

**AN ANALYSIS REGARDING ZIRP, NIRP AND QE: AN APPRAISAL  
OF THEIR STRENGTHS AND WEAKNESSES**

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# 1. INTRODUCTION

The largest economies in the world have undergone massive changes in their policies in order to combat crises in their respective countries. Monetary policy has been used before the recession in 2008 but never before have central banks been confronted with the zero lower bound. This relatively new phenomena is cause for caution, as improper policy by unsure central banks may plummet a country into the dreaded liquidity trap. In this paper I focus on three central banks and the measures they took to combat the problems in each of their respective countries. The Bank of Japan (BOJ) is probably the most important to examine since Japan was the first country to adopt zero interest rate policy (ZIRP). Japan was also the first country that used Quantitative Easing, and its relatively early adoption of these policies in 1999 has led to the most available information and data regarding the policies' effects. Other countries were able to look towards the steps the BOJ took and learn from their outcomes. The Federal Reserve (Fed) is an essential case study to analyse, since the subprime crisis in the United States has had a global impact. The Fed was able to look at Japan and modify the BOJ's strategy to combat deflation. This paper also inspects the European Central Bank (ECB), primarily because it was the first to adopt a negative interest rate policy or NIRP. The ECB is harder to investigate since the policy it chooses might have a different effect for a different country. However, it provides a better analysis of NIRP and I am able to see the similarities between some of the issues that plague all three nations.

Open market operations is usually effective and is the most well-known method when implementing monetary policy, however during a crisis it is not quite as effective. Where generally, open market operations are carried out with shorter term government securities such as buying or selling Treasury bonds, Quantitative Easing includes longer term government

securities. The goal is to reduce long-term interest rates, since it is an important component of spending decisions by consumers, and there are two methods employed to achieve this outcome. The first is for the central bank to peg a very low interest rate on long term bonds and purchase a large amount of these bonds at the pegged rate (Bernanke 2002). The other way, as described by Orphanides and Wieland (2000), is to persuade markets that a ZIRP will continue even after deflation is over. The idea behind this strategy is that expected future short term rates would be low, and since long-term rates are an average of the former, they would consequently fall.

In the first section, this paper provides details regarding the crises in each country and the steps each of their respective central banks took as well as compare the actual effect versus the desired effect of said policies. In the second section, the viability of the Taylor rule is tested with Japanese and American data, to examine whether the rule can act as a feasible tool in times of crisis. Finally, the paper discusses the consequences the policies have had on other sectors of the economy.

## 2. HISTORICAL BACKGROUND

### 2.1 JAPAN

Japan was the first country to have used ZIRP in the 1990s and was used as a tool to combat severe deflation and to promote economic recovery. The cause of such economic problems was the asset price bubble collapse that occurred in the 1980s which led to a sluggish economy for two decades, referred to as ‘The Lost Decade’. Japan experienced a strong economy in the latter half of the 20<sup>th</sup> century, however the Bank of Japan imposed credit growth quotas on commercial banks. This led to Japanese banks lending more without knowing for certain that the borrowers would be able to pay them back leading to a massive bubble in the economy. In order to keep the targeted inflation and to avoid speculation, the BOJ announced that it would raise its

discount rate to 4.25% in December 1989. For a short period of time after the announcement the economy seemed stable with a GDP growth rate higher than 3% as well as a steady interest rate of 6%. Even though it was fairly evident at this point in time that there was a bubble, investors and bankers believed that the collaboration between the public and private sector would be enough to keep the growth sustained. However, in 1992 the stock market crashed and the unsolved asset bubble subsequently burst. The Consumer Price Index (CPI) which is generally used as a proxy measure for inflation rates kept declining until it hit 0% in 1995 (figure 2). Interest rates followed a similar path as well and were at 0% in 1995, causing the bubble to finally burst and crash the Japanese stock market (figure 1).

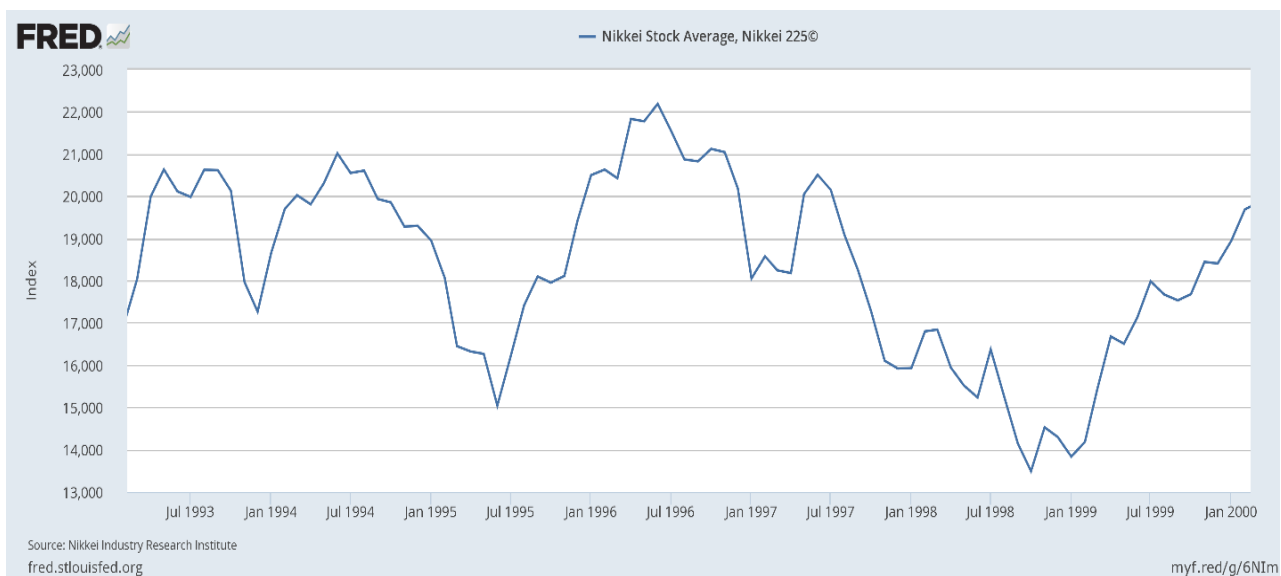


Figure 1

Source: Federal Reserve System

The abrupt fall of asset prices and equity led Japanese banks and insurance companies to have a lot of bad debt. Ultimately a bailout by the government was provided to these financial institutions but had the inadvertent effect of turning these institutions into zombie banks. The term is used to describe a financial institution that has a negative net worth, and is only kept 'alive' by government backed debt payments. Due to the size of these institutions, the

government was forced to support them in order to keep the financial sector afloat. The banks themselves knew that they were deemed 'too big to fail' and had an implicit guarantee of a government bailout (Hutchison and Frank 2006). Finally in November 1997, these large institutions such as Yamaichi Securities Company, Hokkaido Takushoku Bank and others were insolvent and were declared bankrupt.

In 1999, Japan's inflation rate had finally gone below zero and with an extremely low GDP growth rate the country started to face unprecedented problems. The BOJ decided to lower the interest rate, in accordance with monetary policy, which would spur lending leading to hopefully higher prices. Unfortunately, interest rates were already at an all-time low, therefore the interest rates were set to virtually zero which was unprecedented and the policy was termed Zero interest Rate Policy (ZIRP). Going into such a low interest rate policy was uncharted territory but the economy showed signs of overcoming its deflation and seemed to be recovering (figure 2). Looking at these results the BOJ removed ZIRP in August 2000, even though it had previously stated that it would not remove ZIRP until the inflation rate had reached zero or above, and raised the overnight call rate to 0.25%. This was deemed by economists to be a mistake and soon after the economy seemed to regress again and ZIRP was reinstated in March 2001 with one added feature – Quantitative Easing (QE).

