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the 1990s and the United States since 2007**

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Abstract

Both Japan in the late 1980s and the U.S. in the mid-2000s experienced an unsustainable boom in real estate prices along with high stock market valuations, and when the bubble burst, many households and financial institutions found themselves in dire straits. One major lesson from this experience is that deleveraging attempts by individual economic agents in the aftermath of large financial imbalances can generate significant negative macroeconomic externalities. In Japan's case, a negative feedback loop developed among falling asset prices, financial instability, and stagnant economic activity. This negative feedback loop has sometimes been called "Japanization."

Japan's deleveraging became serious because the negative feedback loop was not contained in its early stage of development. The Japanese government did not act promptly to recapitalize banks that were suffering from the erosion of their capital buffer due to their large holdings of stocks. As a result, Japan's banks only slowly recognized bad loans, while stopping lending to promising new projects. Slow, but protracted asset sales resulted in a long period of asset price declines. Nonfinancial companies perceived the deterioration of their balance sheets as permanent and cut spending drastically. As Japan's economy stagnated, the total amount of bad loans turned out to be much larger than initially estimated.

In contrast to Japan, U.S. policy authorities responded to the financial crisis since 2007 more quickly. Surely, they learned from Japan's experience. It is also important to recognize, however, that the market-based nature of the U.S. financial system, as compared to a Japanese financial sector.

This paper also shows that a rapid response by a central bank in a situation of financial crisis and economic stagnation can be a better choice than allowing a process of Japanization to drag on for years. In a weak economy, interest rates are already very low and the zero lower bound on interest rates limits a central bank's ability to stimulate the economy further. Moreover, nonconventional monetary policy measures work by reducing risk premiums and spreads between long-term and short-term interest rates. However, when a long period of economic stagnation occurs, these spreads have a tendency to decline to low levels, which then limits the effectiveness of such measures.

Deleveraging and Monetary Policy: Japan since the 1990s and the United States since 2007*

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The U.S. economy in the aftermath of the Great Recession that started in 2007 has a number of similarities with Japan's experience since the early 1990s, at least on the surface. Both economies experienced an unsustainable boom in real estate prices along with high stock market valuations, and when the bubble burst, many households and financial institutions found themselves in dire straits. One major lesson from this experience is that deleveraging attempts by individual economic agents in the aftermath of large financial imbalances can generate significant negative macroeconomic externalities. In Japan's case, a negative feedback loop developed among falling asset prices, financial instability, and stagnant economic activity. This negative feedback loop has sometimes been called "Japanization." As the U.S. economy works through a sluggish recovery several years after the Great Recession technically came to an end in June 2009, it can only look with horror toward Japan's experience of two decades of stagnant growth since the early 1990s.

Japan's deleveraging became serious because the negative feedback loop was not contained in its early stage of development. The Japanese government did not act promptly to recapitalize banks that were suffering from the erosion of their capital buffer due to their large holdings of stocks. As a result, Japan's banks only slowly recognized bad loans, while stopping lending to promising new projects. Slow, but protracted asset sales resulted in a long period of asset price declines. Nonfinancial companies perceived the deterioration of their balance sheets as permanent and cut spending drastically. As Japan's economy stagnated, the total amount of bad loans turned out to be much larger than initially estimated.

In contrast to Japan, U.S. policy authorities responded to the financial crisis since 2007 more quickly. Surely, they learned from Japan's experience. It is also important to recognize, however, that the market-based nature of the U.S. financial system, as compared to a Japanese financial sector, which is more intertwined with government and less subject to market pressures, meant that the need for government action was more apparent in the U.S. context.

When a national economy is confronted with Japanization, the central bank finds itself on the front line of policy making. As with Japan's other policymakers, the Bank of Japan's response in the 1990s was slow. As a result, the process of deleveraging became overly severe and protracted. This criticism of the Bank of Japan is not a new one: for example, Ben Bernanke (2000, see also 2003), then still a professor at Princeton University, criticized the Bank of Japan for not being more aggressive in its fight against deflation. Krugman (2012), Ball (2012), and others have argued that, in a

provocative turnabout, Federal Reserve Chairman Ben Bernanke has not been willing to push for the same aggressive monetary remedies for the United States that he earlier prescribed for Japan. Bernanke has responded by making two points: 1) the U.S. economic situation is objectively different, in the sense that Japan faced actual deflation in the late 1990s; and 2) the Fed has indeed pursued aggressively expansive monetary policy in a number of nonstandard ways (Federal Reserve, 2012b, p. 9).

This paper does not seek to resolve the debate over the degree of consistency between what Bernanke wrote in the early 2000s and the policies that the Federal Reserve has undertaken since 2007. However, the paper does show that a rapid response by a central bank in a situation of financial crisis and economic stagnation can be a better choice than allowing a process of Japanization to drag on for years. In a weak economy, interest rates are already very low and the zero lower bound on interest rates limits a central bank's ability to stimulate the economy further. Moreover, as I will explain below, nonconventional monetary policy measures work by reducing risk premiums and interest rate spreads between long-term and short-term financial instruments. However, when a long period of economic stagnation occurs, these spreads have a tendency to decline to low levels, which then limits the effectiveness of such measures.

I will begin by describing how Japan's economic situation unfolded in the early 1990s and offering some comparisons with how the Great Recession unfolded in the U.S. economy. I then turn to the Bank of Japan's policy responses to the crisis and again offer some comparisons to the Federal Reserve. I will discuss the use of both the conventional interest rate tool—the federal funds rate in the United States, and the “call rate” in Japan—and nonconventional measures of monetary policy and consider their effectiveness in the context of the rest of the financial system.

The Deleveraging Experience

Japan experienced an enormous bubble in asset prices during the 1980s. For example, the value of the Nikkei 225 stock market index rose from 6,000 in 1980 to about 40,000 in 1989 before falling back to half of that level in 1990, and it fell further back to about 8,000 by 2003, which was still the level in early June 2012. Property values in Japan experienced a huge bubble as well, essentially doubling from the beginning to end of the 1980s, and sliding back to early 1980s levels by the early 2000s. At present, property prices in Japan have fallen about 60 percent since their peak circa 1990. Thus, both stock and property prices in Japan have been on a downward trend for

more than two decades. Those interested in a discussion of the causes underlying Japan's asset price bubbles and their bursting might begin with Hoshi and Kashyap (1999) and Ueda (2000). Here, we take up that story in the early 1990s.

The U.S. economy in the 2000s experienced a bubble in housing prices, along with a sharp up-and-down-and-up-again movement in stock prices. U.S. housing prices rose 90 percent from 2000 to 2006, according to the Case–Shiller Index, but then fell by about one-third from 2006 to 2009—leaving them at about 25 percent above the price level of 2000. Although U.S. housing prices seem to have stabilized in the last couple of years, it is of course impossible to know whether they will drop further. The U.S. stock market, as measured by the Dow Jones Industrial Index, nearly doubled from mid 2002 to mid 2007, then fell to slightly below mid 2002 levels during the worst of the financial panic in early 2009, but since then has rebounded back to less than 10 percent away from its mid 2007 high.

These extreme fluctuations in asset values created severe economic problems for overleveraged households and firms, and for the financial institutions that were holding the loans. This financial crisis and the associated economic slowdown brought deflationary tendencies, but although these pressures were stronger in Japan than in the United States, they weren't the central problem. Here, I say a few words about deflation and then turn to the more substantial problem—the process of deleveraging.

Mild Deflation

Inflation in Japan has been in negative territory since 1998, but only modestly so: the cumulative decrease in Japan's consumer price index since the late 1990s (adjusted to purge the effects of the consumption tax rate hikes in 1989 and 1997) has been only about 5 percent. Thus, the classic debt-deflation dynamic—that is, deflation making it harder to repay debts, and the resulting lack of buying power leading to more deflation—has not been a major cause of Japan's economic stagnation.

The U.S. economy has largely escaped deflation since 2007, although four of the five months at the end of 2008 reported negative movements in the Consumer Price Index, and this index fell by 0.4 percent from 2008 to 2009. However, the Consumer Price Index rose 3.2 percent from 2010 to 2011, and seems to be rising at a similar pace in 2012.

Even though these mild deflationary pressures did not throw the economies of Japan or the United States into a deflationary spiral, they have hindered the effectiveness of monetary easing. The real interest rate has stayed at higher levels than

desirable, especially in Japan, and undermined the power of near-zero interest rates to stimulate the economy.

