The Monetary Policy Rescuer: A Long-Run Nominal Interest Rate Target

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"If one does not know to which port one is sailing, no wind is favorable"--- Seneca

Abstract

Is the U.S. monetary policy aging? To find the answer we developed a framework to quantify the magnitude of monetary stimulus offered during a recession. The proposed framework estimates that, over the past 30 years, the FOMC offered larger incentives and for a longer duration in a recession relative to the past cycle. Furthermore, each recession drained the FOMC's resources and left the Committee with "less ammunition" to fight the next recession. Therefore, our work suggests that monetary policy is aging.

To de-age monetary policy, our study proposes that the FOMC may need to declare a commitment to an explicit long-run fed funds rate (FFR) target. Due to the absence of a long-run FFR target, market participants are unable to gauge whether the current policy stance is accommodative or restrictive and by what magnitude. One supposed benchmark is the equilibrium interest rate, or r-star. However, there are at least half a dozen different measures of the r-star, which makes it very difficult to evaluate monetary policy accommodation. In addition, we are not just looking for a benchmark to evaluate policy stance but also an expectations anchor. That is, an anchor in the sense market participants expect the FFR to return to the target in the medium to long-run.

We propose 4% as a long-run target for the nominal FFR. Some of the major benefits of our proposed framework include: helping market participants gauge magnitude of accommodation; anchoring market participants' expectations; reduce time spent at the zero lower bound; lessen dependence on balance sheet expansion; ensure that the real FFR will be positive when the FOMC meets its interest rate and inflation targets.

Studies show that the FOMC may be already trying to influence market participants' expectations through the meeting's statements and SEP/dot-plot chart, but those tools lack explicit commitment by the FOMC to maintain a certain level of the FFR. Therefore, we suggest that by declaring a long-run FFR target would show an explicit commitment by the FOMC to maintain the rate close to target in the medium to long-run. Put differently, a long-run target may change the current declining FFR trend and, thereby, boost the effectiveness of the monetary policy. As such, the FOMC and other central banks should entertain the idea of declaring an explicit long-run policy rate target.

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Introduction

Central banks around the globe introduced large-scale monetary stimulus to mitigate the economic impact of the COVID pandemic. For example, The Federal Open Market Committee (FOMC) brought the fed funds target rate (FFR) to zero lower bound in March 2020 and the Fed's balance sheet hit unprecedented $7 trillion in summer 2020. The Eurozone's entire yield curve (including yields on the 30-year bond) hit the negative zone and the United Kingdom's policy rate also dropped into negative territory. However, even before the COVID pandemic, monetary policy in most of the developed world was under pressure such as the FFR was only 1.75% by the end of 2019. Therefore, some monetary policy observers were wondering what the FOMC will do to fight the next recession/crisis. One major reason of the worries that the FOMC may have "less ammunition" to combat the next recession is that, typically, the FOMC has cut the rate by 500 basis points (bps) during a recession (the FOMC roughly cut the FFR by 500 bps during the Great Recession, for example).

This paper proposes a framework to quantify the magnitude of monetary stimulus offered during a recession. That is, whether the FOMC needs to cut the FFR by 500 bps to combat a recession? Or the magnitude of the stimulus is larger/smaller for a recession compared to other recessions. The proposed framework estimates that, in each recession since mid-1980s, the FOMC offered larger incentives to stimulate the economy in a recession compared to the past cycle. In addition, those incentives were offered for a longer duration relative to the past cycle. Furthermore, each recession in our analysis drained the FOMC's resources and left the Committee with "less ammunition" to combat the next recession. Therefore, our work suggests that monetary policy is aging in the sense it offers larger incentives and those incentives remain in place for a longer duration to stimulate the economy in each of the past three business cycles.

We believe business cycle dynamics are the key factor behind this monetary policy ageing and affect monetary policy in this context through two primary channels. First, the past three recoveries were weak (jobless), requiring more monetary accommodation for a longer period of time and leaving less time to restore the Fed's crisis toolkit. Second, damages from a recession, particularly

from the Great Recession, have been long lasting in the sense that the trend of economic growth has shifted downward. Put differently, damages from a recession affect the aging process in the sense that the process to refill the incentives bag (policy normalization process) would be slower due to the lackluster economic performance. Therefore, weaker recoveries are forcing policy makers to offer larger incentives for longer duration and leaving less time (shorter duration) to refill the ammunition bag. Additionally, shifting of the economy to a lower growth mode because of recessions' damages means longer time to refill the ammunition bag to fight the next recession.

To de-age (and to revive the effectiveness of) monetary policy, our work proposes that the FOMC may need to declare a commitment to an explicit long-run nominal policy rate target. One major reason (in addition to business cycles/structural issues) of the diminishing effectiveness of monetary policy is the lack of an explicit long-run FFR target. Due to the absence of a long-run FFR target, market participants are unable to gauge whether the current policy stance is accommodative or restrictive and by what magnitude. One supposed benchmark is the equilibrium interest rate, or r-star. However, there are at least half a dozen different measures of the r-star, which makes it very difficult to evaluate monetary policy accommodation. In addition, we are not just looking for a benchmark to evaluate policy stance but also an expectations anchor. That is, an anchor in the sense market participants expect the FFR to return to the target in the medium to long-run. While this may not directly address the impact of weaker recoveries and slower growth, it could help reinvigorate the Fed's toolkit in the face of these macroeconomic trends.

We propose 4% as a long-run target for the nominal FFR. Some of the major benefits of our proposed framework include: helping market participants gauge whether the current stance is accommodative/restrictive and its magnitude; anchoring policy watchers' expectations in the sense that analysts would expect the FFR to stay close to its target; reducing the risk that the FFR would hit and stay at the zero lower bound for an extended period of time; lessen dependence on the balance sheet expansion by providing enough room to cut rates in the case of a slowdown/recession; and, with the inflation target rate set at 2%, ensuring that the real FFR would be positive when the FOMC meets its interest rate and inflation targets.

Some studies show that the FOMC may be already trying to influence market participants' expectations through the meeting's statements and survey of economic projection (SEP)/dot-plot chart, but those tools lack explicit commitment by the FOMC. Therefore, we suggest that by

declaring a long-run FFR target would show an explicit commitment by the FOMC to maintain the rate close to its long-run target. Put differently, a long-run target may change the current declining FFR trend and, thereby, boost the effectiveness of the monetary policy. As such, the FOMC (and other central banks) should entertain the idea of declaring an explicit long-run policy rate target.