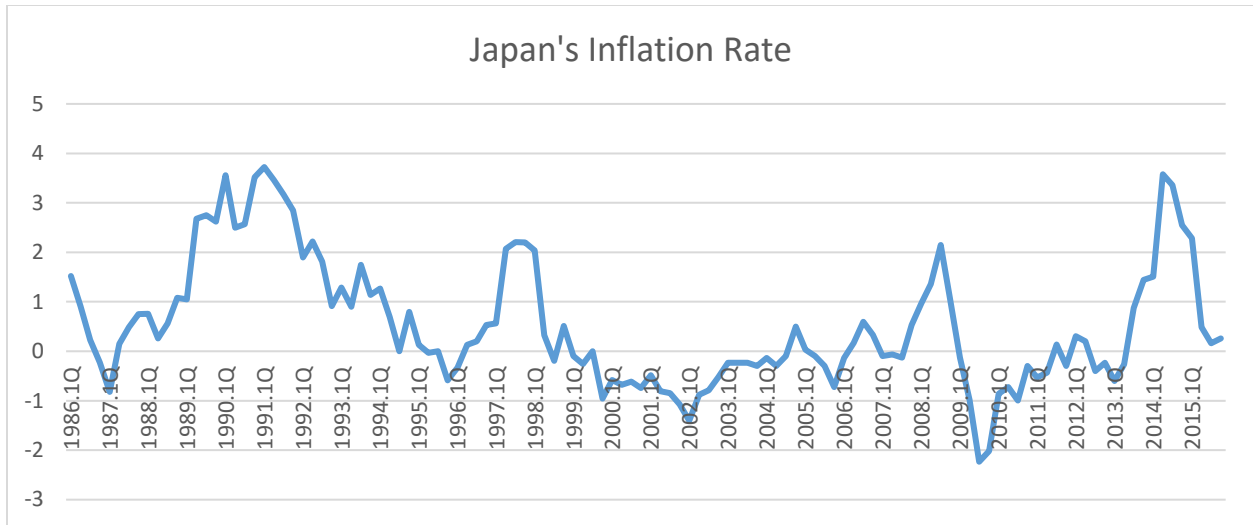


Figure 2

Source: OECD

Another important goal of the BOJ's QE policy was to increase the amount of reserves into the banking system, instead of the usual targeting interest rates controlled by open market operations. The reason for this was to give banks liquidity which would in turn increase lending leading to a greater money supply and ultimately higher prices which would get the economy back on track. However, in order for their QE policy to work, a massive amount of asset purchases needed to be done. Open market operations are typically effective and commonly used, however during a severe crisis it becomes inert. Japan thus turned to the unconventional monetary policy of QE in order to stimulate economic growth. The target current account balances (CABs) was set at 5 trillion yen, whereas the required reserves were around 4 trillion yen. By January 2004, this target amount was raised to between 30-35 trillion yen. Another task carried out by the BOJ was the increased monthly purchase of Japanese Government Bonds (JGBs) to use as a liquidity injection. The original amount was 400 billion yen in March 2001 and was increased to 1,200 billion yen in May 2004.

The BOJ abandoned ZIRP and their QE policy in March 2006 after seeing signs of the deflation ending. A year later the subprime crisis occurred and Japanese financial markets



experienced a large amount of capital inflow due the occurrence of yen-carrying trading. The yen carry trade refers to investors borrowing the yen which had a low yield due to ZIRP and investing it into high-yielding currencies. However, once the subprime crisis took place, the interest rates in Europe and the U.S. were expected to fall leading to investors selling their foreign currencies and returning to the yen. The corresponding appreciation of the Japanese yen severely diminished the country's exports and stock prices. Deflation re-emerged and economic recovery slowed down causing the BOJ to introduce the comprehensive monetary easing (CME) policy in 2010, meaning Japan faced ZIRP once more. CME was similar to their QE policy where they purchased JGBs but now also included private assets such as corporate bonds, commercial paper, real estate investment trusts and exchange-traded funds. In March 2011, Japan was hit by an earthquake and tsunami that reverberated into the economy, decreasing GDP growth rate and causing an estimated economic loss between \$171 billion and \$183 billion. Japan's Nikkei stock market index dropped by 10.6% upon receiving news of rising radiation levels from the Fukushima nuclear power plant.

In 2012 Shinzo Abe won the election and advocated economic policies referred to as 'Abenomics' in December 2012 thereby ending the short life of CME. The policies use fiscal stimulus, monetary easing and structural reforms, known as the "three arrows". They included inflation targeting at 2%, depreciation, setting negative interest rates, quantitative easing and expansion of the monetary base. In 2013, the BOJ undertook a round of QE where the balance sheet was doubled. Inflation still remained stagnant below 1% and therefore they added a new phase consisting of purchasing \$660 billion a year in JGBs, the amount is unmatched across the globe. In January 2016, Japan announced negative interest rate on marginal excess reserves to spur investments and lending. Currently Japan has an interest rate of -0.1% and an inflation rate

of 0.8% but seems to be decreasing even further. The country also has the largest Debt to GDP ratio; currently above 200%.

## 2.2 UNITED STATES

Similar to Japan, the United States of America also had a housing bubble burst in 2007. Luckily, the U.S. was able to learn from the long history of Japanese policies. Once again, due to the economic meltdowns of the “too big to fail” financial institutions, the Fed reduced the short term interest rates to a zero lower bound in December 2008. This was done in order to prevent severe deflation which was one of the biggest problems Japan was dealing with as well as to provide liquidity to ward off the economic freeze ups. However, at a zero lower bound they ran the risk of falling victim to the liquidity trap. It was therefore decided to follow Japan’s method and introduced QE. The Fed did not follow Japan’s exact QE policy and instead concentrated on a wider range of assets such as mortgage backed securities, long-term treasury securities and agency debt, in contrast to Japan’s JGBs.

The Fed went through four rounds of QE, the first of which started in November 2008 (QE1). By March 2009, a mere one year after the Fed announced its initial purchasing plan, the total asset purchases consisting of agency debt, mortgage-backed securities(MBS) and long-term Treasury securities amounted to \$1.75 trillion which was double the amount of Fed assets before 2008. The agency debt and MBS were purchased from Fannie Mae (FNMA) and Freddie Mac (FHLMC). This was constructed to help the housing market by increasing the availability of credit for purchasing houses by reducing the long-term interest rates. The purchases reached a peak of \$2.1 trillion in June 2010, and was subsequently paused since the economy showed signs of improvement. The improvement was not deemed enough and the second implementation of QE was announced.

QE2 was announced in November 2010 during which the Fed purchased only US Treasury securities, a strategy akin to what the Japanese had done. The objective was to ensure stable prices and help economic recovery. The Fed purchased a total of \$778 billion long-term Treasury securities during this period, \$178 billion of which was a reinvestment of principal payments from the MBS holdings and agency debt.

The third phase called “Twist” was announced in September 2011. In this phase, the Fed used the proceeds from short-term Treasury securities (less than 3 years) and bought long-term Treasury securities with maturities between 6 to 30 years amounting to \$668 billion. The aim of the “Twist” was to again help economic recovery and to avoid severe deflation such as the one Japan went through. New MBS were also purchased since the old ones were due.

The last phase, QE3, was announced in September 2012 where the fed bought \$40 billion MBS per month. This relieved banks of subprime mortgages in order to stimulate lending and thus the economy. Two months later, long-term Treasury securities worth \$45 billion were also added as a continuation of the “Twist”. In December 2013 the Fed announced the “tapering” of QE3 and decreased its rate of monthly purchases of MBS and Treasury securities by \$10 billion each Fed meeting, which takes place once a month. QE3 was officially ended in October 2014. By 2014 the combined assets amounted to 26.25% of the GDP, up from the 6% of GDP in 2007. The Fed finally increased its interest rate range from 0% - 0.25% to 0.25% - 0.5% in December 2015.

## 2.3 EUROPE

At the end of 2009, Europe entered a debt crisis due to Greece, Spain, Ireland, Portugal and Cyprus being unable to bail out their debt-ridden banks. For some European countries, the culprit yet again was a housing bubble whereas for others it was high spending levels and low

tax revenues. The five countries stated above were unable to fix the problems by themselves and requested help from the ECB and the IMF. The presence of one currency amidst countries with different tax policies made it harder for Europe to fix the problem collectively. The ECB needs to look at all the countries in the EU as a whole when making decisions, even if it might hinder the productivity of a single country. The fear that Greece would be unable to repay its debt led to a higher interest rate on its sovereign debt, making it difficult for the ECB to take any action without affecting other countries. The problem snowballed, and soon Italy was faced with higher interest rates on government bonds causing the rate of the government debt to grow faster than the national income (Feldstein 2012). In 2010, the ECB bought private and government debt securities and announced that it would accept any debt regardless of the credit rating. Viewing the crises faced by Japan and the US, the ECB announced its plan to follow suit and reduced its interest rates in 2011. The discount rate reached an all-time low of 0.25% in late 2013. After noticing signs of the inflation rate falling in 2014 and dreading the problem of deflation, especially after seeing the immense problem Japan was in, the ECB set the deposit rate at -0.1%. This was the first time NIRP was used on such a large scale. Sweden, Switzerland, Denmark and Hungary adopted NIRP as well in the following couple of years. In 2015, current President of the ECB, Mario Draghi, announced a QE policy consisting of purchasing 60 billion euros per month of European bonds. This was in order to prevent deflation and was increased to 80 billion euros in 2016 including corporate bonds. Currently the deposit rate mandated by the ECB is -0.4%, with Mario Draghi saying that the rates will stay low for a long period time.

### 3. CONSEQUENCES OF THE POLICIES

In this section I will provide an overview of the results obtained after the various policies were undertaken by the countries mentioned above. I will examine whether the policies achieved what they originally set out to do, as well as the impact they had on the country. From this overview, I will be able to present the advantages and disadvantages of ZIRP, NIRP and QE including the adverse effects that these policies had on other sectors of the economy.

