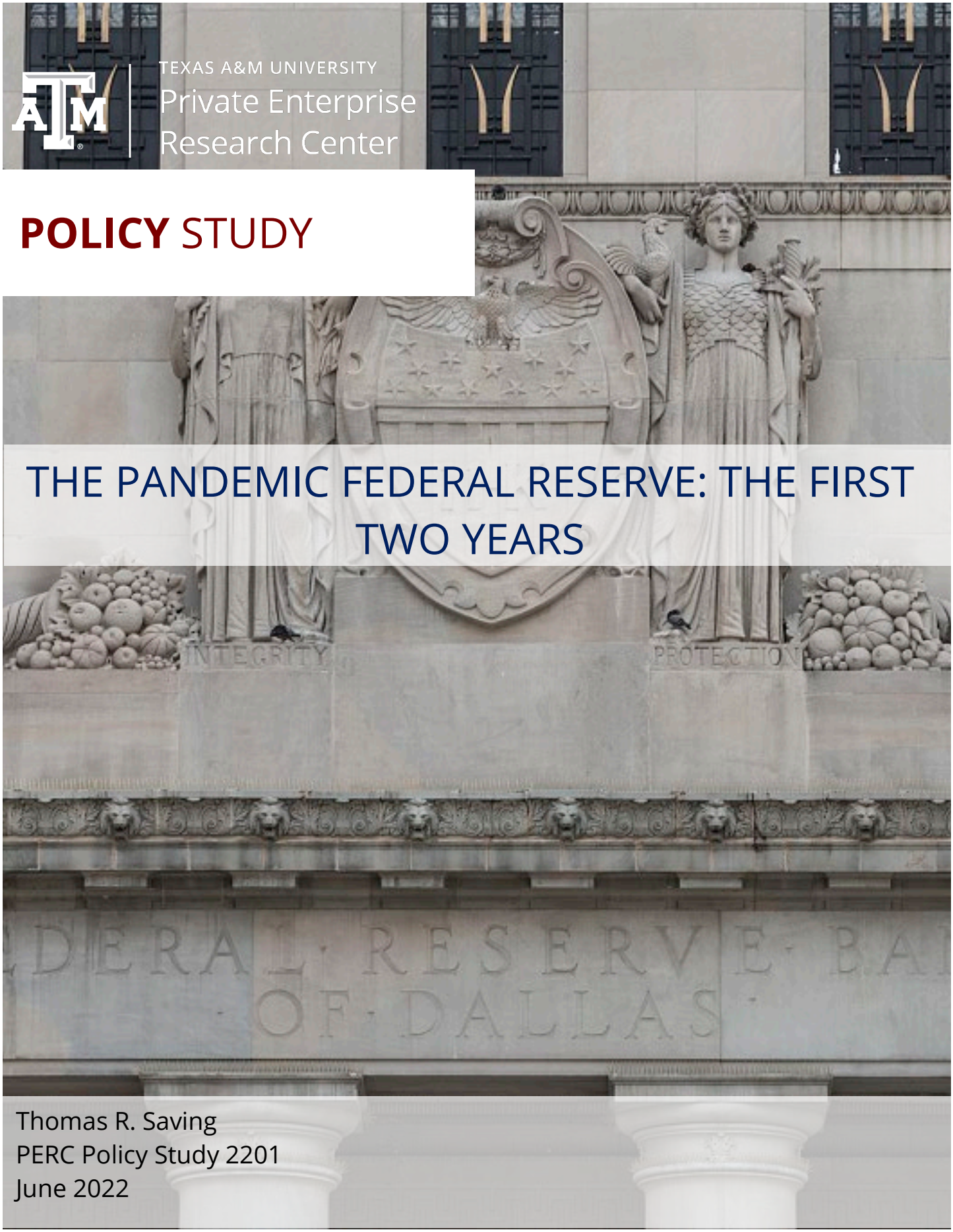

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POLICY STUDY

THE PANDEMIC FEDERAL RESERVE: THE FIRST TWO YEARS

Thomas R. Saving
PERC Policy Study 2201
June 2022

SUMMARY

Due to the Covid-19 pandemic, developed world governments engaged in unprecedented spending. Over just the first year of the pandemic, the Federal Reserve increased its securities holdings by more than $3.3 trillion, an increase of 82%. The second year was not as dramatic but still saw an increase in Federal Reserve securities holdings of more than $1.4 trillion, an additional 21%. Federal Reserve securities holdings were an astounding 36.5% of the nation's Gross Domestic Product after two pandemic years. These tremendous increases in Federal Reserve holdings have resulted in bank reserves that exceeded $4 trillion at their peak and even after some reductions still stood at $3.9 trillion after two years of the pandemic.

During the last period of rapid Federal Reserve asset expansion, its response to the Great Recession, bank excess reserves reached $2.6 trillion but inflation remained below 2%. Even though the banking system had the potential to increase the money stock and cause inflation, the money stock increases never happened due to the practice of paying interest on bank reserves (IOR), essentially paying banks to keep reserves as an investment. But now we have a bank reserve problem that is 25% larger and the question is: can the Federal Reserve set an IOR high enough to stave off an inflationary increase in the money stock?

To prevent the Federal Reserve's pandemic asset expansion from adding to the current inflation disruption of the economy it must induce the banking system to retain much of the expanded assets as excess reserves. With market interest rates rising rapidly since mid-December 2021, can the Federal Reserve maintain an IOR that will induce the banking system to continue to hold as reserves the tremendous increase in market assets that the Federal Reserve has acquired during the Pandemic? If not, are we doomed to see the double-digit inflation that many predicted for the 2008 crisis?

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THE PANDEMIC FEDERAL RESERVE: THE FIRST TWO YEARS

INTRODUCTION

With the onset of the Covid-19 pandemic, the United States and the entire developed world went into a shut-down mode. Developed world governments proceeded to engage in almost unprecedented deficit spending resulting in debt to GDP ratios at levels not seen since World War II. These deficits were at least in part financed by central bank expansions of their assets, principally treasury debt.

The Federal Reserve increased its assets over the first year of the pandemic by more than $3.3 trillion, an increase of 82%. One fear is that once the economies open up this tremendous increase in Federal Reserve assets will return the nation to the double-digit inflation of the late 1970s. This fear is exasperated by the fact that the banking system holds more than $3.8 trillion in reserves. Even with the need to hold 5% of these reserves the banking system could add $76 trillion to the M2 money supply. Current M2 money stock is just over $20.2 trillion, and these reserves have the potential of increasing the M2 money stock by more than 300%!

In the most recent period of rapid Federal Reserve asset expansion, the response to the Great Recession and the 2008 financial crisis, bank excess reserves reached $2.6 trillion but inflation remained below 2%.[1] So even though the banking system had the potential to increase the money stock by $52 trillion in that period, the money stock increase never happened. The reason was that the Federal Reserve introduced the payment of interest on bank reserves (IOR), essentially paying banks to keep reserves as an investment. But now we have a greater than 25% larger bank reserve problem and the question is: can the Federal Reserve set an IOR high enough to stave off an inflationary increase in the M2 money stock?

Clearly, if we are to prevent the Pandemic asset expansion from adding to the current inflation disruption of the economy, the Federal Reserve must induce the banking system to retain much of the expanded assets as excess reserves. Even the pre-crisis interest rates were still below levels that existed throughout the 20th century. Can the Federal Reserve maintain an IOR that will induce the banking system to hold as excess reserves the tremendous increase in market assets that the Federal Reserve has acquired during the Pandemic? If not, are we doomed to see the double-digit inflation that many predicted for the 2008 crisis?

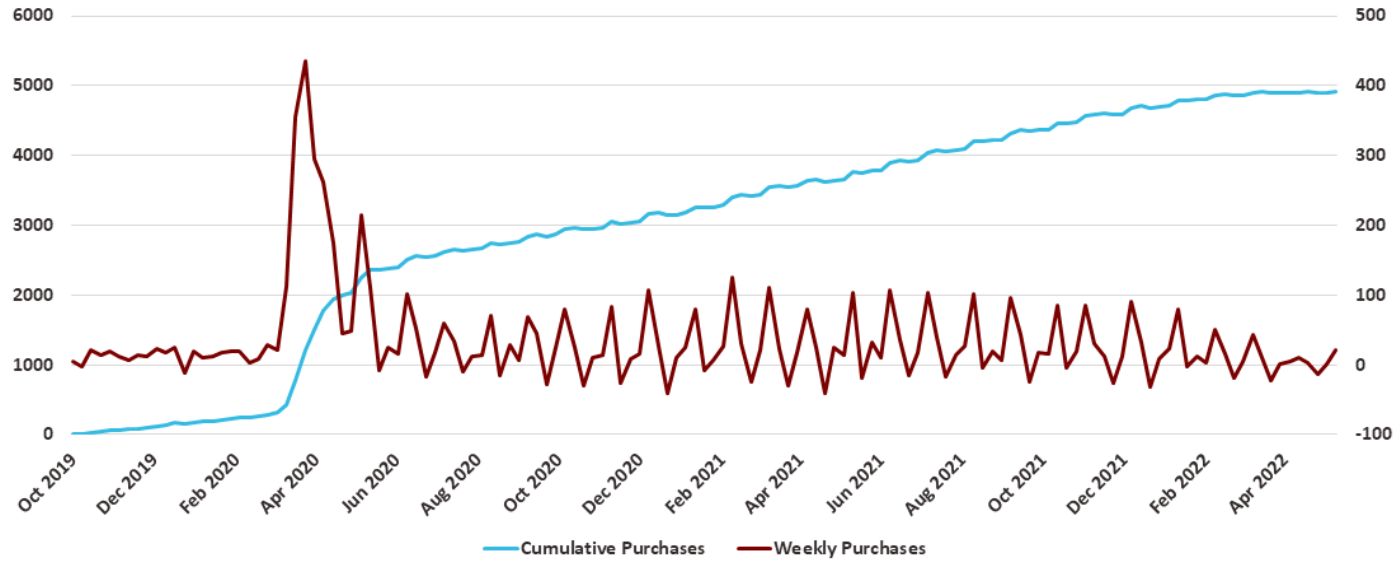
[1] In the aftermath of the 2020 massive response to the pandemic, the Federal Reserve eliminated reserve requirements. This makes sense in that bank reserves exceeded all bank deposits but when things return to some form of normality, reserve requirements will be restored.

THE FEDERAL RESERVE RESPONSE TO THE PANDEMIC

While there is some evidence that the onset of COVID-19 might have been even earlier, its impact on the world economy was certainly no sooner than January 2020. However, for all practical purposes, the economic effects of the COVID-19 crisis began in March 2020 as much of the country simply shut-down. At that time, the Federal Reserve entered the open-market and increased its holdings of treasuries by unprecedented amounts.

Figure 1 shows the Federal Reserve securities expansion program that began in October 2019, well before the onset of the pandemic, through mid-May 2022.[2] The expansion before the pandemic expansion program was a steady asset purchase of less than $40 billion per week and usually less than $20 billion per week. When the pandemic shutdown took hold in March 2020, just three months later, the Federal Reserve increased its securities holdings by 55%, $2.1 trillion. In the whole of fiscal year 2020, the Federal Reserve purchased $2.847 trillion in securities and $1.515 trillion in fiscal year 2021. Considering that the fiscal year 2020 federal deficit was $3.313 trillion, in one sense at least the Federal Reserve could be viewed as financing more than 85% of the fiscal year 2020 federal deficit. Furthermore, the fiscal year 2021 federal deficit was $2.712 trillion and Federal Reserve's $1.515 security purchases were just under 56% of the deficit. Since March 2022, the Federal Reserve has added $4.61 trillion to its securities holdings.

