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The Federal Reserve: Back to the Past

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Summary

Except in times of extreme liquidity crises, traditional monetary policy is about actions that increase or decrease the money supply. These actions are often preceded by an announcement by the Federal Open Market Committee that they are raising or lowering their target for the Fed Funds rate of interest. One way to assess the level of money relative to economic output is the availability of bank reserves. The Fed Funds rate is related to, but does not determine, the connection between money and economic output. When output rises relative to the money supply, banks economize on reserves and the Fed Funds rate rises.

Since the institution of paying interest on bank reserves balances, such balances are investments rather than just insurance against a run on the banking system. The paying of interest on reserves allowed the Federal Reserve to engage in an unprecedented increase in its assets without incurring significant inflation in the economy.

Now, the Federal Reserve has announced that it will begin a gradual reduction in its asset portfolio. This reversal of the almost decade long increase in Federal Reserve assets will require a slow, but careful process. This process must account for the effect of the policy on the Federal Reserve's goal of 2% annual inflation.

Here, we measure the scale of the asset reduction required to return the Federal Reserve's assets to GDP ratio back to its pre-Great Recession level. Using simple analysis, we show the magnitude of the problem and the factors that make the transition possible. Our analysis demonstrates the wisdom of the slow approach envisioned by the Federal Reserve Board's method of beginning the reduction in its assets. Uncertainty about the future path of market interest rates is particularly important.

The Federal Reserve: Back to the Past

Thomas R. Saving

Introduction

It takes very little imagination to see that the Federal Reserve of today is very different than the one we knew before 2008. It is certainly different than what was imagined when the Act that established the Federal Reserve was passed in 1913. There are at least three major differences in this Federal Reserve and the traditional version.

- First, this Federal Reserve has, as part of its permanent asset portfolio, private financial assets from a specific industry.
- Second, this Federal Reserve has issued financial liabilities in the form of bank reserves.
- Third, as a result of the Dodd-Frank legislation, this Federal Reserve is greatly involved in the regulation of a broad range of financial markets.

The important issue, however, is whether or not this Federal Reserve is still capable of doing its specified job of protecting the value of the currency. Or does the configuration of this Federal Reserve make it difficult or perhaps impossible to conduct monetary policy independent of the political part of the government?

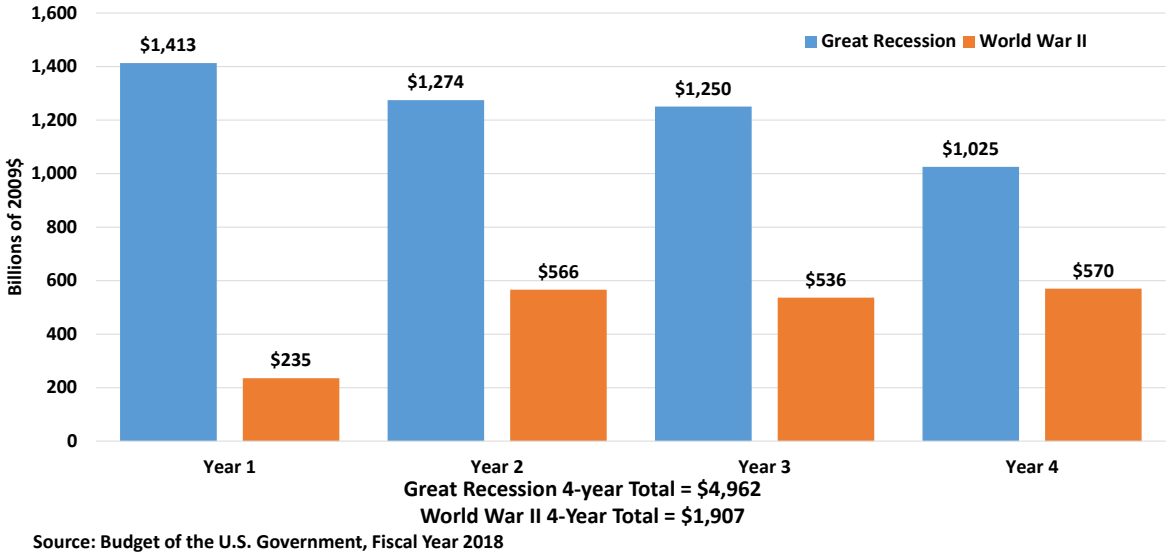
How We Got Here

Now that the Great Recession is on the wane, it is natural to ask: how have the policies of persistently large deficits and the Federal Reserve's response to these deficits affected both the future of the economy and the Federal Reserve? When the Obama Administration began the federal debt stood at $5.8 trillion, or 39.3% of GDP, and when it left the federal debt was $14.2 trillion, 77% of GDP. The debt rose by 244% and its share of national output almost doubled.

To get a perspective on the extent of these deficits, consider only the first four years of the Obama Whitehouse, from 2009-2012. For these four years, deficits were all in excess of $1 trillion. Of note, the deficits in the subsequent four years were not small by historical standards, they were just on the order of only half a trillion annually.

Now consider, what before the onset of the Great Recession we would have pointed to as the largest deficits in history, the financing of World War II. Figure 1 below shows the deficits from the first four years of Obama Administration and the four years of World War II, expressed in 2009 dollars. The comparison is striking!

Figure 1. Great Recession versus World War II Deficits (Billions of 2009$)



Source: Budget of the U.S. Government, Fiscal Year 2018

To finance and win a war, the Roosevelt Administration incurred deficits in the four World War II years of a little over $1.9 trillion, measured in 2009 dollars. The Obama Administration spent almost three times as much in its first four years, almost $5 trillion 2009 dollars, the outcome of such spending did not have similar positive effects and may have impeded economic growth.[1]

Another comparison immediately suggests itself: What did all this debt accomplish?

For World War II, the deficit bought war materials (guns, tanks and planes) and paid personnel in our military services. Output rose as the wartime labor force grew with the addition of women.

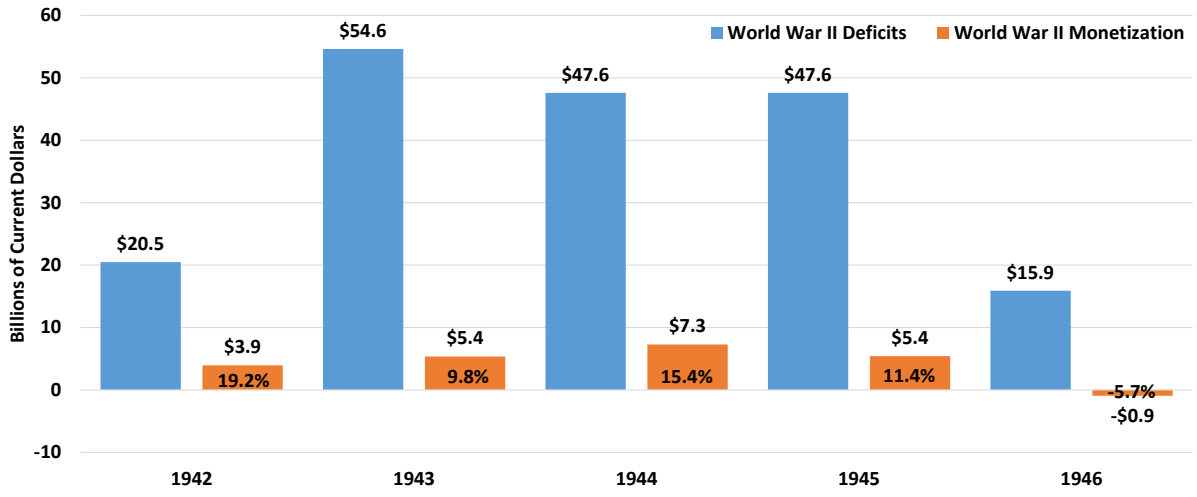
For the Great Recession, the deficits funded an expansion of income transfer programs. These programs resulted in a declining labor force, as the labor force participation rate that did not start to rise with the beginning of the recovery that began just six-months into the first Obama Administration. The bottom line is that the Great Recession deficits bought a smaller work force and lower income growth.