#### 3.1 JAPAN

Since the asset bubble collapse Japan has been referred to have been in the dreaded liquidity trap. In order to get itself out of the problems it resorted to monetary policy which has been criticized by some economists (Krugman 1998) (Meltzer 1998). To see if Japan should have done something differently in order to prevent the asset bubble from even happening, Bernanke and Gertler (1999) recreated the situation by building an asset-price model and applying monetary policy rules, and then compared it to the Japanese policies. They found that the stock bubble was fueled from a tight Japanese policy from 1985 to 1988 and then a lax policy from 1988-1990 and argued that a tight policy during the late 1980s would have prevented or at least ended the bubble earlier. Since ZIRP was supposed to be a temporary measure and the economy showed signs of recovering, it was only natural for Governor Hayami of the BOJ to hike up the interest rate in August 2000 (Takahashi 2013). Others argued that the BOJ misjudged the economy and were “too eager to go back to positive interest rates” (Ito and Mishkin 2006). Hayami was also not explicit in his policies which led to speculation and uncertainty. The BOJ had received independence in 1997, and this independence was considered so important to them that they did not work cohesively with the government, even though the economy desperately needed collaboration (Cargill, Hutchison and Ito 1997).

When Governor Fukui of the BOJ replaced Governor Hayami in 2003, he increased the CAB and more importantly explicitly stated that ZIRP should be maintained until inflation turned positive. The increase in GDP and economic recovery in 2003 may have been due to the increased liquidity, however the deflation did not stop (figure 2 and 3). Theoretically this makes sense as an increase in reserves would not help much in a liquidity trap as short-term bonds could become a perfect substitute for money with zero interest rates. Based on the strict assumption of complete financial markets with no limits on borrowing against future income, Eggertsson and Woodford (2003) showed that the outcome would hold even if money and short term bonds do not become perfect substitutes. They conclude that if the expectation that the reserves would continue to be higher after deflation ceases, then QE would be able to stimulate the economy.

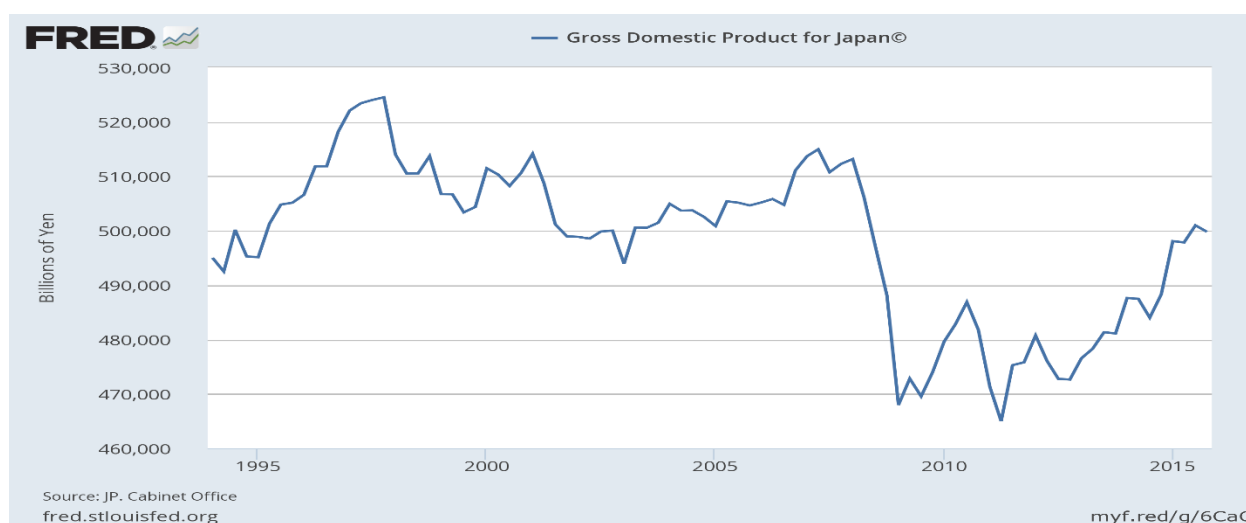


Figure 3

Source: Federal Reserve System

Japan's exit from QE was smooth due to the BOJ allowing short-term bonds that had been purchased from banks to mature. The BOJ had also been careful in keeping their long term bonds lower than issued banknotes. This took care of excess reserves without resorting to selling JGBs (Murtaza and Yamaoka 2010). The subprime crisis happened in 2008 which reduced

global demand, and Japan suffered from a big loss in exports. The BOJ mistakenly did not respond to the crisis by adopting unconventional measures, perhaps due to recently ending QE and wanting to show the public that it was recovering. This was a big mistake as other countries such as the US and Europe started QE of their own which led to Japan's monetary base becoming much smaller in comparison. This led to an appreciation in the yen and further worsened the export industry. Albeit too late, the more aggressive policy of CME was finally introduced to again help the economy get rid of deflation. It is hard to establish the effect that CME had due to its short time span and the effect of exogenous factors such as the earthquake and tsunami in 2011. Needless to say, this made it much more difficult for Japan to recover. There is no doubt that QE worked in keeping long-term interest rates down in Japan, but had little to no effect on inflation. Lam (2011) reports that the impact on the long-term interest rates comes from the announcement rather than the actual operations.

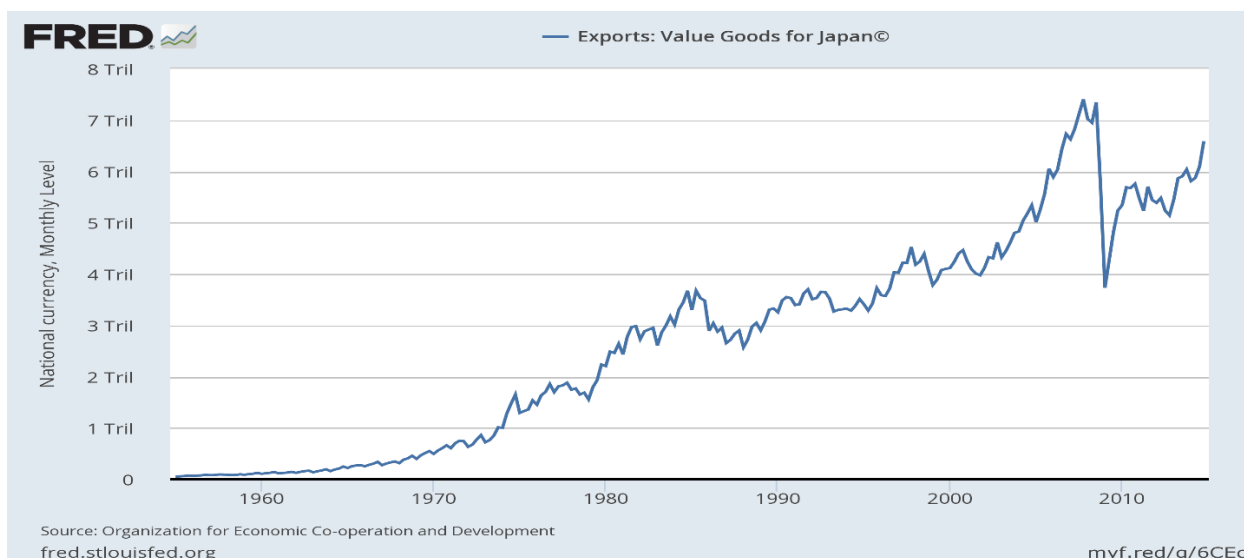


Figure 4

Source: Federal Reserve System

With the new Prime Minister Shinzo Abe gaining power, the political as well as financial structure was changed. The BOJ was forced by Abe to adopt a 2% inflation target even though

they had previously announced a 1% target. The new target may have been established to increase the already large support Abe held and provided the public a sign of a strong leader. The 1% inflation target was more achievable but the BOJ succumbed to political pressure and accepted the new target. Haruhiko Kuroda took over as the new governor of BOJ in 2013 and set to increasing the monetary base. We can see, from figure 4, that the exports did indeed increase sharply, accomplishing one of the goals, however deflation still persists. An earlier inflation-targeting regime would have been much more beneficial to Japan by preventing the mistakes it made after 1998 allowing monetary policy to move in the correct direction (Ito and Mishkin 2006). Simulations run by Ahearne et al. (2002) show that an easing of monetary policy would have reduced deflation and promoted a better economy. Kurihara (2013) argues that the good performance of the economy is a result of ZIRP and not Abenomics, and that more time needs to pass in order to see properly the effect of the latter.

### 3.2 UNITED STATES

The concept behind the Fed purchasing long-term Treasury securities and MBS is a relatively simple one. When they buy these securities, it reduces their supply and leads to an increase in price and reduces yield. Thus, any announcement made by the Fed regarding their intention of buying securities will increase demand thereby providing liquidity to stop any freeze ups. The efficient market theory states that an efficient market will always incorporate and reflect all relevant information. In terms of the real world, when the Fed announces its plans regarding securities, the price of these securities will adjust immediately. Regarding whether the real world follows the efficient market theory, it was shown that the Treasury bill market is efficient (Roll 1968). This has been further elaborated and confirmed that the securities market is generally “fairly efficient” with respect to information (Ang, Goetzmann and Schaefer 2011 and Malkiel 2003).