Deleveraging

Declines in asset prices in Japan since around 1990 and in the United States since 2007 have generated serious negative effects on both the Japanese and the U.S. economy. I will focus first on the initial shock the asset price declines created in Japan, then discuss how the shock was amplified by economic policy mismanagement, and finally offer some comparisons with what has happened in the U.S. economy during the aftermath of the Great Recession.

At the peak of the bubble, Japan's nonfinancial firms held 34.6 percent of total stock market value in the economy and 24.4 percent of land value. Deposit-taking banks held 11.7 percent of the stocks (according to data from Japan's National Income Accounts and Flow of Funds Statistics). The large holdings of stocks by these two groups are in sharp contrast to the U.S. economy, where the corresponding figures are almost zero. Of course, U.S. banks and the so-called "shadow bank" financial institutions had huge exposures to mortgage loan-related assets and suffered dearly from the sharp fall in real estate prices since 2007. The reconciliation accounts of Japan's national income accounts show that nonfinancial firms lost 133 trillion yen in unrealized capital losses from their land holdings during 1990–91 (20.8 percent of their net worth in 1990) and 201 trillion yen from their stock holdings during 1989–91 (30 percent of their net worth in 1990). Banks lost 36.4 trillion yen from their stock holdings between 1989 and 1991, which was 35.9 percent of their net worth in 1988. Thus, the initial shock to their balance sheets was extremely large. The damage to the balance sheet of nonfinancials is consistent with a model of deleveraging by Eggertsson and Krugman (2011) whereby asset price declines worsen information asymmetries and lead to decreased financial intermediation and spending by borrowers.¹

The decline in capital ratios in Japan's banks constrained their risk-taking behavior severely. Hanson, Kashyap, and Stein in this journal (2011) point out that generalized asset shrinkage by financial institutions generates two primary macroeconomic costs (or "external diseconomies"): credit crunches and fire sales. Japan also saw these negative

¹ Ogawa and Suzuki (1998) analyze the role played by the use of land as a device to alleviate information asymmetry between lenders and borrowers in Japan. They show that firms increasingly relied on the use of land as collateral in the 1980s as land prices soared, which was one of the reasons for the sharp rise in business fixed investment during the period. Conversely, the decline in land prices since the early 1990s exerted strong negative effects on investment through this route.

effects of asset price declines, but they manifested themselves in peculiar ways. Fire sales did not come in one bout, but were spread out across a long period of time. The credit crunch, a quantitative shortage of credit at the prevailing prices, also involved a significant degree of credit misallocation. Thus, economic stagnation became a prolonged process in Japan, aggravating asset price declines and causing further financial instability.

To gain a sense of how long the deterioration in the balance sheets in Japan lasted, Figure 1 presents estimates of leverage—that is, total assets (including loans and reserves) divided by net worth, with stocks and real estate on the asset side evaluated at market value—for nonfinancials and deposit-taking banks (excluding Japan’s “postal savings accounts”). For both sectors, the leverage ratio started to increase around 1990 in response to the collapse in asset prices. The increases in the ratio continued until the late 1990s for nonfinancials and to the early 2000s for banks. It was not until the mid 2000s that the leverage ratios returned to the levels of the late 1980s.

The increases in leverage during the 1990s were largely unintentional; players in both the financial and nonfinancial sectors were attempting to deleverage, but changes in the numerator of their leverage ratios were overwhelmed by further declines in asset prices affecting the denominator of that ratio.² Japan’s banks were large net sellers of stocks in late 1990 toward early 1991 and then again between 1996 and 2006. Nonfinancial firms were net sellers of land in the mid to late 1990s. Such asset “fire sales” that occurred under pressure to deleverage contributed to further declines in asset prices and made the deleveraging process even more severe—a process observed again during 2007–09 in the United States for many financial instruments.

Regulatory Forbearance

The protracted nature of Japan’s deleveraging substantially magnified the cost associated with the process. Decisions by Japan’s regulatory authorities were a major factor behind the delay. In line with the international standards established by the Basel Committee at the Bank of International Settlements, capital adequacy regulation was introduced in Japan the early 1990s: specifically, the rules required that the ratio of the bank’s capital to its risk-weighted assets must exceed 8 percent. However, the rule was poorly designed. The regulatory minimum was fixed and did not allow for fluctuations in response to the state of the economy. The definition of capital included unrealized capital gains on stocks held by banks. Thus, the sharp fall in stock prices meant a

² Increases in bank leverage between the mid-1990s and early 2000s were also caused by bad-loan write-offs.

serious erosion of bank capital. Bank of Japan (2001) shows that the risk-based capital adequacy ratios for Japanese banks were barely above 8 percent in 1990–1992. Despite this, Japan’s regulatory authority for years delayed making the tough decision to recapitalize the banks. One early attempt at the resolution of the bad loan problem reportedly came in the summer of 1992, when then-prime minister Kiichi Miyazawa discussed the possibility of bank recapitalization with a group of bank chief executive officers, who rejected the plan (Nishikawa 2011, pp. 137–38).

As a result, Japan’s banks found it difficult to recognize and dispose of bad loans in large amounts. Instead, the disposition of bad loans became a long and protracted process, which in turn made the declines in property prices protracted as well. As property prices kept falling, giving no indication of bottoming out, nonfinancial firms holding property increasingly felt that their balance sheet deterioration was permanent. They started to repay excessive debt by cutting spending, especially investment in structures, which is the component of aggregate demand most sensitive to property prices.³ This component of aggregate demand alone subtracted about 0.4 percent per year from Japan’s GDP growth during the 1990s. In turn, property prices declined more.

The sharp fall in banks’ capital buffer led to another characteristic of Japan’s deleveraging process—credit misallocation. Banks were obliged to lend to “zombie” companies in order to avoid recognition of losses on their balance sheets. As a result, banks found it difficult to increase lending to more-promising firms (given the capital constraint on the expansion of total assets). New entry into banking was strictly controlled by regulators. Banks became an obstacle to creative destruction and sowed the seeds for a long period of stagnation.

There is a large literature on such misallocation of credit. Using firm-level data, Fukao and Kwon (2006) present a striking result that the productivity level of exiting firms was higher than that of staying firms in many industries in Japan during 1994–2001. Peek and Rosengren (2005) go further by showing that Japanese banks allocated credit to severely impaired borrowers. Caballero, Hoshi, and Kashyap (2008) provide evidence of the negative effects of zombie survival on other more efficient firms in the same industry. This literature also provides a bridge between the literature emphasizing reduced productivity growth (for example, Hayashi and Prescott 2002) and the works that focus on financial factors in the analysis of Japan’s stagnation.

Thus, Japan offers a typical example of the pro-cyclicality of simple capital adequacy rules as discussed by Kashyap and Stein (2004). It was, however,

³ For details of how Japan’s nonfinancial corporations deleveraged, see Figure A1 in the online Appendix available with this paper at <<http://e-jep.org>>.

compounded by the absence of prompt recapitalization of banks. The pro-cyclicality took the form of a negative feedback loop among asset prices, financial instability, and the economy. The failure to react promptly was a serious mistake on the part of regulators given that they could have learned from the U.S. saving and loan crisis in the late 1980s (for an example in this journal, see Kane 1989).

In passing, I would add that through the postwar period until about the mid-1990s, Japan's regulatory authorities used the so-called convoy approach to the resolution of troubled financial institutions. That is, they let healthier financial institutions take over troubled ones, thus protecting depositors and other debt holders. The public's belief that the authority would continue to honor this approach was an important factor behind the absence of serious liquidity problems for Japanese banks and thus the absence of sharp fire sale pressures in the early 1990s, until circumstances changed dramatically for the worse in the late 1990s (as discussed in the next subsection).