[1] Measured as a share of GDP World War II deficits averaged 20.3% while the deficits in the first four years of the Great Recession averaged 8.3%. Aside from World War II the largest deficit share of GDP was 5.7% in 1983.

The Federal Reserve in World War II versus the Great Recession

There is another distinction between these two episodes of federal debt explosions: how they affected the nation's central bank, the Federal Reserve System. In spite of the fact that the Federal Reserve was required by the Treasury to support the market for federal debt during and briefly after World War II, as Figure 2 shows, the actual contribution of the Federal Reserve to funding the war was relatively small.[2] From the beginning of fiscal year 1942 through the close of fiscal year 1946, the monetary base grew 94%, an annual rate of 14.2%.[3] During that period, the federal debt grew 471%, an annual growth rate of just over 36%. For the entire war period, the Federal Reserve funded only 11.3% of the deficits through purchases of Treasury securities.

Figure 2. World War II Fiscal Year Deficits and Federal Reserve Monetization (Current Dollars)



Sources: Budget of the U.S. Government, Fiscal Year 2018 and 2010 Federal Reserve Annual Report.

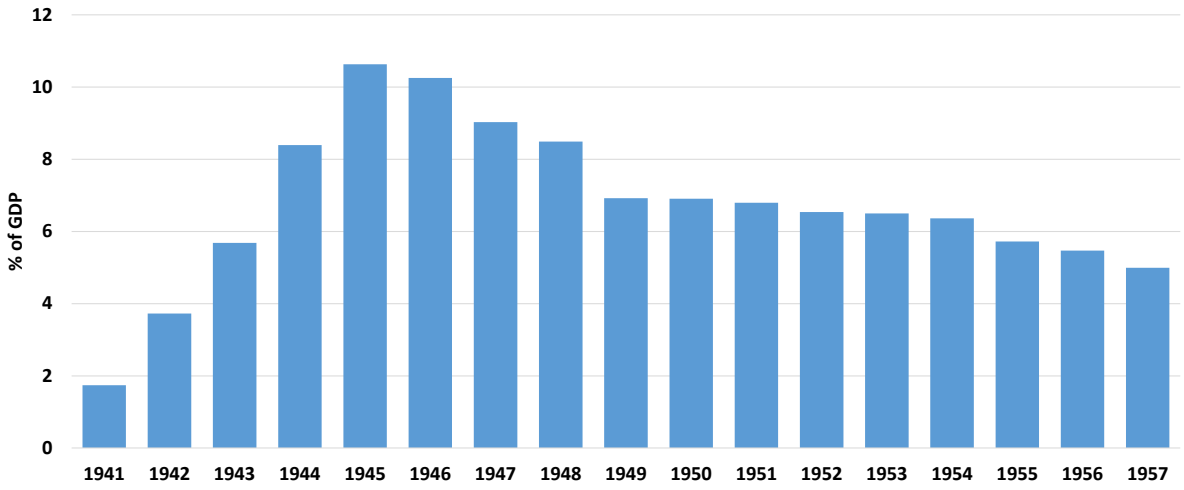
Once the necessity of helping finance the war was over, the expectation was that a central bank would revert back to a normal level of asset holdings. Figure 3 shows that this is exactly what happened after World War II- the Federal Reserve quickly reduced the level of assets following the war. Federal Reserve holdings of securities outright (U.S. Treasuries) as a share of the nation's GDP rose rapidly during the early war years from their pre-war level of just under 2% of GDP at the close of 1941 to more than 10% in four years. After the close of hostilities, the GDP share of Federal Reserve security holdings fell rapidly until by 1958, they were at levels that became the pre-Great Recession norm.

[2] The Federal Reserve was required to support an interest rate ceiling on Treasury Bills of 0.375% and on Treasury Bonds of 2.5%. Because of rationing and the general unavailability of durables goods and automobiles these ceilings put little pressure on Federal Reserve policy.

[3] Fiscal years at that time began in July and ended in June. Thus, Fiscal year 1942 in the above figure was from July 1, 1941 through June 30, 1942.

This rapid reduction was due to two factors. First, the Federal Reserve had reduced its holdings of securities and disposed of 25% of its war-time acquisitions by 1950. Secondly, both real and nominal GDP grew rapidly during the 1947-1957 period, at 3.95% and 6.63% respectively. The combined result of rapid GDP growth and reduced security holdings of the Federal Reserve is exhibited in Figure 3.

Figure 3. Federal Reserve Securities as a % of GDP

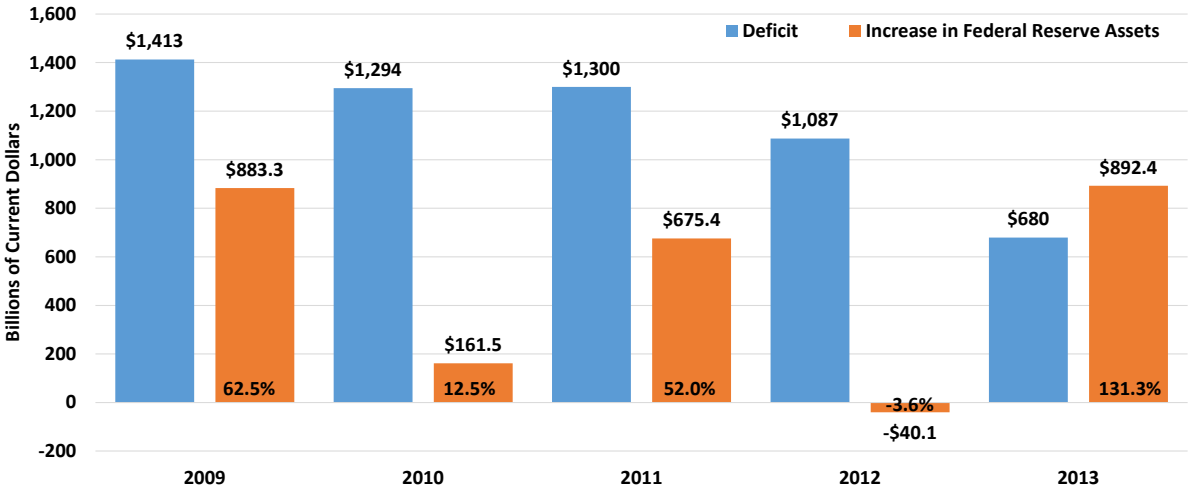


Sources: 2010 Federal Reserve Annual Report and Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

By focusing on the first five years of the Great Recession, Figure 4 shows the Great Recession Fiscal year deficits and the level of Federal Reserve involvement. In marked contrast to the role of the Federal Reserve in financing World War II, its role in the Great Recession was enormous. In three of the first five Great Recession years, the Federal Reserve covered over half of the federal deficit. After actually decreasing its holdings in fiscal 2012, it doubled down and increased assets by the largest amount for the entire period. In fiscal 2013, the Federal Reserve increased assets by almost $900 billion, covering 131% of the $680 billion fiscal 2013 federal deficit.

