Quantitative Easing:
A Literature Review

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Abstract

In this paper we review the academic evidence on quantitative easing and its implications for policy makers and financial market participants. More specifically, we structure our review around literature questioning the effectiveness of quantitative easing in Japan near the start of the 2000s and the United States after the financial crash of 2008. This paper identifies the different methods different groups of researchers take in pursuing the answer, implications of their findings, as well as suggestions to improve future quantitative easing programs.

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1 Introduction

The Financial Crash of 2008 has led to the US Federal Reserve pushing the federal funds rate to almost zero, hitting the "zero bound". In light of this, the Federal Reserve has engaged in three rounds of quantitative easing, hereafter referred to as QE, a policy whereby the central bank buys long-term government bonds and private sector financial assets (particularly mortgage related assets) in an attempt to stimulate the economy. Since September of 2008, the US Federal Reserve has injected over three trillion dollars[1] into the US economy.

The term quantitative easing (量的金融緩和, *ryōteki kin'yū kanwa*) was coined by the Bank of Japan in the early 2000s as they tried to fight domestic deflation. While several literatures have looked into the Japanese QE, the topic did not catch fire until the recent financial crash, and has since seen massive amounts of debates and arguments across economists and financial scholars. QE3 was released less than a year ago, and very little researchers have had the time to analyse the effects of QE3. In terms of QE1 and QE2, the policy has been supported and argued against by different economists around the world. In this paper, I will be discussing the economic logic behind QE, how it is initiated, and its anticipated effects. I will also be taking a look at some alternative instruments to help contrast and better understand why QE was used. Then, I would like to examine literature discussing the Bank of Japan's early 2000s QE policy, its increasingly positive views over time, in addition to a brief discussion on their new QE plan launched in April of 2013. Next, I would like to review the literature released in

[1] First round of QE reached a peak of $2.1 trillion in June 2010. The US Federal Reserve announced QE2 on November 2010, resulting in $600 billion of Treasury securities purchased by the end of the second quarter of 2011. QE3 was announced in September of 2012, where the Federal Reserve decided to launch a $40 billion per month, open-ended bond purchasing program, which later increased to $85 billion per month in December of 2012. On June 19, 2013 Ben Bernanke announced a tapering of some of its QE policies, scaling back per month bond purchases from $85 billion to $65 billion later in the year.

regards to QE policies released by the US Federal Reserve during the 4 years after the financial crash of 2008, with special attention to the global impact of the US Federal Reserve's policies, as well as concerns over the QE program's exit strategy. Finally, I would like to write about the Federal Reserve's plans to slow down QE in a speech last month (Bernanke 2013), and what that could mean as we head towards a very uncertain future.

1.2 Economic Logic of Quantitative Easing

The economic logic of QE was first laid out in 2004 by Ben Bernanke, then the Federal Reserve Governor (Bernanke 2004), with much influence coming from his studies of the Great Depression (Bernanke 1983) and his observations of monetary strategy across six industrialized countries (Bernanke 1993). From his study of the Great Depression of the 1930s, Bernanke found that institutions that perform well at normal times become counter-productive during periods with exogenous shocks, which led to his next research on methods of correcting the market and helping institutions return to their normal productive state. His paper in 1993 examines six different industrialized countries[2] to come up with three major findings that would have great effects on the QE policy decades later. First, the successful use of monetary target requires the central bank to "not play games" with its target, as clarity, openness and consistency of the target is almost as important as whether the target is met. Second, deviations in the short run are not important as long as they are corrected in the long run.[3] Lastly, the outcome of the policy does not depend on the details of the operating procedure or the choice of its instruments. While the third point may be debatable, it is clear that the first and second point have had some influence in the QE policies of the US Federal Reserve, when they

[2] United States, United Kingdom, Canada, Germany, Switzerland, and Japan from 1973 - 1991
[3] Switzerland compensates one period of growth with another period of depress to ensure reaching the long run target

recently made a clear announcement of the eventual slowdown of their QE policy in a speech done by Bernanke in June of 2013 (Bernanke 2013). By 2004, Bernanke had a fairly firm grip on monetary policy at the zero bound when he and his colleagues Reinhart and Sack released their paper on that subject. Their idea was that central banks can perform three types of alternative policy: (1) utilizing communications policies to shape public expectations about the future course of interest rates; (2) increasing the size of the central bank's balance sheet, and (3) changing the composition of the central bank's balance sheet. Through data gathered from the US and Japan in the early 2000s, Bernanke was able to achieve a clear understanding of the implementation and effects of QE.

While these papers may have been the primary influence for the US Federal Reserve's actions at the wake of the financial crisis of 2008, QE's roots can be traced as far back to a proposal by Tobin and Buiter (1980). They believe that the Federal Reserve should consider buying equities as a way of increasing asset prices, and thus stimulate investment. The zero bound to the federal fund rate places a limit on how low the Federal Reserve can push the short-term policy rate during times of crisis. QE allows the central banks to find a way around this constraint by buying other assets to stimulate the economy as the asset prices are bid up by the increased demand, leading to greater liquidity into the financial system. Liquidity is especially important during times of recessions, as is the situation known as the "liquidity trap"[4], which arose after the disastrous US Great Depression of the 1930s. As long as the consumers hold cash instead of investing, the economy will remain weak, and as long as the economy remains weak, there would be no reason to invest, resulting in a downward spiral for the economy.