How does the deleveraging of the U.S. banking sector since the Great Recession compare with that of Japan in the 1990s? In Figure 2, on the horizontal axis, time $T = 0$ is taken to be the year that was the peak of the stock market: that is, 1990 for Japan and 2007 for the United States. The solid and dotted lines show bank loan growth rates before and after the collapse in asset prices. Bank loan growth in Japan fell sharply in the early 1990s, but stayed in positive territory until the late 1990s. At this time, many of Japan's banks were still supporting zombie companies by rolling over loans. Japan's banks became earnest about bad loan disposal in year 1995 (year $T + 5$) onwards, as is shown by the bar graph superimposed on that figure. However, by this time bad loans had become much larger than would have been the case had they been addressed in the early 1990s. The growth rate of U.S. bank loans became sharply negative in year $T+2$, but has stabilized around zero since then. So far, the U.S. pattern is consistent with much more swift adjustment of the banking sector than in Japan. But much depends on what will happen from here.⁴

The International Monetary Fund (2012) presents estimates of the leverage of U.S. large banks, which rose to 28 in December 2008 from 20 in March 2006, but was down to 15 by December 2011. The sharp decline in leverage between 2008 and 2011 reflects the recapitalization by public money and contributions from retained earnings. The

⁴ U.S. household leverage calculated from the flow of funds statistics increased sharply in 2008 as property prices declined, but has returned to levels in the early 2000s due mainly to declines in household debt. Part of this seems to be a result of the nonrecourse nature of U.S. mortgage loans, which shifts the burden to the lenders. However the level of debt relative to GDP still remains very high compared with the late 1990s for both households and financial institutions.

spreads between lending and borrowing rates have been much larger for U.S. banks than Japanese banks, and thus have helped U.S. banks more. On these measures, it appears that the deleveraging pressure remaining in the U.S. economy five years after 2007 is less serious than it was in Japan in the late 1990s and early 2000s, 10 years and more after Japan's crisis erupted.

Political Dynamics of Crisis and Response

The East Asian economic crisis of 1997–98 and a hike in Japan's consumption tax rate in 1997 became a trigger for a serious financial crisis in Japan in 1997–98. A medium-sized securities company, Sanyo Securities, went under in November 1997 and defaulted on call market loans (remember, these are the overnight loans between financial institutions similar to those governed by the federal funds interest rate in the United States); it was the first time such a thing had happened in Japan during the post–World War II period. A financial panic ensued, which led to a series of bankruptcies for Japanese banks and securities firms. This event was Japan's equivalent of the Lehman bankruptcy that rocked the U.S. financial system in September 2008. Japan's financial system could no longer stand the weight of mushrooming bad loans. It is also noteworthy that the Japanese authorities underestimated the consequences of a failure of a broker/dealer.

Figure 3 presents the behavior of the money market risk premium for the United States and Japan, which is a useful measure of financial instability. In the figure, $T + 0$ is set to June 2007 for the United States and January 1990 for Japan. A risk premium for the banking system can be measured by the difference between an interest rate that fluctuates with the perceived risk of the banking sector minus a risk-free interest rate. For the United States, the risk premium is measured by the three-month LIBOR (London Inter-Bank Offered Rate), which is the rate at which banks lend money to each other, minus the three-month Treasury bill rate. This measure of the risk premium for U.S. banks increased immediately in 2007, after property and stock prices started to fall in the United States, and then spiked higher in late 2008 and early 2009. For Japan, the risk premium is measured by the three-month uncollateralized call market rate minus Japan's three-month treasury bill rate.⁵ Despite Japan's meltdown of asset prices in 1990 and 1991, it was not until late 1997 and early 1998 that this risk premium rose

⁵ A better measure of the bank borrowing rate is the Tokyo Interbank Offered Rate. But it is available only back to late 1995. Also, the Japanese three-month treasury bill rate is available only since 1992. The Japanese government started to issue short-term debt in the market only in the mid-1980s, and its market was not well developed until sometime in the 1990s.

sharply in Japan. As pointed out above, the market believed that the authorities would in the end act to avoid an outright default in financial obligations. Hence, the call loan defaults by Sanyo securities took the rest of the market by surprise.

Japan's government finally responded by recapitalizing large banks in two stages in 1998–99 and by committing to use public money to protect all deposits and other bank debt. In March 1999, a more significant capital injection to 15 large banks took place in the amount of 7.5 trillion yen.⁶ By 2001, 17 other banks received capital injections. Figure 3 indicates that these measures succeeded in containing the money market risk premium.

The years 1997–98 marked a departure of Japan's banking policy from what was earlier called the “convoy approach,” in which weak banks and financial institutions would be absorbed by stronger ones. The public's anger toward “finance” turned towards the cozy relationship between bureaucrats and bankers, and resulted in the separation of the Financial Service Agency from the Ministry of Finance and a revision of the Bank of Japan law to make the bank more independent. Government and central bank officials were prohibited from having meals with bankers. As an undesired by-product of these rules, smooth communication between officials and bankers was impaired. The Financial Service Agency focused on prompt resolution of the bad loan problem and did not seem to consider its macroeconomic implications.

These events worsened Japan's credit crunch. Banks intensified their efforts at deleveraging; they now had the capital to recognize bad loans. Bank loan growth turned negative and did not come back to positive territory until the mid-2000s (as shown in Figure 3). Many researchers have found significant negative effects of the deterioration of bank balance sheets on business fixed investment, especially for this period (for example, Sekine 1999; Kasahara, Sawada, and Suzuki 2011). At the same time the efforts of Japan's nonfinancial corporations to use savings to repay existing debt also intensified after 1998. Both the demand and supply sides of the bank loan market were shrinking. This pattern explains why Japan's “credit crunch” was not accompanied by very high borrowing costs except for the brief period in 1997–98.

The negative feedback loop became even more serious after the credit crunch of 1997–98. Events during these years led to declines in expectations about inflation and

⁶ All large banks except the Bank of Tokyo Mitsubishi were pressured into receiving capital. Capital was injected in the form of preferred shares, subordinated loans, and bonds. The government put governance pressure on banks by threatening that it would turn preferred shares into common stocks if banks do not perform well. On the other hand, the government continued to encourage misallocation by asking banks to lend to small and medium-sized companies.

growth.⁷ Moreover, Japan's property prices had largely returned to pre-bubble levels by the late 1990s or earlier 2000s, but have continued to decline thereafter, which also suggests the possibility of negative interaction between growth and asset prices.

Japan's government and the Bank of Japan were slow to perceive this emerging dynamic. For example, the Bank of Japan's official economic report did not recognize the negative interaction between financial factors and the real economy until the fourth quarter of 1993. It took the financial crisis in 1997–98 to persuade the public and the government of the need for recapitalization. To put it another way, one important reason for Japan's forbearance approach through most of the 1990s was that Japan didn't actually experience a serious financial panic until late 1997.

In contrast, the U.S. financial system exhibited serious instability starting in 2007, almost immediately after the collapse of the property and credit market bubble, and the U.S. economy experienced a severe financial crisis from September 2008 into early 2009. Thus, the U.S. government and the Federal Reserve found it easier to gather sufficient support for addressing problems in the banking system, including the bank recapitalization that occurred in 2008, than Japan did in the 1990s; so the U.S. government was able to move more quickly.

The acuteness of the financial crisis in the United States can be explained in part by the fact that the U.S. financial system is more market-oriented and less bank-centered than in many other countries. Table 1 compares Japan, the United States, and the euro area in terms of the share of financial assets/liabilities of different types of financial intermediaries in the economy in 2001. (The choice of the year of comparison does not matter much.) The U.S. economy is clearly an outlier with a large weight for the "others" component, which consists of investment banks, hedge funds, dealer/brokers, various special purpose vehicles, and so on. In a market-oriented financial system, stresses spread across the system swiftly and the financial authorities are obliged to respond. This may be the major reason for the differences in the speed of authorities' response to the financial crisis between the three areas.

In addition, the U.S. authorities may have learned from Japan's mistake.

⁷ In the Appendix available with this paper at <<http://e-jep.org>>, Figure A2 shows expected inflation calculated by implied forward rates from the SWAP curve and growth expectations compiled by the Cabinet Office. Although Figure A2 suggests that medium- to long-term inflation expectations fell in advance of deflation, it does not seem to support the Benhabib, Schmitt-Grohe, and Uribe (2001) story that an exogenous emergence of deflationary expectations was a cause of a zero interest rate and deflation. Inflation expectations in the figure are mostly positive and their declines in 1996–1998, as argued in the text, seem to have been a result of developments in the economy.

Remember that Ben Bernanke, chairman of the U.S. Federal Reserve after 2007, was giving speeches back in 2000 about how Japan's central bank should react. However, Bernanke's earlier writings often focused on the threat of deflation. It seems the U.S. authorities failed to learn from the earlier Japanese experience that the bankruptcy of an investment bank can have implications for systemic risk across an economy. For example, in Japan's case the failure of securities companies led to a systemic crisis in 1997. The risk of a similar outcome could have been foreseen when Lehman Brothers was allowed to fail in September 2008.

Monetary Policy for Addressing Financial Instability and Deflation

Just a few years ago, discussions of monetary policy would have largely begun and ended with changes in the policy rate, normally a short-term interest rate, and perhaps a mention of other conventional methods of conducting monetary policy, like adjustments to reserve requirements or discount rates. But starting in the late 1990s, the Bank of Japan began implementing various nonconventional monetary policies, and in the aftermath of the Great Recession, the Federal Reserve and other central banks around the world have followed suit.