In contrast to past increases in Federal Reserve assets, this growth changed the Federal Reserve from a central bank whose assets were almost entirely U.S. Treasuries to a central bank that was invested in private financial assets, principally mortgage backed securities. While the expansion of the Federal Reserve's private market assets has ended, both the scale and the composition of its assets have changed the nature of the central bank.

Figure 4. Great Recession Fiscal Year Deficits and Federal Reserve Monetization (Current Dollars)



Sources: Budget of the U.S. Government, Fiscal Year 2018 and Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

Given the tremendous increase in Federal Reserve assets and the concomitant increase in the traditional monetary base, inflation expectations abounded, especially among economists. But this inflation never happened. This absence of inflation was due to a significant change in Federal Reserve policy. This change involved the Federal Reserve being an issuer of debt rather than just a purchaser of debt. This debt was primarily due to the introduction of paying interest on bank reserves but also issuing reverse repurchase agreements. The combination of these two debt instruments offset the inflationary effect of the tremendous asset expansion. Instead of the pressure of a 51% annual growth of Federal Reserve assets on the money supply and inflation, we experienced a much smaller, but still significant, 25% growth in net assets. Truly, this is not your parent's central bank! But the question is: can it ever be the old Federal Reserve again?

During the same period, in an effort to keep long-term rates low, especially for mortgage rates, the Federal Reserve engaged in what we might term "Operation Twist squared." The original Operation Twist involved replacing the normal Federal Reserve portfolio of short-term Treasuries with long-term Treasuries. The Federal Reserve sold short term Treasuries to raise their interest rate and bought an equivalent quantity of long-term Treasuries to lower the long-term rate. In "Operation Twist Squared " they doubled down by making bank reserves the equivalent of short-term bonds putting further pressure on short term rates.

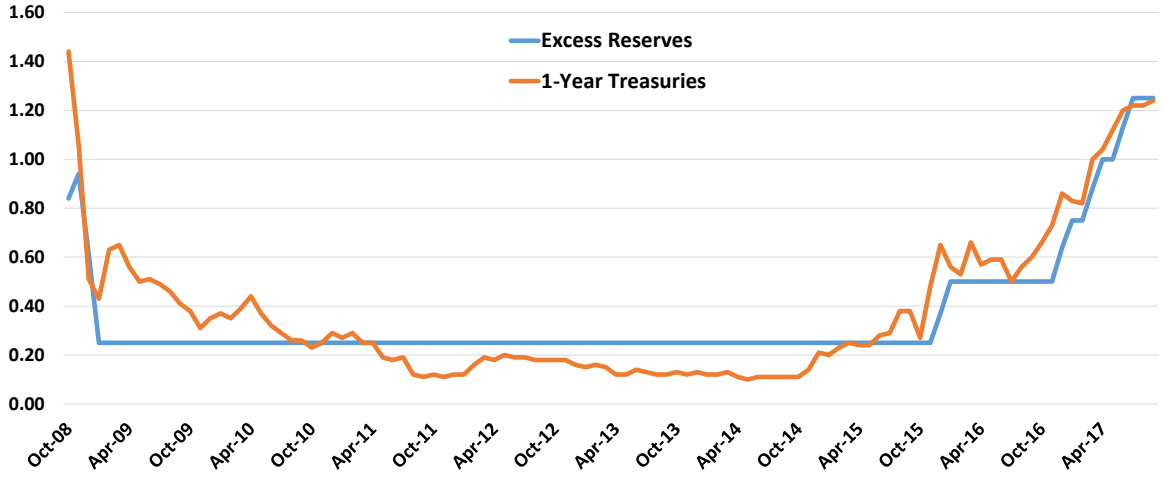
It now appears that the Federal Reserve is speculating in financial markets. It is buying long-term high yielding private financial assets, mortgage backed securities, and issuing on-demand short-term liabilities; bank reserves and reverse repos. The difference in interest rates is all profit that accrues to the Treasury. Last year, that difference was on the order of $100 billion,

over 40% of the cost of servicing the national debt. As anyone familiar with the Orange County California bankruptcy is aware, this is a high risk strategy. A flattening of the difference between the long term and short term rates of return can eliminate this subsidy to the Treasury. Of course, the Federal Reserve itself is immune from bankruptcy or insolvency since it has the printing press.

The biggest change however, is that this new Federal Reserve is now subject to being a victim rather than a determiner of interest rates. The fact is that the Federal Reserve determined interest rate on reserves is now more important to monetary policy than open-market operations. This fact is apparent in the relation between the Federal Reserve determined interest rate on reserves and the rate of return on 1-year Treasuries as shown in Figure 5.

For most of the period of paying interest on reserves, the rate of return exceeded the yield on 1-year Treasuries. This is not surprising, as the reason for paying the banks to hold reserves, rather than investing in financial assets, was to make the massive increase in Federal Reserve assets inflation-proof. As the yield on 1-year Treasuries has risen, the Federal Reserve has been forced to increase the interest rate on reserves. In a sense, the Federal Reserve is a captive of market interest rates. If the Federal Reserve wants to prevent the inflation that is pent up in the massive holdings of reserves, they must continue to make reserves competitive with other short-term bank investments.

Figure 5. Interest Rate on Reserves and 1-Year Treasuries



Source: Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

Currently, the Federal Reserve's assets consist of roughly 60% long Treasuries with a duration of seven years and 40% Mortgage Backed Securities (MBSs) with a duration of 25 years. The combination of these two assets shows that the Federal Reserve's asset portfolio has

a duration of almost 15 years- long by most financial standards.

Now, we come to the issue of Federal Reserve liabilities. Historically, Federal Reserve liabilities were, for all intents and purposes, easily rounded to zero. All that has changed and Federal Reserve liabilities are now significant. These liabilities consist primarily of bank reserves, essentially demand liabilities, and short- term reverse repos, typically 15 days.

As the spread between the interest rates on long-term assets held by the Federal Reserve and the Federal Reserve's short-term liabilities (reserves) falls, the yield on its net assets will fall. Currently, that yield measured by the level of transfers to the Treasury is on the order of 5.7%.

