq war caused the United States economy in 2008 to be stronger than Europe's economy. The Obama administration ran a \$1.3 billion government fiscal deficit in 2009. Note in the figure that there was a spike in the value of US dollar in 2009. The rise in the dollar was partly caused by the decline in the euro driven by Europe's own economic collapse and panic over the weakness in Greece. Following that, the dollar dropped from its 2009 high and stayed moderately low until nearly 2015. This post 2008 low value for the dollar helped the United States economy but slowed recovery in Europe. US exports were higher and imports were lower than they would've been otherwise. The reverse was true in Europe.

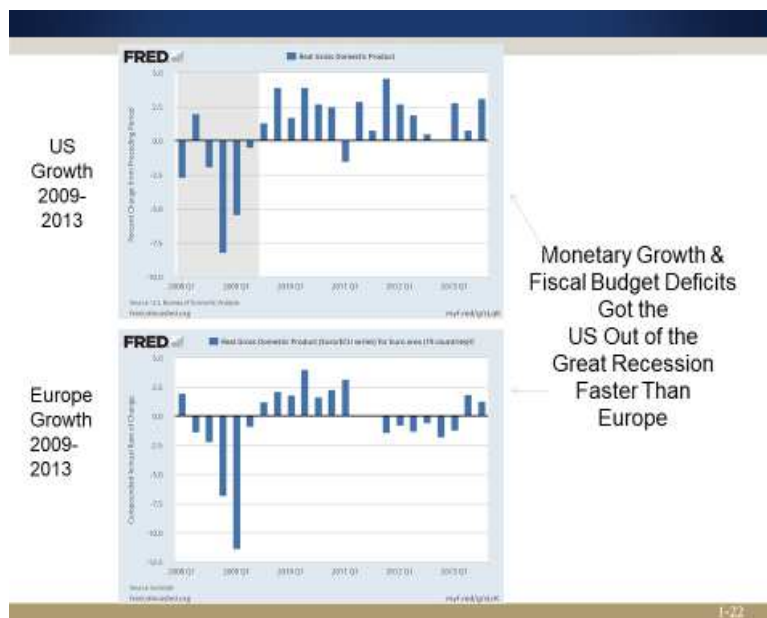
<sup>2</sup> A regression of the Y variable in the figure on the X variable using 44 observations was highly significant with an R squared of .52 and an F ratio significance value of .0000.

To summarize, in the period from 2002-2008, the US over-expanded its money supply which created the subprime lending bubble that led to the 2008 crash. The decline in the value of the US dollar and the resulting rise in the euro were indications of the excessive expansion of US money supply. The consequence was that the value of the real euro rose from below 100 in 2000 to around 135 in 2008 (the real euro captures both price levels and exchange rate effects relative to other countries). The increasing and high euro made Europe's goods less competitive outside of Europe. This strong euro is the mirror image of the US quantitative easing. The real euro dropped after 2008 from \$1.35 to as low as \$1.12 in 2011. But then the euro rose back to \$1.40 in 2014. The increasingly high euro caused by US QE hurt Europe's exports and caused increases of its imports. In that period, the US was winning the initial currency war.

Europe reversed its monetary policy and started pushing the Euro down beginning in the second quarter of 2014. Mario Draghi's European central bank quantitative easing began caused the dollar value of the Euro to fall from \$1.40 around the second quarter of 2014 until \$1.10 in late 2016.

### 5. The US Five-Year US QE 2 Slowed Europe's recover

Figure 8 shows that as a result of starting earlier and having more aggressive monetary and fiscal policy, the US had 8 quarters from 2009-III through 2013 III with annualized growth of at least 2.5% while Europe only had 2 quarters with growth that high. Similarly, the US had only one quarter of negative growth over that period while Europe had seven quarters of negative growth.