The experience of the central banks during this period reveals some close relationships between the deleveraging process ongoing in these economies and monetary policy. On the one hand, monetary policy has been an indispensable tool to mitigate the pain of deleveraging. On the other hand, beyond restoring a degree of stability in the financial system, central banks have had a difficult time actually stimulating the economy.

Differences in individual central bank experiences, however, do exist. We will mainly discuss those between the Bank of Japan and the Federal Reserve. Most notably, the United States, unlike Japan, has essentially escaped deflation—at least so far. Although asset prices declined sharply in the United States as in Japan, at least U.S. stock prices have rebounded more briskly. With these differences in mind, let us now compare the Federal Reserve with the Bank of Japan in their use of monetary policy, starting with conventional monetary policy and then proceeding to unconventional approaches.

Conventional Monetary Policy

The major difference between the Federal Reserve and the Bank of Japan's use of the conventional monetary policy tool is the speed with which they responded to the financial and economic crises. Figure 4 presents the movements in the overnight call rate that is targeted by the Bank of Japan and the federal funds rate that is targeted by the U.S. Federal Reserve. The figure shows both nominal overnight rates as well as the real rates calculated using the core inflation rate that was later announced—that is, the Consumer Price Index excepting food and energy prices. Again, the horizontal axis is the time elapsed after the start of the collapse of the stock market bubble, with $T = 0$ as 1990 for Japan and 2007 for the United States.

The Bank of Japan started to lower the call market rate in 1991. By the second half of 1995 the rate had been brought down to less than 0.5 percent. However, even the rate cuts amounting to more than 800 basis points over four years did not turn Japan's economy around. The behavior of the real interest rate suggests that the Bank of Japan was cutting the nominal rate faster than the speed with which inflation fell, and thus was providing stimulus to the economy. (Otherwise, the real interest rate would rise and exert negative effects on the economy.) The decline in the real interest rate, however, came to a halt and started to move upward in the late 1990s as the deflationary trend set in. We see here the severe constraint on monetary policy that results from the inability of a central bank to cut interest rates below zero percent—the so-called “zero lower bound.” Since the late 1990s, the Bank of Japan's nominal policy rate has been in the zero to 0.5 percent range for more than a decade and a half.

Figure 4 shows that the Federal Reserve reacted to the financial crises and recession of 2007–2008 much more rapidly than did the Bank of Japan in the 1990s. The policy rate was brought down to near-zero within about 18 months of the start of the crisis. Given that U.S. core inflation has remained positive (that is, the inflation rate after stripping out the more volatile energy and food prices), the real interest rate has been clearly negative. In contrast, the real policy rate was never below -0.5 percent in Japan in the 1990s. Faced with the severity of the financial crisis, the Federal Reserve moved quickly to the zero percent lower bound within a short period, which surely is one of the reasons why the U.S. economy has avoided deflation so far.

In both Japan's economy of the 1990s and in the U.S. economy during and after the Great Recession, however, near-zero policy interest rates failed to stimulate the economy adequately. Japan has not escaped from its deflation scare yet, and the U.S. has suffered from an extremely weak labor market.

A Typology of Nonconventional Monetary Policy Measures

Given that the policy rate reached the zero lower bound, the Bank of Japan has adopted many nonconventional monetary policy measures starting in the late 1990s, and the Federal Reserve has done so starting in 2007. Indeed, central banks all around the world began to use such policies in the aftermath of the Great Recession. They can be classified into “quantitative easing” and “forward guidance of interest rates.”

Quantitative easing, in turn, consists of large-scale asset purchases in distressed markets and in more normal markets, and “pure quantitative easing” (defined below). The term “large-scale asset purchases” is usually used when the central bank is concerned with what type of assets are purchased, while “pure quantitative easing” is used when the bank is only concerned with the size of its balance sheet. In Ueda (2012a), I offer more details on this classification.

Large-scale asset purchases have occurred in many forms. The theoretical rationale for such actions seems to rest on the existence of market imperfections. During a financial crisis, a sharp decline in investors’ ability to take risks reduces market liquidity in certain segments of the financial system. In such markets, central bank purchases of assets can lower liquidity/risk premiums and in this way support the economy. Allen and Gale (2007), Curdia and Woodford (2010), Gertler and Karadi (2012) discuss the usefulness of such operations, which are sometimes called “credit easing.” In addition to security markets, interbank markets can become dysfunctional due to heightened counterparty risks, especially in term markets. In such a case central banks can make term loans in order to contain risk premiums. Such operations may also be regarded as credit easing.

Other types of large-scale asset purchases by central banks are purchases of Treasury bonds or private financial instruments. Apart from how such operations affect the supply of liquidity for a certain security, they may also affect the term structure for that financial instrument and have spillover effects to other financial instruments. For example, in a so-called “operation twist,” the a central bank purchases long-term Treasury bonds while at the same time selling short-term Treasury bills. If investors in such securities are segmented or have “preferred habitats,” this type of operation affects the yield curve, and the effects could spill over into other markets such as the corporate bond market through portfolio rebalancing effects.

Some have argued that irrespective of what a central bank buys, an expansion of the central bank balance sheet generates an easing effect by itself. An example would be central bank purchases of Treasury bills in order to supply liquidity beyond the level required for a zero percent policy rate. Such a policy may be called “pure quantitative easing.” At a zero interest rate, however, the economy is largely satiated with liquidity.

Hence, it is not clear why attempts to add still more liquidity will produce any significant results. Of course, it would be a different story if the central bank was financing government purchases of goods and services—a helicopter drop of money. Consequently, many researchers now consider it more important what types of assets central banks purchase in their pursuit of nonconventional policies, rather than the size of their balance sheet increases per se. Let us say, however, that the effectiveness of pure quantitative easing remains an open question.

An entirely different form of unconventional monetary easing is *forward guidance*—providing assurance to the market that the key policy interest rate, like the federal funds interest rate, will be lower in the future than currently expected. To affect market expectations of future short rates, the central bank needs to commit to monetary easing even after the economy no longer requires it. This promise of unnecessary easing in the future creates an expectation of rising inflation. As a result, the current market interest rates will be lowered up to a certain maturity, but raised beyond that maturity if inflation expectations rise. Bauer (2012) argues that large-scale asset purchases, by sending the signal that the central bank will continue to be aggressive in monetary easing in the future, also entail an element of forward guidance—a signaling effect.

The underlying logic of how nonconventional monetary policy measures work suggests limits on what they can be expected to achieve. Credit easing—that is, operations in temporarily dysfunctional markets—should come to an end once the markets have adjusted. Forward guidance is an attempt to narrow long–short interest rate spreads up to a certain maturity. Asset purchases in more normal markets may reduce risk premiums. But there are likely to be limits to the extent of the fall in interest rate spreads or risk premiums. Also, as the size of such operations becomes very large, one has to start worrying about distortions generated by direct central bank involvement in financial intermediation.

Nonconventional Monetary Policy at the Bank of Japan and the Federal Reserve

Table 2 illustrates some of the typical nonconventional measures adopted by the Bank of Japan and the Federal Reserve. Although details are different, the two central banks have adopted many similar measures, except that the Federal Reserve has not resorted to what I call “pure” quantitative easing nor to purchases of stocks.

In early years of financial stress—that is, the late 1990s to early 2000s for Japan and 2007–2010 for both the United States and Japan—both central banks employed credit-easing measures extensively. The specific measures used reflect the

characteristics of the financial system in the two countries. In Japan, efforts focused on channeling funds into the banking sector, the major players in the financial system. Even the Bank of Japan's early purchases of equities (2002–2004) were from banks; that is, they were designed to contain a negative systemic externality stemming from banks' forced sale of equities during their deleveraging. Also the Bank of Japan's purchases of asset-backed securities were aimed at substituting for the impaired ability of banks to make loans, but this move was unsuccessful given the underdeveloped nature of the market in Japan. The Federal Reserve channeled funds into a variety of agents, reflecting the more market-based nature of the U.S. financial system, including lending to money market mutual funds and broker-dealers. It also lent against asset-backed securities to respond to the stress in the housing finance market. In addition, the Fed bought huge amounts of mortgage-backed securities and debt from the quasigovernment agencies of Fannie Mae and Freddie Mac in 2008–2009.