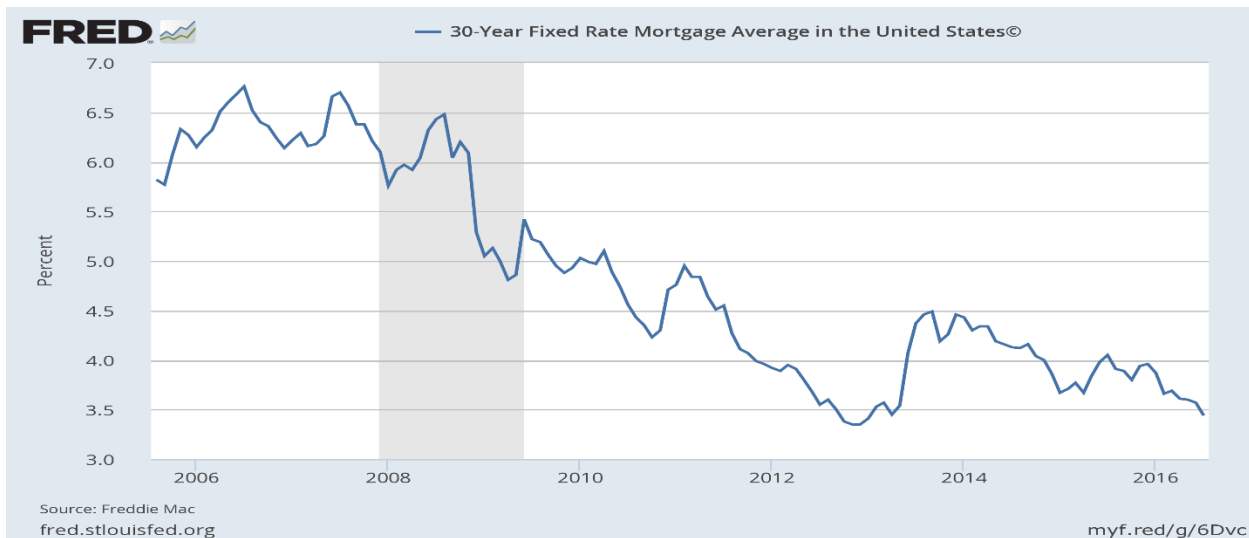


Figure 5

Source: Federal Reserve System

QE1 was successful, which can be seen from the reduction of the 30-year fixed rate mortgage from 6.2% in October 2008 to 4.93% by the end of 2009 (figure 5). The 10 year Treasury security rate declined as well. There were still a couple of problems: banks not lending as much as the Fed wanted them to and bad assets on the balance sheet. However, the Fed has the ability to print money in order to cover the bad debts, which would lead to inflation. However, in this case, especially after seeing the problems Japan was having with deflation, the prospect of inflation was welcome. Reducing inflation would also be a minor problem as the Fed could just sell any of the assets they now held, reducing the money supply. The low interest rates also helped the housing market, especially after the subprime crisis, and facilitated the improvement of the economy.

We can see from the figure 6 that the 10-year Treasury yield decreased drastically after the announcement of QE1 and reached a low of 2.42% by December 2008. However, the yield rebounded right after and reached 3.72% in June 2009. This meant that investors may have been moving money into the stock market from the Treasury securities and as can be seen in figure 10,

the S&P 500 escalated the same month the Treasury yield increased in March 2009. Also, the Fed purchased a small amount of Treasury securities relative to the outstanding Treasury issuance (Asin, Doerner and Patrabansh 2014), which is why the Fed announced more buying in QE2.

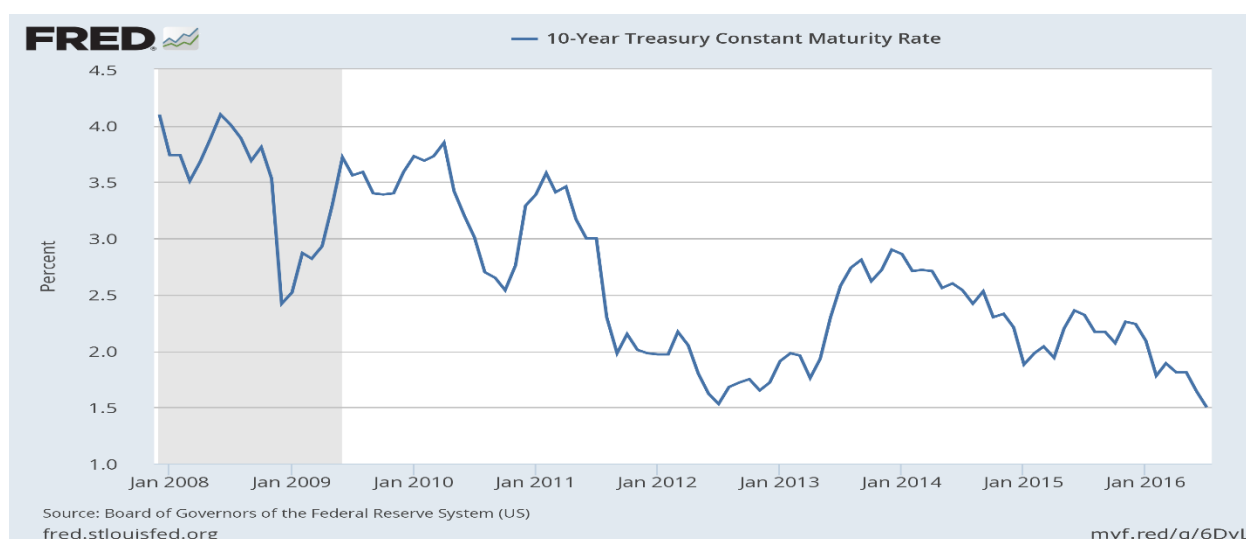


Figure 6

Source: Federal Reserve System

The announcement of QE2 was made on November 2010, but the Treasury yield did not fall. It was not until February 2011 that the yield showed signs of decreasing. This may have been due to the improvement of the stock market leading to an increased number of stocks purchased by investors. The decrease was most likely attributable to the debt crisis in Europe causing investors to shift toward U.S. Treasury securities. Yield of the 30-year fixed mortgage reduced after the announcement of the “Twist” in 2011. QE3 continued this general trend and both the Treasury yield and the 30-year mortgage rate decreased upon announcement. However, even though the Fed announced tapering, the Treasury and Mortgage rates are still decreasing which is surprising. Numerous event studies were done regarding each QE phase to see the effectiveness of the policies (Krishnamurthy and Vissing-Jorgensen 2011). The results confirmed

that each phase was effective and Nellis (2013) showed that QE1 was more effective than the others. The reason for QE1's effective impact is likely due to it being unanticipated.

The Fed's policies differed from the BOJ, and had a better outcome. Not only did they respond quickly to the global crisis, they also employed more aggressive strategies. Perhaps the Fed had learnt from the BOJ, and realising the severity of deflation, former Fed Chairman Ben Bernanke introduced inflation targeting to avoid it. In a December 2008 FOMC meeting, Ben Bernanke explained the difference between the policies enacted by the BOJ and the Fed by saying that the Japanese focused on the liability side of the balance sheet with their JGBs and the quantity of bank reserves, whereas the Fed focused on the asset side of the balance sheet and have bought securities other than the typical Treasuries onto their balance sheet (Federal Open Market Committee 2008).

### 3.3 EUROPE

The announcement that the ECB would purchase government debt securities regardless of credit rating was a boon for a country like Greece which had an extremely low credit rating on its bonds. This allowed countries to have more breathing room but resulted in bad debt holdings for the ECB. Bad debt would normally not be a problem for a central bank as it can print more money, however multiple countries having the same currency makes the situation strikingly more complicated. The Danish National Bank (DNB) was the first bank to reduce its deposit rate below zero due to rising capital inflows from the financially stressed Euro Area. After the ECB adopted NIRP, the Swiss National Bank (SNB) was forced to adopt it as well, due to its currency appreciating relative to the euro (World Bank 2015). The ECB introduced NIRP and QE in order to prevent deflation, however they are currently struggling to keep their inflation in the positive which was one of the main concerns (figure 7). GDP had been increasing since 2013, but now

seems to be stagnating since late 2014. Negative rates has led to an increase in household lending, although not as much as the ECB wanted, as well has strengthened portfolio rebalancing by “encouraging banks to substitute investment in riskier assets for excess reserves” (Lin and Jobst 2016).