2. Is Monetary Policy Dying?

The federal funds target rate (FFR) is a key tool of the U.S. monetary policy. The FFR is used as an incentive/discount as well as a disincentive/penalty. Typically, the FOMC reduces the FFR during recessions/slowdowns to stimulate the economy. Conversely, during expansions, the FOMC tends to raise the FFR to prevent the economy from overheating. Therefore, monetary policy affects the economy through discount/penalty channels.

This spring, as the world grappled with the ramifications of the impending pandemic and the rapidly deteriorating economic outlook, policymakers stepped in to restore confidence and re-open closing credit channels. In two unscheduled meetings, first on March 3 and then on March 15, the FOMC cut the fed funds to 1.25% and then to 0.25%, the effective lower bound. The FOMC also restarted its large-scale asset purchase program and a number of emergency lending facilities.

However, even before the COVID pandemic, monetary policy in most developed nations was under pressure. With key policy rates either negative or close to zero, analysts were wondering what central banks would do to fight the next recession. For instance, in the post Great Recession era the fed funds rate peaked only at 2.50%, well below the 5.25% peak in August 2007 (the pre-Great Recession peak). Furthermore, the FOMC started to lower the fed funds rate in summer 2019 and brought the rate to 1.75% in its October 2019 meeting. Some analysts raised the question whether the FOMC has "less ammunition" to fight the next recession. Typically, the FOMC cuts the fed funds rate by around 500 bps in a recession. It brought the rate from 5.25% to zero lower bound during the Great Recession and from 6.50% to 1.75% during the 2001 recession (between December 2000 and December 2001). Therefore, with the fed funds rate at 1.75% by the end of 2019, analysts were wondering what the FOMC would do to combat the next recession/crisis.

We believe there are some major issues with the simple benchmark that a 500-bps-cut in the FFR is needed during a recession to stimulate the economy. First, the benchmark does not accurately

measure the magnitude of the monetary stimulus. For example, the 475-bps-cut in the FFR (from 6.50% to 1.75%) during the 2001 recession is slightly smaller than those of the Great Recession cut (500-bps-cut, from 5.25% to 0.25%). However, the FOMC had more room to cut rates in the 2001 cycle, and it did (brought the FFR to 1.0%) during the weaker recovery from the 2001 recession. On the other hand, because of the zero lower bound, the FOMC ran out of conventional tools (unable to cut FFR) and it employed unconventional methods (started several rounds of quantitative easing [QE]) to jump-start the economy from the Great Recession.

Therefore, the level of the FFR, particularly peak/trough of the FFR, is important to determine the magnitude of the monetary stimulus as well as "ammunition" to fight the next recession. That is, a relatively higher peak (6.50% peak for the pre-2001 recession compared to the 5.25% peak for the pre-Great Recession) would suggest relatively more "ammunition" to fight the upcoming recession and vice versa. By the same token, a higher trough (1.0% for the post-2001 recession versus 0.25% for the post-Great Recession era) would help the FOMC refill the "ammunition bag" faster than a lower trough, all else equal. Therefore, we need a new tool that incorporates the peak and trough (level) of the FFR to accurately measure the magnitude of the monetary stimulus offered during a recession.

The second issue with the simple 500-bps-cut benchmark is that it ignores the duration of the monetary stimulus which is an important factor to determine the "ammunition" to fight a future recession. That is, during the 2001 monetary cycle, the total number of rate cuts were twelve and the total monetary easing period (period includes the time in which the FFR was either reduced or remain unchanged) consisted of 42 months. There were only eight rate cuts (mainly due to the zero lower bound) during the Great Recession era, but the easing period spread to 100 months. Theoretically, a faster rate cut (along with higher magnitude of the cut) would suggest depth/severity of a recession (in March 2020, the FOMC reduced the FFR to zero lower bound in two unscheduled meetings) as well as how quickly the available ammunition is utilized (at least the conventional toolkit may be exploited). The duration of the easing period would shed light on the available resources to fight a future recession. That is, a longer duration of the easing period may leave the Committee with a shorter duration to refill the ammunition bag for the next recession, all else equal. An example of such a scenario is the post-Great Recession era and that era experienced the longest duration of the easing period in the recent history (100 months) and the FFR peaked at only 2.50%. It is worth mentioning that the post-Great Recession era also

experienced the longest expansion in the post-World War II (WW II) era, and a longer expansion may provide more time for the FOMC to rebuild its toolkit to fight the next recession, at least in theory.

The final major issue with the 500-bps-cut benchmark is that it assumes, implicitly, the effectiveness of the monetary policy remains the same for each business cycle. However, if we include the true magnitude of the stimulus along with the duration of the easing period then it seems that monetary policy effectiveness is diminishing overtime. Figure 1 shows that since the mid-1980s, each peak in each monetary cycle is lower than the previous peak (i.e., 9.75% peak for the 1990 recession, 6.50% for 2001, 5.25% for the Great Recession and only 2.50% for the 2020 recession), which may suggest relatively lower ammunition to fight the next recession. The easing period of 100 months for the Great Recession period compared to just 42 months for the 2001 recession may indicate that monetary policy is aging (diminishing effectiveness). Therefore, instead of using the simple benchmark of a 500-bps-cut, we need a new tool to quantify the effectiveness of the discount/penalty channel (aging) of monetary policy as well as an accurate measure of the monetary stimulus offered during a recession.