As the acute phase of the financial crisis passed, both the Bank of Japan and the Federal Reserve shifted to purchasing mostly government bonds. In both countries, the size of the operations was unprecedented. The Bank of Japan during 2001–2006 proceeded to target on the “current account balances” held at the Bank of Japan—essentially bank reserves—and raised its target from 5 trillion yen initially to 30–35 trillion yen in 2004. This was by itself pure quantitative easing, but it was also accompanied by government bond purchases and forward guidance. Forward guidance has been used extensively by the Bank of Japan. It was first introduced in April 1999 when the bank committed to maintaining a near-zero interest rate “until deflationary concerns were dispelled.” The commitment was lifted in August 2000, but was reintroduced in March 2001 with quantitative easing, which was continued until March 2006. The Bank has made a similar commitment since 2009.

The Federal Reserve has used the forward guidance approach since December 2008 when it announced “the [Federal Open Market] Committee anticipates that weak economic conditions are likely to warrant exceptionally low levels of the federal funds rate for some time” (Federal Reserve 2008).⁸ It was strengthened in January 2012 to “the maintenance of a near zero rate until the end of 2014” (Federal Reserve 2012a).

Evidence on the Effectiveness of Nonconventional Monetary Policy Measures

Turning to the effectiveness of the measures adopted, let us first examine the extent and effectiveness of the expansions of central bank balance sheets. Figure 5

⁸ A similar statement was actually first used in 2003 when the Federal Reserve lowered the target rate to 1 percent (Federal Reserve 2003).

shows the monetary base (that is, currency outstanding plus bank reserves) relative to GDP for four countries including the United States and Japan. The monetary base has behaved in almost the same way in the four countries since 2007. It has more than doubled, except in Japan where it started from a higher level. The Bank of Japan carried out its massive balance sheet expansion in the early to mid 2000s. Despite such injections of money, none of the economies have expanded by as much as a simple monetarist calculation would suggest (for example, the doubling of money has not led to a parallel doubling of nominal GDP, nor anything close to it).

The reason the expansion of base money failed to stimulate the economy can be inferred from Figure 6, where the so-called money multiplier is shown: that is, the ratio between a broader measure of the money supply, M2, and the monetary base. In general, to varying degrees, the period of sharp expansions in the monetary base saw corresponding declines in the multiplier. That is, central bank money supplied has been largely held by financial institutions, rather than used for credit creation. Otherwise, M2 would have increased more sharply. This pattern accords with the discussion of Japan's deleveraging earlier in this paper. Japan's banks did not trust each other and were not able to borrow in the interbank market. Even those who had plenty of liquidity did not lend, either because lending was constrained by absence of capital buffer or nonfinancial firms were deleveraging. The central bank could provide liquidity by stepping in, but this pure quantitative easing was not very effective in stimulating the real economy. Such stories seem to apply to other countries as well.

However, there is a literature that has found that nonconventional monetary policies do have some effect on interest rates and other asset prices. Among other things, various credit easing measures have contained risk premiums that might otherwise have created considerable instability. For example, the Bank of Japan's fund-supplying operations reduced money market risk premiums almost to zero (Baba, Nakashima, Shigemi, and Ueda 2006; Bank of Japan 2009). This pattern can be seen informally in Figure 3, where the money market risk premium has been kept at very low levels with only two exceptions, one, during Japan's credit crunch of 1997–1998 ($T = 7, 8$) and, the other, right after the September 2008 shock in the United States ($T = 18, 19$). The same figure suggests that the Federal Reserve's credit easing measures also succeeded in containing the money market risk premium after 2009 ($T = 2$).

Event study approaches have been used to analyze the effects of the Federal Reserve's large-scale asset purchases on asset prices. (The common use of this approach reflects the limited availability of time-series data for carrying out more detailed analyses.) This literature has several findings. First, asset purchases in general have

affected interest rates (Williams 2011). Second, the transmission channel of the purchases remains unclear. Some emphasize portfolio rebalancing effects, that is, the effects depend on what assets are bought (Krishnamurthy and Vissing-Jorgensen 2011), while others consider the signaling channel of asset purchases more important (Christensen and Rudebusch 2012). Third, the effects on interest rates decline as we move from the Fed's earlier purchases in 2008 and 2009 to those in 2010 and 2011. The decline in effectiveness seems to be due to the disappearance of the credit easing aspect of the purchases as markets returned to normalcy and also due to the repeated use of other measures such as forward guidance to lower interest rates (Bauer 2012).

With regard to Japan's experience, Lam (2011) and I (Ueda 2012b) apply a similar approach, with some similar findings. First, the Bank of Japan's asset purchases have affected government bond and corporate bond yields as well as stock prices. Thus, there is some evidence of portfolio rebalancing effects. However, the effects on the yen exchange rate are not discernible in most cases. Second, the first introduction of forward guidance in 1999 and quantitative easing in 2001 generated larger effects than other measures. Third, pure quantitative easing, that is, increases in the target amount of the current account balances without increases in government bond purchases did not generate a significant response of asset prices.

More formal analyses of the Bank of Japan's forward guidance also find significant effects on the term structure of interest rates (for example, Okina and Shiratsuka 2004; Baba, Nakashima, Shigemi, and Ueda 2006; Oda and Ueda 2007). However, few find significant effects of the pure quantitative easing.⁹ In short, a body of evidence suggests that the two central banks' nonconventional monetary policy measures, with the exception of pure quantitative easing, have had nonnegligible effects on asset prices. The effects of the measures on the real economy, however, have been less well analyzed.

Failure to Stop Deflation/Stagnation

The above summary of findings on the effectiveness of the two central banks'

⁹ One exception is Honda, Kuroki, and Tachibana (2007), who find, using vector autoregression analysis, that an expansion of bank reserves (as measured by the Bank of Japan's current account balance) exerted significant effects on stock prices and in turn on output. Given the methodology, however, it is unclear which aspect of the unconventional monetary policies generated such effects. The analysis also does not include a variable representing changes in perceptions about the stability of the financial system and hence runs the risk of picking up spurious correlation between money and output.

monetary policy raises the obvious question of why they have so far failed to stop deflation in Japan and economic stagnation in the United States. If we assume that the avoidance of deflation in the United States so far has been partly due to monetary policy, there is also the question of why the Federal Reserve was more successful in avoiding deflation than the Bank of Japan.

Surely the first and foremost reason why monetary policy in Japan and the United States seems to have been ineffective is the sheer size of the negative shocks to the economy. As we have discussed, deleveraging forces in the aftermath of the burst of the bubbles generated tremendous difficulties in the two economies. As of June 2012, real interest rates in the United States are at two-decade lows for Treasuries and high-rated corporate bonds. Still, growth is sluggish and the labor market is extremely weak. Real interest rates in Japan are not as low given the deflationary trend, but nominal interest rates have been at record low levels for more than a decade. As Eggertsson and Krugman (2011) suggest, the natural rate of interest may well have been negative in the two countries.

In Japan's case, a second reason for the ineffectiveness of monetary policy lies in the suboptimal policy making that in some ways intensified deleveraging forces. As with bank recapitalization and conventional monetary easing, nonconventional monetary policy measures should have been adopted earlier in Japan. The effectiveness of the measures to stimulate Japan's economy may have been undermined by the emergence of deflationary expectations. For example, the forward guidance strategy of the Bank of Japan, if it had been successful, would have lowered expected future short-term rates up to that point in the future where the forward guidance extends, but then raise expected interest rates beyond that (because forward guidance should bring an expectation of increased inflation in the future). However, in Japan, that expectation of future inflation—and hence, a steepening of the yield curve beyond some maturity—has not materialized.

Moreover, a significant portion of the favorable response of asset prices to nonconventional measures as discussed above did not last long. For example, the introduction of quantitative easing by the Bank of Japan in March 2001 led to a significant increase in stock prices, which faded away in a few months as the economy remained weak. On this point, it is interesting to note that the response of stock prices in the United States to the Fed's Treasury purchases during 2010–2011 was very similar to the pattern in Japan, although the period of favorable response was longer.

A third aspect of the difficulty the Bank of Japan had in stimulating the economy with nonconventional monetary policy relates to the lack of well-developed capital

markets. In the U.S. economy, the markets for mortgage-backed securities and for corporate bonds are comparable in size to the government bond market. The Federal Reserve has been able to carry out operations in these capital markets to affect private financial intermediation. In particular, mortgage-backed securities and debt from Fannie Mae and Freddie Mac exceeded 50 percent of the Federal Reserve's total assets in early 2010. The Fed also lent against asset-backed securities as collateral. These operations reduced risk premiums in the capital markets and contained the deleveraging attempts by holders of the instruments.