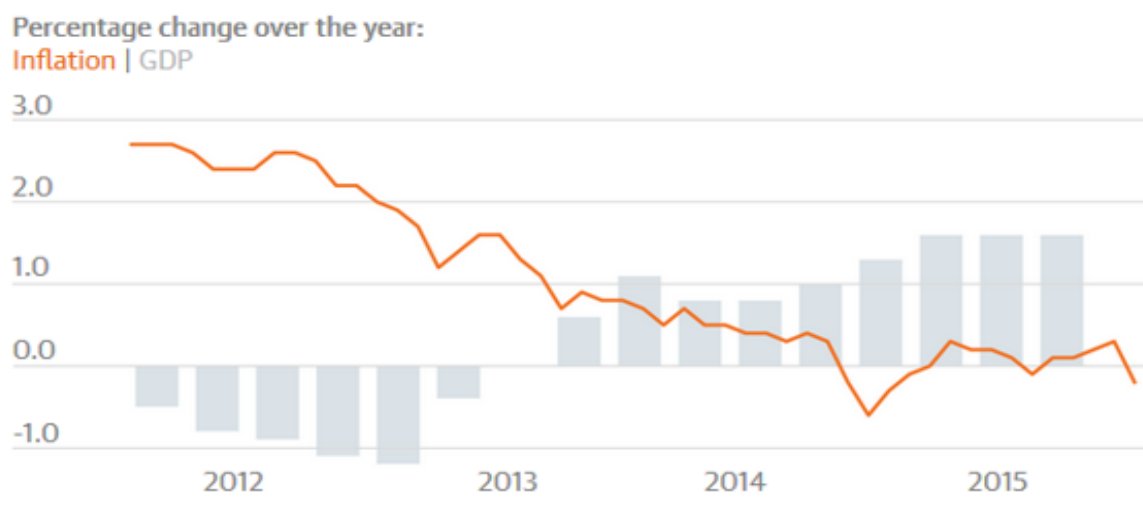


Figure 7

Source: Eurostat

#### 4. THE TAYLOR RULE

The Taylor rule is probably one of the most famous tools to assess how the central bank should set the nominal interest rate with regards to inflation and GDP. A tight or lax monetary policy at the wrong times may have made it more difficult for an economy in the aftermath of a burst bubble. To judge whether the central banks were following the Taylor Rule, this paper used the simplest formula as proposed by John Taylor (1993) :

$$i = \pi + r^* + \theta_{\pi}(\pi - \pi^*) + \theta_y(y - y^*)$$

where  $i$  is nominal interest rate,  $\pi$  is the rate of inflation,  $r^*$  is the assumed equilibrium real interest rate,  $\pi^*$  is the desired rate of inflation and  $(y - y^*)$  is the output gap. Taylor originally proposed the value of  $r^*$  to be 2 and the parameters -  $\theta_{\pi}$  and  $\theta_y$  - to be 0.5. This has been slightly

revised by him in 1999 with the coefficient of the output gap being greater than zero, however this paper will be using his original 0.5 value.

For Japan, the dataset used quarterly data from 1986-2015. The interest rates as well as the output gap was collected from the BOJ, and the inflation rate was collected from OECD. To measure inflation, CPI was used instead of GDP deflator. This is due to the CPI being the usual reference to inflation and includes foreign goods bought by consumers. Another reason is that CPI measures only goods purchased by consumers, whereas the GDP deflator includes the prices of all goods and services. For the U.S., the dataset used quarterly data from 1992-2015. The Federal Reserve Bank of Philadelphia's Real-Time Data Center for Macroeconomists provided the inflation rates as well as the output gap from 1992-2006. Output gap from 2006-2009 was collected from the Federal Reserve Board of Governors. The remaining output gap estimates was calculated using the estimate of potential GDP published by the Congressional Budget Office and the estimates of real GDP compiled by the Philadelphia Fed. The fed funds rate was collected from FRED. The Fed's preferred measure of inflation is core personal consumption expenditures index (PCE) as it excludes items with volatile prices such as food and energy items.

Since the BOJ has indicated that it is targeting a 2% inflation rate, it is easy to compare the interest rate gained from the Taylor rule with the actual interest rate. It can be seen in figure 8, that from 1989 to the end of 1990, the actual interest rate is lower than the Taylor rule interest rate. This implies that the monetary policy was too lax during this period, whereas from 1992 to 1996, it was too tight. Bernanke and Gertler (1999) came to the same conclusion when using forward looking reaction functions, however their results were more pronounced. They applied methods of Clarida et al (1998), using an expected deviation of inflation from its target rate over the next 12 months. The Taylor rule has met with some criticism regarding the difficulty to

measure the output gap, as well as it being a reaction function and not an optimality condition. It also does not impose a zero bound, which should be expected from an “optimal” monetary policy (Ito and Mishkin 2006).

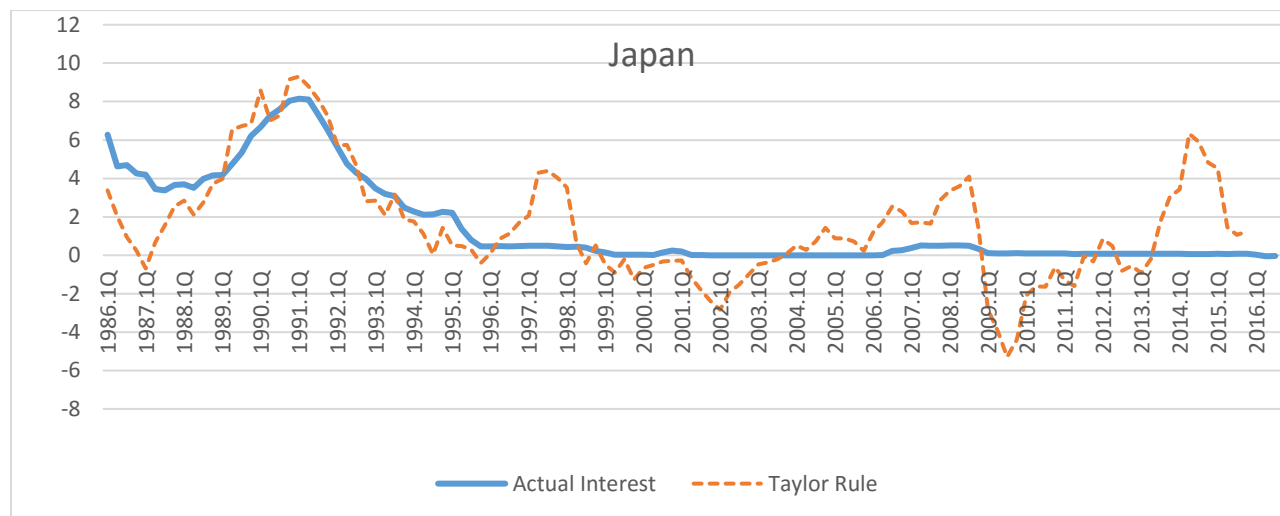


Figure 8

Source: OECD, BOJ

Apart from using the GDP deflator instead of CPI, this paper used the exact same framework as above using US data. The Fed Funds rate (figure 9) has been close to the Taylor rule. However, from 2009-2015 there is a steep drop where the Taylor rule suggests a negative interest rate. Such a sharp decrease, especially into uncharted negative territory seems implausible.

In 1999, Taylor asserts that his rule is useful in providing a framework to inspect U.S. monetary policy. His results claim that the Taylor rule is consistent with the results of historical data (Taylor 1999). Even so there are difficulties with calculating and getting an accurate value when using the Taylor rule. The values of potential GDP and the real interest rate are obtained by observing past behaviour. This means that the forecast of the future will be based on the past, which does not give a proper guideline for an economy, making the levels of these variables

uncertain (Greenspan 1997). Accurately measuring the potential GDP and the real interest rate will provide a better estimate when using the Taylor rule and may help to reduce the chances of a mistake in monetary policy.

In 2015, Taylor argued that the Fed kept interest rates lower than they should have during 2003-2005 (Taylor 2015). As can be seen in figure 9, the Fed's fund rate is indeed lower than what is proposed by the Taylor rule. According to the rule, a drop into negative interest rates in 2009 would have spurred the economy back on track with a positive interest rate by 2011. Instead the Federal funds rate has stayed at the zero lower bound from 2009 to 2015. The deviation from the Taylor rule is argued to have caused the economy to stay at the zero lower bound longer than it should have and is a cause for the slow recovery.

Ben Bernanke, the former chairman of the Federal Reserve, countered Taylor's result by insisting that the way the Taylor rule was calculated was incorrect with respect to the U.S. A different variant of the rule was shown by Bernanke (2015) where he used a coefficient of 1.0 for the output gap and used core personal consumption expenditure (PCE) instead of the GDP deflator. The core PCE was used due to it being the Fed's preferred measure of inflation as it disregards items with volatile prices such as food and energy. The decision to use a larger coefficient implies that the rule would allow a larger response of the Federal funds rate to the output gap. Bernanke argued that the coefficients are dependent on whether "policymakers wish to accept greater variability in inflation in exchange for greater stability of output", and that the FOMC focused on output gap. The decision to choose a higher coefficient is consistent with the Fed's response in dealing with inflation (Yellen 2012). As can be seen from figure 9, this led to a much closer relationship of the Fed Funds rate with the Taylor rule, however has a much larger drop of the Taylor rule into negative territory. The Taylor rule proposed by Bernanke requires

the Federal funds rate to stay at an extremely low negative number of below -4% in 2010, and remain in the negative until 2015. Such a massive decline in funds rate is impossible for the Fed to do, especially since having a negative interest rate is uncharted territory. The Taylor rule seems to be a simple guide to assess nominal interest rates in a “normal” working economy, however falls short when faced with a crisis especially when dealing with negative interest rates.