[4] A Liquidity Trap is when people hoard their money instead of investing or spending due to a pessimistic outlook of the future of the economy.

QE has five primary channels of expansionary effects in order to combat the liquidity trap. The first is through buying long term bonds, increasing the bond price while decreasing the bond rate relative to the short rate, thus reducing the gains from long term bonds as opposed to short term ones. The second results from increases in liquidity which is directed to equity purchases, increasing stock prices and thus increasing investments. Third is via a consumption wealth effect resulting from higher bond and equity prices, allowing for consumers to consume more today. The fourth is through expected inflation, with firms and households expecting higher future prices, there will be more incentive to consume and invest today as opposed to the future. The fifth channel is via the exchange rate, reducing real exchange rate leading to more exports.

While QE does provide many channels of expansionary effects to influence the economy like most policies, there are many costs and adverse effects that come along with it. In terms of cost, over three trillion US dollars for the US economy was spent for the three QEs. While the US Federal Reserve stated that they have started to slow down the QE3 policy and may eventually recover the money spent, there are still questions as to the cost/benefit of this policy. The opportunity cost of the three trillion dollars, which could have been used to invest in emerging markets or commodity-based economies as well as commodities themselves, could have led to far greater gains than QE, but that is up for debate. Another major concern is in savings and pensions, as a group of conservative Republican economists and political activists released an open letter to Bernanke on November 2010 questioning the QE program. Without returns that outstrip the increased inflation, pension investors may face the real value of their savings declining rather than increasing. Questions of economic inequality also arose when the Bank of England issued a report in August 2012 stating that its QE policies had mainly benefitted the wealthy. Some have suggested fiscal policy as a better alternative to

stimulate the economy. However, during his recent speech, Bernanke repeatedly cited fiscal drag in his comments on the economy, "the risk remains that tight federal fiscal policy will restrain economic growth over the next few quarters by more than we currently expect of that the debate concerning other fiscal policy issues, such as the status of the debt ceiling, will evolve in a way that could hamper the recover." (Bernanke 2013)

1.2 Comparison with Other Instruments

Quantitative Easing has been nicknamed "printing money" by many members of the media, leading to confusion amongst those trying to understand QE. The physical act of printing more money was what happened in Germany in the 1920s, where Germany became the infamous textbook example of a hyperinflation disaster. While there is no longer the need to print money physically, as all transactions can be done electronically today, creating money used to directly finance government deficits or paying off government debt can still be referred to as printing money or monetizing the government debt. Central banks in most developed nations[5] are forbidden by law to buy government debt directly, and must instead buy it from the secondary market. While "printing money" is to finance government spending, QE is a policy in which the economy is temporarily stimulated through monetary injections, with the stated intention of recovering the money spent when the economy has recovered by selling the purchased assets back into the market. Printing money simply increases aggregate money supply by "printing" more money into the economy in order to pay off government debts, but theoretically QE would later reverse the effects on the aggregate money supply. When the term printing money is used, it is often believed that the money will never be recovered, whereas in reality, QE has a clearly stated intention of reversing its spending when the economy has recovered. As a matter of fact, purchasing the assets when the prices are

[5] Including Japan, the United Kingdom, and the United States

undervalued, and selling the assets at their proper value years later when the economy has returned to normal may lead to a net gain for the government.

Professor Willem Buiter of the London School of Economics differentiated quantitative easing from what he coins as qualitative easing when he said "quantitative easing is an increase in the size of the balance sheet of the central bank through an increase in its monetary liabilities, holding constant composition of its assets … Qualitative easing is a shift in the composition of the assets of the central bank towards less liquid and riskier assets, holding constant the size of the balance sheet." (Buiter 2008) He believes that the US Federal Reserve and the Bank of England are engaging in both quantitative and qualitative easing, resulting in a larger balance sheet consisting of riskier and less liquid assets. The Bank of Japan's early 2000s QE however, had more quantitative easing and less qualitative easing.[6] Bernanke acknowledged the differences between the US Federal Reserve and Bank of Japan's QE policy in his 2009 speech, where he announced,

"*Our approach—which could be described as "credit easing"—resembles quantitative easing in one respect: It involves an expansion of the central bank's balance sheet. However, in a pure QE regime, the focus of policy is the quantity of bank reserves, which are liabilities of the central bank; the composition of loans and securities on the asset side of the central bank's balance sheet is incidental. Indeed, although the Bank of Japan's policy approach during the QE period was quite multifaceted, the overall stance of its policy was gauged primarily in terms of its target for bank reserves. In contrast, the Federal Reserve's credit easing approach focuses on the mix of loans and securities that it holds and on how this composition of assets affects credit conditions for households and businesses.*" (Bernanke 2009)

In his speech, Bernanke described credit easing as increasing the money supply by purchasing private sector assets such as corporate bonds and residential mortgage-backed securities as opposed to government bonds. In 2010, 1.25 trillion dollars of these riskier mortgage-backed securities were purchased in order to support the sagging mortgage market. Due to the lack of a clear definition of QE, the media, central bankers and financial analysts often use incorrect terms to characterize the US Federal Reserve's QE policy. It is important to learn the unique aspect of each QE policy, and understand that there are many different types of QE policies, each entailing a different result.