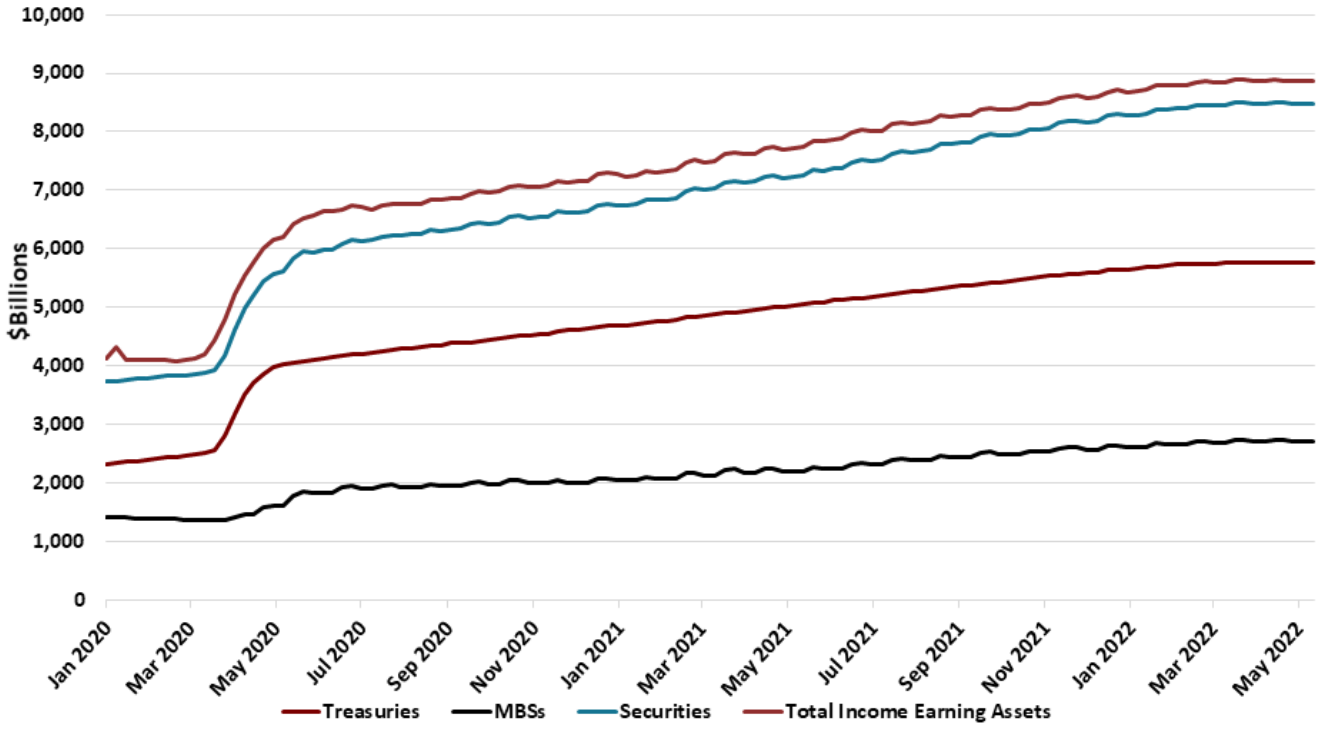
Figure 1. Weekly and Cumulative Federal Reserve Securities Held Outright Purchases
October 2, 2019 to May 18, 2022
$Billions



[2] The October onset of a Federal Reserve asset expansion was the result of the end of a period of falling bank reserves that was allowing money supply expansion.

But it is the period from the beginning of the COVID-19 response in early March 2020 that is most astounding. Figure 2 shows the path of Federal Reserve earning assets and securities holdings for the period beginning January 2020 through mid-May 2022. The huge jump in assets at the beginning of March 2020 is easily apparent in the figure. In just the first three months of the pandemic, the Federal Reserve added $2.1 trillion to its securities portfolio, a 60% increase. Although Federal Reserve security acquisitions slowed by the close of July 2020, the Federal Reserve has continued to add securities at an average rate of $26 billion per week. Since the onset of the pandemic, the Federal Reserve has added $4.5 trillion to its securities holdings, a 110% increase. At the end of March 2022, Federal Reserve securities holdings were at $8.477 trillion, more than 35% of the nations' GDP. Additionally, the Federal Reserve increased its income-earning assets during the same period also by 110% to $8.8637 trillion.[3]

Figure 2. Federal Reserve Assets
January 1, 2020 to May 18, 2022



The non-securities Federal Reserve income earning assets stem from the Federal Reserve operating in private markets and aiding financial institutions. The private market aid for the pandemic are essentially Federal Reserve investments in the economy and are revenue generating. Some of the market aid was in the form of Federal Reserve loans. These loans supplied aid to the Money Market Mutual Fund market, the Primary Dealer Credit market and the Paycheck Protection Program. Then five separate facilities were established in the form of LLCs.[4] These facilities were the *Commercial Paper Funding Facility* (CPPF), *Municipal Liquidity Facility* (MLF), *Primary Market Corporate Credit Facility* (PMCCF), *Secondary Market Corporate*

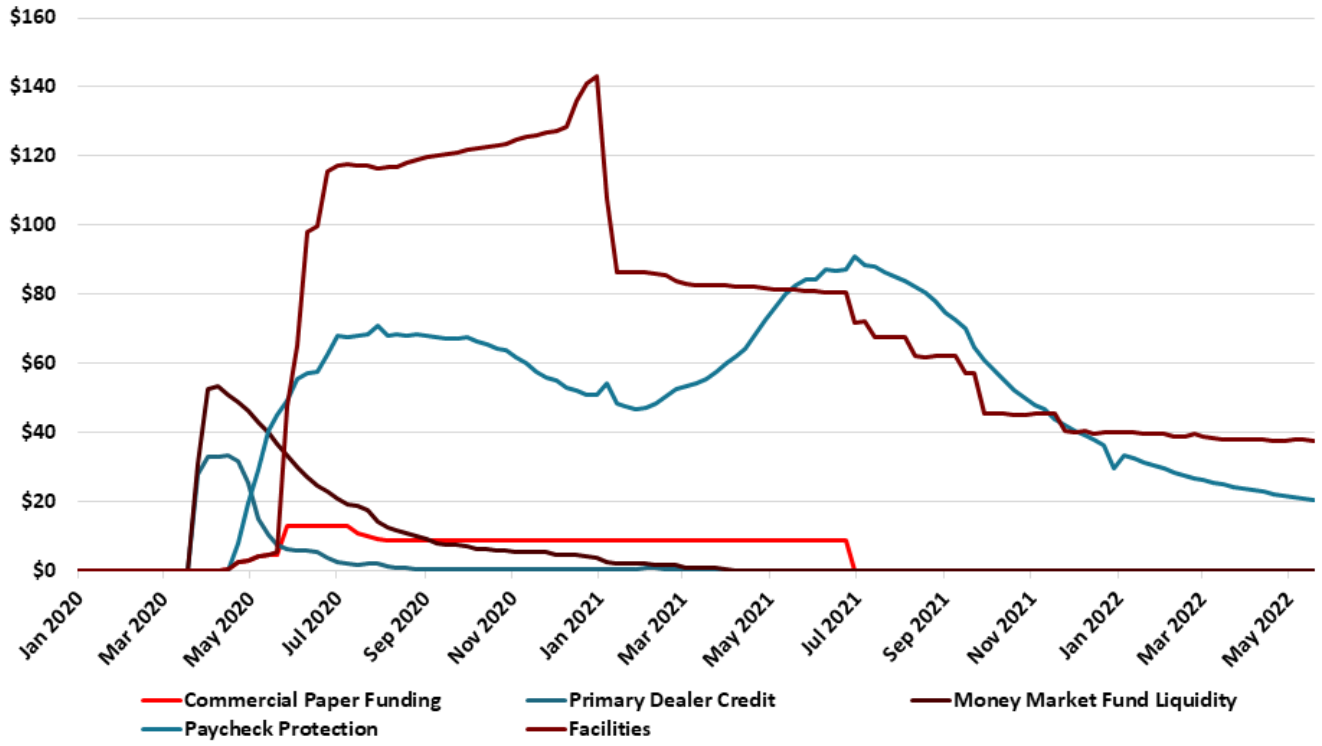
[3] Income earning assets are relevant here because the Treasury is the residual income recipient of the Federal Reserve earnings less costs.

[4] The only LLCs in the 2008 era were Maiden Lane LLCs related to AIG loans and stock shares.

Credit Facility (SMCCF), *Term Asset-Backed Securities Loan Facility* (TALF), and the *Main Street Lending Program* (MSLP). The Treasury has an equity position in both of the Corporate Credit Facilities and the TALF. TALF enables the issuance of asset-backed securities (ABS) backed by student loans, auto loans, credit card loans, loans guaranteed by the Small Business Administration (SBA), and certain other assets.

Figure 3 shows the path of the pandemic loans and the special facilities through mid-May 2022. Each is shown separately in the figure. By July 2021, all except the paycheck Protection Program had disappeared, and it had already begun a low decline, having fallen from a peak of $90.9 billion at the end of June 2021 to its January 2022 level of $30.2 billion. The total sum of these facilities is denoted in the figure as Facilities. Facilities funding reached a peak of $143 billion at the end of December 2020 to its mid-May 2022 level of $37.5 billion.

Figure 3. Covid-19 Pandemic Loans and Special Facilities
January 1, 2020 to May 18, 2022
$Billions



In the first 6 months of the pandemic crisis, the Federal Reserve increased its securities holdings by $2.48 trillion, a 64% increase. In fiscal year 2020, the Federal Reserve increased its securities holdings by $2.85 trillion, a 75% increase. The federal budget for fiscal year 2020 deficit was $3.131 trillion, more than double the previous record, the 2009 fiscal year deficit of $1.4 trillion. In fiscal 2020, the Federal Reserve increased its earning assets by $2.864 trillion, or just over 90% of the fiscal 2020 deficit. The federal budget fiscal 2021 deficit was $2.775 trillion, just slightly less than the fiscal 2020 deficit. The Federal Reserve's fiscal year 2021 increase in earning assets was $1.428 trillion, or 51.5% of the 2021 deficit. On the surface then it appears that the Federal Reserve financed almost the entire fiscal 2020 deficit and just more than 50%

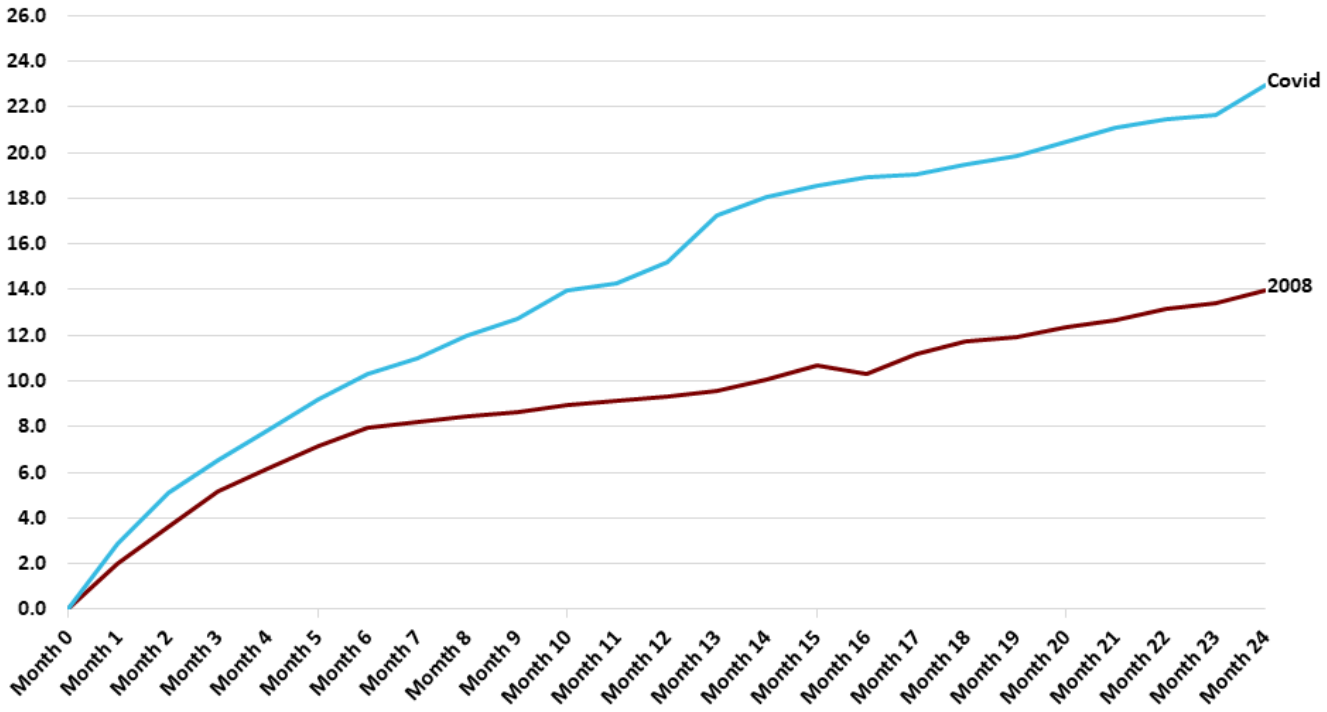
of the fiscal 2021 deficit. Can it be this simple? Can it be that the tremendous expansion in federal expenditure is essentially a "free lunch?" The answer is no, as the introduction of the payment of interest on bank reserve balances has converted these balances into Federal Reserve debt.