In contrast to the case in the United State, the size of Japan's market for nonfinancial corporate bonds is only 10 percent of GDP while Japan's market for long-term government bonds exceeds 130 percent of GDP. Japan's market for asset-backed securities is even smaller than its corporate bond market. As of the end of 2011, capital market debt and stocks made up only 4.1 percent of the assets of the Bank of Japan. The rest was long-term government bonds and short-term lending to financial institutions backed mostly by government debt. The Bank of Japan has been able to ease the funding pressure of financial institutions by lending to them, but it has less ability to affect private capital markets through asset purchases, due to the fact that such markets are smaller in Japan. Purchases of stocks have been an attempt to alleviate this problem. Given the obvious risks involved, however, the Bank of Japan tiptoed into this measure in 2002 after a 70 percent fall in stock prices from the peak.

Finally, as nonconventional measures are used over time within a stagnant economy, risk premiums/interest rate spreads are lowered to extreme levels, and they could be approaching their limits, especially in Japan. For example, back in January 1999, the spread between ten-year and two-year Japanese government bonds was 1.45 percent. Just a few months later in April 1999, after the announcement of the zero interest rate policy—the first wave of nonconventional policy using forward guidance—the spread had fallen to 1.29 percent. By May 2003, in the quantitative easing period, the spread was down to 0.5 percent. However, by June 2012, despite massive bond purchases by the Bank of Japan, the same spread was up to 0.67 percent. Perhaps these spreads can decline again, but one cannot escape the impression that with the protracted stagnation in Japan's economy and the repeated application of nonconventional monetary policy measures, such policies are close to a lower bound in reducing the spread between long-term and short-term interest rates.

Something similar may be taking place in the United States, as a study by Bauer (2012) points out. However, with the spread between ten-year and two-year Treasury bonds at 1.39 percent in June 2012, the traction left for this aspect of the Fed's

nonconventional monetary policy seems roughly equal to that of the Bank of Japan in the late 1990s as far as the government bond market is concerned. The Fed also probably has room for more action elsewhere, like in the markets for corporate bonds and mortgage-backed securities.

But overall, nonconventional monetary policies in both economies have experienced strong headwinds from deleveraging pressures. Their repeated application gradually lowered effectiveness. In addition, in Japan the same factors that made the deleveraging process severe—namely, the slow response of policymakers and the absence of well-developed markets for private debt—have limited the scope of nonconventional monetary policies.

Concluding Remarks

The parallel between Japan's economy since the 1990s and the U.S. economy since the Great Recession is far from a perfect correspondence. First, the growth rate of Japan's economy was probably due for a slowdown. Japan's economy grew at an annual per capita rate of 3.3 percent per year from 1974 to 1990. As Japan's economy approached the technological frontier, this growth rate was unlikely to be sustained. Second, Japan faces a severe demographic adjustment. The size of Japan's workforce started shrinking in the late 1990s, and the size of Japan's population began declining in 2005. Third, Japan's economy has long been powered by firms focused on international markets, but has yet to encourage innovation and greater competition in many service industries in the domestic market.

But while Japan's economy was unlikely to sustain its boom period forever, Japan's economic stagnation since the bursting of Japan's asset price bubble in 1990 is at least partly due to mismanaged macroeconomic policy. Some of the Bank of Japan's interest rate increases in the early 1990s may have been unnecessary or even counterproductive, and its interest rate cuts in the early to mid 1990s could have been more aggressive. Japan's government should have acted to recapitalize banks in the early to mid 1990s. As a result, Japan's economy was more vulnerable to a severe financial crisis in 1997–1998 and a negative feedback loop developed among asset prices, financial stability, and growth. Deflation, if mild, ensued in response, and along with strong expectations of a low-growth, low-inflation future, the Bank of Japan's ability to stimulate the economy through conventional and nonconventional monetary policy measures became highly constrained.

Although the U.S. Federal Reserve and the Treasury have sometimes been criticized for not acting aggressively enough to stimulate the U.S. economy in recent years, U.S. policymakers have been far more aggressive since 2007 than were their Japanese counterparts back in the 1990s. The Federal Reserve lowered the federal funds interest rate virtually to zero percent within about 18 months of the onset of the financial crisis and has adopted various nonconventional monetary policy measures as well. U.S. banks were recapitalized in late 2008. Thanks to these measures, the U.S. financial system has resumed stability to a certain extent and core inflation has stayed in positive territory. Moreover, the Federal Reserve strengthened forward guidance in January 2012 by stating that a near zero policy rate would continue until late 2014, even though core inflation was already around its target of 2 percent.

In contrast, financial markets have questioned the Bank of Japan's resolve to fight deflation. Its initial use of forward guidance was discontinued in August 2000 when Japan's core inflation was still -0.5 percent. Similarly, the Bank of Japan exited from its second wave of nonconventional monetary policy in March 2006 with a core consumer price inflation rate of -0.5 percent, despite an earlier promise of the continuation of the policy until "inflation is stably positive." Such a seeming difference between the two central banks' resolve to fight deflation may have contributed to the differences in the effects of policy measures.

The U.S. economy in mid 2012 remains far from full recovery from the financial and economic crisis of 2007–2009. Households are still deleveraging. U.S. property prices relative to the previous peak are now roughly at levels where Japanese land prices were in the mid to late 1990s, which is when the negative feedback loop between falling asset values and the real economy in Japan became more significant. While the Federal Reserve does have some additional room to ease credit with nonconventional monetary policies, such choices are unlikely to be as effective as they were several years ago. The power of the Fed's tools may or may not be enough to counteract possible negative forces coming from further deleveraging in the U.S. economy or from other external shocks such as instability in the euro area.

Both the U.S. government and the Federal Reserve have been quick to respond to financial stresses in the economy. There is a deeper question here, however, as to whether the prompt responses of U.S. policymakers during the crisis have sowed the seeds of future crises by generating moral hazard on the part of private investors, who will expect such actions to continue in the future. This possibility will need to be addressed in future studies and taken into account in future policymaking.

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Table 1

Financial Assets/Liabilities of Financial Intermediaries in 2001 as Percent of Total
Financial Assets/Liabilities

	<i>Japan</i>	<i>United States</i>	<i>Euro Area</i>
Depository corporations	59	25	60
Insurance and pension funds	18	28	13
Others	23	47	27

Source: Flow of Funds, Bank of Japan.

Table 2

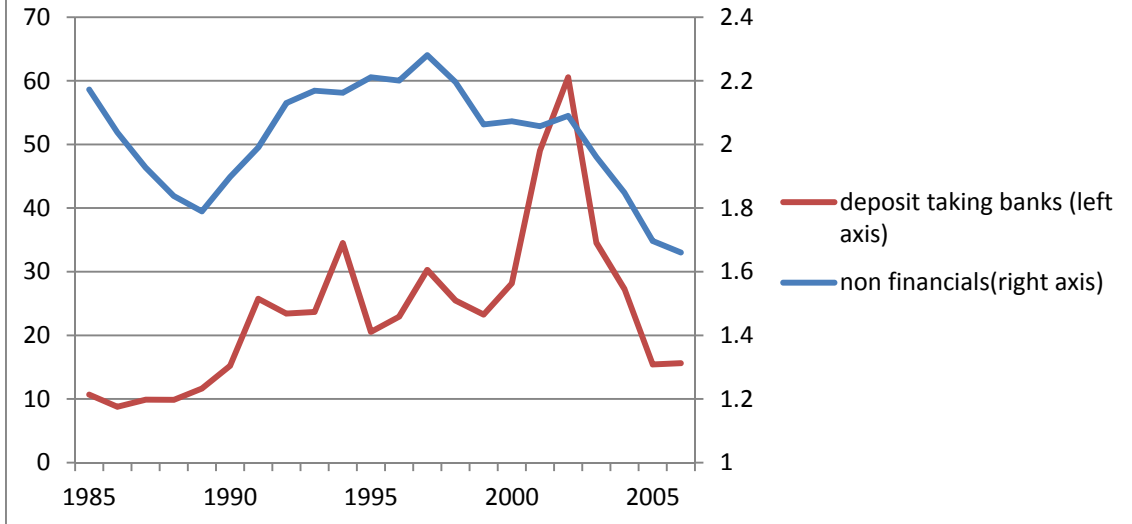
Examples of Unconventional Monetary Policy Measures

Operations in dysfunctional markets or sectors (credit easing)	Japan	Funds-supplying operations in term markets (1–12 months) Purchases of commercial paper, equities, asset-backed securities, and corporate bonds
	United States	Term Auction Facility Lending against asset-backed securities Lending to money market mutual funds and broker-dealers Purchases of mortgage-backed securities, agency bonds
Asset purchases in more normal markets	Both countries	Purchases of long-term government bonds
	United States	Operation Twist (2011–12)
Pure quantitative easing	Japan	Setting target on the current account balances at the Bank of Japan (2001–2006)
Forward guidance	Japan	"maintain the current zero interest rate until deflationary concerns [are] dispelled" (1999–2000) ^a
	United States	"[T]he Committee . . . anticipates that economic conditions . . . are likely to warrant exceptionally low levels for the federal funds rate at least through late 2014." (2012) ^b

^aBank of Japan (1999).