[6] The Bank of Japan's QE was accomplished by purchasing mostly government bonds instead of private assets, which is the act of increasing their balance sheet, without changing the composition of their balance sheet to holding riskier assets

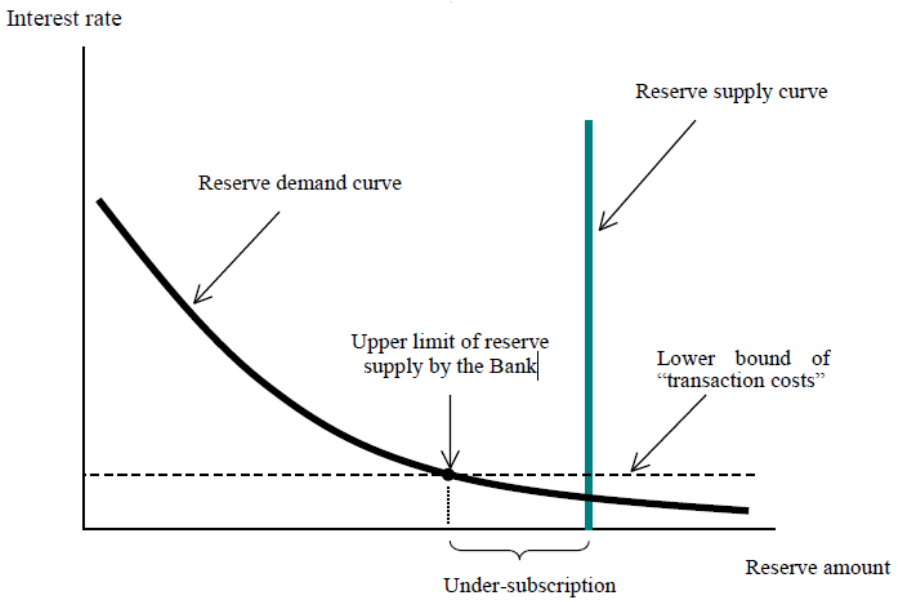
2 Quantitative Easing in Japan

After World War II, Japan became the fastest growing country in the world, despite being a fairly small country, its GDP was second only to the United States. Driven by their high savings rate, the money was mostly spent on reinvesting; as well as research and development in the high-tech industry, where Japan held an enormous edge when it came to high-tech consumer products. With so much money readily available for investment, speculation was inevitable, leading to massive bubbles in the Tokyo Stock Exchange and the real estate market, which resulted in a particularly hard crash. As investments were increasingly directed out of the country, Japanese products became less competitive overseas, and Japan's low consumption rate began to bear on the economy, causing a deflationary spiral. Japan fell into a liquidity trap, as the interest rates have long been zero bound due to Japan's propensity to save, and correcting the credit problem became even more difficult as the government began to subsidize failing banks and businesses. Before implementing QE, according to Lars Svensson of the National Bureau of Economic Research (Svensson 2001), many economists, in particular, Bernanke, Krugman, Meltzer and Posen had suggested monetary policy actions and changes that may improve the economic situation in Japan. However, Okina and Ueda from the Bank of Japan had consistently defended a policy of not taking any actions beyond lowering the instrument rate to zero. The idea behind the Bank of Japan at the time, seems to be that; "since one cannot be absolutely sure that any given policy action or change in the monetary policy regime will succeed in getting the economy out of the liquidity trap, it is safer not to try." (Svensson 2001) Given that the past 50 years of the world economy has been growing rapidly due to technological advances, there has been little need for policies or research in regards to unconventional monetary policies. Therefore, it came to no surprise that the Bank of Japan would be hesitant in implementing a very experimental

policy at the time. After a decade of deflation in Japan, on March 19th 2001, the Bank of Japan and the Japanese government tried to eliminate deflation in the economy by adopting QE. Over the next 4 years, the Bank of Japan increased the commercial bank current account balance from 5 trillion yen to 35 trillion yen (about 300 billion USD).

2.1 Opposing Literature

One year after the implementation of QE in 2001, Masaaki Shirakawa, advisor to the Governor of the Policy Planning Office in Japan finds that economic activity had not been stimulated despite an aggressive increase in reserves. (Shirakawa 2002) Shirakawa first examines QE using a standard textbook supply and demand argument, whereby in theory, demand for reserves increases as nominal interest rate declines. However, he believes that in reality, transactions costs[7] constrain the amount of reserves which a central bank can provide, creating an upper limit.



Shirakawa, M. "One Year Under Quantitative Easing." *Bank of Japan, IMES Discussion Paper Series* 3rd ser. 2002.E (2002): pag 40. Web.

[7] Including transaction charges accompanying the extension of call loans and the receipt of call money, charges for using settlement services, and staff expenses

Shirakawa believes Japan has already hit the upper limit, thus QE would have little practical effect on the economy. He continues on his discussion by examining economic activities since March of 2001, where he finds that economic activity was not stimulated. The period from March of 2001 to September of 2001 saw very little change in interest rates, bond yields, and reserves. The September 11th terrorist attack in the United States caused a period of uncertainty in Japan, further diluting the possible effects QE had on the economy. The author criticizes the QE policy, and believes that there is little room for a further decline in short-term interest rates, and it would be better to consider what kind of policy could be more effective.