Figure 1: The Fed Funds Target Rate
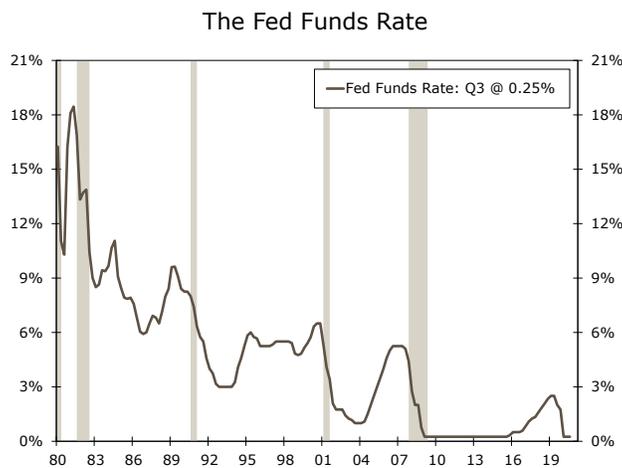
Source: Federal Reserve and Wells Fargo Securities

2.1Quantifying Magnitude and Duration of the Monetary Stimulus during Business Cycles

Our proposed framework analyzes the effectiveness of the incentive channel through which monetary policy operates. The first step determines the peak and trough in the FFR for each business cycle. The second phase incorporates the pace of monetary policy changes in relation to the FFR peaks/troughs. A lower peak in the FFR compared to the previous cycle suggests the FOMC has fewer incentives to offer in the current cycle given the zero lower bound of the nominal FFR. By the same token, a lower trough relative to the prior cycle requires a more time to rebuild the ammunition box, all else equal. Additionally, a faster rate-cut would utilize available incentives quickly and a longer duration of the easing period may reduce available resources to fight the next recession.

Table 1: The Federal Funds Target Rate during Business Cycles

Recession	level change during recession	percentage change	number of Rate Cuts	Change from previous peak	% Change from previous Peak	Months of Easying**	Pre-recession Peak	Recession Trough	Post-recession Trough
July 1990 - Mar 1991	2.50%	30.30%	16	6.75%	69.20%	44	9.75%	6.00%	3.00%
Mar 2001 - Nov 2001	3.75%	68.20%	12	5.50%	84.60%	42	6.50%	2.00%	1.00%
Dec 2007 - Jun 2009	4.25%	94.44%	8	5.00%	95.20%	100	5.25%	0.25%	0.25%***
Feb 2020--*	1.50%	85.70%	2	2.25%	90.00%	N/A	2.50%	0.25%	0.25%***

*NBER did not announce a Trough for the 2020 recession, yet   ** Rate cuts plus rate on hold   *** The FOMC started QE

The results are reported in Table 1. There are some major reasons to start our analysis from the mid-1980s, particularly from the 1990-91 recession, and the sample period includes the past three business cycles. First, the fed funds rate series goes back to 1954 but the series utilizes an estimated measure of the effective fed funds rate for the pre-1990 era. Although both the fed funds target rate and effective fed funds rate are highly correlated but the effective fed funds rate primarily reflects market participants' actions. The fed funds target rate, on the other hand, is determined by the FOMC.

Second, the pre-1990 fed funds rate exhibits materially different behavior than in the post-1990 era. During the Pre-1990 era, the fed funds rate was much more volatile and operated in a different range than it has over the past three decades. For example, fed funds rate often went above 10% during the 1970s and 1980s as policymakers struggled to combat rampant inflation. After averaging touching 20% in the early 1980s, the fed funds rate has remained below 10%, averaging

5.1% in the 1990s and 3.0% in the 2000s. Therefore, the post-mid-1980s' era is more relevant for current and near future outlook of monetary policy as well as for the discount/penalty channel.

The third major reason to exclude the pre-1990 era from the analysis is that the nature of the recessions in this period and the Fed's response differs from the more recent cycles. That is, in the post-1990s era, the FOMC reduced the FFR during each of the four recessions (including 2020 recession). However, during the 1970s and 1980s, the FOMC raised FFR during recessions because of rising inflation. For example, the effective fed funds rate jump from around 9% to around 13% during the 1973-1975 recession and from 14% to 20% during the 1980 recession. Finally, we believe these four recessions present a sufficient range to conduct our analysis. The 2001 recession is widely considered mild, while the 1990-1991 recession is labeled moderate and the 2007-2009 recession is more severe (the Great Recession). Therefore, we can analyze the monetary policy and its incentives and disincentives channels in different business cycles. At the timing of this writing, the NBER has yet to declare the ending of the 2020 recession, and thereby, we are unable to characterize the current recession into a mild or severe recession.

The severity of a downturn may seem like the primary determinant of how much monetary stimulus the Fed provides, but that is not always the case. Although the 2001 recession was less severe than the 1990-1991 recession, the FOMC offered larger incentives, such as the FOMC reducing the FFR by 3.75% during the 2001 recession compared to a 2.50% reduction in the FFR during the 1990-1991 recession. With a 4.25% reduction in the FFR during the Great Recession, it appeared that the FOMC offered larger incentives in each recession compared to the past recession in the post-1990 period. Therefore, incentives offered in a recession may not be correlated with the depth of that recession.

As mentioned earlier, the magnitude of the rate cut may not depict the whole picture, and if we compare the total reduction in the FFR as a percentage of the FFR level during that time, that statistic would shed more light on the size of the monetary stimulus. For instance, the FOMC reduced the FFR from 8.25% to 5.75% (total reduction of 2.50%) during the 1990-91 recession and that was a 30.30% reduction (2.50% as a percentage of 8.25%) from the available resources (8.25% being the total possible reduction or available resources). In other words, the FOMC utilized its 30.30% ammunition during the 1990-91 recession and it still had around a 69.70% arsenal if it needed to jump-start the economy from the recession. In retrospective, with so many

arrows left in the quiver, the FOMC was able to cut rates further in September 1992, to further stimulate the then-weak recovery. The FOMC utilized 68.20% of available ammunition during the 2001 recession and 94.44% (if use 0.25% which is the upper limit) during the Great Recession. Technically, the FOMC utilized 100% of its ammunition during the Great Recession as the FFR hit the zero lower bound and the FOMC could not lower the FFR further and it started several rounds of QE to stimulate the economy. Therefore, even after accounting for its available resources, this measure suggests that the cumulative effect of these post-1990s recessions put a strain on the FOMC's ammunition that affected the magnitude of accommodation beyond the depth of a recession.