^bFederal Reserve (2012a).

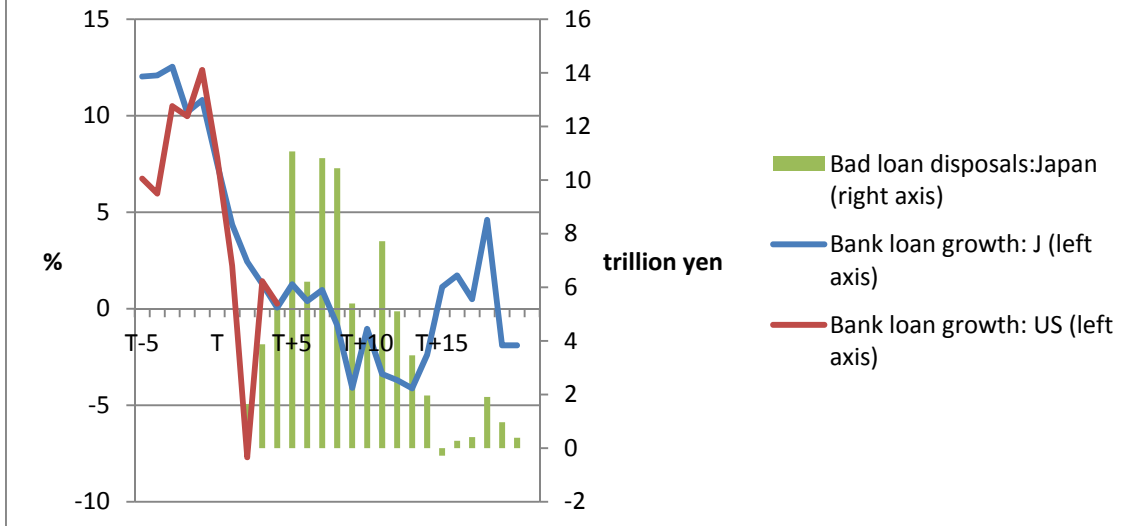
Figure 1 Leverage For Japan's Nonfinancial Firms and Deposit Taking Banks



Source: Japan's National Income Accounts and Flow of Funds.

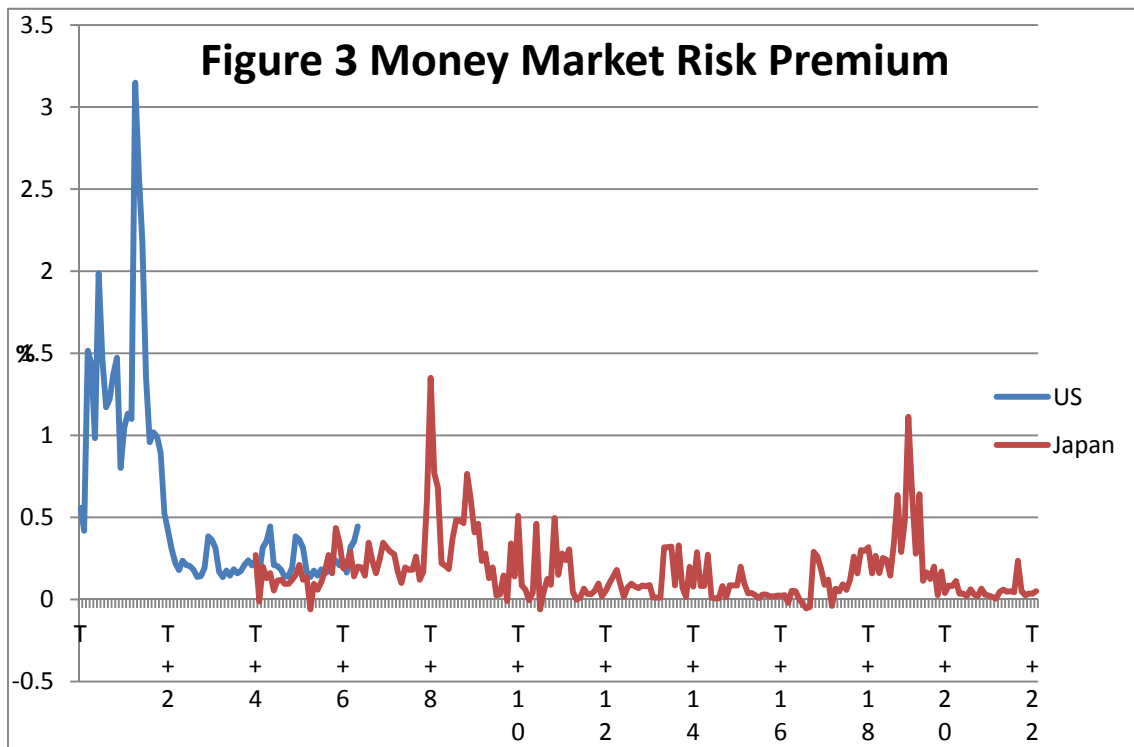
Notes: Leverage is measured by total assets with stocks and real estate at market value divided by net worth. Deposit-taking banks exclude postal savings and agricultural banks.

Figure 2 Bank Loan Growth Rate in Japan & the U.S., and Bad Loan Disposals in Japan



Source: Datastream, and Japan's Financial Services Agency (FSA). FSA data available at <http://www.fsa.go.jp/en/regulated/npl/index.html>.

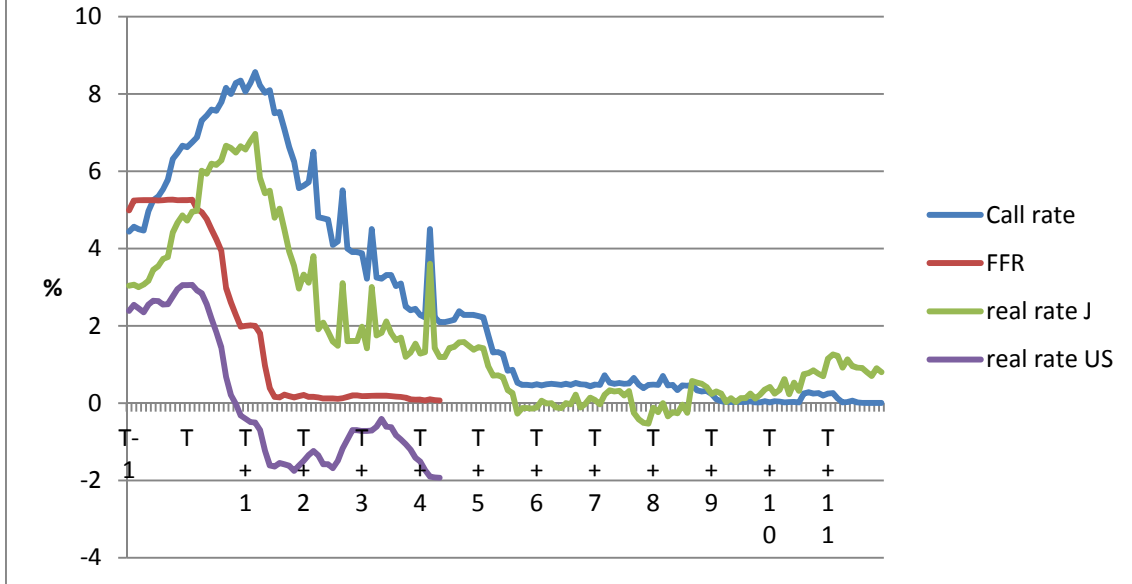
Notes: T = 0 corresponds to 1990 for Japan and 2007 for the United States.



Source: Bloomberg.