Shigenori Shiratsuka and Hiroshi Fujiki of the Bank of Japan continued the study a year later (Fujiki 2002) with focus on "The Policy Duration Effect", essentially putting emphasis on how long the current abundant provisions of funds will last rather than how abundantly the funds are provided. In order to promote current spending, it is important to reduce long term interest rates, which is reflected by the market expectation of the future policy actions. For example, the one-year interest rate is determined by market expectations for overnight interest rate during the subsequent 12-month period. Therefore, if market participants believe the Bank of Japan will continue their policy for the entire year, then the long-term rates and yields will reflect the expectations and lower accordingly. Shiratsuka and Fujiki provide empirical evidence for the long term yields using implied forward rates, and show a significant decrease after the Governor's press conference announcing the QE policy. They continue to study the forward rate curves

using Nelson and Siegel's 1987 model[8] to estimate the instantaneous forward rates and found significant downward shifts in forward rate curves after policy announcements. Despite significant effects inside the financial system, the transmission channel linking the financial and nonfinancial sector remains blocked, and the authors argue that to make QE sufficiently effective to overcome the lower bound of nominal interest rates, a new tailor-made economic policy package with adequate authority should be considered. One year later, Shiratsuka tackles the same topic with the help of Okina, where they repeat the experiment using Nelson and Siegel's model along with the new data released.[9] Through the model, the authors found that while QE has strengthened the policy duration effect, the market expectations that deflation and low economic growth will continue in the future has hardly been reversed. Essentially, while market participants are confident the QE policy will continue for the near future, and liquidity will not be a problem, they are not confident that the Japanese economy will recover any time soon. Though it is clear there is a lack of confidence for the future outlook of the Japanese economy, it is unclear why that is the case. One possibility might be the September 11th, 2001 terrorist attack in the United States, which caused huge economic repercussions across the world, thereby leading to a largely pessimistic view of what is to come. Shiratsuka briefly discusses the possibility that the Japanese economy would be in much greater trouble due to the terrorist attack period if not for QE, but acknowledges there is no way to isolate the effects separately.

[8] The Nelson and Siegel's 1987 model is based on the equation $r(m) = B_0 + B_1 \exp\left(-\frac{m}{\tau}\right) + B_2(\frac{m}{\tau}) \exp\left(-\frac{m}{\tau}\right) + B_3(\frac{m}{\tau}) \exp(-\frac{m}{\tau})$ where B_0, B_1, B_2, B_3, τ are parameters to be estimated from the data. The equation stands for the instantaneous forward rate curve.

[9] Data for euro yen Tokyo interbank offered rates and yen swap rates were used for the model

2.2 A More Optimistic View

While much of the early literature had suggested abandoning QE and seeking an alternative policy, Kimura, Kobayashi, Muranaga and Ugai provided a more optimistic view of the QE policy (Kimura 2004). The authors find that with the monetary base posting double digit percentage growths per year, the financial market had five major reactions: (1) Amid the unprecedented abundant supply of liquidity, the interest rate was lowered to literally almost zero, as well as creating downward effects on medium-term forward interest rates. (2) Prior to QE, there had been large amounts of shifts from time and savings deposits to liquid deposits, creating instability for banks, but the provision of reserves by the Bank of Japan succeeded in dispelling the liquidity concerns of financial institutions. (3) A current account balance increase did not affect corporate bond, commercial papers and other capital markets. Much of the effects of QE had been reaped by firms with high credit ratings, while firms with low credit ratings have not benefitted nearly as much due to investors becoming more conscious of credit risk. (4) Equity prices do not seem to be responding to QE, as they temporarily rose around May of 2001, but declined thereafter due to deterioration in the economic outlook. (5) Bank lending has kept decreasing, with banks having increased investment in government bonds and Bank of Japan current accounts. The authors continue their research using a time-varying VAR[10], and find that unlike the monetary transmission process which took place in the 1980s, such transmissions do not work now at zero interest rate. This reflects the recent observation that high growth rate of the monetary base does not necessarily lead to inflation. From their model, the authors believe that while room may remain for monetary

[10] VAR with time-varying coefficients, or a Bayesian VAR allows for possible changes in the interest rate elasticity of money demand and changes in the transmission mechanism at zero interest rates. Since the research is done using quarterly data over the sample period 1980 – 2002, a shift in regime change from interest rate targeting to quantitative easing must be captured through a time-varying VAR.

base channels to work even at zero interest rates, its effect is very uncertain and small. They attribute this to two possible hypotheses: (1) precautionary demand for money following the Y2K problem and terrorist attack on September 2011 has kept individuals from spending despite increase in liquidity. (2) Concerns about capital positions at private banks have prevented them from taking risks, which fails in raising the relative price of riskier assets. While banks have been provided extra liquidity, they have not changed their lending behaviors, leading to financing problems for smaller firms. On the other hand, the authors believe the extra liquidity provided by the QE policy was instrumental in preventing further damage to the economy post Y2K and during September 11th. Moreover, they are optimistic that as time moves on, and the economy stabilizes, individuals will start spending and banks will be willing to lend to riskier firms with their extra reserves from QE.