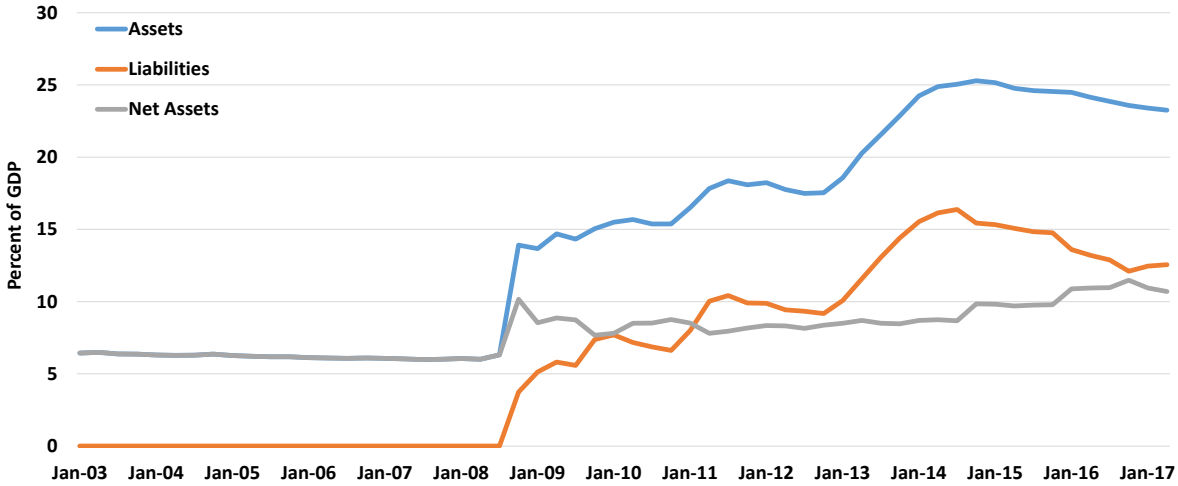
Rising interest rates will dramatically affect the federal cost of servicing the ever growing federal debt. At present, the Federal Reserve is transferring almost $100 billion to the Treasury- over 40% of the total debt servicing cost. A return of interest rates to their historically typical levels will increase the debt servicing cost and reduce the transfers from the Federal Reserve, a double whammy, so to speak!

Once the Federal Reserve sets a desired level of money stock growth, it becomes a reserve interest rate taker. If market interest rates rise with no change in the reserve interest rate, banks will move away from reserves and into other assets. Consequently, the money supply will rise. If the Federal Reserve does not want the money supply to rise, it must raise the interest rate on reserves to meet the market. If market interest rates fall, banks will move away from investments in the economy and into reserves and the money supply will fall. Once again, if the Federal Reserve does not want the money supply to fall it must lower the interest rate on reserves to meet the market.

Eventually, the Federal Reserve must extricate itself from the asset-liability mix that resulted from the Great Recession budget deficits. However, that restoration will not be simple. Figure 6 shows Federal Reserve assets, liabilities and assets net of liabilities. Several things are apparent from the figure. First, the Federal Reserve before October 2008 had virtually zero liabilities. Second, the pre-crisis Federal Reserve had assets that kept pace with GDP and remained virtually constant at about 6% of GDP. Third, the surge in liabilities that began in October 2008 was principally bank reserves that now paid interest but also, to a much smaller extent, reverse repos.

The result of the three QEs (Quantitative Easings) is very apparent in the figure as gross Federal Reserve assets more than quadrupled as a share of GDP from about 6% to just under 25%. At the same time, in order to stop the inflation pressure that would have existed with this dramatic increase in assets, the Federal Reserve began paying interest on bank reserves, essentially converting these reserves to short-term liabilities. The net effect of the asset and liabilities increase was an increase in Federal Reserve net assets from their 2003-2008 average of roughly 6% of GDP to roughly 11% of GDP earlier this year.

Figure 6. Federal Reserve Assets, Liabilities and Net Assets Relative to GDP



Source: Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

Returning to the Traditional Federal Reserve

Can we return the Federal Reserve to its pre-Great Recession configuration? How can this be achieved? Before we can answer these questions, we must first decide what we mean by such a return. We can begin by reiterating the goals of an independent central bank. The Federal Reserve Act indicates that these goals are maximum employment, stable prices, and moderate long-term interest rates in the United States.

We might question these goals, especially the maximum employment and moderate long-term interest rates as relevant for a central bank. Certainly, the goal of maximum employment is admirable. However, in any long-run sense, the central bank is helpless in this arena.

The same should be said concerning the goal of moderate long-term interest rates. In fact, there is no real meaning to the adjective “moderate” in any real economic context. Interest rates are market-determined. In a completely static world, the time preference of the population would determine the rate of interest for both the short-run and the long-run rate. In a dynamic world of changing technology, the marginal productivity of new capital would interact with the population’s time preference to determine interest rates.

One way out is to let the growth of GDP and the resulting increase in the money stock required to support that GDP absorb the excess reserves. During that reserve absorption, the interest rate on reserves could be gradually reduced until excess reserves return to their historic near zero level. At the same time, the Federal Reserve must reduce its holdings of non-

traditional assets. The sale of MBSs would also help in the absorption of reserves. But, the Federal Reserve holds a significant proportion of all MBSs, 34% of Ginnie Mae and of Freddie Mac and the other Government Sponsored Enterprises (GSEs), so that their disposal must be done so as to not have large market effects.

In Figure 6, the post October 2008 balance sheet of the Federal Reserve shows a rapid increase in both assets and liabilities. After a jump in the 4th quarter of 2008, net assets remained about the same throughout the period. Essentially, the QE2 and QE3 increase in assets was accompanied by an equivalent increase in bank reserves. Federal Reserve assets peaked in 2015 at the close of QE3.

Returning to the traditional Federal Reserve involves two components. First, the composition and scale of the Federal Reserve's investment in the economy's financial instruments is far from its normal asset portfolio. Traditionally, the Federal Reserve operated in the economy's short-term markets. As such, their portfolio of assets was largely comprised of Treasury debt of less than one year to maturity. The current Federal Reserve asset portfolio composition is largely comprised of long-term assets. The duration of its Treasury portfolio is greater than seven years, in contrast to its traditional duration of less than one year. In addition, almost one-half of its asset portfolio consists of non-Treasury debt, mortgage backed securities with an even longer duration.

Second, the traditional Federal Reserve ran the printing press and issued the resulting currency and reserves to buy assets. Neither currency nor reserves issued in this manner were liabilities of the Federal Reserve. For all practical purposes, the traditional Federal Reserve had no liabilities. This new Federal Reserve has introduced two forms of liabilities. One, by paying interest on bank reserves, it converted these reserves into liabilities. Essentially, it issued short-term debt to finance the acquisition of long-term assets. Two, it sells short-term debt to the banking system in the form of reverse repurchase agreements. The total of these two liabilities are now over $2 trillion.

Beginning in October, 2017, the Federal Reserve plans to transition back to the pre-2008 Federal Reserve. Initially, it intends to proceed by not renewing assets in its portfolio as they mature. Currently, the principle payments for these assets are reinvested in new issues so that the Federal Reserve portfolio stays the same.

On September 20, 2017, the Board set the goal for the non-reinvestment program as follows. For payments of principal that the Federal Reserve receives from maturing Treasury securities, the Committee anticipates that for Treasuries initially no more than $6 billion per month will not be reinvested and that amount will increase in steps of $6 billion at three-month intervals over 12 months until it reaches $30 billion per month. For payments received from agency debt and mortgage-backed securities initially no more than $4 billion per month will not be reinvested and that amount will increase in steps of $4 billion at three-month intervals until it reaches $20 Billion per month.