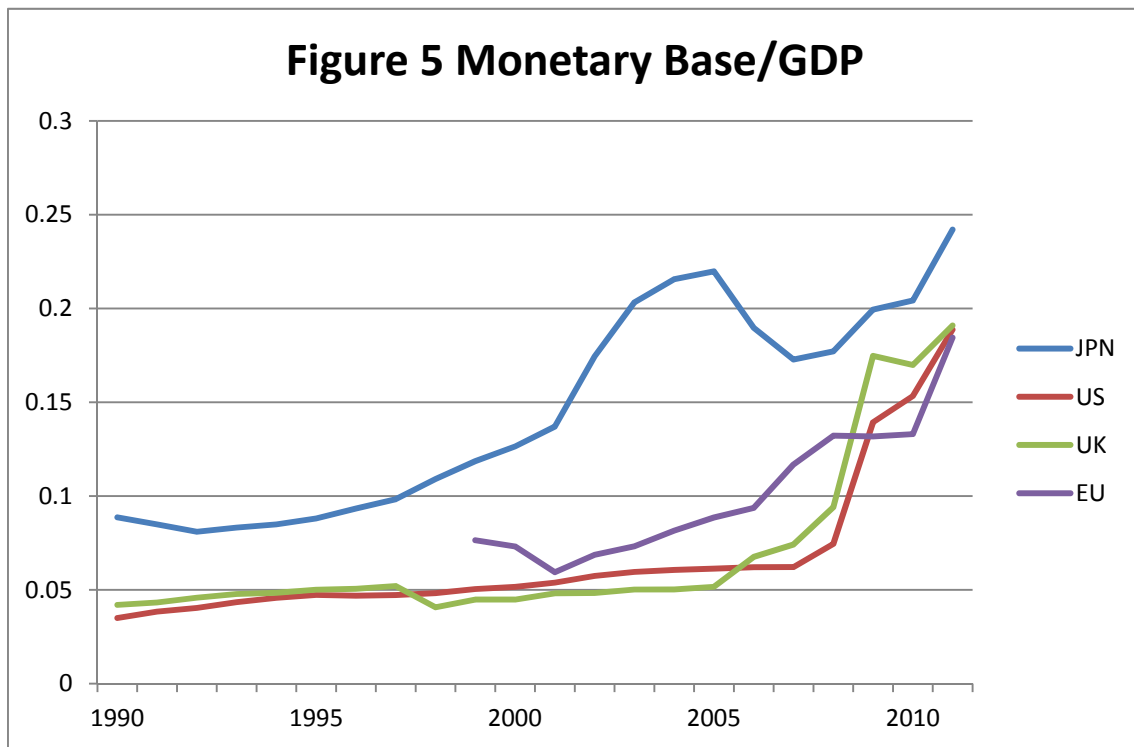
Notes: The risk premium is the 3-month LIBOR (London Inter-Bank Offered Rate) minus the 3-month Treasury bill rate for the U.S., and 3-month uncollateralized call market rate minus 3-month treasury bill rate for Japan. T = 0 stands for June 2007 for the U.S. and January 1990 for Japan. The line for Japan starts at T + 4 because the three-month call market rate is available only since 1994 (see Foonote 5).

Figure 4 Real & Nominal Overnight Rates in Japan and the U.S.



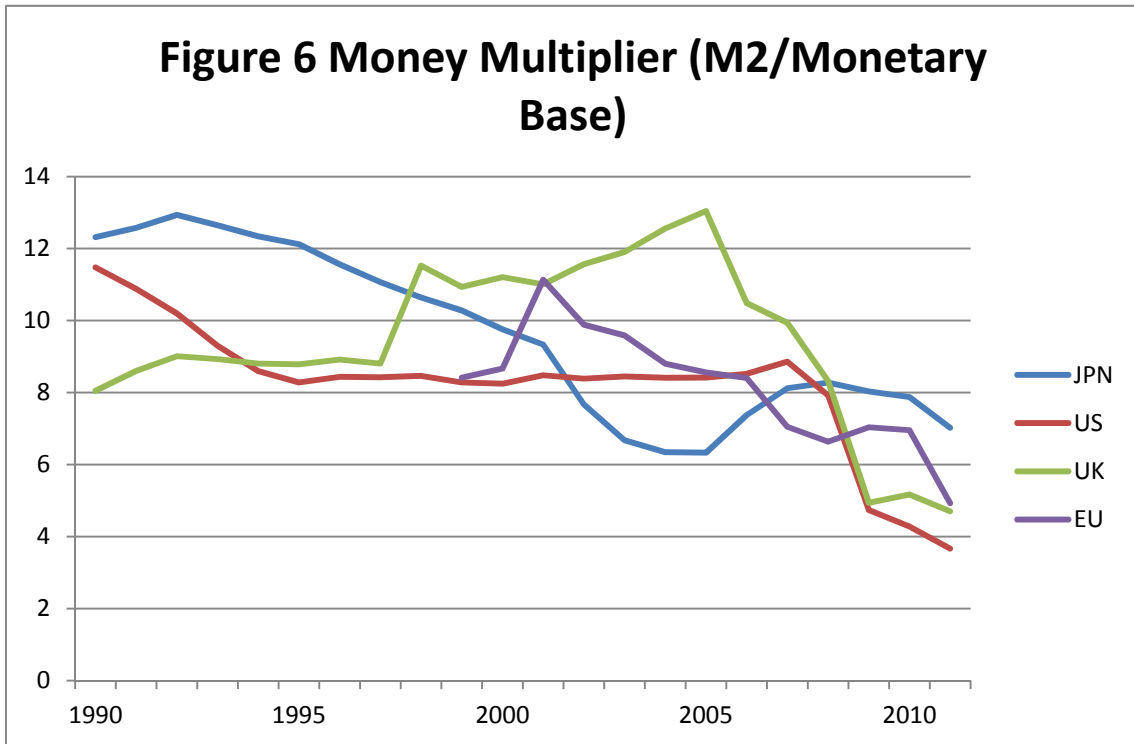
Source: Bloomberg.

Notes: Figure 4 presents the movements in the overnight call rate, which is targeted by the Bank of Japan, and the federal funds rate, which is targeted by the U.S. Federal Reserve. The figure shows both nominal overnight rates as well as the real rates calculated using the core inflation rate that was later announced. T = 0 corresponds to June 2007 for the United States and January 1990 for Japan.



Source: Datastream.

Notes: Figure 5 shows the monetary base (that is, currency outstanding plus bank reserves) relative to GDP for four countries.



Source: Datastream.

Notes: M2 equals currency outstanding plus bank deposits.

Figure A1 Deleveraging by Japan's Nonfinancial Corporations

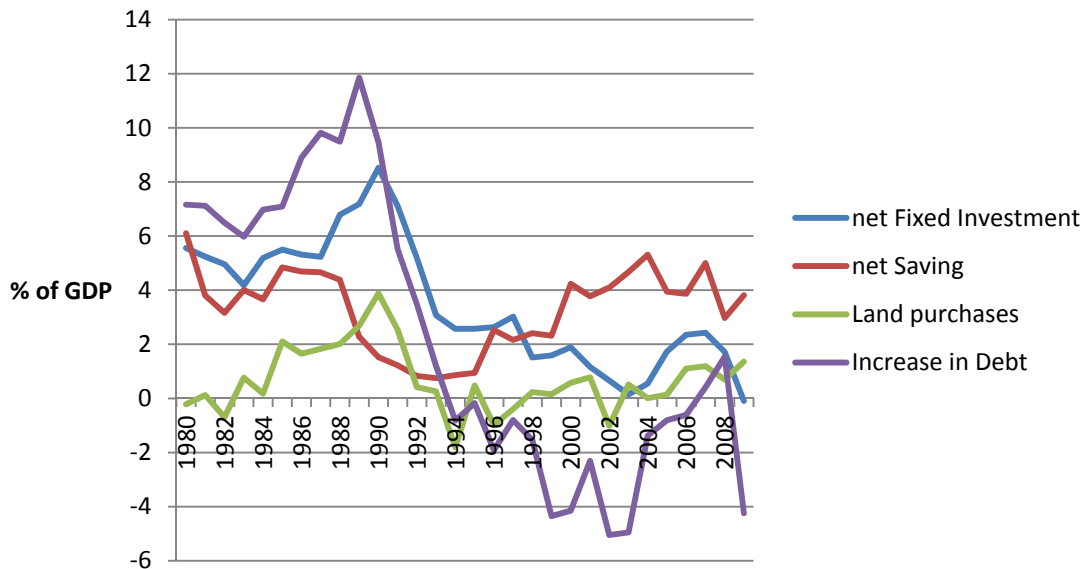


Figure A2 Inflation Expectations in Japan Calculated from Implied SWAP Forward Rates and Survey Measure of Growth Expectations