Kazuo Ueda, professor of Economics at the University of Tokyo, who had once strongly defended against taking any policy action contributed to two papers which also shared some optimism in terms of QE. Along with Nobuyuki Oda, (Oda 2005) Ueda studied QE's effects on the yield curve with a macro-finance model building on a model by Oda and Kobayashi in 2003 which combines a small macroeconomic model with a finance theory approach[11]. The model-based yield curve is derived two times using Monte-Carlo simulations, one time with QE policy commitment and then again without the policy commitment. For the three-year, five-year and ten-year interest rate, the model shows a significant reduction in the interest rate due to QE policies, especially after 2002. While it is not clear why the effect increased significantly after 2002, Oda believes it may

[11] The model consists of aggregate demand and supply equations (IS/AS) and a monetary policy rule. The IS and AS equations are both of simple backward-looking types, where the present GDP gap is determined by past GDP gaps and real interest rates. The present inflation rate is determined by past inflation rates and GDP gap. The model is then estimated using data from 1980 – 1999, and combined with the no-arbitrage asset pricing theory in order to derive a model-based yield curve.

be due to the Bank of Japan clarifying their commitment to QE policies in October of 2002, and their increases in purchases during this time could have further signaled their intentions. Ueda and Oda furthered their research by collaborating with Baba, Nishioka, and Ugai that year by addressing the Bank of Japan's market operations and their method of implementing monetary policy. (Baba 2005) Due to proactively providing liquidity, as well as the Bank of Japan's own risk-taking activities, the Bank of Japan succeeded in preventing a repetition of the Asian liquidity crisis of 1998. However, because of the reduced net worth of lenders and borrowers along with the associated negative financial accelerator, the supposed increase in lending and fixed investments due to QE was never realized. The authors believe that in order to effectively combat deflation, coordination between monetary and fiscal policy should be examined, as Japanese fiscal policy had stopped since 1996.[12]

2.3 Supporting Literature

On March 9 2006, the Bank of Japan decided to end their QE program during a monetary policy meeting.[13] With five years worth of data on hand, scholars began to analyze the impact of QE over the past five years on the Japanese economy. Three months after the end of the QE program, Kobayashi, Spiegel and Yamori released their research on QE and its effects on Japanese bank equity values. (Kobayashi 2006) As opposed to previous literature that have focused on interest rate, the authors acknowledged that a primary goal of the QE program was to provide assistance to the nation's troubled banking sector, therefore the Japanese bank's equity value after QE was released would be a good indicator of its effectiveness. Kobayashi examines the period

[12] Public investment in 1996 declined by about 40% from its peak in 1995

[13] The minutes of the policy meeting revealed that the Policy Board had paid particular attention to financial market conditions, including commercial banks disposal of non-performing loans and the recent downgrading of the credit of 19 Japanese banks by a major rating agency.

from the start of QE in March 2001 to the end of 2004 to identify 10 dates associated with significant announcements concerning changes in the QE policy. An event study is then conducted to examine the impact of these events on the overall banking portfolio.[14] Their results show a generally positive raw return on the dates the QE policy was expanded, as seven out of ten event dates saw a positive return, with an average raw return of 1.8%. The highest individual event day excess returns were 2.8% on August 14, 2001, and 2.6% on December 19, 2011. On these two days, not only did they increase the target for the Bank of Japan's current account balances, the ceiling on purchases of long-term Japanese Government Bonds was also increased. The other five event dates did not include raising the ceiling on long-term Japanese Government Bonds, and saw significantly lower returns. These results suggest that banks disproportionately benefited when the limit on purchases of long-term Japanese Government Bonds was raised. Nevertheless, QE appears to also benefit banks by stimulating the overall economy. Studying cross-sectional evidence from 87 Japanese banks, the authors found that QE had strengthened Japanese financial conditions - particularly with respect to weaker Japanese banks, which saw a significant positive improvement in the bad loan ratio and time deposit growth variables. The authors then continued to examine the impact on firms and industries, where they found ten of the industries[15] had significantly positive returns on event dates - again with weaker firms benefitting the most. The results of the paper were overwhelmingly positive in favor of QE, especially in aiding weaker firms. This may not be an unmixed blessing however, as keeping weak Japanese banks and industries afloat may have delayed the needed restructuring of the Japanese economy. This paper is one of

[14] A simple CAPM specification is estimated to evaluate bank excess returns on the event dates, where the daily stock return of the TOPIX bank index is estimated using the market portfolio return for the day and a dummy variable representing sensitivity of the bank portfolio to the announcement.

[15] Including Pharmaceuticals, Electric Power and Gas, Retail Trade, Air Transportation, Land Transportation, Foods, Metal products, Real Estate, Fishery, Agriculture and Forestry, Construction.

the few literatures to fully support the QE program, unfortunately by the time this paper was published, the QE program had already halted in Japan

Although most of the literature believe the Japanese's QE program as negative or negligible, on April 4, 2013 the Bank of Japan announced the Abenomics[16] program, an expansion of its asset purchase program by $1.4 trillion USD in two years. It is likely the success of the US Federal Reserve's QE program may have had an effect on their decision, as well as new research published with more positive views on the Japanese QE program of the early 2000s. Either way, it will be interesting to see if Japan can finally end their decade of economic stagnation and deflation with this new QE program.