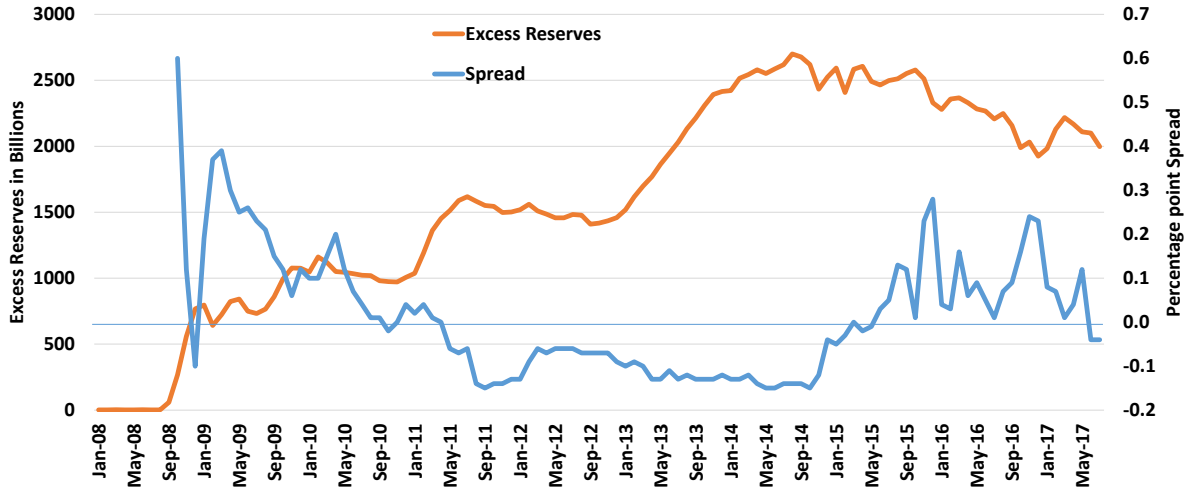
The issuers of these securities regularly rollover these maturing securities and a part of the rollover is purchased by the Federal Reserve. Now, the Federal Reserve will reduce its participation in the rollover of this debt financing. The part of the rollover that had been purchased by the Federal Reserve will be purchased by the general public. As a result, the public's share of these securities will rise by an amount equal to the decline in Federal Reserve holdings.

As the assets mature, the Treasury and other agencies issue replacement securities. To the extent that the Federal Reserve does not reinvest the earnings, they turn these assets back to the issuer and essentially destroy the revenue it receives from them. For all practical purposes, this approach is equivalent to an open-market sale of assets and it immediately reduces reserves and the monetary base.

In what we might call a 'normative Federal Reserve world' this reduction in reserves would result in a reduction in bank loans, an increase in interest rates and a reduction in the money stock. In that normative world, an open-market sale would also result in a reduction in the public's wealth as Federal Reserve transfers to the Treasury fall so that taxes must rise.

In this new Federal Reserve world of bank reserves being income earning assets for banks and bountiful excess reserves, how does the reduction in reserves affect the banking system? Figure 7 shows the path of excess reserves and spread between the interest on reserves and 1-year Treasuries.

Figure 7. Interest Rate Spread (1-Year Treasury - Rate on Reserves) and Excess Reserves



Source: Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

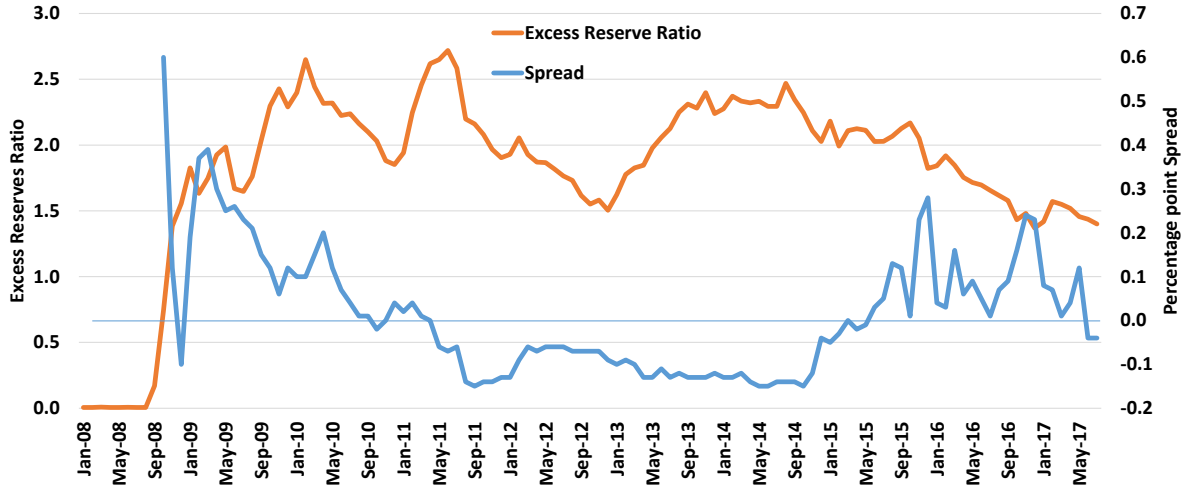
In Figure 7, the benefits of holding reserves is represented by the spread between a potential bank investment, 1-year Treasuries, and the interest rate banks receive on reserve balances. This spread represents the cost of holding reserves rather than 1-year Treasuries. As the figure shows, the rapid growth in bank reserves occurred when the spread was actually negative, i.e., the yield on reserves exceeded the return on 1-year Treasuries.

What are the issues that arise when the Federal Reserve fails to reinvest assets that mature? Three effects arise. First, the income earned from these assets had been, but will no longer be transferred to the Treasury. Thus, there will be a loss to the Treasury in next year's transfer equal to the rate of return on the assets not reinvested. Second, the total of the non-reinvested assets represents an equal reduction in bank reserves. Third, the Treasury must now increase its sale of debt to the public by the amount that the Federal Reserve is not reinvesting. In fact, it is this sale that would ultimately result in the reduction in bank reserves.

The bottom line is that a failure to reinvest maturing assets is equivalent to an open-market sale of the assets. How will the banking system react to the reduction in reserves? Specifically at the current interest rate on reserves, will it want to restore the previous reserve to total asset portfolio? If so, then the money supply will fall, but such a fall would be inconsistent with the desired 2% annual inflation.

It is clear that the banking system demand for reserves is an important part of the effect of this new asset reduction policy. To get a feel for member banks desire to hold reserves in lieu of external earning assets, Figure 8 shows the banking system's holdings of excess reserves per dollar of demand deposits.

Figure 8. Interest Rate Spread and Excess Reserves per Dollar of Demand Deposits

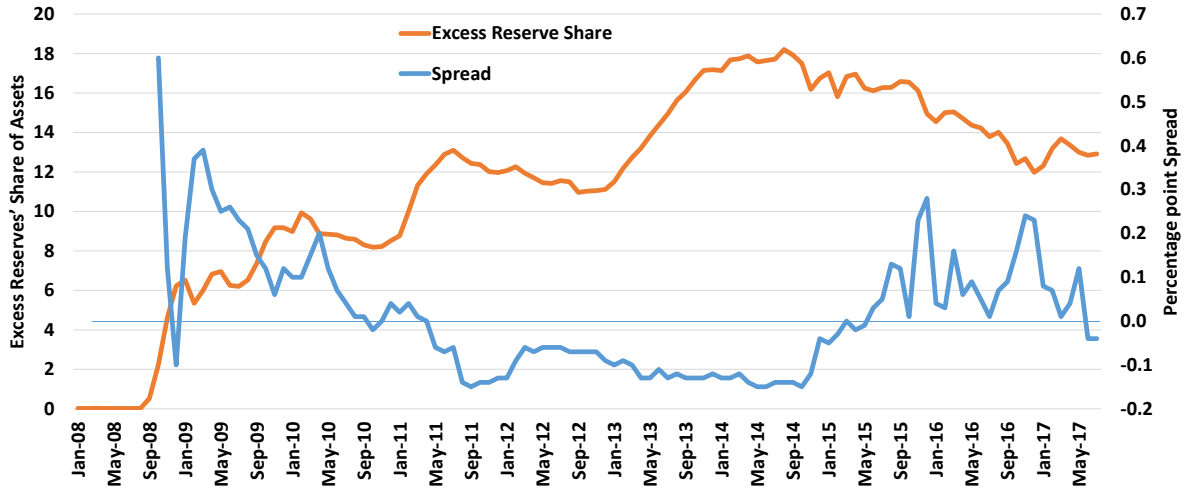


Source: Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

As noted, before the Fed began paying interest on reserves, banks essentially held zero excess reserves. Banks now hold $2.1 trillion in excess reserves and have total assets of $16.2 trillion. Now with the payment of interest on reserves, excess reserves make up 12.5% of bank assets. During the period when the spread between 1-year Treasuries was averaging 14 basis points in favor of reserves, the banks held $2.5 of excess reserves per dollar of demand deposits. The spread is now essentially zero and banks are still holding $1.4 of excess reserves per dollar of demand deposits.