Another statistic which helps us to capture the true magnitude of the incentives is the number of rate cuts during a recession/cycle. A rate cut can be seen as a dose of incentive that calms market participants during turbulent times/recessions. More rate cuts in a recession may highlight a longer duration of incentives as well as a longer time horizon to utilize the available ammunition, all else equal. There were 16 rate cuts during the 1990-91 cycle (during and after the recession, with roughly eight during the recession and other eight during the recovery phase). Essentially, the FOMC utilized its ammunition first to fight the recession and then to jump-start the recovery from the recession. The FOMC brought the FFR down to 3.0% in September 1992 and kept the rate at that level for the next 16 months (until January 1994). The 2001 cycle has 12 rate cuts and only two of those cuts occurred during the recovery. Furthermore, the FOMC brought the FFR down to its lowest level in decades (at 1% on June 2003). The Great Recession experienced eight rate cuts and all of those cuts occurred during the recession. As the FFR hit the zero lower bound, the FOMC started QE to stimulate the economy from the recession. As the lowest peak in our analysis is 2.50% (the FFR peaked at 2.50% on December 2018 and then stayed there until July 2019), the 2020 recession has only two rate cuts.

Essentially, the 1990-91 cycle has more rate cuts mainly because that cycle had greater ammunition (only 30.30% used during the recession). The 2001 cycle is associated with fewer rate cuts than the 1990-91 cycle and that is due to relatively lower resources available during that cycle (the 2001 peak value is smaller than the 1990-91 cycle). The Great Recession and the 2020 recession followed the declining rate-cut trend (as well as the lower peak values for the FFR). Therefore, the FOMC offered larger incentives (as percent of available pool of ammunition) in each recession since 1990-91. Furthermore, each recession reduced the FOMC's future

ammunition (smaller peak value of the FFR in each cycle compared to the past peak) to fight the next recession.

Total reduction (from pre-recession peak to post-recession trough) in the FFR also highlight the similar conclusion. As shown in Table 1, the 1990-91 cycle utilized 69.20% of available resources, 84.60% for the 2001 cycle, 95.20% during the Great Recession (technically, 100% due to the zero lower bound) and 90% (again technically 100%) during the 2020 recession. This measure is forward looking in that it sheds light on the remaining resources to fight the next recession. That is, when the 1990-91 cycle ended (the FOMC stated raising the FFR) the FOMC had 30.8% ammunition remain in the bag (as it used 69.2% during the cycle) to fight the next recession. It also indicates that when the FOMC started to refill its ammunition bag (raising rates, for example) it didn't have to start from zero which would take a longer period to refill the bag, all else equal. However, the 2001 cycle left only 15.4% of resources in the toolkit and the Great Recession emptied the bag (utilized 100% which is also the case for the 2020 recession). One can argue that the Great Recession may have utilized the future resources in the sense that the Fed's balance sheet exploded to the unprecedented level of over $4 trillion. Essentially, during the post-Great Recession era, the FOMC had to fight on multiple fronts such as to raise rates as well as reduce the balance sheet to accumulate ammunition to fight the next recession.

The final piece of our framework is the duration of the offered incentives and the duration would complete the picture of the monetary stimulus offered during a cycle along with potential ammunition for the next recession. For example, between December 2000 (as the first rate cut occurred in January 2001) and May 2004, the FOMC reduced the FFR or held it steady, leading to monetary easing duration of 42 months during the 2001 cycle. Forty-four months for the 1990-91 cycle and 100 months are attached to the Great Recession monetary cycles.[1] In theory, a longer duration of incentives (monetary easing) would suggest relatively less ammunition to combat the next recession in the sense less time to refill the ammunition bag, all else equal. Furthermore, although the 2001 cycle's duration is almost similar to the 1990-91 cycle's (42 months vs. 44 months), given that the 2001 recession was a mild and attached to a larger magnitude, the cycle put larger pressure on the ammunition bag (a smaller peak than the previous peak would certify

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[1] As of December 2020, the 2020 cycle is in progress. Once the cycle is completed, we'll know the total duration of monetary incentives offered in the current cycle.

the conclusion). Moreover, the Great Recession is deeper than the previous two recessions and attached to larger incentives for longer duration.

Therefore, our analysis suggests that the monetary incentives were offered for longer durations for each recession in our sample period, meaning that over the past 30 years or so, every peak/trough in the FFR is lower than the previous peak/trough. Furthermore, in each recession, the FOMC offered larger incentives compared to the previous cycle. Additionally, those incentives were offered for a longer duration relative to the past cycle. Essentially, each recession in our analysis drained the FOMC's resources and left the Committee with "less ammunition" to combat the next recession, leading us to the conclusion that monetary policy is aging.

2.2 The Rise and Further Rise of the Federal Balance Sheet

The 2020 recession utilized all ammunition in just two rate cuts (a total reduction of 150 bps) and therefore the lower-ammunition-for-next-recession trend continues since the 1990-91 recession. Put differently, the aging of monetary policy continuously lowers the ammunition level to fight the next recession (than the previous recession) and, at the same time, every recession requires higher incentives (compared to the previous recession) to jump-start the economy. The FFR hitting the zero lower bound along with a 100-month period of monetary easing during the 2007-09 recession may suggest that the Great Recession helped to expedite the aging process of monetary policy. However, one can argue that the fed funds target rate is an important but conventional tool to fight recessions as well as to stimulate the economy from a recession/economic slowdown. Subsequently, the continuously declining trend along with recent very lower level of the fed funds rate may indicate *aging of this conventional tool*. During the Great Recession, the Fed has introduced unconventional tools that are labeled as quantitative easing (QE). Do those unconventional tools also age?

The FOMC brought the FFR to zero lower bound on December 2008 and the Committee also announced large-scale asset purchases to pump liquidity into the financial system. Those asset purchases programs are known as QE. The impact of QE can be seen on the Federal Reserve's balance sheet (Fed's balance sheet) which more than doubled by the end of 2008 (from a pre-recession level of less than $1 trillion to over $2.2 trillion by December 2008, Figure 2). Due to the depth of the Great Recession and the lackluster recovery from the recession, the Fed started several rounds of QE and the balance sheet hit an unprecedented level of $4 trillion in December

2013. Furthermore, the balance sheet stayed above $4 trillion until January 2019 before dropping slightly below $4 trillion and remaining there until September 2019. The Fed's balance sheet crossed $4 trillion in October 2019 and then hit $7 trillion in the summer of 2020 as the FOMC announced several programs to mitigate the economic impact of the COVID pandemic.