Importantly, because of the financial relationship between the Treasury and the Federal Reserve, for all practical purposes, bank reserves are now federal debt. As a result, to get an idea of the extent that the Federal Reserve has financed fiscal year 2020 and 2021 deficits, the increase in bank reserve holdings during fiscal years 2020 and 2021 must be deducted from Federal Reserve income-earning asset increases. By this measure, Federal Reserve liabilities in the form of bank reserves increased during fiscal year 2020 by $1.256 trillion and during fiscal year 2021 by $1.352 trillion. If so, then Federal Reserve net assets during fiscal year 2020 increased by only $1.408 trillion and during fiscal year 2021 by a miniscule $76 billion. By adjusting the increase in Federal Reserve assets by their liability increase, the Federal Reserve still financed 45% of the federal fiscal year 2020 deficit but virtually none of the fiscal 2021 deficit as Federal Reserve net assets fell by $1.3 trillion in fiscal 2021.

Even with the tremendous increase in bank reserves, the increase in Federal Reserve assets has been so large that the net of reserves monetary base has grown rapidly. Figure 4 shows the percentage growth in the net monetary base for the first 24 months of both the 2008 Great Recession and the pandemic crises. In the first month of the Great Recession crisis the net base grew 2% while the pandemic crisis net base grew only 50% faster at just under 3%. After an 18-month period, the Great Recession net base growth was 11.7% while the pandemic net base growth was 19.5%, 70% greater. Then after a full 2 years the Great Recession net base grew 14% while the pandemic net base growth was 23%, 64% greater.

Figure 4. % Net Monetary Base Growth: 24 Months of Great Recession Versus Covid-19 Pandemic

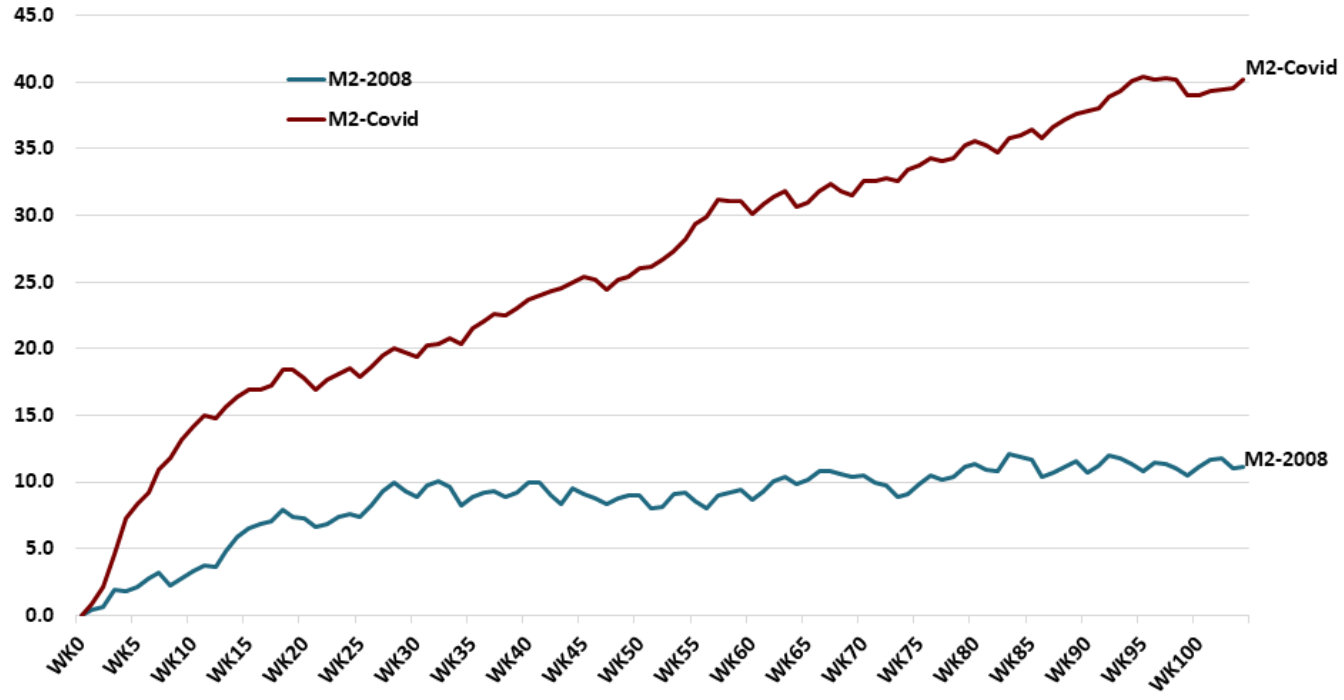
% Growth



Just as in the post 2008 budget crisis the fear is that the tremendous expansion of Federal Reserve assets will lead to double digit inflation. Figure 5 compares the effect on the M2 measure of the money supply for the first 2 years of the Federal Reserve's response to the 2008 financial crisis with the first 2 year of the Covid-19 response.[5] The date axis represents the weeks after the beginning date of each crisis, denoted as WK0 in the figure. The comparison in the figure dates the beginning of the 2008 financial response as the last August 2008 reporting date and the beginning of the Covid-19 response as the last February 2020 reporting date. The figure shows the weekly level of M2 relative to their pre-response levels so that all values are 0 at WK0. In effect, the levels of the lines in the figure are percentage changes from the base. The difference is startling! The M2 Covid-19 response is triple the 2008 response. In fact, the growth of M2 in the 2008 response virtually ceased after week 26, one half year after the beginning of the crisis.

[5] The Federal Reserve no longer reports a measure of M1 as changes in policy have made time deposits that were excluded from M1 essentially checkable deposits.

Figure 5. % M2 Growth – 2 years of Great Recession Versus Covid-19 Pandemic



The annual rates of monetary growth implied by the rates of change shown in the figure for the first year of the pandemic response are staggering. The Covid-19 M2 growth is 26%. In contrast, while the 2008 money growth rate responses were very large by historic standards, its M2 one-year growth rate was only 8% which pales in comparison to the early Covid-19 monetary growth response. Moreover, the Pandemic 26% one-year M2 growth is double the M2 growth rate during the double-digit inflation of the late 1970s. Finally, the Pandemic's 2-year 40% M2 growth is almost four times the Great Recession's 11% M2 growth.

WHERE DO WE GO FROM HERE?

We know that the tremendous increase in Federal Reserve assets that accompanied the 2008 financial crisis did not result in inflation. But there are two significant differences in that episode and the 2020 crisis caused by the Pandemic.

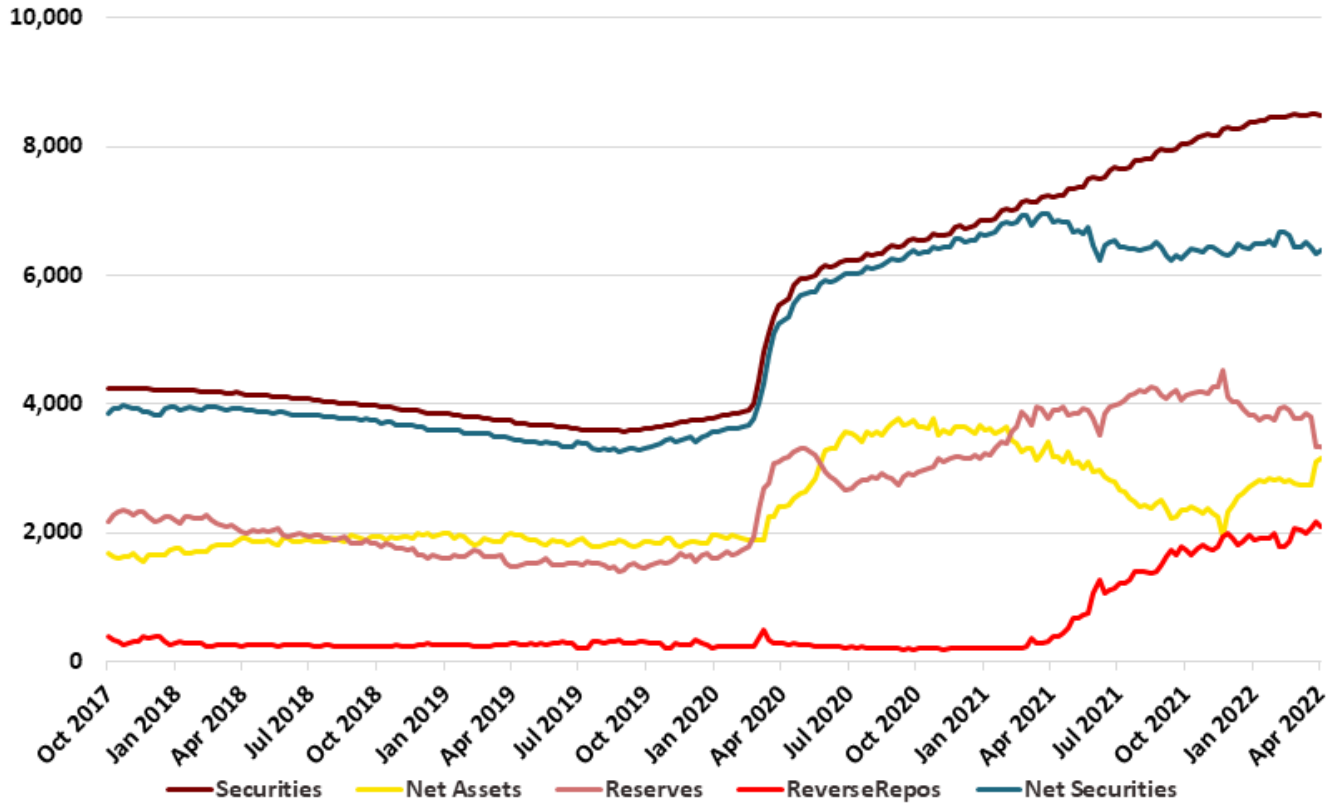
First, the level of asset increases in the 2008 crisis occurred over an extended period, ending only at the close of 2014. The total asset increase in the 2008 crisis was $3.6 trillion, a 387% increase in Federal Reserve assets over 6.25 years. In just the first 19 months of the pandemic, Federal Reserve holdings of securities increased by $4.1 trillion, an increase of 106%.

Second, when the 2008 financial crisis occurred, the nation was in a recession that began in the fourth quarter of 2007. At the onset of the 2020 crisis in March, the nation was in a boom that began in 2017. In fact, just before the government-ordered shut-down of the economy, the unemployment rate was at a three-decade low of 3.5%. This record low unemployment rate is remarkable because it was accompanied by rising labor force participation. Thus, while

unemployment rates had been declining since 2010, much of that decline was due to falling labor force participation. Further real GDP growth was at 2.5% compared to negative real GDP growth at the beginning of the 2008 financial crisis.

After the tremendous asset increases associated with the 2008 crisis, the Federal Reserve began an asset reduction program in October 2017. That program failed by mid-summer of 2019 as money supply growth and net asset growth ceased. Figure 6 shows the path of Federal Reserve securities holdings, bank reserves, Reverse Repos, Federal Reserve net securities and net assets on the left axis and M2 on the right axis for the period from October 2017 through mid-May 2022. The falling Federal Reserve securities holdings, both total and net, from October 2017 to summer 2019 are clearly shown. Then the gradual pre-pandemic asset expansion is also evident. Finally, the unprecedented pandemic asset response is especially evident. The Federal Reserve securities holdings by the close of March 2022 are a record $8.4 trillion. But reverse repos are the equivalent of securities sales so actual net Fed securities holdings have been falling since March 2021 and now stand at $6.436 trillion. Then on the liability side, bank reserve holdings were $3.746 trillion and reverse repos, essentially temporary securities sales, were $1.993 trillion so that liabilities plus temporary securities sales were over $5.7 trillion.