As a further indication of the effect of interest on reserves and the resulting competition between reserves and the non-reserve investment portfolio of banks, Figure 9 shows the share of bank investments in excess reserves in their total investment portfolio. During the period of a negative spread between 1-year Treasury interest rates and the interest rate on reserves, the excess reserve share of bank assets rose from about 9% in early 2011 to more than 18% in mid-2016, when the spread once again reached positive levels. Figures 7, 8 and 9 all demonstrate the importance of the interest rate spread in the value of excess reserves as a part of an optimal bank portfolio.

Figure 9. Interest Rate Spread and Excess Reserves' Share of Total Bank Assets



Source: Federal Reserve Economic Data, Federal Reserve Bank of St. Louis.

As the directive from the Federal Reserve Board indicates "The Committee intends to gradually reduce the Federal Reserve's security holdings by decreasing its reinvestment of the principal payments it receives from securities held in the System Open Market Account. Specifically, such payments will be reinvested only to the extent that they exceed gradually rising caps."[4] The Board wants to set caps in order to limit the volume of securities that private

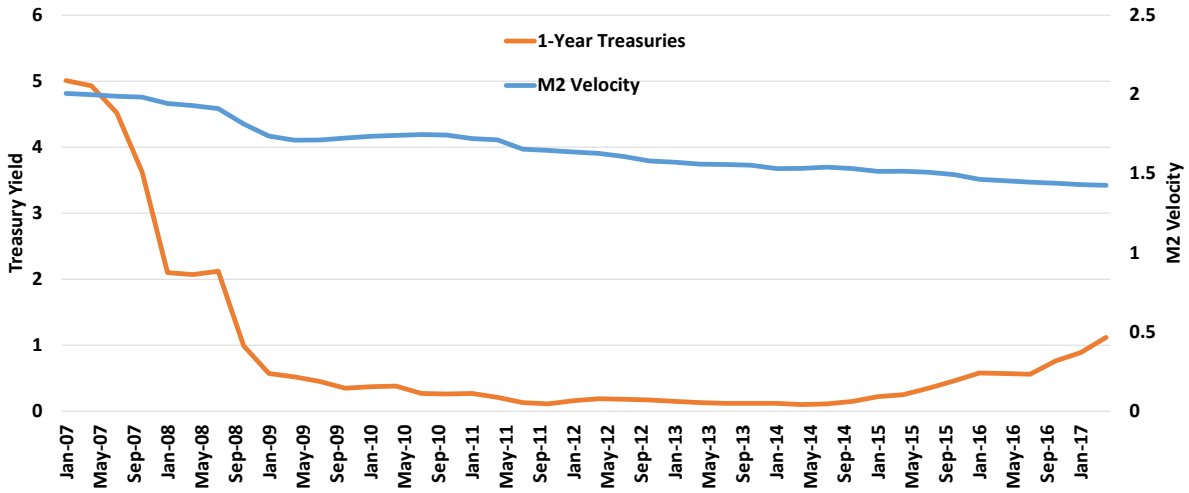
[4] Federal Reserve Press Release, "FOMC issues addendum to the Policy Normalization Principles and Plans," June 14, 2017.

investors will have to absorb.

Since the level of non-reinvesting is equivalent to an open market sale of the same magnitude, the caps are designed to limit the contractionary effect of the policy. But consider the period before the current desire to reduce Federal Reserve assets, the growth in assets period. Here, the expansionary effect of this growth was offset by paying interest on reserves that resulted in the banking system absorbing the tremendous Federal Reserve asset increase in the form of excess reserves.

This effort was further aided by a fall in the velocity of money due to the fall in interest rates in general, as shown in Figure 10 below. The simple theory is that higher interest rates make the public economize on money balances. That money balance economization is reflected in rising velocity. By the same token, falling interest rates make holding money balances less costly and results in falling velocity. This simple idea is reflected in Figure 10. During the 10 year period from the beginning of 2007 to the beginning of 2017, velocity fell in response to the falling interest rates at an annual rate of 3.31% or a monthly rate of 0.28%.

Figure 10. M2 Velocity and 1-Year Treasury Yield



Source: Federal Reserve Economic Data, Federal Reserve Bank of St. Louis and author's calculation.

Issues in the Implementation of the Federal Reserve Asset Reduction Program

Currently, the Federal Reserve is setting a course to reverse the asset increase. Previously, the Federal Reserve responded to interest rate increases by increasing the interest rate on reserves in order to maintain the level of banking system reserves. Can't we now just reverse the excess reserve and velocity movements and reduce both assets and liabilities, excess reserves, pari-passu? The answer lies in examining the conditions that allowed the asset

increase to be offset by an almost equal increase in excess reserves. The answer is clear from an examination of Figure 6. If we pay banks enough they will hold any desired level of excess reserves. But this suggests the answer to our problem: we set the interest rate on reserves such that bank investing in the economy is superior to holding reserves. We want just the right amount of substitution of market investments to investment in reserves.

The asset reduction program is equivalent to a series of open-market sales of Federal Reserve assets. Once the resources used to purchase Federal Reserve assets reach the Federal Reserve, they are essentially absorbed into the money printing press. Such sales taken alone reduce the monetary base, currency plus reserves, as well as make banks search for reserves and reduce their loan portfolio. In addition, the public in general is made poorer as the reduction in Federal Reserve earnings transferred to the Treasury results in higher taxes or increased public debt.

This asset reduction program is not intended to have a negative, or tightening, economic effect. The relevant question becomes “What can be done to offset the negative effect?” In the traditional central banking world there would be no way to offset the negative effect of an open-market sale of assets. However, in the current world of interest on bank reserves it is possible for the banking system to totally offset the open-market sale effect. To accomplish this, the banking system moves investments in reserves to investments in the economy. And the fact that the Federal Reserve controls the interest rate on reserves gives it the power to control the relative value of reserves to the banking system.

Just as the directive states, the non-reinvestment program will be capped at a relatively low level. To get a feel for the scale of this policy reversal, assume that the Federal Reserve does not change the announced policy of a total non-reinvestment of $30 billion in the first quarter, $60 billion in the second quarter, $90 billion in the third quarter and for the final quarter, $120 billion. For the year beginning October 2017 to October 2018, this asset reduction will total $300 billion. How does this potential $300 billion reduction in the Federal Reserve portfolio compare to the previous three portfolio expansions that occurred over the past decade? In 2013, the Federal Reserve added just over $1 trillion to its asset holdings-a 41% increase. They followed that in 2014 by adding $482 billion-a 13% increase. In comparison, the first year of the planned asset reduction program represents a $300 billion reduction-just over 7% of the September 2017 total security holdings of over $4 trillion.