**Figure 8: Successful US vs European growth, 2009-III to 2013-III**

#### **The US Had 8 Quarters of Annualized Growth Above 2.5% - But Europe Only 2**

In the period immediately after 2009, the European economy was weak. By late 2012, only Germany had a real GDP above 2008 levels. In late 2012, the entire Euro area was 2.5% lower than 2008; France was 1% lower; Spain was 6% lower; and Italy was 7% lower. The quantitative easing the US started to get out of the great recession generated very low dollar interest rates. As result, capital-intensive extractive industries such as oil, copper and other raw materials industries in the emerging markets borrowed over \$5 trillion in dollar-denominated debt post 2008. Because of their high capital costs, it was prudent for these industries to borrow in such periods of low interest rates. Borrowing also seemed like a sure bet since China was the target market and it was still growing rapidly until 2015.

However, a perfect storm descended on the emerging markets: China had overproduced and cut back its orders; the emerging markets had overproduced oil and many other raw materials. Extensive oil fracking in the United States also increased the supply of global energy. As a result, oil prices plummeted to \$60 by May 2015 and stayed around \$40 a barrel thereafter.



The bottom line was that same US financial community that had created the subprime lending crisis in 2002 – 2008 then created a cure in 2009 and after that created even a bigger global financial crisis including the emerging markets. They borrowed, overproduced, the prices of their raw materials plummeted, and their exchange rates fell with this economic weakness. With less revenue and cheaper exchange rates, these countries now had to repay their dollar-denominated debt. That debt was skyrocketing because QE retaliation by the other advanced countries after mid-2014 was reducing their exchange rates but driving up the dollar exchange rate. The Third World countries attempting to repay their dollar debts now faced 25% increases in repayments thanks to the strengthening dollar.

The strong dollar after 2015 made the United States the import market of last resort. Advanced countries as well as the Third World were desperate to export to the United States. The dollar being expensive meant that the United States was hampered from exporting and a haven for increased US imports.

#### 6. The Mathematical Model of the Effect of US International Quantitative Easing (QE 2) 2009-2014 on the Value of the US Dollar

The second avenue discussed above by which quantitative easing can stimulate the domestic economy is through the “foreign exchange rate” effect. This is more intricate than the straightforward domestic economic effect. There are drivers of the supply and demand for dollars in the United States and another set of factors driving the supply and demand for euros in Europe. The supply of each currency,  $M$ , is controlled by each region’s central bank. Whichever central bank can grow its currency the fastest has the most stimulative “foreign exchange rate” effect due to changes in the money supply, i.e., a QE advantage. In periods in which the US increased its money supply faster than Europe, the US dollar has fallen in value relative to the euro. An analogy is the market for potatoes. When the supply of potatoes increases, the price of potatoes falls. Similarly, when the US Fed increases the supply of dollars faster than Europe increases the supply of euros, the dollar gets cheaper on foreign exchange markets – i.e., it takes fewer euros to buy dollars. Hence the price of US goods falls: US exports rise and US imports contract.<sup>3</sup>

With the dollar cheaper, Europeans want to buy more US exports, which increases export production in the US economy. That increases US real national income, or gross domestic product, GDP. There is another positive effect on the US import side. A cheaper dollar means the euro is more expensive so it takes more dollars to buy euros than before. This raises the dollar price of European goods so Americans will buy fewer of them and more US goods, which also raises US income. Higher US income results both from greater exports and reduced imports. These are the stimulative foreign-exchange rate effects of quantitative easing.

The mathematical model for the closed economy for QE I was a simple one equation model. But for an open economy model that uses exchange rates to stimulate trade, things are more complex. We rewrite the quantity theory equation

$$MV = PQ \quad [1]$$

$M$  money supply    $V$  velocity of money    $P$  price level    $Q$  real GDP

Expressing the natural logs of the variables as lower case, [1] can be rewritten as

$$m + v = p + q \quad [2]$$

We convert this to an open economy model by tying two countries together using purchasing power parity (PPP) which links a foreign country, say Europe (e) and US (u) price levels through the level of the foreign exchange rate,  $F$  (eg., euros per dollar):

<sup>3</sup> The US import reduction occurs because the QE lowered euros per dollar meaning dollars per euro increases and thus more expensive for Americans to buy European goods.