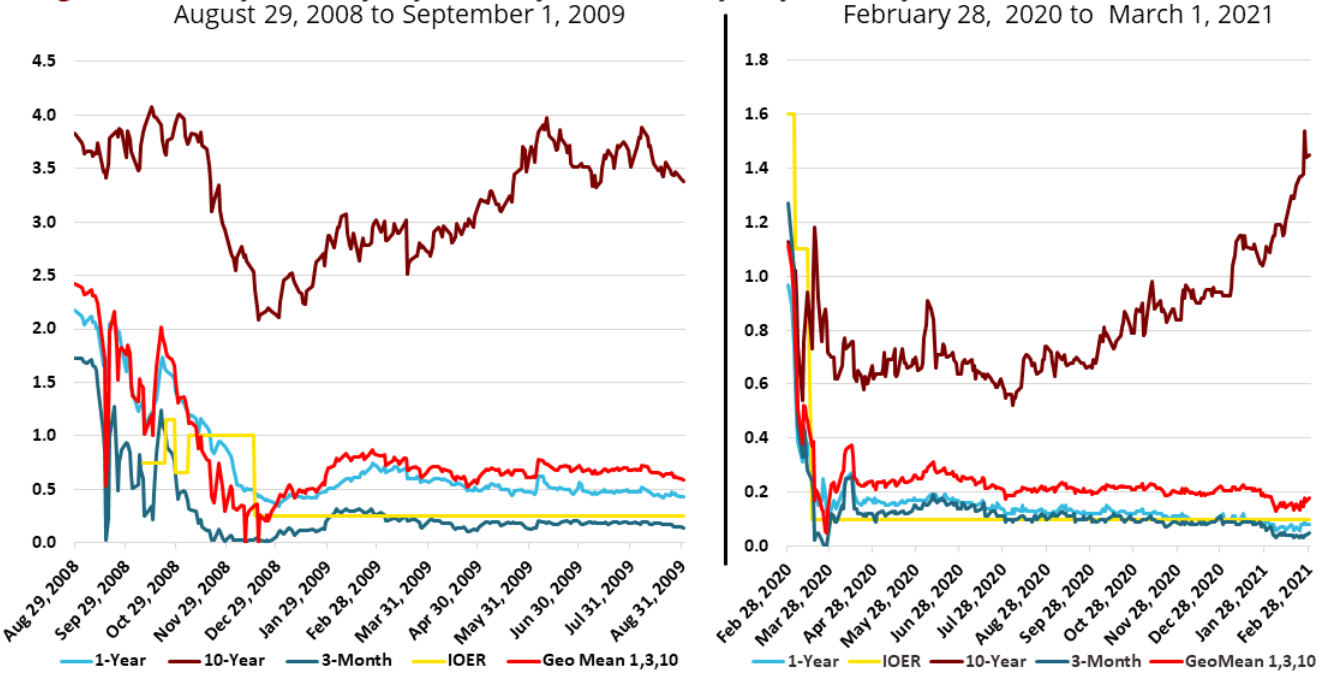
Figure 6. Federal Reserve Assets and Liabilities
October 2017 - May 18, 2022
$Billions



While the tremendous first pandemic year net asset expansion is readily apparent in Figure 6, the next year saw an almost equal net asset reduction. In fact, the December 15, 2021, level of Federal Reserve net assets was only 2% greater than in March 11, 2020. As a result, during this 21-month period, Federal Reserve net assets grew at an annual growth rate of less than 1%, well less than would be consistent with the long-run 2% Federal Reserve inflation target. Furthermore, inspection of Figure 6 also shows a significant change in how the Federal Reserve controls its net asset position. In particular, the fall in net assets in the second year of the pandemic was mostly due to a $1.7 trillion increase in temporary asset sales, referred to as reverse repos.

Both the Great Recession and the Covid-19 pandemic crises experienced a rapid fall in market interest rates over the subsequent seven months. Figure 7 shows the path of 3-month, 1-year, and 10-year Treasury interest rates, as well as the geometric average of these three rates for the first twelve months of each crisis. While market interest rates in 2008 were much higher than at the onset of the 2020 pandemic, both fell by a similar percentage. In 2008, 10-year Treasury rates fell by 50%, or 200 basis points, in the first 4 months of the crisis. During the Covid-19 pandemic in 2020, 10-year Treasury rates fell by 50%, or 60 basis points, in less than two months. In both crises, 3-month Treasury rates fell to essentially zero in the first 3 months. The introduction of the payment of interest on bank reserves is noted on the left panel of the figure by the green line. As noted above, it was the payment of interest on reserves that induced the banking system to hold much of the subsequent expansion as reserves.

Figure 7. 3mth, 1yr Treasury, 10yr Treasury, Mean 3mth-1yr-10yr Treasury and IOER



At the close of the Great Recession, Federal Reserve expansion bank reserves reached $2.7 trillion. We know that we dodged that inflation bullet through the Federal Reserve paying banks to hold reserves rather than invest them in the economy. In fact, in October 2020, bank reserves reached an all-time high of $4.53 trillion. Federal Reserve securities holdings at the close of the Great Recession expansion was $4.2 trillion and on May 11, 2022 was almost $8.5 trillion, more than double.

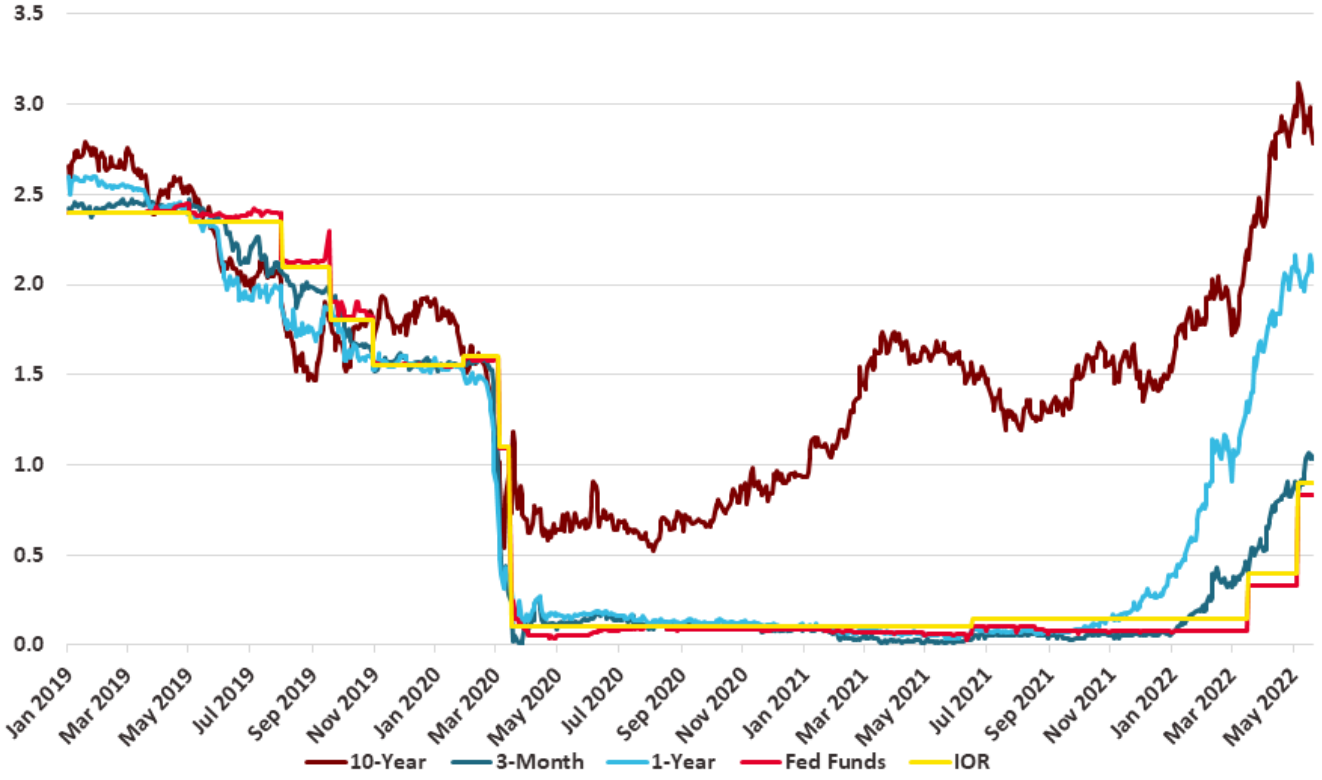
To put this level of Federal Reserve assets in perspective, on March 30, 2022, publicly held federal debt was $23.85 trillion. Since the Federal Reserve is considered part of the public, it holds more than one-third of the official publicly held federal debt.[6] To further put the Federal Reserve holdings in perspective 2021 GDP was, according to the BEA, $23.0 trillion. Without considering the Federal Reserve, publicly held federal debt would be just over 100% of GDP. But accounting for the Federal Reserve publicly held federal debt is only $15.3 trillion, or 66.5% of GDP.

The caveat here is that bank reserves are now a debt of the Federal Reserve and since the Federal Reserve is essentially owned by the Treasury, bank reserves are the equivalent of federal debt. Correcting the Federal Reserve's $8.5 trillion securities holdings by subtracting its debt holdings, bank reserves plus reverse repos, of $5.5 trillion makes its net federal debt holdings $3.0 trillion. With this assumption, a corrected publicly held debt is $20.85 trillion, or 90.6% of GDP.

It is clear that what saved us from the potential Great Recession inflation was an interest rate on reserves (IOR) that exceeded the 1-treasury rate for most of the Federal Reserve expansion. Banks found it profitable to invest in reserves and that investment controlled the growth in the Federal Reserve net assets, their monetary contribution to the economy. Figure 8 shows the path of the 30-day, 1-year and 10-year Treasury interest rates from January 1, 2019, through March 30, 2022. In the record low interest rate period that began in March 2020, the IOR had been 0.10% and has equaled or exceeded the 1-year treasury rate since December 2020. But longer rates began to rise and the spread between 10-year Treasuries and the IOR has risen from its August 2020 low of 45 basis points to more than 150 basis points. As a result, effective June 17, 2021, the Federal Reserve raised the interest rate it pays on bank reserves from 0.10 to 0.15. The IOR remained at 0.15 until mid-March of 2020 when effective March 17, 2020, it was raised to 0.40. Then in May the IOR was increased another 50 basis points to 0.9. Given what had already happened to interest rates, that change was way too little as the May 20, 2022 1-year Treasury rate exceeded the 0.90% IOR by 117 basis points.

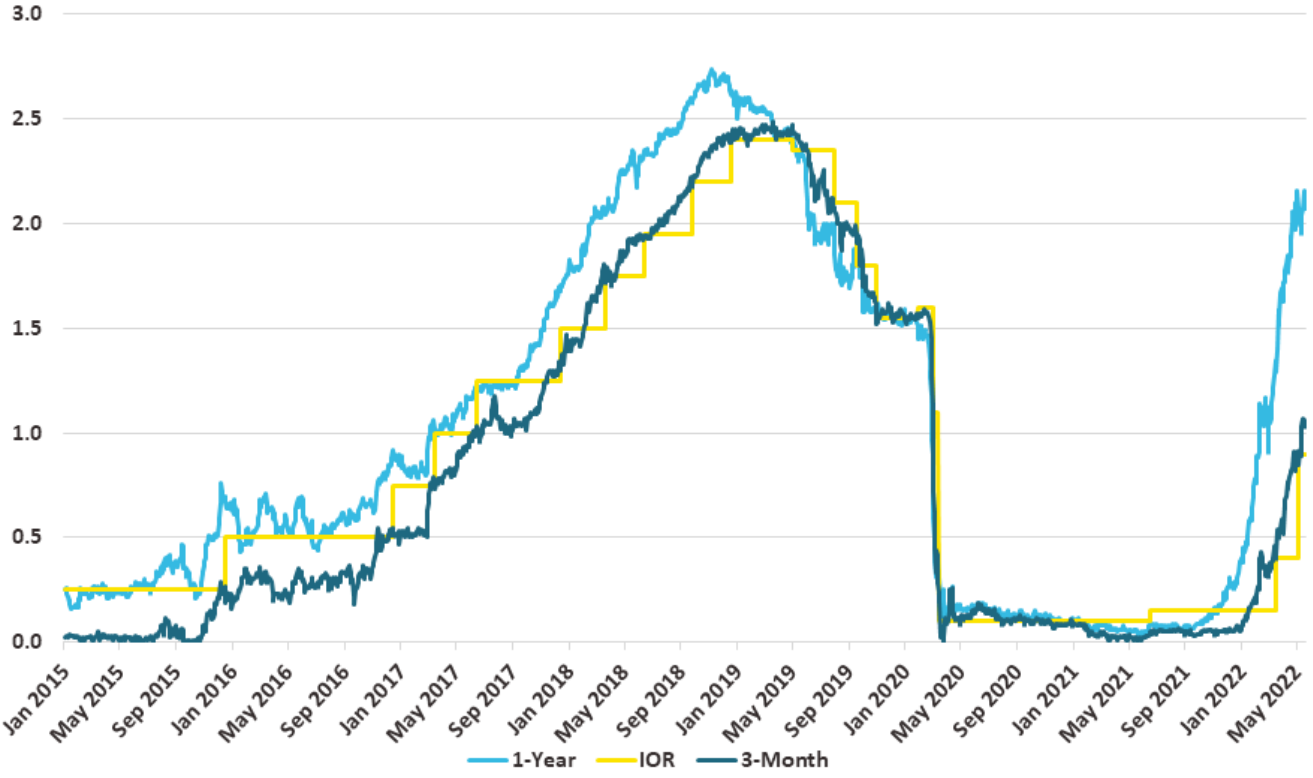
[6] Actually as of June 9, 2021 the Federal Reserve held $5.129 trillion in treasuries and $2.244 trillion in Mortgage Backed Securities (MBSs). However, since all Federal Reserve earnings less cost must be transferred to the Treasury, in terms of debt service the MBSs are the equivalent of holding treasuries.