Assume for a moment that the Federal Reserve wants to restore its asset portfolio to pre-Great Recession levels as a share of GDP by the close of the next decade. If the Federal Reserve meets its annual inflation goal of 2% and real GDP grows at the same low 1.39% annual rate as the last decade, then nominal GDP in ten years will be $27 trillion. In the ten years leading up to 2007, the ratio of Federal Reserve securities held outright to GDP was 5.2%. Restoring this securities to GDP ratio sets the ultimate goal for Federal Reserve security holdings in 2027 at $1.3 trillion. It is the difference between current securities holdings of $4.2 trillion and this ten-

year out goal of $1.3 trillion-$2.9 trillion that is the issue.

This analysis assumes that real GDP growth will stay at the historically low level of the last decade. If we can undo the counter-growth measures of the last Administration and achieve even modest tax reform we can restore the historic faster real GDP growth more quickly. This faster growth will significantly reduce the difficulties in restoring the Federal Reserve as we previously knew it. For example, even with a modest real GDP growth of 3% and the Federal Reserve goal of 2% inflation, nominal GDP in ten years will be $31 trillion. To be more optimistic, if real GDP growth equals the 3.95% of the first ten post-war years and the Federal Reserve achieves its 2% inflation goal, nominal GDP in a decade will be $34 trillion.

If we are able to achieve 3% real GDP growth and the 2% inflation target within a decade, restoring the traditional Federal Reserve securities to GDP ratio of 5.2% would require security holdings in 2027 of $1.7 trillion. Even with this faster GDP growth, the task of getting back to the past is formidable. With current holdings of $4.2 trillion, the faster GDP growth scenario would still require that the Federal Reserve draw down their security holdings by $2.5 trillion.

What path is required in order to dispose of the slow GDP growth $2.9 trillion or the faster GDP growth $2.5 trillion that in a decade would return the Federal Reserve to its' traditional size? Importantly, that path must not affect the Federal Reserve 2% annual inflation goal, and more importantly, not have a negative effect on the economy.

The path to successfully giving us back the old Federal Reserve is composed of three parts. Part one is simply reversing the excess reserve growth that essentially financed the expansion. Part two involves accounting for the return of velocity to its pre-crisis level. Finally, part three accounts for the effect of growth in nominal GDP on the desired final level of Federal Reserve securities holdings.

To begin, the interest on reserves induced excess reserve growth can be used to offset the reduction in Federal Reserve securities holdings. Current excess reserve holdings are $2.1 trillion. But, the Federal Reserve has also been selling reverse repos for the last several years. These sales reduce reserves dollar for dollar. Thus, the total amount of reserves available to offset security non-reinvestment is the $2.1 trillion of excess reserves plus $0.4 trillion of reverse repos, which brings the total available for asset reduction offset to $2.5 trillion.

For the low GDP growth of the last decade, the total asset reduction required is $2.9 trillion. A simple reversal of excess reserve growth during the expansion can absorb $2.5 trillion of the open-market sales without affecting the economy. This leaves only $0.4 trillion of asset reduction that can have a negative effect on the economy. Importantly, for the higher GDP growth assumption the level of excess reserves alone can suffice to allow the return to the past to be accomplished without negative effects on the economy.

While the massive Great Recession asset acquisitions of the Federal Reserve did not result

in significant increases in the price level, they did result in significant increases in the money supply. In fact, the money supply grew at a rate more than three times the inflation rate. The 18.4% per year growth in Federal Reserve assets resulted in only 6.5% annual growth in the M2 money supply. The difference between these growth rates was absorbed by the growth in excess reserves.

To find the potential inflationary effect: at a 6.5% rate of growth of the money supply, we must consider that real income was growing at 1.4% per year. With those considerations, money growth in excess of output growth was 5% per year- still well above the CPI inflation rate of 1.7%.

Why didn't the inflation rate match the money growth rate? The answer is that the public's demand for money rose, as evidenced by the fact that M2 velocity was falling at 3.1% per year. In fact, the M2 money growth less the real GDP growth and the negative M2 velocity growth yield a forecast of inflation of 1.76% (6.45-(1.38+3.31) = 1.76).

The increase in the public's demand for money along with the banking system's demand for reserves combined to allow the last decade's increase in Federal Reserve assets. Both have had little effect on the inflation rate. These factors also point to the possibility that the undoing of the past asset expansion can occur with little or no negative effect on inflation or the economy. If so, then what is the problem and why did the Board of Governors caution instituting such an asset reduction? This caution is the result of considerable uncertainty in money velocity as well as uncertainty on the proper amount and direction of the interest rate on reserves needed to absorb each asset reduction.

Bear in mind that every asset reduction is the equivalent to a Federal Reserve tightening of money markets. We know that some or all of this tightening can be untightened by banks. This can be achieved by reducing their demand for excess reserves which increases their demand for market assets. Further, the effect of the asset reduction on the economy can be offset by the public's reducing its demand to hold money balances-an increase in velocity.

One uncertainty in all this is that we do not know the exact relation between the demand for excess reserves and the spread between market interest rates, e.g., 1-year Treasuries, and the interest rate on reserves. What is clear is that once the Federal Reserve has returned to an asset level consistent with their pre-Great Recession asset to GDP ratio, the interest rate on excess reserves should be zero, i.e., the banking system will hold virtually no excess reserves. The beginning and end points of this new policy are known, but the path to that end point is important. Just as the last two Quantitative Easing periods were offset by banks increasing excess reserves, this new 'Quantitative Tightening' event must be offset by banks decreasing excess reserves.[5]

[5] The Appendix contains a method of estimating the amount of change in the banking system's desire to hold reserves as part of their investment portfolio related to speed that the Federal Reserve reduces assets.

Conclusion

As we enter this new era where the Federal Reserve is beginning to reverse the series of Quantitative Easing, is it possible to achieve a return to the past levels of Federal Reserve assets without negatively affecting the economy? The Quantitative Easing was aided by the institution of interest on reserves so that the banking system absorbed the majority of the asset increase. Reversing this process will require that the banking system follow the asset reduction with reserve reduction.

The problem is making this seemingly simple solution to any negative effects of the asset drawdown work. Essentially, the change in the banking system's desire to hold excess reserves must match the level of excess reserves reduction that is consistent with the level of non-reinvestment chosen by the Federal Reserve. The Federal Reserve asset expansion was absorbed by the economy in two ways. First, by initiating the payment of interest on reserves, the banking system absorbed a large part of the increase in assets. Second, the fact that interest rates were near historical lows increased the public's demand for money, as evidenced by the fall in velocity. The combination of these two events allowed the expansion in Federal Reserve assets to have little effect on the inflation rate.

The issue now is whether we can reverse these events and draw down Federal Reserve assets to their historic share of GDP. Certainly, the Federal Reserve can induce the banks to hold fewer reserves by lowering the interest rate of reserves relative to other investment alternatives. Also, the fact is almost certain that as market interest rates rise, a falling demand for money can offset the money reduction inherent in the series of open-market sales of Federal Reserve assets. It is the managing of these two factors that is perplexing. These conditions show why it makes sense for the Federal Reserve to begin small as they try to return to a world where excess reserves do not pay interest and where the banking system reduces excess reserves by an amount equal to the Federal Reserve's reduction in assets.