As the FOMC's conventional ammunition has aged, it has increasingly turned to unconventional tools. Moreover, the opening of the unconventional toolbox affects future ammunition in addition to the magnitude and duration of the incentives offered during easing cycles. For example, Krippner (2015) estimated that the Fed's QE is around 500 bps and if we add that estimated number to the 500 bps reduction in the FFR (from 5.25% to 0.25%), then the total estimated incentives are 1,000 bps (10.0% reduction in the FFR, for example). Essentially, doubling the magnitude of the incentives. The duration of those incentives would be longer than the initial estimate of 100 months. The FOMC raised the FFR in December 2015 and, therefore, the monetary easing duration of 100 months (between August 2007 and November 2015 the FFR was either unchanged or reduced by the FOMC). Furthermore, although the FOMC raised the FFR in December 2015 and ended monetary incentives, the Fed's balance sheet remained above $4 trillion until January 2019. Therefore, if we include conventional plus unconventional monetary incentives, then the duration of monetary easing is 138 months (between August 2007 and January 2019).

Figure 2: The Fed's Balance Sheet
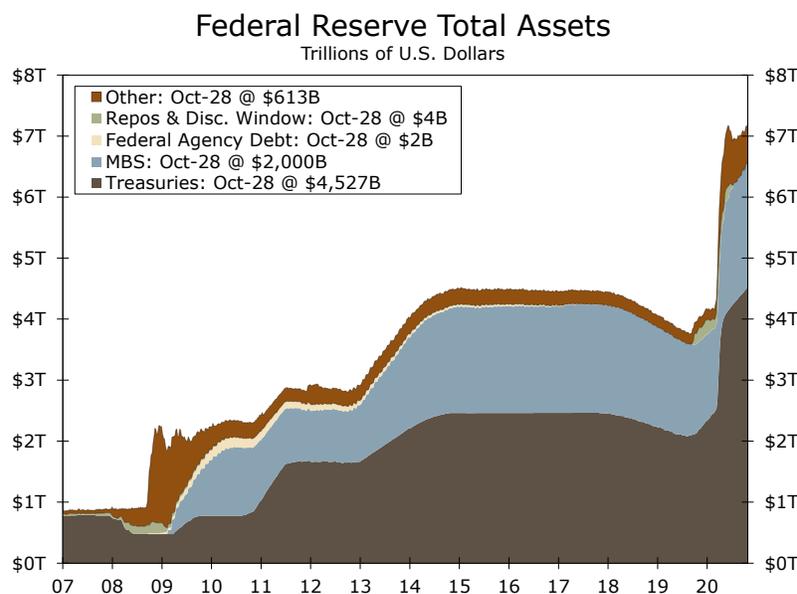
Source: Federal Reserve and Wells Fargo Securities

While the use of unconventional tools provided room for further accommodation, it did not break the monetary policy aging process. The FOMC kept the FFR unchanged for the longest time in modern history (the FFR remains at the zero lower bound for 84 months), and then it raised the rate at the slowest pace in modern times. This combination of the longest on-hold and the slowest rate hike produced the lowest peak value of 2.50% of the FFR in modern times. Essentially, despite unprecedented balance sheet expansion, the FOMC's ammunition to fight the next recession fell to its lowest level in our sample period.

The Great Recession boosted the Fed's balance sheet from less than $1 trillion to over $4 trillion and the 2020 recession took the balance sheet from $4 trillion (around $4.1 trillion by December 2019) to over $7 trillion (around $7.2 trillion by December 9, 2020). One can argue that the FFR has a nominal zero lower bound, but the Fed can boost its balance sheet as high as the Fed wants, at least in theory. However, in addition to finding unlimited assets to buy, the Fed would likely face strong political pushback if it chose to continuously expand its balance sheet. Finally, there would be issues with diminishing effectiveness of QE.

As our analysis suggests, the FOMC offered larger incentives for longer duration to fight recessions and to jump-start the economy over the past 30 years or so. Thereby, the conventional tool of FFR has diminishing effectiveness (aging) and that is one major reason the FOMC started using unconventional tools. Furthermore, for Fed observers, a rising Fed balance sheet as percent of economic growth (real GDP, for example) trend would be unsettling as it would be a sign of diminishing effectiveness of the unconventional tools of monetary policy. For example, the Fed's balance sheet was just 5.7% of real GDP by Q3 2007 (pre-Great Recession), more than double that by Q4 2008 (14.6%) and then jumped to 24.2% by Q4 2013. The last expansion was the longest on record, though the Fed's balance sheet was 21.6% of real GDP by Q4 2019 (pre-2020 recession). By Q3 2020, the balance sheet was 38% of the real GDP.[2]

Real GDP as a benchmark in the sense the Fed's balance sheet may reach up to 100% of the real GDP as the real GDP measures the economic size of an economy, and thereby, the Fed's balance sheet size may not exceed the size of the U.S. economy.[3] This benchmark would help us to determine the effectiveness of the QE tool in the sense whether the unconventional tools are also

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[2] It is worth mentioning that nominal GDP also produces the similar trend but slightly different numbers.
[3] To quantify the size of the unconventional ammunition bag, we assume the Fed's balance can only grow up to 100% of the real GDP.

aging. For example, before the Great Recession the Fed had 94.3% (100% minus 5.7%) of unconventional ammunition to fight the recession. Furthermore, by Q4 2013, the Fed had utilized around one-fourth of the unconventional tool bag and still had 75.8% of resources if needed to handle the next crisis. Moreover, the U.S. economy was in an expansion phase by Q4 2013, and thereby, the Fed may have been able to refill the resources bag by reducing the size of the balance sheet. However, by Q4 2019 (peak of the expansion), the Fed was only able to reduce the balance sheet by a few points (resources move from 75.8% to 78.4%). Then there was the COVID pandemic and the corresponding recession, and available resources to jump-start the economy from the recession dropped to the lowest level of 62% (by Q3 2020, the balance sheet as 38% of real GDP). Put differently, the available pool of unconventional resources is also following a declining trend in our sample period (94.3% for the Pre-Great Recession vs. 78.4% for the pre-2020 recession).