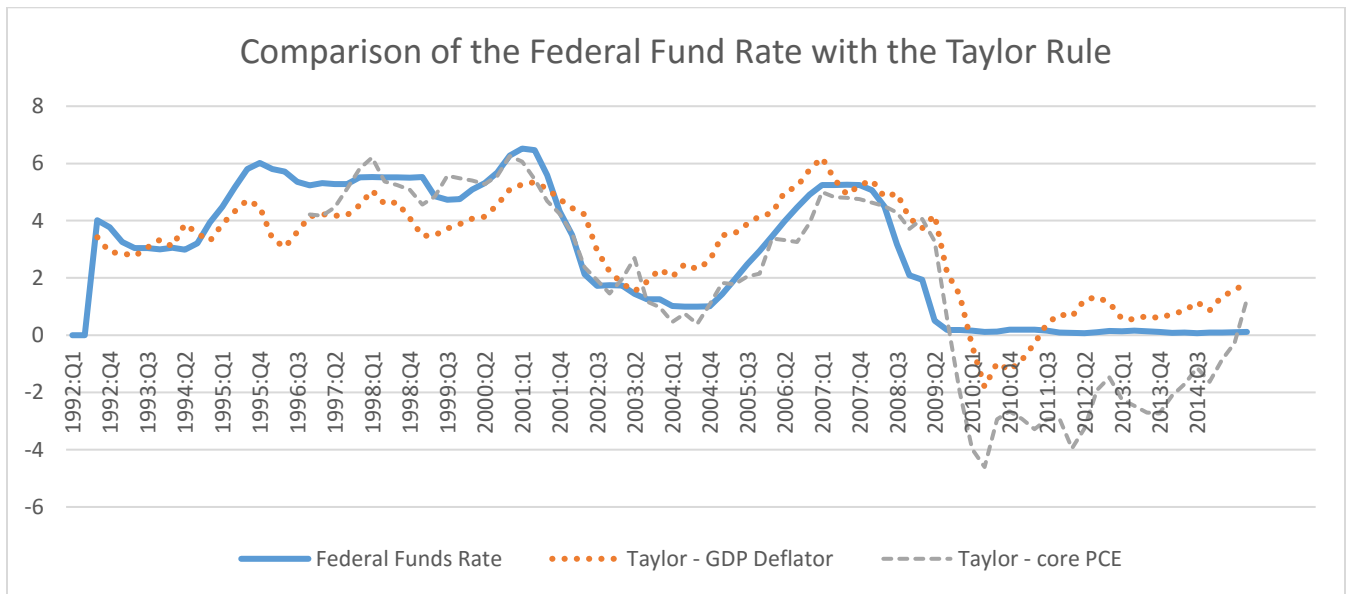


Figure 9

Source: Federal Reserve System, Federal Reserve Board of Governors, ALFRED

## 5. ADVERSE EFFECTS OF ZIRP AND NIRP

A low interest rate policy increases the monetary base and encourages lending. However, there are other sources of concern when a central bank sets a low interest rate which might harm the economy in more ways. This next section examines some of the problems certain countries are facing with their interest rate policies.



## 5.1 SHARE BUYBACKS

With a close to zero borrowing cost as well as an economy in turmoil, companies have resorted to buying back their own shares by leveraging their balance sheets. This has caused the issuing of dividends, debt and executive stock options to be more attractive for companies. The value of shares have increased greatly, and it can be seen that the S&P 500 has increased since the recession, even though new customer dollars may not have been received. This is likely bad news for the economy, as corporations will now be focused on buying back shares and inflating their EPS. There will be no need to improve efficiency or come out with better technologies as the buyback strategy will cast a better company portfolio. The use of financial leverage to facilitate share buybacks increases risk as cash reserves are being drained which could otherwise serve as a cushion during tough times. These companies, which falsely appear in being more successful than they are in actuality, are luring stock buyers who desire to earn more income. This is exacerbated by the fact that the Fed has taken away their bank account and Treasury security earnings with ZIRP. Currently with the falling of announced share buybacks in 2015-2016 in lieu of the Fed increasing interest rates, the S&P 500 (figure 10) has stopped its steady climb (Lu 2016).



Figure 10

Source: Federal Reserve System

The Nikkei may be harder to interpret as the 2011 earthquake and tsunami did cause problems for the stock market, however from 2012 it is easy to see the abrupt rise (figure 11). This increase is probably testament to the announcement of NIRP, and continues until 2015. Strangely enough, Europe has not yet followed the buyback strategy. This may be due to different tax systems, which dissuades companies from issuing domestic debt, or perhaps because earnings per share is not as big a share of executive remuneration. Buybacks also look politically bad during a period of high unemployment and activist shareholders are less common than in the US (Atkins 2015).

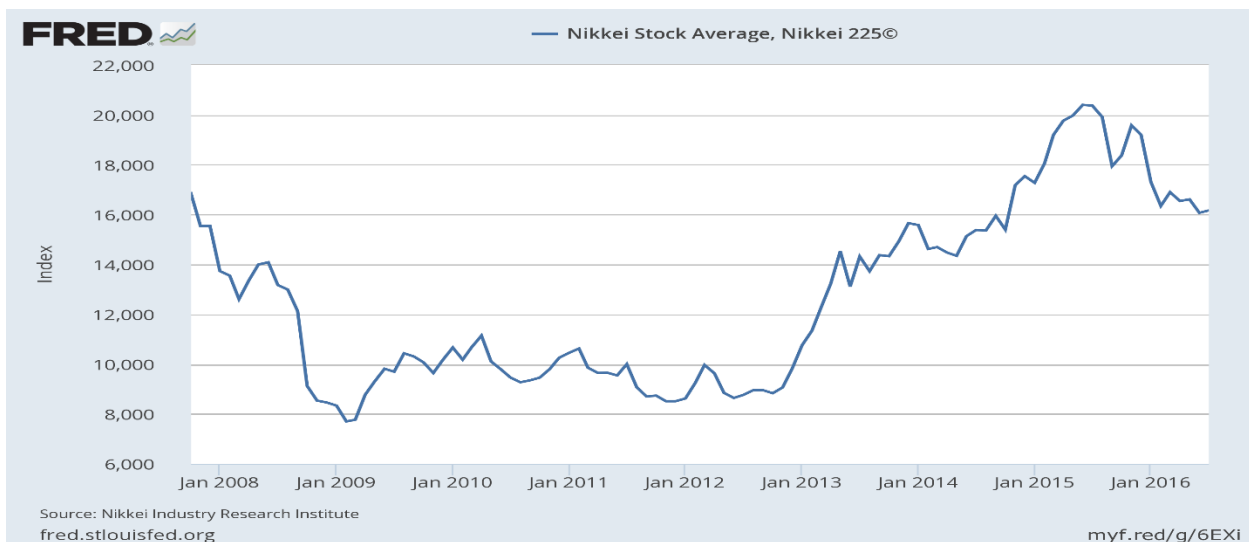


Figure 11

Source: Federal Reserve System

## 5.2 PENSION FUNDS

Another extremely important sector that has been ravaged by low interest rates is pensions. The most recent fund that is currently in great difficulty is the Central States Pension Fund. The fund - which is one of the biggest pension funds in the US - handles the retirement benefits for current and former Teamster union truck drivers, and recently tried to get government approval to partially reduce the pensions of about 115,000 retirees and the future

benefits for 155,000 current workers. The proposed cuts were steep and some were close to 60%, however it was not deemed enough. The Treasury department rejected the plan stating that even these cuts would not be able to prevent insolvency in May 2016. According to the fund director, Thomas Nyhan, there is no way to save the fund and comply with the law. He says that the fund has no new plan to avoid insolvency and without help from the government, it will run out of money in 10 years (Nyhan 2016). It should also be kept in mind that top executives in the fund, including Nyhan, received a raise in salary in 2014 providing Nyhan with a total salary of \$662,060. Central States Pension Fund, like other pension funds, relies on safe investments such as Treasury bonds, and with these securities having a much lower yield – due to ZIRP - the fund is unable to stay solvent.

Usually in the US, if a multi-employer fund like Central States runs out of money, a government insurance fund called the Pensions Benefit Guaranty Corporation (PBGC) acts as a failsafe so that the retirees receive some kind of benefit. However in this case, the amount is much smaller than what pensioners would have received under the Central States reduction plan and is based on the number of years a retiree worked. A retiree would receive \$35.75 a month for each year worked, meaning that for a retiree who has worked for 30 years this amounts to \$1072.50. Even worse is the fact that the PBGC is underfunded – again due to ZIRP - and will not be able to cover all the retirees in the Central Pension Fund. Of course, ZIRP is not the only cause of the inevitable collapse of the pension fund since there has been a shift in the labour market. In 1980 the Central States plan had one retiree for every four participants still working. According to the Center for Retirement Research at Boston College, the ratio was reversed with about five retirees for every one working. It is paying out \$3.46 in pension benefits for every \$1 it receives from employers. With lower yielding Treasury securities coupled with the deficit in

payment structure, it is easy to see that the fund is heading in the wrong direction. Government-run pension plans for public employees are in difficulties for the same reasons as above and will soon face similar problems. Central States Pension Fund is a private pension fund and may therefore be refused a taxpayer bailout, however the public pension funds may demand one leading to more problems for the government. The government recently bailed out financial institutions, the automobile industry, Fannie Mae and Freddie Mac; another massive bailout would be devastating to the already recovering economy. The average American local government pension fund assumes it will earn an annual return of 7.69%, even though the current yield on a 20-year Treasury security is 1.82% (figure 12).