Figure 8. 3-mth Treasury, 1yr Treasury, 10-yr Treasury , Fed Funds Upper Bound and IOR, January 1, 2019 to May 20, 2022



Even the short interest rate history contained in Figure 8 contains ample evidence that the Federal Reserve is a market interest rate follower rather than playing a role in determining market interest rates. That said, the longer period depicted in Figure 9 that depicts the relation between the short rate Treasuries and the IOR clearly shows that the Federal Reserve follows, rather than leads, market interest rates. Here, the figure shows that the Federal Reserve's changes to the IOR follow the rising interest rates from the beginning of 2015 through the end of 2019, and then follow the interest rate down throughout 2019. What is also apparent in both figures is that the most recent period is unique in terms of the market advantage over the IOR. The result will be, indeed is, a rapid reduction in bank reserves with a resulting large increase in Federal Reserve net assets - exactly the opposite of what the Federal Reserve suggests it wants in order to control continued inflation.

Figure 9. 3mth, 1yr Treasury and IOR
January 1, 2015 to May 20, 2022



The challenge for the Federal Reserve is to maintain an IOR rate above market rates if they want to neutralize bank reserve holdings. As result of the large difference between market interest rates and the IOR as shown in both the above figures, Federal Reserve net assets have risen by 60% since December 15, 2021, as bank reserves have fallen. But because of the relationship between the Federal Reserve and the Treasury, the payment to the banks resulting from the IOR are essentially net interest on the federal debt. Assuming they succeed, the end result will create a major government debt service problem as Federal Reserve transfers have already fallen from close to $100 billion in 2015, almost 44% of 2014 total debt service, to $55 billion in 2019, only 15% of total debt service. With the tremendous 2020 Federal Reserve asset expansion, transfers to the Treasury rose to $88.8 billion, or 25.7% of total debt service.

The problem that the Federal Reserve will have once economies reopen and interest rates return to non-pandemic levels is political pressure. Chairman Powell keeps saying that the Federal Reserve will keep interest rates low. But the Federal Reserve has no control over market interest rates. The only interest rate they control is the IOR, a very visible interest rate. At the conclusion of every FOMC (Federal Open Market Committee) meeting, the interest rates announced to the public are the IOR and the Fed Funds upper and lower bound targets. However, the relation between the IOR and market interest rates does affect the banking system's willingness to hold reserves relative to investing in market assets such as commercial loans. Importantly, as both Figures 8 and 9 show, the rate of interest on 1-year Treasuries is now 1.79%, more than four-times the IOR at 40 basis points.

To control the huge inflation potential of their current securities holdings, the Federal Reserve must incentivize banks to gradually reduce their reserve holdings. That means that the Fed must set the IOR above many market interest rates. As of May 16, 2022 treasury interest rates have returned to the levels immediately before the pandemic with 10-year Treasuries at 2.88%, and 1-year Treasuries at 2.07%. Before the pandemic the IOR was 2.2%. In May 2022 the Federal Reserve has increased the IOR in two steps to 0.9%. On May 18 the 1-year Treasury rate was 2.16%, 126 basis points above the IOR. An additional significant increase in the IOR that will be required to stem the inflation potential of the $3.7 trillion of reserves held by banks. But given the publics and the political government view of the Federal Reserve and market interest rates, such a change in the IOR will be viewed as the Federal Reserve raising interest rates. Clearly, there is a real potential for a return to double-digit inflation that could make the 15% CPI inflation of the late 1970s pale in comparison.

INFLATION: ARE WE ALREADY THERE?

In the last year, inflation as measured by the CPI and the PPI have increased by the largest amount since 2010 for the PPI and 2008 for the CPI. Are these price increases part of a trend that will continue as the tremendous increases in M2 over the past year imply or are they simply a once-and-for-all increase in prices due to supply conditions of the Pandemic? We know that the M2 money stock rose 40% in the pandemic's first two years. During that time output first fell and has only now returned to its pre-pandemic level. These two events together should and did result in an increase in the price level. But do these two events mean that a continued increase in the price level is inevitable? Or will further increases in output as the economy opens up fully absorb the money stock increase and return us to the 2% inflation level of the last decade?

The low interest rates that are now on the rise reflect the tremendous demand for secure assets emanating from fact that disposable income is at record levels and output is reduced. Once output is restored and the public increases spending using funds invested for security in short-term treasuries, there is the potential for both inflation and a continuation of the increase in interest rates.

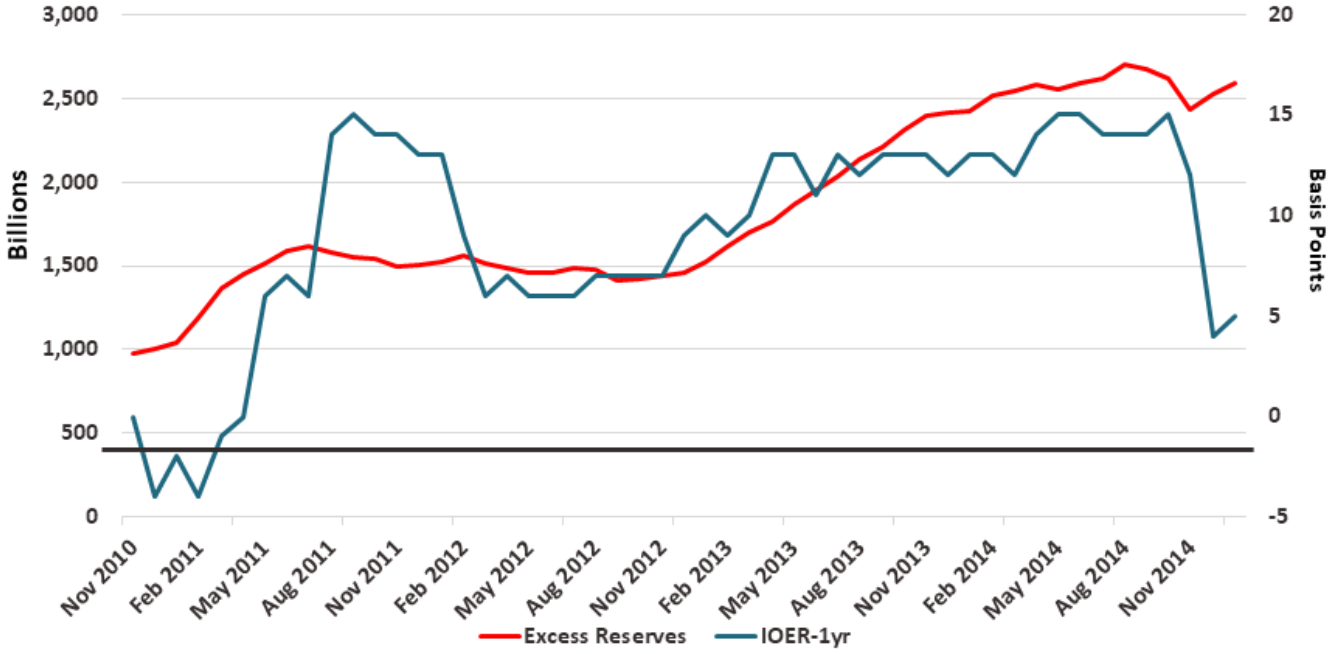
Perhaps even more important as an explanation of the recent price inflation is the fact that the pandemic has resulted in the largest fall in consumption goods production since World War II. The World War II reduction in consumer goods production was the result of the transition into military hardware production. In that case, the combination of wartime rationing on consumables and the virtual cessation of consumer durable good production led the public to use their income to purchase government-issued securities with little inflation.

The next period of falling production and subsequent inflation was the result of the establishment of OPEC and the Arab oil embargo. Once again, we had a significant downward shift in the nation's, indeed the world's, production possibility frontier and price inflation.

It is not surprising that with demand for output unchanged, the tremendous pandemic reduction in supply has resulted in inflation. It's simple. Falling supply with constant monetary availability always means rising prices. The question now is how long after the pandemic is over will it take to bring output back even to its pre-pandemic level?

Even after the pandemic reduction in output is past, the threat of continued inflation is contained in the tremendous overlay of bank reserves. As of mid-May 2022, bank reserve holdings were $3.3 trillion, well below their December 2021 level of $4.5 trillion. Even with the assumption that reserve requirements will ultimately be restored to average levels before the pandemic, current reserves could support a six-fold increase in bank deposits. That level of bank expansion would result in a doubling of the M2 money stock and massive inflation. That said, however, we know from the 2008 Great Recession that the fact that the Federal Reserve can set the IOR so that the banks will hold reserves as an investment can and will control the level of bank expansion. During the second Federal Reserve asset expansion of the Great Recession, November 1, 2010 to December 31, 2014, the Federal Reserve increased its securities holdings by 207%, or $2.194 trillion. But did the money supply explode? No, because bank holdings of excess reserves rose during this same period by 266%, $1.621 trillion, as banks responded to the IOR exceeding the 1-year treasury rate by an average of 73%. Figure 10 shows the path of banking system excess reserves and the basis point advantage of holding reserves versus 1-year Treasuries during the second Federal Reserve asset expansion.