Therefore, our work suggests that monetary policy is aging in the sense both conventional and unconventional tools may have diminishing effectiveness as the FOMC offered larger incentives for longer duration during each recession compared to the previous one. Furthermore, the Great Recession may have expedited the aging process of monetary policy due to its depth and then weakest recovery in modern times. The FOMC offered the largest incentive and for the longest duration to mitigate the economic impact of the Great Recession and then to jump-start the economy. Those large incentives and longest duration may have accelerated the already declining effectiveness of the monetary policy. Therefore, our work suggests monetary policy is aging and we need a new framework to de-aging the monetary policy.

2.3 Monetary Policy is Going Nowhere Fast

Monetary policy is aging in the sense the ammunition to fight the next recession is on a declining path. Furthermore, with the FFR already at the zero lower bound and the Fed's balance sheet at a record high, we discuss the near-term outlook of the monetary policy in the sense of whether, in the future, the FOMC would be able to refill the resources bag faster/slower than in the past. That is, whether the FOMC would raise the FFR faster/slower than in the past. Although, future rate hikes depend on several factors including economic/financial conditions and the containment of the COVID pandemic. There are some indicators which may help us to paint a likely scenario of the near-term monetary policy stance.

The FOMC regularly provides its members' economic projections and outlook for the FFR for the next few years. These projections are known as the survey of economic projections (SEP) and the dot-plot chart of the FFR. The most recent SEP/dot-plot chart (December 2020) suggests that most members of the FOMC expect the FFR to remain at the zero lower bound during the next few years, at least by the end of 2023. If we take the SEP projections of the FFR at the zero lower bound until the end of 2023, that may suggest the Fed's balance sheet may remain at the current elevated level at least until the end of 2023 (or go higher in the case of more rounds of QE, which seems the likely scenario given the worsening COVID situation). It is worth mentioning that the FOMC may choose to reduce its balance sheet without changing the level of the FFR. However, in the past cycle, the FOMC first started to raise the fed funds and then paid attention to reducing the balance sheet. We are assuming the same scenario for the near future, for the sake of simplicity. Essentially, what we are suggesting is that it is unlikely that the FOMC would start refilling its ammunition bag (in the sense either raising the FFR or reducing the balance sheet size) in the near future (before the end of 2023).

What would be the likely peak level of the FFR during the next cycle? It would be very difficult to make an accurate guess of the likely peak value of the FFR during the next cycle; however, we have a tool that helps us to predict the likely monetary policy stance. We can utilize that tool to forecast a likely scenario for the monetary policy beyond the next few years.

Iqbal-Bullard-Silvia (2019) presented a new framework utilizing a threshold between the fed funds rate and the 10-year Treasury yield and that threshold has predicted all recessions and changes in the monetary policy stance. That is, Iqbal-Bullard-Silvia (2019) claimed that, since 1954, in a simulated experiment, their framework not only predicted all recessions but also changes in the monetary policy stances (from accommodative to normalize, for example). Essentially, using the Iqbal-Bullard-Silvia (2019) study, we can predict the likely peak of the FFR in the sense whether it would follow the current every-peak is lower-than-the-previous-peak trend. The Iqbal-Bullard-Silvia proposed threshold is, "*in a rising fed funds rate period, the fed funds rate crossing/touching the lowest level of the 10-year yield in that cycle is a prediction of an upcoming recession.*"

The FOMC brought the fed funds target rate to zero lower bound in March 2020, and at one point in the future, the FOMC would raise the FFR. Once the FOMC raises the FFR, then that would meet the first condition of the Iqbal-Bullard-Silvia threshold, which is "in a rising fed funds rate

period." The 10-year yield dropped below 1% on March 3, 2020, for first time ever (the series goes back to 1953) and the lowest value in the current cycle is 52 bps (August 4, 2020). Furthermore, one rate hike by the FOMC would breach the Iqbal-Bullard-Silvia threshold, and once the threshold is breached, then, on average, within 18 months the FOMC has changed the monetary policy chance, historically.[4] Assuming, the threshold proposed by Iqbal-Bullard-Silvia would repeat its historical accuracy during the current business cycle, then that implies *only one rate hike* (two rate hikes if we don't round 10-year Treasury yield lowest level from 52 bps to 50 bps) would breach the threshold, which would indicate a change in the stance of monetary policy (in this case from a rising FFR to either on hold or reducing) would occur within the next 18 months. That also means, the FOMC may be able to raise the FFR only a few times during the current cycle. It also indicates that chances of a sizable reduction in the balance sheet are very low in the current cycle.

Therefore, the currently available FOMC's SEP along with the forecasting tool to predict the likely path of the monetary policy suggest that the current monetary cycle may repeat the historical aging process of monetary policy. That is, the FOMC's ammunition bag may decline to the new low when the next crisis hits, all else equal. In other words, we need a new framework to de-age (revive the effectiveness of) monetary policy.

2.4 Potential Factors behind the Aging of Monetary Policy

Before we outline our proposed framework to de-age monetary policy, we discuss some major causes behind the aging process. We believe business cycles are the key factor behind monetary policy aging. Furthermore, business cycles seem to affect monetary policy effectiveness from two major directions. First, the past three recoveries were weak (jobless) and consequences of those weak recoveries can be seen as larger monetary incentives for longer duration, which also mean a smaller duration to refill the ammunition bag to fight the next recession. For example, the 1990-91 recession ended in March 1991, though the first rate hike occurred in February 1994. The 2001 recession ended in November 2001, but the first rate hike was recorded on June 2004. The FOMC first time raised rates on December 2015 even though the Great Recession ended in June 2009. Therefore, the weaker recoveries from the past three recessions are behind the aging of monetary

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[4] If we round the current lowest level of 52 bps to 50 bps then the threshold would breach with one rate hike. Otherwise, two rate hikes will breach the threshold.

policy in the sense those recoveries forced the FOMC to offer larger incentives for longer duration and as a result less time to refill the incentives bag to utilize during the next recession.

The second effect of business cycles on the aging process of monetary policy is relatively less-known. In other words, the second effect deviated from the conventional macroeconomics. That is, standard macroeconomics suggests economies follow business cycle phases of recession and recovery/expansion, and during a recession, an economy's output level falls below the potential level and a recovery/expansion phase brings output back to normal (pre-recession trend). In addition, standard macroeconomics textbooks consider recessions as temporary shocks and that only reduce the output level in the short-run, as the economy eventually gets back to the "normal" level in the medium to long-run.