3 Quantitative Easing following the 2008 Financial Crash

In contrast to the QE policy of the Bank of Japan, the QE policy implemented by the US Federal Reserve at the wake of the late 2000s financial crash can be described as quick and aggressive. The monetary policy that took the Bank of Japan over a decade to implement was put into action several months after the crash. By March of 2009, the Federal Reserve had already held 1.75 trillion US dollars worth of bank debts, mortgage backed securities and treasury notes. In November 2010, the Federal Reserve continued its aggressive stimulus plan by announcing a second round of QE. A third round of QE, known as QE3 was announced on September 13th, 2012, where the Federal Reserve decided to purchase 40 billion US dollars worth of mortgage-backed securities per month. It was open ended (eventually turning into 85 billion a month), and has continued on as of July of 2013, although Bernanke has announced a "tapering" of some of its QE policies due to continued positive economic data. Due to the amount of money involved in the QE policy, the impact of QE has become a greatly debated topic amongst

[16] The policy was named after Shinzo Abe, the current Prime Minister of Japan and economic politics, by combining the words Abe and Economics together.

economists. While we had five full years of data and another five years of time to slowly examine the QE of Japan, the US Federal Reserve's QE program is still ongoing and has very limited data. Therefore, the following literature should be considered with reservations, as their conclusions may change with new data. Additionally, many of the outspoken authorities (such as Paul Krugman and Richard Fisher) on the topic have had many articles and speeches but have not yet released any scholarly literature with empirical research behind them. Furthermore, due to QE3 having been implemented less than a year ago, the results of the literature have not taken QE3's economic impact, nor the recent positive economic data in mind.

3.1 Positive Impact

Similar to QE in Japan, the goal of the US Federal Reserve's policy is to reduce long term interest rates to discourage long term investments, and promote current spending and consumption. According to Gagnon, Raskin, Remache and Sack, QE1 and QE2 were very effective in achieving this goal. (Gagnon 2010) By using an OLS regression[17] to estimate the changes in the 10-Year Term Premium based on changes in each explanatory variable during the periods from 1985 – 2008, the authors found the overall size of the reduction to be somewhere between 30 and 100 basis points. In addition to this reduction in the term premium, the QE program had an "even more powerful effect on longer-term interest rates on agency debt and agency mortgage backed securities by improving market liquidity and by removing assets with high prepayment risk from private portfolios." While the arguments are sound, and the regressions give statistically significant results, one has to question whether looking at data from 1985 –

[17] The authors follow Backus and Wright (2007), where an OLS regression is done in the form of $tp_t^{10} = X_t\beta + \varepsilon_t$ where tp_t^{10} is the nominal 10-year yield term premium, and X_t is a set of observable factors including unemployment gap, core CPI inflation, long-run inflation disagreement, 6-month realized daily votalitity of the on-the-run 10 year treasury yield

2008, where market conditions are relatively normal, is exactly a good indication of what happens in the economy during times of crisis. Otherwise, the economic methods and arguments employed in this article are sound, and it would be interesting to repeat the methods of this paper a decade from now, when we have the proper data set for examination.

Due to the lack of data available for thorough empirical research, Krishnamurthy and Vissing-Jorgensen uses an event-study methodology to exploit both daily and intra-daily data. (Krishnamurthy 2011) Studying intra-day data allows the authors to document price reactions and trading volumes in the minutes after the main announcement, as well as allow separation of specific shocks from the daily data. Krishnamurthy and Vissing-Jorgensen believe the impact of QE1 on the safety-premium reduced yields by more than 100 basis points. The money spent on purchasing mortgage backed securities had a large effect on interest rates, but when only treasury purchases are involved, the effect was much smaller at around 20 basis points. It seems like the Federal Reserve's QE program is only effective when quantitative easing is complemented by qualitative easing. Not only does the Federal Reserve need to restructure their balance sheet, they also have to absorb much of the risk in the market in order to stimulate the economy. The literature also mentions the significant effect of signaling, as Bernanke's attempt at being transparent in terms of policy creates a level of expectation, leading to significant reductions for the yields on shorter maturity bonds. The signalling effect, was recently examined by Ali Ashraf, where Ashraf finds that both expected and unexpected shocks have statistically and economically significant effects on Dow Jones Industrial Average and SNP 500 returns during all periods of time from 2002 – 2011. (Ashraf 2013) Ashraf examines three possible sample periods: overall period, pre-QE, and QE period with a

VAR analysis of each period and related pair-wise Granger[18] causality relationships among the variables. To decompose and analyze the causality between monetary policy tools and target variables, Ashraf follows a three step process: (1) analyze the causality between monetary policy tools and shocks that are possible transmission channels (2) analyze causality between monetary shocks and target variables (3) discuss the combined effect of the earlier two by analyzing causality between monetary policy tools and target variables. While expected monetary shock has positive effect on bank stock returns, unexpected shocks generally have negative impacts, which is analogous to the argument in Bernanke 2004, where he believes signaling is just as important as the actual implementation of monetary policies. Ashraf also concludes that monetary shocks are not significant in explaining weekly stock returns; however change in the Federal Reserve's total asset holding in special programs is significant, reflecting the results found by Krishnamurthy 2011. Overall, this paper is able to take the available data on the QE regime, and empirically provide results which are, in general, consistent with Bernanke 2004 arguments that even during a zero-bound interest rate regime; the Federal Reserve may still affect target variables through managing its asset-side components. While this paper does not include QE3, it could still be regarded as the most recent and detailed literature which supports the QE monetary policy and the ideologies of Ben Bernanke.

3.2 Negligible Impact

From the literature above, it can generally be assumed that a 100 basis point reduction in the spread of long interest rates over short interest rates was caused by QE1. Smith and Pesaran also agree to this notion, but argue that the effect tends to disappear quite quickly, and the long run effect is not significantly different from zero. (Smith

[18] The Granger Causality test is a statistical hypothesis test used to examine whether one time series is useful for forecasting another.