Figure 10. IOR - 1yr Treasury Spread and Excess Reserves
November 2010 - January 2015

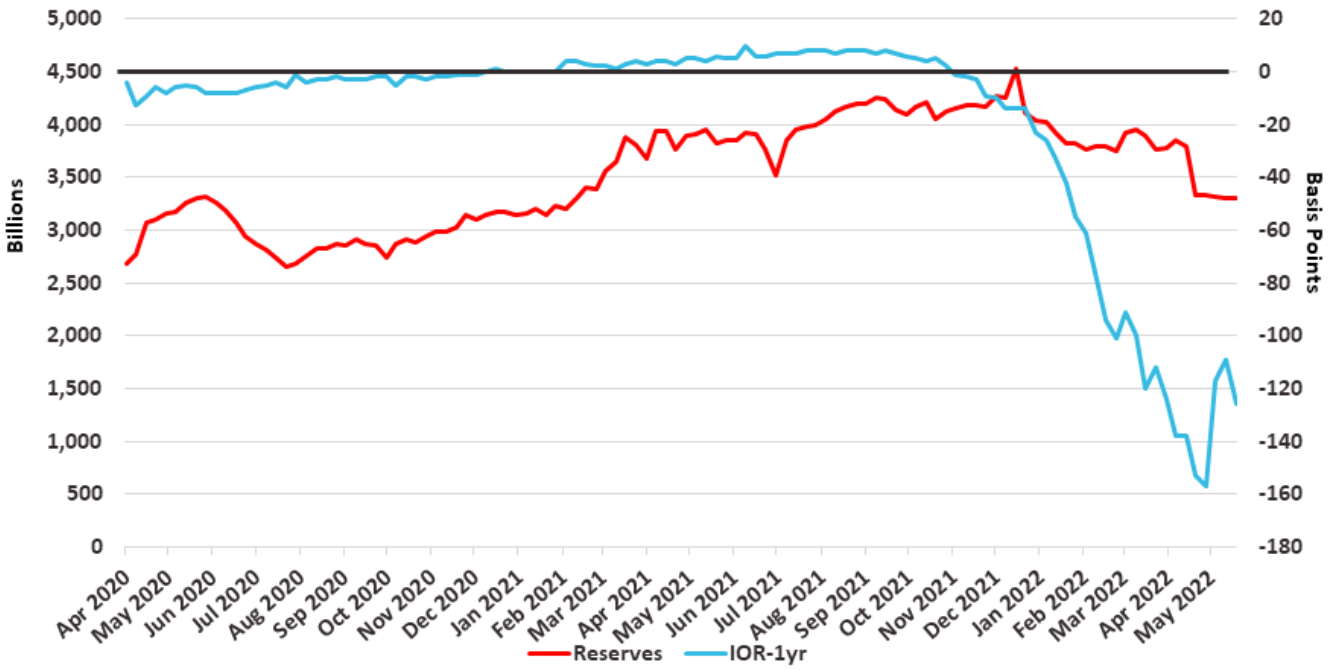


But the question that must be answered is as the recovery gains strength and the demand for bank loans increase, will the Federal Reserve set the IOR appropriately to control the growth of the money supply? The current problem is larger than it was during the Great Recession crisis. That time excess reserves maxed out at $2.7 trillion in 2014. Now total reserves exceed $3.2 trillion, down from their maximum of $4.5 trillion.[7] Even adjusting for a reintroduction of a 5% reserve requirement on demand deposits, well above what existed before required reserves were abandoned, excess reserves would exceed $3 trillion.

Figure 11 is the pandemic equivalent of Figure 10. It shows the path of total bank excess reserves, the IOR, and the 1-year treasury interest rate for the period from April 1, 2020 through May 11, 2022. During this period, bank reserves rose 56%, from $2.68 trillion to $4.53 trillion, before falling to their May 11 level of $3.3 trillion. By mid-December 2020, bank reserves began yielding more than banks investing in 1-year Treasuries. From mid-December 2020 until mid-October 2021, bank reserves rose by more than $1 trillion, from $3.15 trillion to $4.20 trillion, as Federal Reserve holdings of securities increased by $1.12 trillion, from their mid-December 2020 level of $6.64 trillion to $7.76 trillion. Additionally, from early 2021 until November 2021, the yield on reserves exceeded the 1-year Treasury rate. In November, the 1-year Treasury yield rose above the yield on reserves and by the close of February 2022, the difference was 101 basis points in favor of Treasuries. In early March 2022, it was still 91 basis points above the interest rate on reserves. In mid-March 2022, the rise from 15 to 40 basis points occurred and then in mid-May 2022 a second increase in the IOR brought it to 90 basis points. But market rates were rising fast enough that the two IOR increases barely affected the tremendous market advantage of 1-year Treasuries as their yield over the IOR on May 11 2022 was more than 100 basis points. If the Federal Reserve is to prevent the huge level of reserves turning into investments in the economy and continuing inflation, the IOR must be increased significantly.

[7] Given the tremendous increase in reserves required reserves no longer exist. Reserve requirements could be reinstated at any time but for now only total reserves matter.

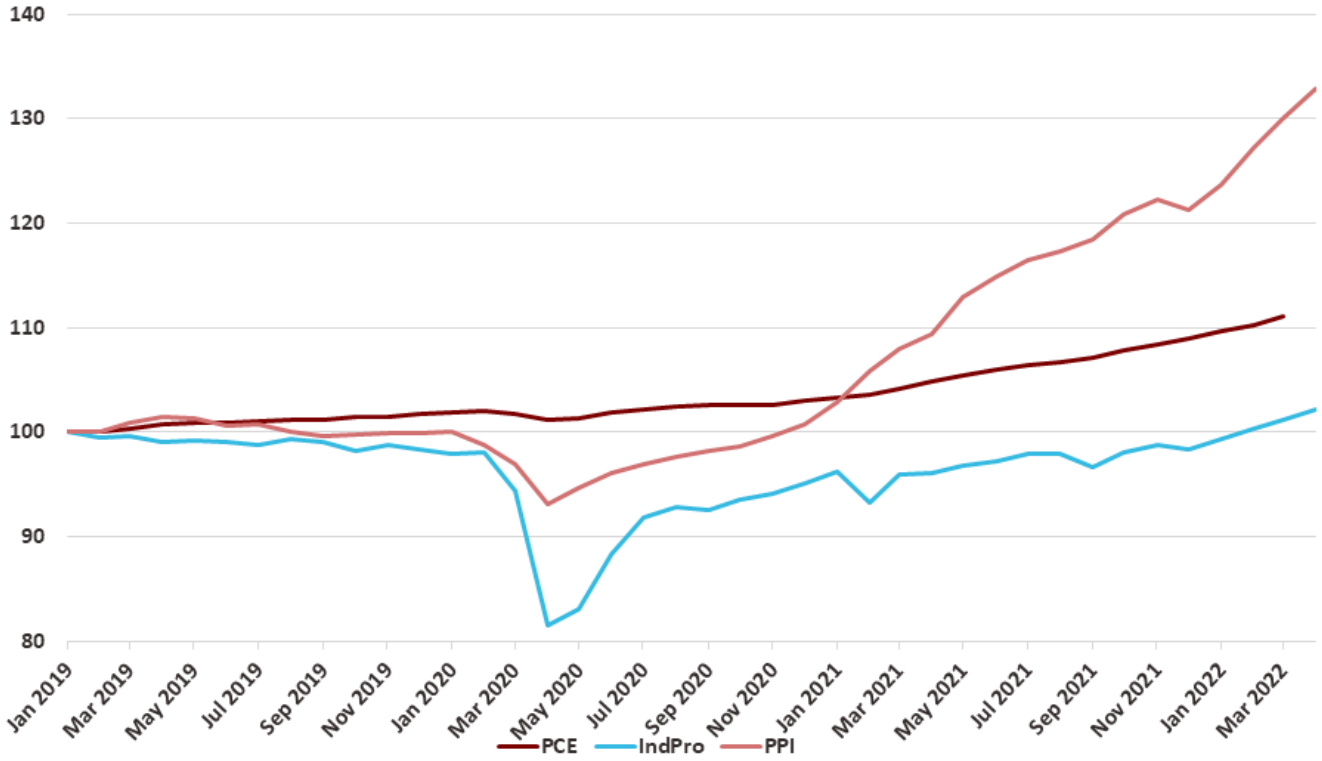
Figure 11. IOR - 1yr Treasury Spread and Reserves
April 1, 2020 – May 18, 2022



IS THE PANDEMIC INFLATION HERE TO STAY?

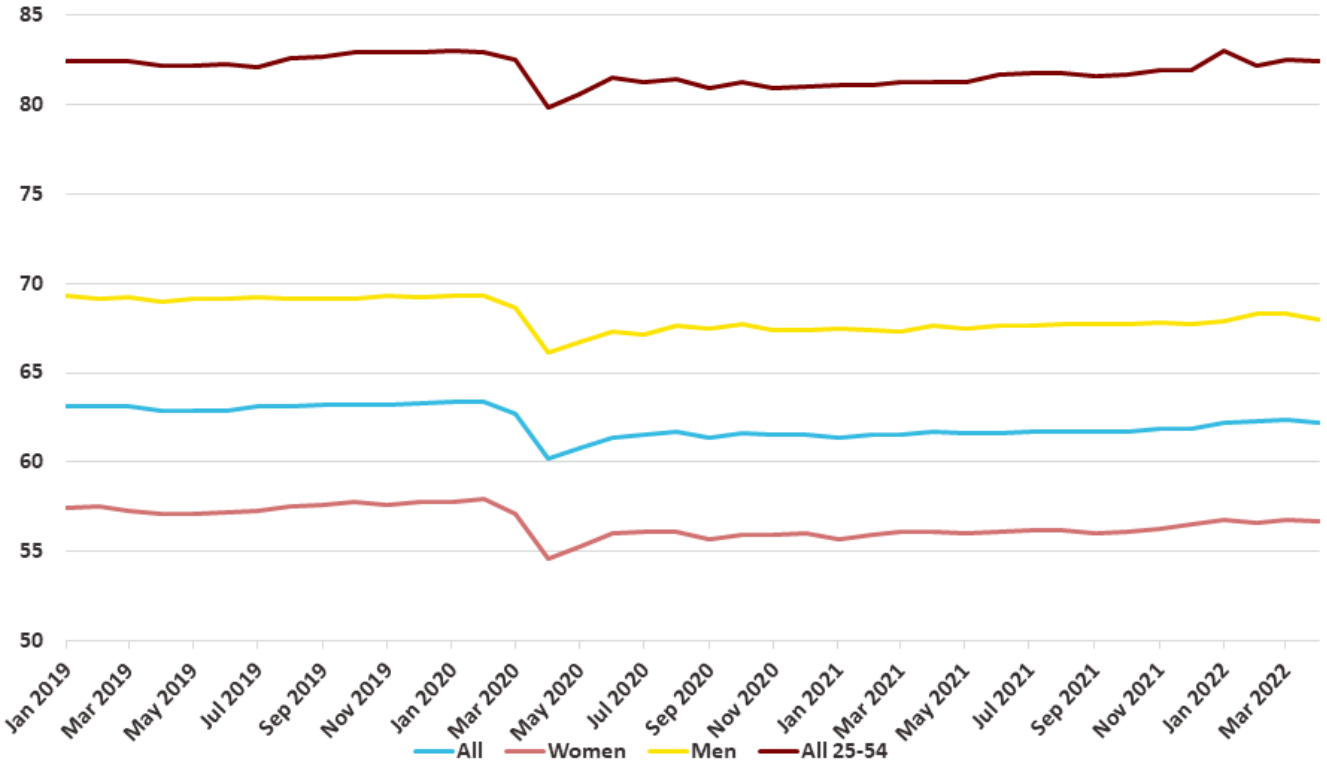
The pandemic's effect on output has certainly contributed to the observed price level increases. The question is that when output returns of pre-pandemic levels, will inflation go away? To get a feel for the relationship between the reduction in output and prices, Figure 12 shows the path of the PCE price index, the Producer Price Index, PPI, and the Industrial Production Index, IPI, for the period from January 2019 through April 2022, all rebased to January 2019 for ease of observation. The effect of the onset of the pandemic is easily seen in both the PPI and the IPI. Both the PPI and the industrial production index were more sensitive to the onset of the pandemic than consumer prices. The production index fell more than 15% while producer prices fell 7%. Consumer prices fell less than 1%. Industrial production finally returned to its January 2019 level a full two years later. In contrast, after the early 2020 fall in producer prices, they rose 20% in 2021 and have continued to rise and are now 33% above their April 2020 level.