However, the economic performance of the U.S. economy (and many other developed nations) since the Great Recession (2007-2009) has raised questions regarding the traditional notion that recessions have only short-run effects. Many studies have estimated the output losses in the short-to-medium-run and concluded that the damages from the Great Recession were significant in the short/medium-run. For example, Silvia-Iqbal-Bullard (2017) proposed a framework to estimate the economic cost (losses) from the Great Recession for the U.S. economy, in particular for the nine major variables. They concluded that damages from the Great Recession are long lasting in the sense the level (trend) of all nine variables has shifted downward, and this is true for both actual and potential forms of these variables. That means, these nine major sectors shifted to a lower growth mode relative to the past. Furthermore, these results are consistent with the overall economic environment since the Great Recession. That is, a painfully slow economic recovery (using GDP as proxy) along with slower growth in the personal income, employment, wages and business fixed investment.

Therefore, damages from a recession affect the aging process in the sense that the process to refill the incentives bag (policy normalization process) would be slower due to the lackluster economic performance. For example, 30 months (June 2004) after the 2001 recession ended, the FOMC raised the FFR and then during the next two years (by June 2006), the FFR was up by 425 bps. However, the first rate hike occurred after 77 months (December 2015) of the Great Recession end date, and then during the next two years (by December 2017), the FFR was up only by 100 bps.

Therefore, damages from the Great Recession slowed the policy normalization process (refilling incentives bag to fight the next recession).

In sum, business cycles are behind the aging of monetary policy. That is, weaker recoveries are forcing policy makers to offer larger incentives for longer duration and leaving less time (shorter duration) to refill the ammunition bag. In addition, shifting of the economy to a lower growth mode because of the recessions' damages means a longer timeframe to refill the ammunition bag to fight the next recession.

3. De-aging the Monetary Policy

Monetary policy is one of the key tools to fight recessions in the sense an accommodative policy stance is adopted by the FOMC to stimulate the economy during recessions and economic slowdowns. In other words, on one hand, monetary policy is one of the key elements of economic policies to mitigate economic damages from a recession. On the other hand, business cycles are behind the aging of monetary policy. That means we need an effective monetary policy to combat future recessions. Therefore, we present a new framework that would de-age monetary policy in the sense the framework would help policymakers refill ammunition in a timelier manner.

3.1 We Propose 4% as a Long-run Target for the Nominal Fed Funds Rate

To de-age (and to revive the effectiveness of) monetary policy, the FOMC may need to declare a commitment to an explicit long-run nominal policy rate target. One major reason (in addition to business cycles/structural issues) of the diminishing effectiveness of monetary policy is the lack of an explicit long-run federal funds rate (FFR) target by the FOMC. There are some potential ways in which lacking of an explicit FFR target affects the aging of monetary policy. First, due to the absence of a long-run FFR target, market participants are unable to gauge whether the current policy stance is accommodative or restrictive and by what magnitude. As mentioned earlier, an accurate measure of the policy stimulus is not just how much reduction in the FFR but also rate cut as percentage of the level (and reduction from the peak). Furthermore, without a benchmark, it would be difficult to compare monetary stimulus offered during a recession compared to other recessions.

The second important drawback of not having a long-run FFR target is that there is no anchoring for market expectations in the sense of where the FFR rate would be during "normal" times. That

is, an anchor for the fed watchers' expectations may influence analysts' expectations that the FFR would return to the target in the medium to long-run. The lack of anchoring expectations about a long-run target rate may correlate with declining FFR peaks (every business cycle has a smaller FFR peak value than the previous cycle's peak) during the past 30 years or so. As a relatively smaller peak value of the FFR indicates less ammunition to fight the next recession.

The final and most important disadvantage of the long-run FFR target absence is that it does not show an explicit commitment by the FOMC to maintain the FFR at a certain level in the long-run. That is, there is no explicit target by the FOMC to refill the ammunition bag at a certain level to fight the next recession. Put differently, there is no explicit commitment by the FOMC to take the FFR (when the expansion started) to higher than the previous FFR peak of 2.50%, and thereby, analysts worry about the less ammunition to fight the next crisis/recession.

We propose that the FOMC may want to declare 4% as a long-run target for the nominal FFR. Some of the major benefits of our proposed target rate include, first, helping market participants gauge whether the current stance is accommodative/restrictive and by what magnitude. Furthermore, a benchmark would help to estimate an accurate measure of monetary stimulus (magnitude and duration instead of a simple notion to cut FFR by 500 bps) to fight a recession. A benchmark would also differentiate the policy normalization process (raising rate to 4.0%, for example) from the restrictive policy stance (rate above the target of 4.0%). In other words, analysts could quantify whether the FOMC is taking the rate to its long-run target (policy normalization) or economy is over-heating and restrictive policy is in place. That is, a long-run target rate does not mean that the FFR cannot go above the target, instead the FOMC may utilize the target to send market participants signals as to whether the current stance is policy normalization or restrictive policy.

The second benefit is that a long-run target would anchor policy watchers' expectations in the sense that analysts would expect the FFR to stay close to its target. In other words, a long-run target would help the FOMC to take the rate to 4.0% (our proposed target) as market participants are expecting the rate to stay close to its target in the medium to long-run. That also means, by declaring a long-run target, the FOMC may be able to break the current declining-peak trend of the FFR and possibility of a higher than 2.50% peak (the peak value for the previous cycle) during the future cycles. The third benefit of a long-run target of 4.0% is that it would reduce the risk that

the FFR would hit and stay at the zero lower bound for an extended period of time as both the FOMC and market participants expect the rate to go back to its long-run target. The fourth major benefit of our proposed framework is that the target rate would help the FOMC to refill its conventional ammunition bag appropriately and that would reduce burden on the Fed's balance sheet by providing enough room to cut the FFR in the case of a slowdown/recession. The final benefit of the long-run target of 4.0% is that with the inflation target rate set at 2.0%, it ensures that the real FFR would be positive when the FOMC meets its interest rate and inflation targets.

Therefore, we suggest a long-run FFR target would boost the effectiveness of the monetary policy and the FOMC should entertain the idea of declaring an explicit long-run nominal policy rate target.