2012) These results were tested using a counterfactual analysis[19], where a model of the economy without QE was built, and the long term results are compared to real world data. While QE does temporarily have a large impact on the economy, in the long run, the differences between the counterfactual and real world data smoothes out. While the counterfactual is a great tool for analyzing what would have happened in a hypothetical world, there are many limitations to its accuracy and effectiveness. The authors paid extra attention in defining the variables and parameters, but acknowledged the need for error invariant assumptions, which may not be very realistic. It is especially difficult to judge whether the economy would have recovered or spiraled down into a liquidity trap if the QE program was not announced.

. While the counterfactual analysis is a very good method for arguing against the implementation of the QE policy, time and data is needed to provide a more compelling argument. Thomas Palley of the New America Foundation takes a different approach, and tries to analyze QE from a theoretical perspective in his research. (Palley 2011) The author critiques QE based on the Keynesian IS-LM model, and further extends the basic model with eight equations[20], creating the IS-QQ[21] model. While most Keynesians will embrace QE on the grounds that it increases demand at times of demand shortage, Palley believes QE holds dangers of backfiring with respect to demand stimulus. He believes that there are structural problems on the demand side of the economy, especially concerning income distribution which leads to a lack of demand generation. In addition to these problems, there is also the possibility of creating another price bubble alongside

[19] With the focus on the use of counterfactuals in *ex post* macro-econometric policy evaluation
[20] The eight equations include IS, QQ, nominal term structure, short term interest rate, long term interest rate, expected inflation, nominal exchange rate, and wealth as the real value of the stock market
[21] The IS schedule is based on an equation where output is equal to aggregate demand. The QQ schedule describes equity prices as a positive function of income, expected inflation, high powered money, and investor confidence.

adverse international effects. While QE can be useful in facilitating the transition to a new system, pursuing QE alone without addressing the demand side structural problems may end up harming the economy. While the theory presented in this literature is sound, Palley acknowledges the arguments are purely theoretical, and further research should be pursued for a more conclusive discussion on the QE program.

3.3 Global Impact

As mentioned by Palley in his paper, one of the major concerns of the QE program is its adverse effects on other countries. While the United States economy may have benefitted from the QE program, one of its biggest trading partners suffered greatly as US currency depreciated. Cho and Rhee of the Asian Development Bank examine the effect of the US QE program on Asia's capital flows and financial markets. (Cho 2013) To understand whether QE has increased or changed the composition of capital flow into Asia, the authors compare trends before and after the 2008 financial crisis. In 2007, the inflow of capital to Asia was as high as $1.4 trillion, but collapsed in 2008 and 2009. However, in 2010 the capital inflows sharply rebounded to levels even higher than pre-crisis, only to slow down again when the European crisis escalated. It appears the quick rebound of capital inflows in 2010, despite heightened uncertainty and massive constraints of financial institutions suggests that QE may have contributed in stabilizing the global financial market, and turning capital flows back to Asia. A more rigorous analysis was done through regression analyses using weekly data, with 10 dummy variables[22] as proxies for QE. The authors found that QE1 events had pronounced effects on domestic financial variables, while QE2 and QE3 effects are relatively small. QE1

[22] Dummy variables for the weeks of important QE announcements

generally lowered CDS, BOND, and EXR[23] from eight Asian economies[24], which is in line with existing literature where capital inflows recovered quickly after 2008. QE were also likely to have influenced Asia's financial markets through their impacts on global variables, as Asia's CDS premiums were significantly lower when VIX[25] was lower, and Asia's Bonds were lower when the yield rate on a 5-year US treasury was lower. The impact of domestic variables on Asia's financial market were minimal however, as once the global variables were controlled for, the country-specific factors were completely dwarfed by the global factors. In light of these results, Cho provides areas where Asian policy makers could focus on to avoid adverse effects from QE in the future. First, the need to strengthen macro-prudential policies, as the QE program must end at one point or another, the future unwinding of the QE policy will also have impacts on Asia, which must be taken into consideration for the near future. Secondly, the need to maintain the size of reserves in line with the increasing volatility of financial flows, to provide a sufficient buffer to cope with potential sudden reversals of financial flows.

Aside from the Asian countries, other countries have shown concerns on the international spillovers of the US QE program.

"*This crisis started in the developed world. It will not be overcome simply through … quantitative easing policies that have triggered what can only be described as a monetary tsunami, have led to a currency war and have introduced new and perverse forms of protectionism in the world.*[26]"

President Rousseff of Brazil (2012)

Fratzscher, Duca, and Straub of the European Central Bank attempt to address this problem by considering 65 foreign financial markets and how they are affected by the QE

[23] Credit Default Swap Premium on 5-year sovereign debt, local currency denominated bond yield rate on 5-year government bond, and exchange rate vis-à-vis the US dollar
[24] China, Hong Kong, Japan, Korea, Malaysia, Philippines, Singapore, and Thailand
[25] Index of global investor sentiment and market volatility
[26] Rousseff, the first female President of Brazil in her 20-minute acceptance speech