We know that the banking system's response to the Federal Reserve's acquisition of assets was to increase reserves as the yield on excess reserves exceeded the rate of interest on 1-year Treasuries by 10 to 15 basis points. To get the banks to give up reserves as an investment will require that reserves be inferior to non-reserve investments. The question remains: by how much?

Essentially, the Federal Reserve can manage two components of the equation that will allow them to reduce assets without harming the economy. These two components are the interest rate on reserves and the rate of asset reduction. The remaining two components, market interest rates and the velocity of money, are out of its control. It is these last two components that the Federal Reserve must counter if it hopes to succeed in a no-harm asset reduction program.

Appendix

Estimating the Required Changes in Banks Demand for Reserves

Assume that the Federal Reserve in its new policy to return to its roots, so to speak, leaves its annual inflation goal of 2% unchanged. The initial projected annual reduction in assets is $300 billion, or just over 7% of current securities holdings. While a reduction of 7% of assets sounds small, Federal Reserve asset reduction is totally uncharted territory. As Figure 5 shows in dramatic fashion, previously, the accumulation of assets was seamlessly associated with the absorption of the majority of the asset accumulations as bank reserves. That absorption was facilitated by the fact that almost from the get-go, the rate of interest on reserves exceeded the 1-year Treasury rate of return by an average of at least 10 basis points.

Considering that the commencement of an asset reduction is new territory, assume that the initial non-reinvestment by the Federal Reserve will be $300 billion in this next year. For simplicity, assume that, rather than the gradual increase in asset reduction, the rate of reduction remains constant at $25 billion per month. The implied monthly percent rate of reduction in the monetary base would be 0.657%. The problem for the Federal Reserve is to ensure that the monetary base reduction does not affect its goal of 2% inflation. For this to happen as the Federal Reserve transitions to a smaller asset portfolio, the banking system must simultaneously reduce their demand for excess reserves.

We now come to the main problem facing the Federal Reserve. To get a feel for the issues, we begin by assuming that the 2% annual inflation goal of the Federal Reserve should remain intact throughout the asset reduction program. Since the asset reduction program will proceed on a monthly basis, the 2% annual inflation goal translates into a desired monthly inflation rate of 0.165%.

Actual inflation depends on the rate of change in the money supply compared to how fast the economy is growing. This relation is often expressed in the simple equation of exchange that states that the rate of inflation equals the rate of money growth plus the rate of velocity growth less the growth in real output shown below. In the equation, the dots over a variable indicates the time derivative of that variable, i.e., $\dot{x} = (dx/dt), \forall x$. In the equation then, $(\dot{P}/P)$ is the percent rate of change in prices, i.e., the inflation rate, $(\dot{M}/M)$ is the percent rate of change in money, however defined, $(\dot{V}/V)$ is the percent rate of change in the velocity of the appropriate definition of money and velocity is defined as the ratio of nominal Gross Domestic Product (GDP) and the quantity of that same definition of money, and finally $(\dot{g}/g)$ is the percent rate of change in real GDP.

$$\frac{\dot{P}}{P} = \frac{\dot{M}}{M} + \frac{\dot{V}}{V} - \frac{\dot{g}}{g}$$

The table below indicates how this simple equation explains the rate of inflation for three common definitions of the money supply, M1, M2 and MZM and the three common price level measures, Consumer Price Index (CPI), Personal Consumption Expenditures Index (PCE) and the GDP deflator. Inspection of the table shows that the simple equation of exchange is very successful in explaining the actual monthly rate of change for all three measures of inflation. The equation predictions are slightly below the actual CPI inflation and slightly above the PCE and GDP deflator inflation measures.

Actual and Equation of Exchange Predicted Monthly Inflation Rates
2007-2017

Money Definition	Predicted Inflation	CPI inflation	PCE inflation	GDP deflator
M1	0.130%	0.138%	0.124%	0.125%
M2	0.127%	0.138%	0.124%	0.125%
MZM	0.128%	0.138%	0.124%	0.125%

There is a simple relation of the money supply to the monetary base. It recognizes that the users of the monetary base are currency held by the public and reserves held by the banking system. The public controls how much currency they want relative to other components of what we call money- the currency-deposits ratio that we denote as the symbol γ. The banking system decides the level of reserves they hold above that required by the Federal Reserve. Here, we denote the ratio reserves required per dollar of deposits as ρ and the ratio of the banking system's excess reserves to deposits as ε. Using the simplest version of the relation between the money supply and the monetary base yields the equation below that shows the effect of the monetary base on the money supply.

$$M = \left(\frac{\gamma + 1}{\gamma + \rho + \varepsilon} \right) B$$

The proposed reduction schedule of Federal Reserve assets will reduce the monetary base. The goal during the reduction is to retain the policy goal of 2% annual inflation. As a result, the money supply must grow, even though the fundamental input into the money supply is falling. In the above equation, the only element of the multiplier of the monetary base that the Federal Reserve can affect is the excess reserve ratio. Specifically, the higher the Federal Reserve sets the interest rate on reserves, the greater share of the banking system's assets will be invested in reserves. Thus, to offset a reduction in the monetary base, the Federal Reserve must change the interest rate on reserves enough to more than offset the reduction in the monetary base.

Let's return to the equation of exchange. First, the Federal Reserve target for inflation is 2%

per year-that is 0.165% monthly and this percent becomes the left hand side of the equation of exchange. Assuming that the public demand for currency will be unaffected by the asset reduction program, the rate of growth of the money supply is determined by the following equation.

$$\frac{\dot{M}}{M} = \frac{\dot{B}}{B} - \frac{\dot{\varepsilon}}{\gamma + \rho + \varepsilon}$$

The Federal Reserve asset reduction program makes the rate of growth in the monetary base negative. Thus, to make monetary growth positive, which is necessary to reach the inflation target, the rate of change in the banking system's desire to hold reserves must be negative. The equation below incorporates the equation above and uses the fact that real GDP growth for the last decade has been is 2% annually, or 0.165% monthly.

$$0.165\% = -\frac{\dot{\varepsilon}}{\gamma + \rho + \varepsilon} + \frac{\dot{B}}{B} + \frac{\dot{V}}{V} - 0.165\%$$

The only parts of the above equation that are in the control of the Federal Reserve is the rate of decline in the monetary base resulting from non-reinvestment rate and also because they control the rate of interest on reserves, the banks desires excess reserve to deposit ratio. The monthly rate of change in the monetary base as shown above will be -0.657%, i.e., $\left(\dot{B}/B\right) = -0.657\%$. Also, the current levels of $\gamma, \rho, \varepsilon$ are respectively $1.018, 0.081, 1.436.$ Then, the above equation can be written as

$$\frac{\dot{\varepsilon}}{\varepsilon} = -0.577\% + 1.765\frac{\dot{V}}{V}$$

If we don't have to worry about changes in velocity, then this indicates that the Federal Reserve must adjust the interest rate of reserves so that the banks desire to hold excess reserves falls by 0.577% per month. Or, if velocity rises as interest rates rise at the same rate it fell as interest rates fell -0.28% a month, then a smaller rate of change in the banking system's desire to hold excess reserves of 0.083% per month is required. But, without exact knowledge of the banking system's demand for reserves and the fact that market interest rates are uncertain, this suggests that the asset reduction program must proceed slowly so that Federal Reserve adjustments in the interest rate on reserves is consistent with their inflation goal.