$$P_e = F * P_u \quad [3]^4$$

Expressed as natural logs [3] can be rewritten

$$f = p_e - p_u \quad [4]$$

Attaching the subscripts to Europe and the US in equation [2] yields

$$m_e + v_e = p_e + q_e \quad m_u + v_u = p_u + q_u \quad [5]$$

$$m_e + v_e - q_e = p_e \quad m_u + v_u - q_u = p_u$$

Substituting the prices from [5] into the PPP equation [4] yields

$$m_e + v_e - q_e = f + m_u + v_u - q_u \quad [6]$$

Rearranging [6] yields the final foreign exchange rate equation f in logs

$$f = (m_e - m_u) + (v_e - v_u) + (q_u - q_e) \quad [7]$$

	A	B	C
f		euros/\$	
m		money supply	
v		velocity of money	
q		real GDP	

(all lower case variables are in natural logarithms)

The intuition behind equation [7] is as follows: our foreign exchange rate f in any period will have a value (in euros per dollar) equal to A + B + C.

Three important observations. One, only one of the three terms,  $(m_e - m_u)$ , relates to quantitative easing. The other two are control terms. Second, foreign exchange rate QE effects are all *relative*. Third, be aware that from equation [4] that purchasing power (PPP) is assumed to hold. But [4] will hold on average only over long periods of time. Thus, the natural logarithm of the foreign exchange rate, f, wanders around through time within the long run bounds of  $p_e - p_u$  in equation [4]. That is called reversion to the mean.

#### 7. The QE Foreign Exchange Rate Model: A Statistical Test of Equation [7]

We turn now to a statistical test of the foreign-exchange rate model in [7] applied to the US vis-a-vis three foreign countries. The dependent variable in the regressions is foreign currency per dollar for the euro, the Japanese yen and the British pound. We test whether the relative money supply differences in equation [7] have statistically significant effects in explaining movements the value of the dollar.

<sup>4</sup> Notice that  $F = P_f / P_u$  and that the units for F are euros/\$ and the units for  $P_f / P_u$  are also euros/\$. The reason is that  $P_f / P_u = \text{euros per good} / \$ \text{ per good} = \text{euros}/\$$  since the goods in the numerator and denominator cancel out. We now do our empirical test of the exchange rate model equation 7 above

According to equation 7, a necessary condition for a successful QE of the US lowering the price of the dollar is that the term  $(m_e - m_u)$  is negative (ie., the US has created dollars faster than Europe created euros because  $m_u$  is larger than  $m_e$ ). But that is not sufficient.

A sufficient condition for the US to lower  $f$  in any period is that the US must increase its money supply  $m_u$  enough to make the monetary term  $A$  in [7] sufficiently negative so that the sum of  $A + B + C$  is negative. That is a tall order and cannot be done over long periods.

Table 1. Regression Estimation of Equation [7] for the Value of the US Dollar, Regressions explaining the value of the dollar relative to Europe, Japan and the UK:

A rise on foreign currency per dollar is a strengthening of the \$

Regressions+	Foreign Country (f)		
	Europe	Japan	United Kingdom
Currency >	Euro*	Yen	UK pound
Dependent variable f >	LN (euros/\$)	LN (yen/\$)	LN (pounds/\$)
LN (Money f/Money us)	2.708** (1.175)	0.9732*** (0.1540)	0.3893*** (0.1198)
LN(GDP us/GDP f)	5.519*** (1.739)	1.5007*** (0.4631)	1.5265*** (0.5518)
LN (Velocity f / Velocity us)	2.964*** (0.949)	-1.8087*** (0.0984)	-0.5901*** (0.1422)
Constant	.0661* (0.330)	0.5433 (1.1214)	-2.2763* (1.1712)
R-squared	.576	0.901	0.6131
Observations adj	52	45	45
Data	quarterly	annual	annual
Period of estimation	2004-I - 2016-4	1971-2015	1971-2015

\* Europe estimates lag 1 qtr;  
Newey-West adj of st. errors,  
adjusting for 4 lag qtrs.

+ Robust standard errors in parens. below coefficients.

## 8. Acknowledgement

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