Figure 12. PCE and Producer Price Indexes Compared to Industrial Production Index
January 2019 to April 2022



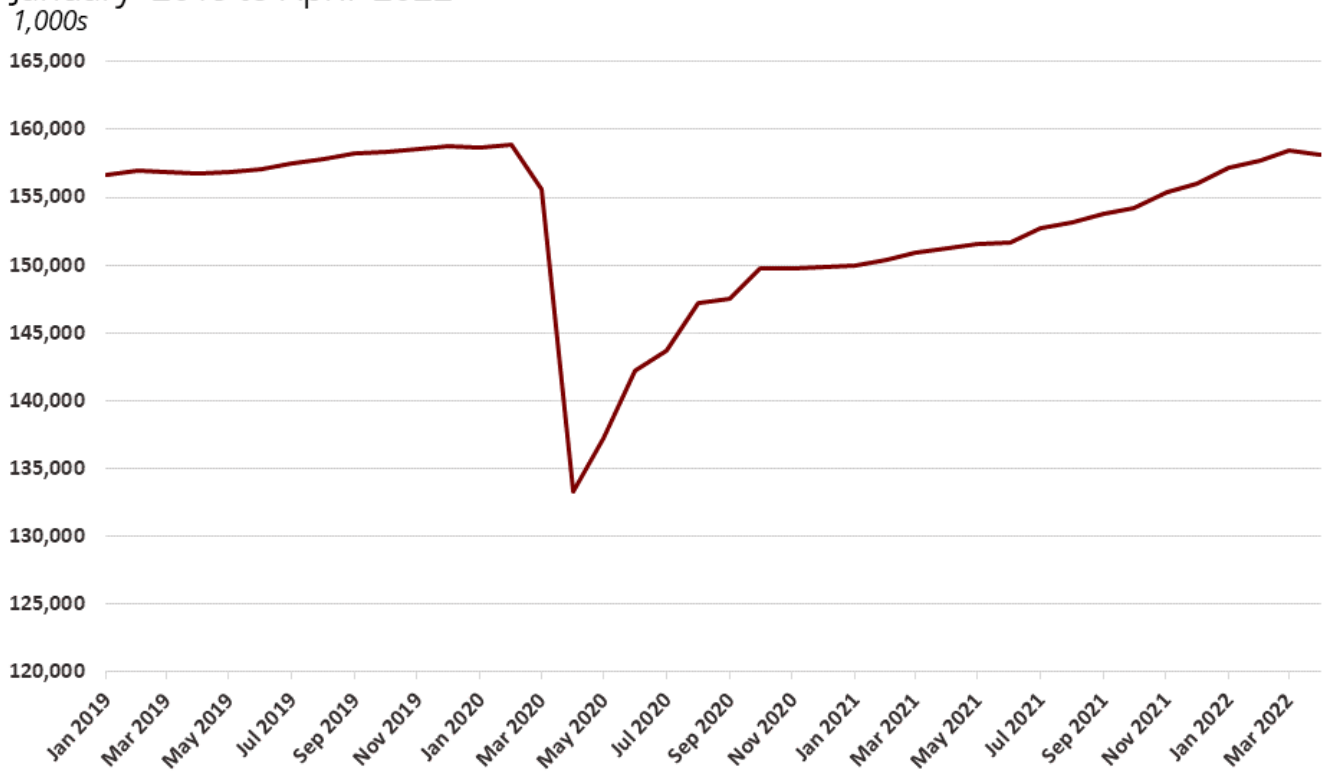
What are the underlying reasons why industrial production has not returned to its pre-pandemic level? First, we know that there is both a world-wide reduction in output and a delay in unloading container ships with critical raw materials. Second, most if not all states reduced the ability of firms to continue normal operations. Third, the government subsidies used to allay the economic effects of pandemic employment reductions made returning to work costly. Figure 13 shows the labor market effects of the pandemic on participation in the labor force, or the desire to enter the labor force, i.e., to look for employment. This reduction in labor force participation is pervasive across all sections, specifically, for women, men, and the population as a whole. The only saving grace is the labor force participation of those in the price working ages of 25 to 54 years of age. In the important group labor force participation fell dramatically at the beginning of the pandemic but has now returned to its pre-pandemic level.

Figure 13. Labor Force Participation Rates
January 2019 to April 2022



Not surprisingly, the decline in labor force participation is evidenced in what has happened to total employment. Figure 14 shows aggregate total employment for the period January 2019 through January 2022. National employment peaked in February 2020 at 158.7 million, one month prior to the beginning of the pandemic effects. As a result of government actions to reduce the pandemic's effects, within two months employment fell 15%, a loss of 25.4 million workers. While employment has been slowly recovering, there were still more than 1.5 million fewer workers in January of 2022 than in February 2020. However, by April of 2022 total employment has finally returned almost its pre-pandemic level.

Figure 14. National Employment
January 2019 to April 2022



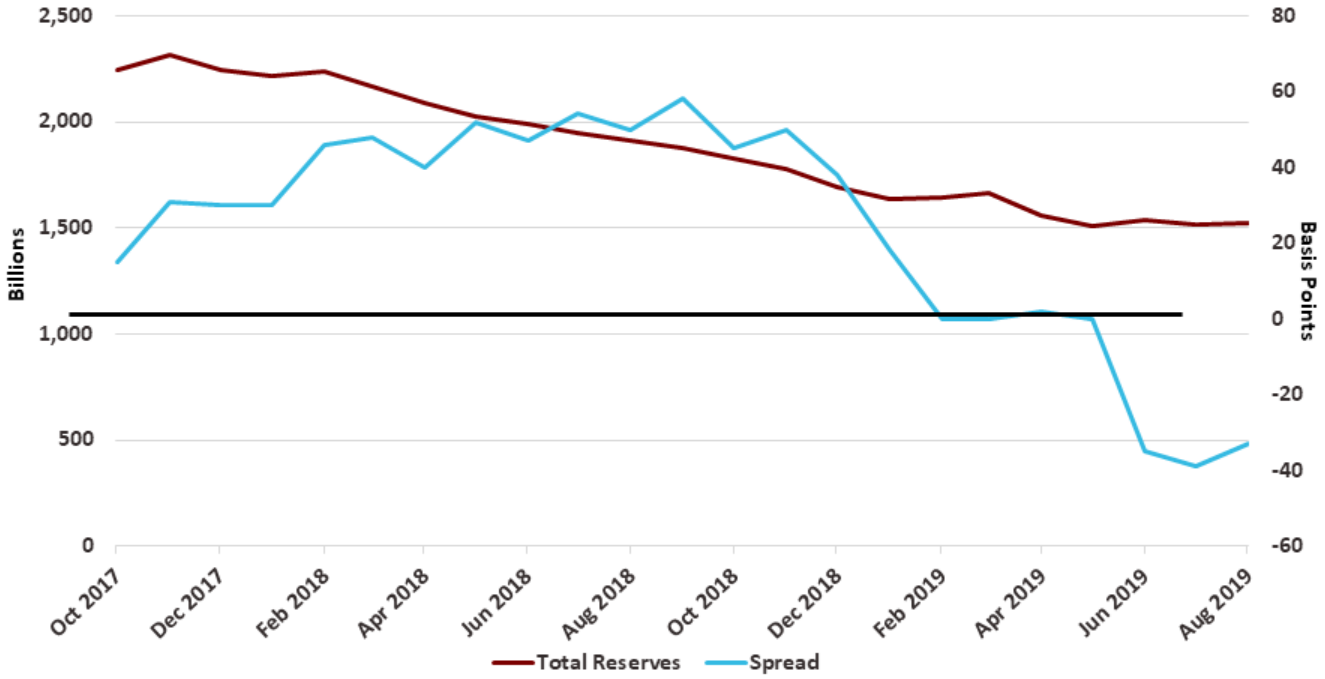
Even if, or when, the pandemic output reduction disappears, are we out of the inflation woods? Put differently, is the current inflation simply too much money chasing too few goods or is the rate of change in money exceeding the rate of growth of goods? The greatest risk for future inflation is the tremendous overhang of bank reserves. As of March 2, 2022, two years after the onset of the pandemic, bank reserves were $3.9 trillion, more than 60% greater than the maximum level of reserves during the Federal Reserve's Great Recession expansion. This level of reserves was actually more than half a trillion less than the December 15, 2021 level of $4.5 trillion. At that maximum, the spread between the 1-year treasury rate and the interest on reserves favored holding treasuries by 15 basis points. Currently, that same spread is 91 basis points in favor of holding treasuries, down from its peak treasury advantage of 101 basis points. Assuming that the end of the pandemic will result in an economic recovery, the reduction of these reserves has the potential to lead to a very significant expansion of Federal Reserve net assets and the money supply.

The Federal Reserve has indicated that they intend to begin reducing their level of securities holdings. The last time the Federal Reserve turned to securities reductions began in October 2017 and lasted until August of 2019.[8] An examination of Figure 6 shows the path of Federal Reserve securities holdings, bank reserves and Federal Reserve net assets. During that period,

[8] For an analysis of this Federal Reserve period of securities reductions see Thomas R. Saving, *The Failed Federal Reserve Attempt to Get Back to the Past*, Private Enterprise Research Center, Policy Study 2002, May 2020.October

bank reserve holdings fell more than Federal Reserve securities holdings so that net assets rose. This result was accomplished by ensuring that market yields were above the interest rate paid on reserves. Figure 15 shows the market advantage and bank reserve holdings for the period of Federal Reserve asset reductions by using the 1-year treasury rate as a proxy for the market. An examination of Figure 6 and Figure 15 shows that the period of successful Federal Reserve securities reductions and increasing Federal Reserve net assets lasted until interest paid on reserves exceeded that rate of return on 1-year Treasuries.

Figure 15. 1-yr Treasury - IOR and Reserves
October 2017 - August 2019



Once the world economies open up fully will financial markets result in a return to pre-crisis interest rates? How will the world's central banks deal with the tremendous expansion in their sovereign debt holdings? All the developed world's governments have run huge pandemic-induced deficits largely financed with central bank expansions. Will these monetary expansions produce runaway inflation? If not, how will central banks neutralize the monetary expansions? We know that the Great Recession monetary expansions did not create inflation in the developed world and, at least for the United States, we understand how the Federal Reserve essentially sequestered much of the expansion in assets through the payment of interest on reserves. The pandemic expansions, however, are much larger.

Clearly, if we are to prevent the pandemic asset expansion from an inflation disruption of the economy, the Federal Reserve must reduce its net assets or at least stop the current excessive growth in net assets. This action will require one of two things. First, the Federal Reserve must begin reducing its securities holdings, either by increasing reverse repos or selling securities in the open market. Second, increase the IOR significantly to make holding reserves a profitable option for the banking system. Can the Federal Reserve maintain an IOR that will induce the

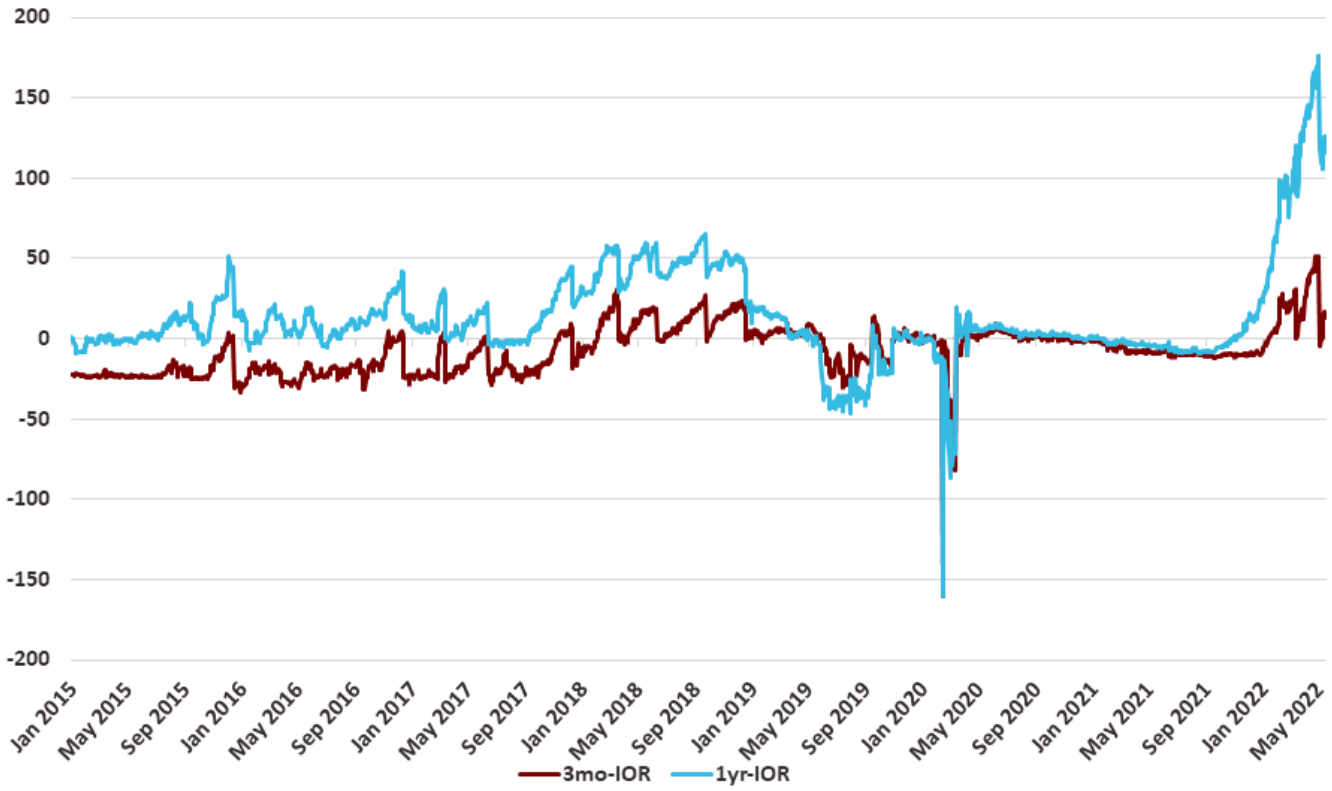
banking system to hold as excess reserves the tremendous increase in market assets acquired during the pandemic? The experience of the period October 2017 through late Spring 2019 demonstrates that it is possible to reduce Federal Reserve securities holdings while increasing Federal Reserve net assets in order to reach a low inflation goal. That goal will require that Federal Reserve net assets grow as fast as real output. Or, if the Federal Reserve is serious about its 2% inflation goal, its real assets must grow 2% faster than real output.