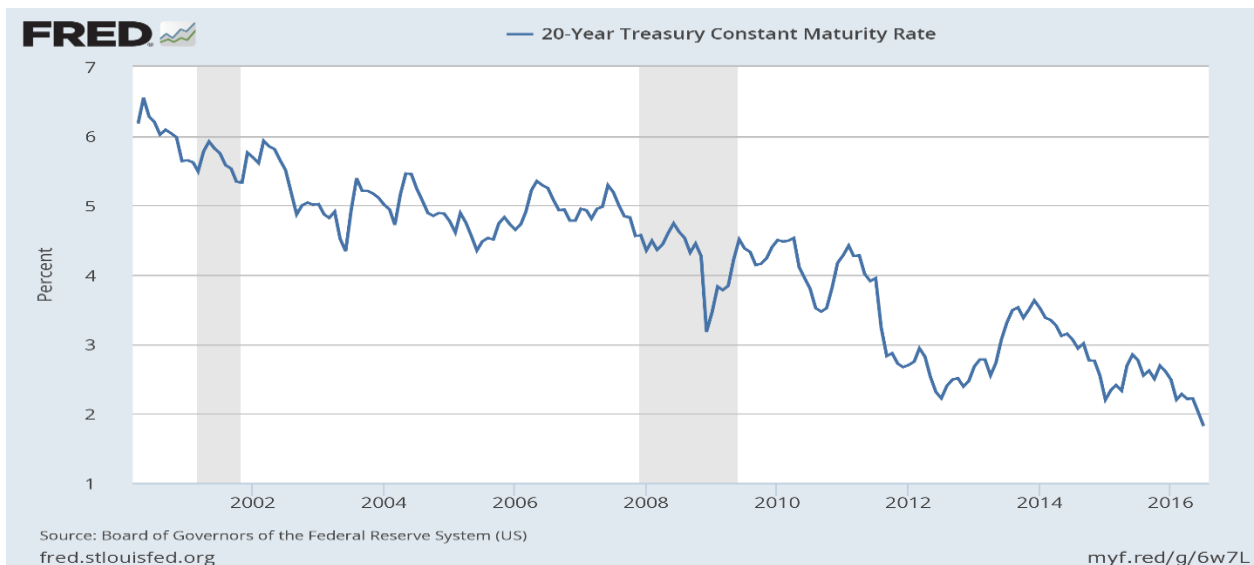


Figure 12

Source: Federal Reserve System

Other countries are facing the same problems. Germany has only had one pension fund cut benefits 10 years ago, and now is being warned that there is a possibility of benefit cuts in this low rate environment. Philippe Desfossés, the head of France’s largest public pension fund - Établissement de retraite additionnelle de la fonction publique (ERAFP) – warned that retirement funds in Europe will implode if the ECB’s low interest rate continues. Stichting Pensioenfond

ABP, Europe's largest retirement fund, which provides pensions for one-sixth of the Dutch population, stated in April 2016 that there is a "distinct" possibility of benefits being cut in 2017 due to declining interest rates. Mario Draghi defended the central bank's position on a benchmark interest rate at zero. He said that pension funds should not be blaming interest rates with everything going wrong in the sector and that in order to go back to high interest rates, a higher growth and inflation is needed. He further stated that US pension schemes have coped with low interest rates longer (Flood and Marriage 2016). Even though Draghi may be correct that US pension funds have coped for longer, they are progressively getting worse (for example Central States Pension) and action before the collapse would definitely lessen the impact and be a step towards fixing the underlying problem instead of delaying the inevitable.

Japan's Government Pension Investment Fund (GPIF) is the world's largest pension fund at an asset value of \$1.3 trillion. GPIF had invested about half of its money into JGBs (figure 13) but with the yield of the bonds so low – the 10-year government bond is actually negative - it has led to significant losses. For the GPIF to reverse its financial losses caused by NIRP, it has slowly reallocated some JGBs towards domestic and international stocks. The GPIF has no choice other than shifting towards stocks and it is conceivable for pension funds in other countries to follow suit. This shift from fairly safe bonds toward a volatile stock market is a cause for concern, especially since it deals with the retirement and therefore livelihood of a lot of people. GPIF reported a \$52 billion loss in the second quarter in 2016.

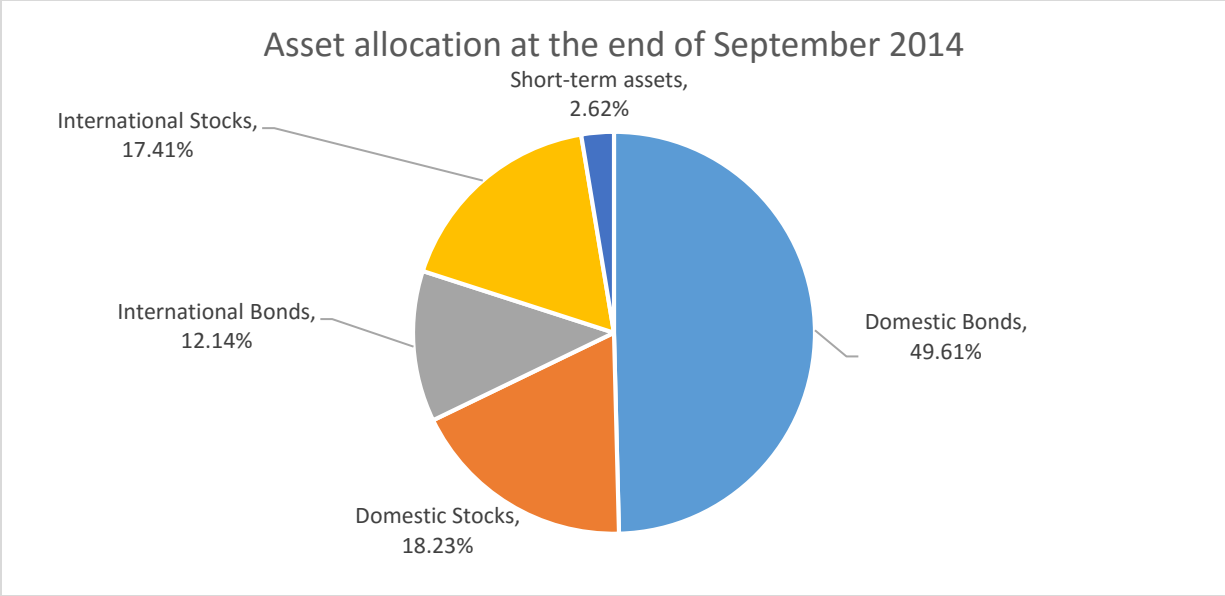


Figure 13

Source: GPIF

With low interest rates borrowing costs have decreased, leading to a greater incentive to use leverage. Therefore, pension funds have increased their leverage, in the short term, to assist in purchasing alternative assets (Bedard-Page, Demers and Tremblay 2016). An increased leverage position, especially in pension funds, requires extensive risk management as it could cause problems if these trends continue. Pension funds by itself may not be a systemic risk even though it is vulnerable to financial market shocks. However, similar solvency requirements mandated by regulators such as Basel III, Solvency II and CRD IV on all financial institutions may increase the impact of financial market shocks on a much wider scale (Beetsma and Vos 2016). The effect of ZIRP is not only confined to pension funds but also has also effected personal pension plans as well. With drastic changes in the economies causing uncertainty, people are saving more money for their retirement rather than spending it (Bagus 2015). Not only is this going against the theory of low interest rates increasing spending, it is also making it much harder for people to retire with a comfortable amount while keeping their current

consumption. This leads to a reduction of their current standard of living, in the hopes to get enough money for retirement which would be lower than it was before.

### 5.3 INSURANCE COMPANIES

Insurance companies are in the same problem as pension funds since they also rely on the yield from government bonds. To combat the subsequent loss in profits, life insurance companies including the largest U.S. life insurance company, MetLife Inc. as well as Prudential Financial Inc. invested in energy bonds. Turning away from the low yielding Treasury securities, energy bonds seemed safe due to the high levels of assets relative to their debt. In 2014, oil prices plunged from \$105 in June 2014 to \$47 in January 2015 (figure 14). This caused the value of assets to decrease causing the life insurance companies to hold \$1.32 billion of bonds that were either close to or in default at the end of the second quarter in 2015 (Boston, Chiglinsky and Emma 2016). ZIRP coupled with the oil price plunge may force the life insurance companies to look into junk bonds as a last resort.