3.2 Are There Alternative Targets to De-age Monetary Policy?

We proposed 4.0% as a long-run FFR target and that target would de-age monetary policy. Are there any other methods that would restore the monetary policy effectiveness? The likely candidates may include the Taylor rule, the equilibrium interest rate (or r-star), unemployment rate and real/nominal GDP. Although the Taylor rule (Taylor, 1993) is utilized to evaluate the current stance of monetary policy, the Taylor rule is widely consider backward-looking and may not capture current policy stance accurately as suggested by Bernanke (2010). Furthermore, there are at least half a dozen different measures of the r-star (such as Williams [2016] and Bullard [2018] measures of r-star and r-dagger), which makes it very difficult to evaluate monetary policy accommodation. In addition, Powell (2018) highlighted difficulties to estimate these r-stars due to the changing nature of macroeconomy.

The vital difference between our proposed framework and the aforementioned alternatives is that these alternatives lack any explicit commitment from the FOMC, and thereby, we are not just looking for a benchmark to evaluate policy stance but also an expectations anchor. That is, an anchor for the fed watchers' expectations in the sense market participants expect that the FFR would return to the target in the medium to long-run.

The unemployment rate dropped to 3.5% in September 2019 and that was the lowest unemployment in more than four decades. Essentially, the previous business cycle reported one of the lowest unemployment rates in decades and that cycle also experienced the lowest FFR peak in decades. GDP (both nominal and real) is also following the typical business cycle properties of a

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fall in recessions and then crossing the previous peak during expansions. Consequently, both the unemployment rate and GDP may not capture the declining trend of the FFR and would not be effective to de-age monetary policy, in our view.

Therefore, the key issue is that the monetary policy tools are losing their effectiveness (as suggested by our analysis), and thereby, the FOMC may want to declare a long-run target for the FFR (a key tool of the monetary policy) to revive its effectiveness.

3.3 How Practical is to Declare an Explicit Long-run Fed Funds Target Rate?

How practical is for the FOMC to declare an explicit long-run fed funds target rate? In our view, the FOMC is already, implicitly, influencing market expectations. That is, some analysts suggest that the FOMC's forecasts may influence private sector expectations (Romer and Romer, 2000). Furthermore, Iqbal et al. (2020) characterized the FOMC's forecasting behavior and their analysis suggests that the FOMC has become overly optimistic, as it tends to forecast a more optimistic GDP growth outlook with "controlled" inflation expectations over the 2002-2018 time period. Put differently, the FOMC utilizes its meetings' statements and forecasts, such as the survey of economic projections (SEP/dot-plot chart) to communication with the markets or send signals about the current stance of the monetary policy. In sum, studies suggest that the FOMC may be already trying to influence market participants' expectations such as through the meeting's statements, SEP and dot-plot chart; however, those tools lack an explicit commitment by the FOMC to maintain a particular FFR target in the medium to long-run. Therefore, we suggest declaring an explicit long-run FFR target would boost the effectiveness of the monetary policy as Seneca said, "*If one does not know to which port one is sailing, no wind is favorable*."

4. Concluding Remarks

In order to examine whether the U.S. monetary policy is aging, we quantifying the magnitude of monetary stimulus offered during a recession. That is, whether the FOMC needs to cut the FFR by 500 bps to combat a recession and how the monetary policy responses of the past four recessions compare in terms of magnitude. The proposed framework estimates that, in each recession since the mid-1980s, the FOMC offered larger incentives and for a longer duration in a recession relative to the previous recession. Furthermore, each recession drained the FOMC resources and left the Committee with less ammunition to fight the next recession. Therefore, our work suggests that

monetary policy is aging in the sense it offers larger incentives and those incentives remain in place for a longer duration to stimulate the economy in each of the past three business cycles.

To revive the effectiveness of, or de-age, monetary policy, our work proposes that the FOMC declare a commitment to an explicit long-run nominal policy rate target. Without a long-run FFR target, market participants are unable to gauge whether the current policy stance is accommodative or restrictive and by what magnitude. One supposed benchmark is the equilibrium interest rate, or r-star. However, there are at least half a dozen different measures of the r-star, which makes it very difficult to evaluate monetary policy accommodation. Additionally, beyond being a benchmark to evaluate the Fed's current policy stance, a long-run FFR target can also act as an expectations anchor. Establishing a credible target would lead market participants expect that the FFR would return to the target in the medium to long-run. While this may not directly address the impact of weaker recoveries and slower growth, it could help reinvigorate the Fed's toolkit in the face of these macroeconomic trends.

We propose 4% as a long-run target for the nominal FFR. Some of the major benefits of our proposed framework include: helping market participants gauge magnitude of accommodation; anchoring market participants' expectations; reduce time spent at the zero lower bound; lessen dependence on balance sheet expansion; ensure that the real FFR will be positive when the FOMC meets its interest rate and inflation targets.

Studies show that the FOMC may be already trying to influence market participants' expectations through the meeting's statements and SEP/dot-plot chart; however, those tools lack explicit commitment by the FOMC to maintain a certain level of the FFR in the long-run. Therefore, we suggest that declaring a long-run FFR target would show an explicit commitment by the FOMC to maintain the rate close to target in the medium to long-run. Put differently, a long-run target may change the current declining FFR trend and, thereby, boost the effectiveness of the monetary policy. As such, the FOMC (and other central banks) should entertain the idea of declaring an explicit long-run policy rate target.

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Table 1: The Fed Funds Rate during Recessions and Expansions

Recession	level change during recession	percentage change	number of Rate Cuts	Change from previous peak	% Change from previous Peak	Months of Easying**	Pre-recession Peak	Recession Trough	Post-recession Trough
July 1990 - Mar 1991	2.50%	30.30%	16	6.75%	69.20%	44	9.75%	6.00%	3.00%
Mar 2001 - Nov 2001	3.75%	68.20%	12	5.50%	84.60%	42	6.50%	2.00%	1.00%
Dec 2007 - Jun 2009	4.25%	94.44%	8	5.00%	95.20%	100	5.25%	0.25%	0.25%***
Feb 2020--*	1.50%	85.70%	2	2.25%	90.00%	N/A	2.50%	0.25%	0.25%***

*NBER did not announce a Trough for the 2020 recession, yet   ** Rate cuts plus rate on hold   *** The FOMC started QE