WHERE DO WE GO FROM HERE?

While the tremendous first pandemic year net asset expansion is readily apparent in Figure 6, the next year saw an almost equal net asset reduction. In fact, the December 15, 2021 level of Federal Reserve net assets was only 2% greater than the March 11, 2020 level of net assets. As a result, during this 21-month period, Federal Reserve net assets grew at an annual growth rate of less than 1%, well less than would be consistent with the long-run 2% inflation target. Furthermore, an inspection of Figure 1 shows a significant change in how the Federal Reserve manages its net asset position. In particular, the fall in net assets in the second year of the pandemic was almost all due to an over $1.7 trillion increase in temporary asset sales, referred to as reverse repos.

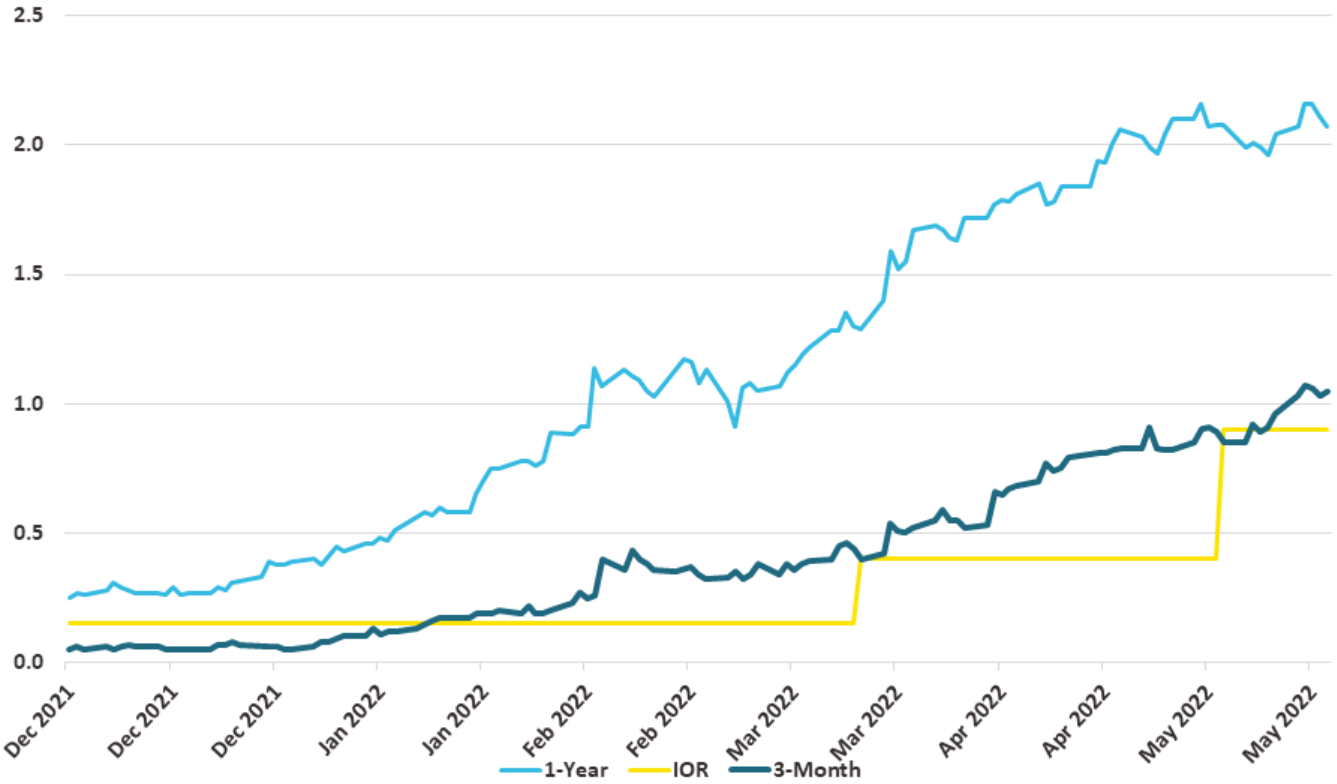
What is also apparent in Figure 6 is that in the last quarter, Federal Reserve net assets rose significantly. In fact, since December 15, 2021, Federal Reserve net assets have risen 60% from a level that was just about equal to their pre-pandemic level. The reason for this rapid net asset increase is rapidly declining bank reserves as banks respond to the fact that market interest rates have risen significantly relative to the interest rate the Federal Reserve pays on reserves. In fact, the advantage of 1-year Treasuries over the IOR is at unprecedented levels. Figure 16 the shows the market interest rate-IOR difference for 1-year and 3-month Treasuries since January 2015 through mid-May 2022. For the period of stable Federal Reserve securities holdings, essentially 2015 through the beginning of their asset reduction program in November 2017, the 1-year-IOR averaged difference clearly shows the market interest rate advantage over holding reserves that began in mid-December 2021. Further, in spite of two increases in the IOR the 1-year-IOR difference remains well above any previous record.

Figure 16. 1yr Treasury - IOR, 3mo Treasury - IOR
January 1, 2015 to May 20, 2022



To put Figure 16 in perspective, the Figure 17 shows difference between the 3-month and 1-year Treasuries and the interest rate paid on reserves. During the period of stable Federal Reserve securities holdings, January 2015 through October 2017, the average 1-yr Treasuries yielded 7.89 basis points above the IOR and the yield on 3-month Treasuries was 19.06 basis points below the IOR. During this period, Federal Reserve securities holdings remained constant while Federal Reserve net assets rose as reserves fell gradually. At that time, the Federal Reserve actively began to reduce its securities holdings. During this period, if net assets were to continue rise at a rate to achieve the 2% inflation goal, reserves would have to fall rapidly. This fall in reserves could only happen if market yields were significantly greater that the IOR. In fact, during the period of success for this strategy, November 2017 through April 2019, on average 1-year Treasuries yielded 36.70 basis points above the IOR and 3-month Treasuries yielded 7.37 basis points above the IOR. However, as an examination of Figure 2 shows, the market yield advantage declined in the Spring of 2019 and, as a result, the Federal Reserve had to abandon its securities reduction program by mid-summer. As a final observation inspection of Figure 17 clearly shows that the Federal Reserve is an interest rate follower rather than a leader.

Figure 17. 3mo, 1yr Treasury and IOR
December 1, 2021 to May 20, 2022



Then we come to the pandemic and plummeting interest rates and the Federal Reserve IOR response. On January 29, 2020, the IOR was 1.60%, above both the yield on 1-year and 3-month Treasuries. As result, reserves stopped falling and, with the unprecedented surge in Federal Reserve security purchases, reserves and Federal Reserve net assets rose tremendously. With the pandemic shutdown's plummeting market interest rates, the Federal Reserve reduced the IOR in March alone from 1.6% to 0.10% where it stayed until the June 2021 FOMC meeting. At that meeting, the IOR was raised to 0.15% where it stayed even with the rapid rise in market interest rates that began in December 2021. As a result, Federal Reserve net assets as shown in Figure 6 began to rise and are still rising.

The Federal Reserve at its May FOMC meeting also announced that they will begin a program of reducing securities holdings. These reductions will offset the falling reserves and if large enough can even reverse the current trend of rising Federal Reserve net assets. If the Federal Reserve's goal is an inflation rate of 2% then net assets must rise 2% faster than real GDP growth. They can accomplish this by setting the IOR below market interest rates so that bank reserve holdings fall more than Federal Reserve securities sales.

The rise in the market advantage of 3-month and 1-year Treasuries displayed Figure 16 is startling! These differences are all-time records, so it is not surprising that bank reserves are falling rapidly. Clearly the Fed must raise the IOR and do it quickly if it is to stem the effect of falling reserves on its net asset position. Or, absent a dramatic increase in the IOR, the Federal

Reserve can sell assets in an open-market operation or increase its level of temporary asset sales, reverse repurchase agreements.

The press keeps reporting that the Federal Reserve intends to, as the press terms it, raise interest rates significantly. But interest rates are rising and have been since December 2021, as is apparent from inspection of Figure 17. Both the 1-year and 3-month Treasuries have risen significantly. As late as mid-December 2021, 1-year Treasuries were yielding 26 basis points and 3-month Treasuries were at 5 basis points. At that time, the IOR was at 15 basis points, above the 3-month Treasury rate and below the 1-year Treasury rate, and very consistent with the stable Federal Reserve net asset period of 2015 through November 2017. But then the market interest rate began to increase, and that increase has not abated. The Federal Reserve finally recognized the market at its March 2022 and May 2022 meetings by raising the IOR to 40 and then to 90 basis points.

CONCLUSION

We are now two years into the Federal Reserve's response to the Covid-19 pandemic. While the Federal Reserve response to the 2008 financial crisis was unprecedented and we thought we would never again see so large an addition to the Fed's balance sheet, we were wrong. The Federal Reserve response to the pandemic makes its 2008 response pale by comparison. In the 2008 crisis, the Federal Reserve increased it holdings of securities by almost 300% from just over $700 billion to over $2 trillion, a $1.3 trillion response. However, in the first two years of the pandemic, the Federal Reserve response has been a $4.6 trillion increase in securities holdings.

Another difference in the two episodes is the first began in a recession and while the response was large there was never any sign of inflation. Indeed, the Federal Reserve's inflation goal following the 2008 crisis was 2%. Even that modest goal was never reached. When the pandemic began, the economy was in a boom that ended abruptly with the forced virtual shutdown of the economy.

A common element of both episodes is that since October 2008, the Federal Reserve has the authority to pay banks to hold reserves. Prior to this first crisis, bank holdings of reserves in excess of the level required by the Federal Reserve were essentially zero. During the Great Recession the Federal Reserve used the level of interest on reserves to control the monetary expansion that would normally result from the vast expansion of Federal Reserve assets. Essentially, bank reserves became a Federal Reserve liability. This new power allowed the Federal Reserve to control the monetary expansion so that in spite of its securities holdings tripling, it avoided the inflation that would have followed such an asset expansion.

There is no doubt that the inflation that was avoided in the 2008 expansion is here in this one. The question is whether the special circumstances of the economic shutdown has simply resulted in a once and for all increase in the price level or are we facing real inflation? The answer is not yet available. The Federal Reserve has the tools to control its net asset growth. Specifically, it can control its net asset growth through controlling the level of bank reserves. But to do so it must either reduce its holdings of securities or control bank holdings of reserves through making the yield on reserves competitive with market yields.

In fact, the Federal Reserve had been successful in controlling its net asset growth so that through December 15, 2021 Federal Reserve net assets were back at their pre-pandemic level. However, as market interest rate began to rise, the Federal Reserve has not kept up in setting the interest rate on reserves. The difference between 1-year Treasuries and the interest rate on reserves is now several times the maximum reached at any time. The all-time 1-year Treasury IOR difference was 65 basis points in September 2018, during the period of Federal Reserve asset reductions. The asset reductions required that bank reserves fall by more than the asset reductions to allow net assets to grow. Now, even after two increases in the IOR, the 1-year Treasury IOR spread on May 18, 2022 was 126 basis points! Without significant asset reductions, Federal Reserve net assets will grow rapidly as bank reserves fall.

The Federal Reserve has all the tools necessary to control any long-run inflation. But as of the end of mid-May 2022, they are not using them. Since December 15, 2021, Federal Reserve net assets have risen 60%. To stem this growth, the Federal Reserve must reduce securities either by open-market sales, by increasing the level of reverse repos, or raise the IOR from its current level of 90 basis points to a rate close to or even above the 1-year Treasury rate that in mid-May 2022 was above 2%.