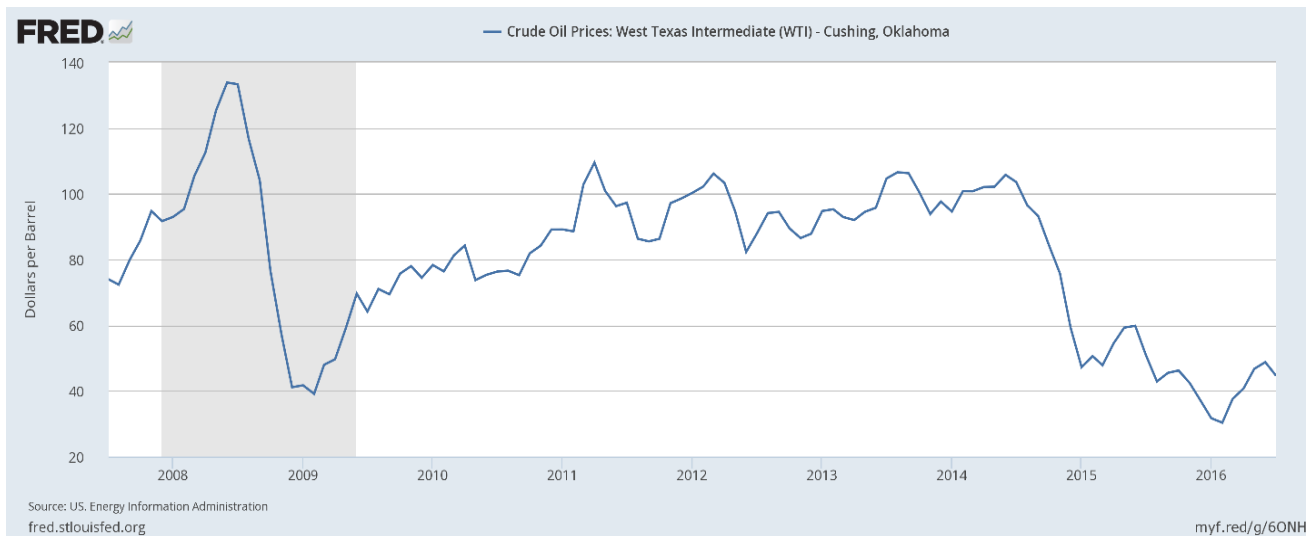


Figure 14

Source: Federal Reserve System

Japan's largest private life insurance company – Nippon Life Insurance Co. - is also having problems. In April 2016, the president of Nippon Life attested to NIRP having a

significant impact on their earnings and that they had to suspend the sale of a product which had previously generated \$3.2 billion during nine months in 2015. The effect of NIRP on Europe is too early to tell at the moment, but seeing the effect of low interest rates on U.S. insurance companies, it is not a far stretch to see that insurance companies anywhere would face problems especially with NIRP. Another way for insurance companies to regain their lost profits, is to charge higher premiums to customers. Some families may no longer be able to afford their previous health insurance plan causing a detriment to society. It seems that insurance companies are not having as much as a problem as pension funds for the time being, however a low yielding bond will definitely cause difficulties if no other investment alternative appears and this trend continues.

#### 5.4 BANK PROFITABILITY

NIRP has reduced bank profitability by decreasing the margin between commercial banks' deposit and lending rates. Banks generally do not wish to pass on negative deposit rates to its consumers, as consumers may either go to another bank or just keep the money under their mattress. This makes it harder for banks in countries with NIRP to make a profit as they need to pay interest to the central bank without receiving any from consumers. Actions such as QE has made it easier for banks is to sell off their government bonds to the central banks in order to gain more capital, which has given some benefit. This is still not a feasible long term plan to survive and banks will likely have to follow in the steps of pension funds and invest in riskier assets in order to find a positive yield. This idea is consistent with different studies concluding an inverse relationship between bank risk-taking and short term interest rates (Altunbas, Gambacorta and Marques-Ibanez 2010; Dell'Ariccia, Laeven and Suarez 2013) (Dell'Ariccia, Laeven and Suarez 2013). It is also difficult to calculate the present values of investments due to an increasingly



sensitive discount rate, making decisions much harder. This also means that zero or negative discount rates for a prolonged period of time would create a lot of ambiguity when valuing assets and liabilities (World Bank 2015). If NIRP continues, financial institutions such as banks and insurance companies may no longer be as viable a business as they once were.

The U.S. did not dip into negative interest rate territory and therefore did not face the problems that plagued NIRP countries. However, with zero interest rates and an easy money environment, the surviving banks were able to merge and subsequently grow larger than they were pre-crisis. This meant that a small number of banks held more assets than ever before (Kroszner and Strahan 2014), for example the ten largest banks held about 70 percent of total banking assets. This is bringing back the problem of “too big to fail” and now that they are bigger than they ever were, it will have a much more severe impact if they run into problems in the future. ZIRP and the buying of Treasury bonds from the Fed, has caused an easy money environment where banks are able to lend more money - which may be exactly what the government wants - but has led to real estate loans being much higher than they were pre-crisis (figure 15). This makes one wonder if we are just delaying the inevitable and will crash a much larger market in the not-so-far future.

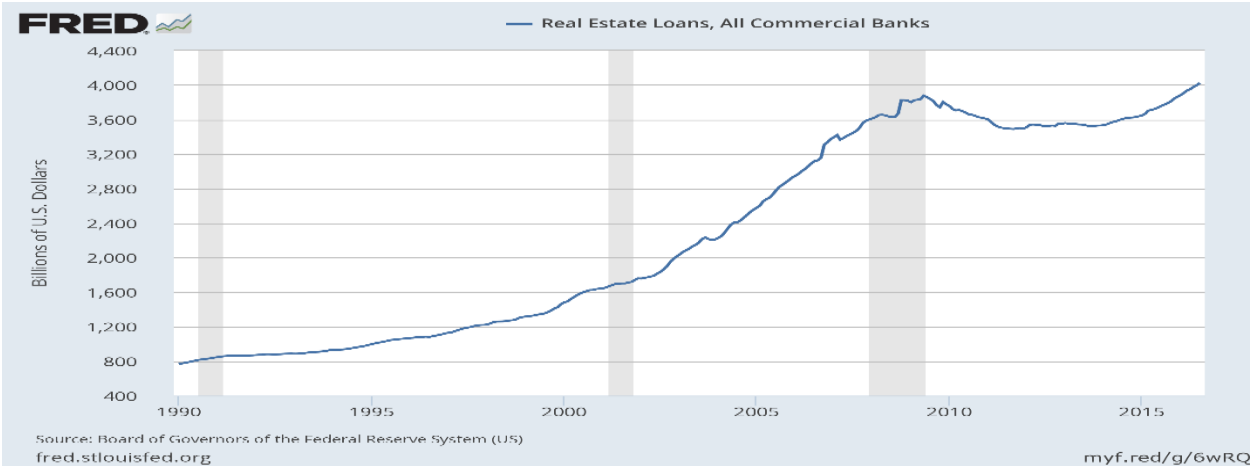


Figure 15

Source: Federal Reserve System

## 6. CONCLUDING REMARKS

ZIRP does provide some benefit in increasing lending and coupled with quantitative easing it is able to move the wheels of a faltering economy. It provides a brief respite to an economy that may desperately need stability. ZIRP has also significantly influenced the expectation of financial markets over one-year future interest rates, and has caused depreciation of the yen and increased stock prices (Kurihara 2014). Lowering the value of a currency leads to a more profitable exports industry, however this is short term and does not seem to create sustained economic growth due to the downsides. Since all the developed nations are going through the same problem and are increasing their monetary base; depreciation seems to be a step everyone is taking in order to boost their exports. Other sectors like banking, pension funds and the stock market are having problems which may culminate to another big crisis in the near future. ZIRP may help when it is enacted and provide immediate benefit in sectors such as housing, but is falling short in providing a stable economy. A main reason for this is that the global financial system is based on an above zero interest rate. An interest rate at zero or even below gives the sign of a weak economy, and financial institutions are unsure as to the path they should take in such a new environment.

Currently, the negative interest rates in Europe and Japan are relatively new and involve interest rates only slightly below zero. But if policies become long and negative interest rates go much lower, how would it impact everyday life for a regular consumer? Would people prepay their various bills months in advance instead of leaving, thereby losing money in their bank account? Would retirees need to risk their money in order to have a chance at a retirement? This does not seem to be a way for a stable economy to run itself. Former Governor of the Bank of England, Mervyn King, states in his new book (2016) “Central banks have thrown everything at

their economies, and yet the results have been disappointing. Whatever can be said about the world recovery since the crisis, it has been neither strong, nor sustainable, nor balanced.” This statement coupled with the overall negative outcomes of ZIRP, NIRP and QE around the world, imply that perhaps there are underlying issues in the system that need to be fixed first.

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