policy in the US. (Fratzscher 2013) The authors approach this question by analyzing the response of portfolio decisions, asset prices and exchange rates to specific QE policy actions and events, importantly, differentiating between US and foreign variables to allow for testing whether foreign markets were affected differently from the US. A key first result of the empirical analysis is that QE1 policies have triggered a substantial rebalancing in global portfolios, leading to a shift into US equity and bond funds. This led to a marked USD appreciation, while the US bond yields were lowered, and equity markets were supported, providing liquidity to financial markets. By contrast, the Federal Reserve's policy for QE2 caused a portfolio rebalancing in the opposite direction, causing a marked depreciation of the US dollar. The foreign countries policy makers, in an attempt to insulate their country from spillovers of QE policy by limiting exchange rate flexibility or imposing controls on capital account openness, proved to be unsuccessful, as there was no evidence the capital flows were slowed down in any way. Instead, an important determinant of capital flows has been the institutional quality of countries, suggesting that the "pull factor" in recipient countries instrumental in determining the impact of QE policies. The findings of the paper seem to indicate that foreign policy-makers are not innocent bystanders, as part of the effect of QE policies on foreign economies is related to risk, and countries with strong domestic institutions are insulated from the US monetary policy spillovers. Thus, while global coordination may be considered to reduce international spillovers, domestic policy reforms are also important to consider.

3.4 Exit Strategy

As the economy has slowly taken a positive turn, Bernanke and the US Federal Reserve are increasingly concerned about the eventual halt of QE, as well as their exit strategy for QE. On Wednesday June 19 2013, when Bernanke announced a "tapering" of

some of its QE policies, the stock markets dropped approximately 4.3% over three trading days. Anil Perera at Monash University warns of difficulties in maintaining price stability in the long run post QE. (Perara 2010) A baseline monetary model was estimated by Perara based on the multivariate modeling techniques by Kimura (2002) using monthly data over a sample of 2000 – 2010. By considering four variables: price levels, output, monetary aggregates, and the central bank policy interest rate, empirical estimates point to possible pressures on prices in the approaching period due to the restoration of linkage between money, credit, and inflation along with the revival of economic activity. She believes that an exit will signal a round of monetary tightening leading to a rise in interest rates, as well as interest rate risk. If concern about the available amount of short term funds prevails among market participants, raising the interest rate might reinforce unwarranted upward pressure on overnight rates. Withdrawing liquidity in large quantities will trigger a substantial contractionary shock[27]; therefore the exit must be timely and gradual.

In addition to the need for a timely and gradual exit strategy, Palley suggests the Federal Reserve adopt a system of asset based requirements (Palley 2013), which would require banks to hold increase reserves, "permanently deactivating the liquidity created by QE without recourse to interest payments and the implicit tax cut that such payments represent." By continuing his theory-crafting using his ISQQ model, Palley believes the Federal Reserve's current method of exiting[28] QE has several problems. First, it will raise the loan rate, decreasing loan demand as well as lending. Secondly, banks will have an incentive to hold reserves with the Federal Reserve as opposed to lending it out. An alternative exit strategy is for the Federal Reserve to implement a system of asset based

[27] As seen by "tapering" announcement by Bernanke on June 19, 2013 leading to Dow Jones dropping 659 points between June 19 to 24.

[28] The Federal Reserve currently contemplate on raising its policy interest rate and increasing the rate paid on banks' holding of reserves

reserve requirements (ABRR), which would strengthen the system of monetary controls, expand monetary policy options, and avoid the problems pointed out above. ABRR will require financial institutes to hold reserves against different classes of assets, with different reserve requirements set for each asset based on regulatory authorities. This will enhance the ability of policy makers to manage the financial market, and the ability to target specific asset classes to control the risks involved. The rise in the cost of lending would also push up loan rates, restraining aggregate demand as intended in the exit strategy. Although the Federal Reserve's exit strategy is still far off in the future, as Bernanke has repeated many times that QE will taper off slowly and gradually, it will be interesting to see how the literature continues to evolve as QE's exit nears.

Conclusion

While there have been theories of unconventional monetary policies since Friedman's "Monetary History of the US" in 1963, Quantitative Easing was not a widely researched or debated topic until the recent financial crash of 2008. The Bank of Japan's version of QE was discontinued after 5 years of operation, but the US Federal Reserve's QE is still standing strong, and may have contributed greatly to the positive turn for the economy in 2013. With limited data and information available, the actual impact of QE has been highly debated, but from the current literature and research, we can make several key conclusions. Firstly, QE has an impact on long-term yields in the short run[29], encouraging spending and investing now as opposed to later[30]. Secondly, signaling has a significant impact, as expectations are adjusted when announcements are made[31]. Thirdly, the composition of the balance sheet is important, as absorbing riskier assets have a more

[29] QE's long run effects have still been highly debated
[30] As discussed in (Kimura 2004), (Baba 2005), (Oda 2005), (Smith 2012)
[31] As discussed in (Krishnamurthy 2011), (Ashraf 2013)

significant positive impact on the economy[32]. It is unclear however, whether the costs associated with implementing QE, the international spillovers, the potential risks to price stability in the long run, as well as the potential problems that may arise with the exit strategy is worth the benefits QE provides.

With QE3 still providing 85 billion US dollars a month, and the Bank of Japan once again returning to QE, one has to wonder what the future has in store for this unconventional monetary policy. While the implementation of the strategy was difficult in its own right, the exit strategy that must follow afterwards should prove to be a whole new set of challenges on its own. We are standing at a point in history, where the US Federal Reserve must make some crucial decisions in terms of QE, which may affect the global economy for years to come. Hopefully, the title of my next literature review will be the success of quantitative easing in the 2010s.

[32] As discussed in (Kimura 2004), (Gagnon 2011), (Krishnamurthy 2011)

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