

19-18 Are Central Banks Out of Ammunition to Fight a Recession? Not Quite.

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Fears of recession have jumped in 2019.¹ With interest rates set by major central banks at or near historic lows, many observers worry that monetary policy has little scope to fight a recession, should one strike. Yet, central banks have shown creativity in recent years, setting policy interest rates below zero and using forward guidance and large-scale bond purchases to push down longer-term interest rates.

This Policy Brief reviews the monetary tools available and quantifies their remaining scope. Based on the tools used to date, central banks in the United States, the euro area, and Japan have limited ammunition to fight a recession in the near term. Of these three, the US Federal Reserve (Fed) has the greatest amount of tried and tested monetary ammunition, equivalent to about a 5 percentage point cut in the federal funds rate. Although this is sufficient to counter a

mild recession, the Fed does not have enough firepower to fight a severe recession.

The European Central Bank (ECB) and the Bank of Japan (BOJ) have little ability to ease policy with tools used to date, about the equivalent of a 1 percentage point cut in the policy rate. But they have the authority to engage in more exotic forms of monetary policy, such as large-scale purchases of equity and real estate, which the Fed cannot do. This Policy Brief does not calibrate the potential macroeconomic benefits of such policies, which are largely untested and face political resistance. But central banks should use all available tools as needed to achieve their mandates.

China's situation is not examined here because interest rates are less important in steering its economy than in advanced economies. Nevertheless, with both short- and long-term interest rates around 3 percent, China has far more monetary ammunition than any of the big three advanced economies.

Our conclusions do not allow for any monetary stimulus from trying to raise inflation expectations after a recession has started because such an attempt would not likely be credible. But raising long-run inflation expectations before a recession starts would increase monetary ammunition much more than the percentage increase in inflation, as previous studies assumed, because such an approach expands the scope for unconventional policy to push down longer-term yields.

MONETARY TOOLS WHEN INTEREST RATES ARE LOW

The conventional way central banks have fought recessions is by lowering their short-term policy interest rates, thereby reducing market interest rates of various maturities. Lower interest rates support economic activity by encouraging borrowing to build houses and factories and to buy cars and machinery. Lower interest rates also push up the prices of equity and real estate, making households feel wealthier and more willing to spend, and they push down the value of the domestic currency in foreign markets, making exports more attractive. This section explores monetary tools that may be available when policy rates reach zero.

1. As suggested by a spike in Google searches for "recession" at <https://trends.google.com/trends/?geo=US> (accessed on October 9, 2019).

Negative Interest Rates

As interest rates fall below zero, there is some point at which households, firms, and banks will choose to hold physical currency—which has a fixed interest rate of zero—rather than assets paying a negative rate. This lower bound was long held to be zero, but it appears that the safety and convenience of digital assets are sufficient to overcome a modest penalty in the form of a negative return. Policy interest rates as low as -0.75 percent (in Switzerland) have not caused a large-scale switch to physical currency. However, the reluctance of central banks to push rates further below zero suggests that it is not possible, or at least not helpful, to push rates much lower.

Research suggests that the stimulative effect of interest rate cuts below zero is less than that of cuts when rates are above zero (Brunnermeier and Koby 2019). A major reason is that banks have refused to cut interest rates on retail deposits below zero. This reduces the impact of rate cuts on households and small firms both directly and indirectly through reduced bank profitability, which hampers the pass-through of low rates to borrowers.

To minimize the harm to bank profits and credit creation, some central banks have set up tiers of accounts that shield a large share of bank reserves from the negative rates charged on reserves at the margin. For example, the marginal interest rate on bank reserves at the Swiss National Bank is -0.75 percent but the average rate is -0.35 percent.²

Sweden's Riksbank did not shield its banks from a one-week deposit rate of -0.5 percent starting in 2015, but the rate was raised to -0.25 percent in January of this year.³ The European Central Bank recently reduced its marginal deposit rate from -0.4 percent to -0.5 percent while simultaneously introducing a tiering system that increased the average rate banks receive from -0.4 percent to an estimated -0.2 percent.⁴ In these countries, money market rates followed

marginal policy rates down one-for-one and bank lending rates also fell substantially, suggesting that cuts this far below zero are nearly as powerful as conventional rate cuts (CGFS 2019).

Despite the novelty of negative nominal rates of interest, real rates of interest (the difference between nominal interest rates and inflation rates) have been negative at many times in the past. The economic effects of a real interest rate of, say, -3 percent, do not depend on whether the nominal interest rate is -1 or $+1$ percent. Nevertheless, many individuals express outrage at the possibility of earning a negative nominal interest rate. German politicians, in particular, are facing severe public pressure against the negative yields on German government bonds. This political backlash reinforces our view that deeply negative interest rates are not likely to materialize.

Altogether, then, the effective lower bound for marginal policy rates may be around -0.75 percent or at most -1 percent. Cuts down to -0.5 percent are found to be nearly as effective as conventional rate cuts. Cuts below -0.5 percent likely have a diminishing stimulative effect.

Forward Guidance

Central bank communications about future policy interest rates may have the power to change monetary conditions immediately by changing yields on medium- and long-term bonds. The scope for such policy depends critically on the clarity and credibility of central bank communications.

Clarity may be increased by communicating a specific path for the policy interest rate and a strong commitment to following that path. However, central banks have typically been reluctant to issue such unconditional commitments.

Credibility concerns arise both because market participants may doubt the resolve of individual policymakers and because those policymakers will be replaced sooner or later by new policymakers who may not feel obliged to honor their predecessors' commitments. Moreover, politicians may change the mandate of the central bank in a way that invalidates prior commitments.

Evidence suggests that forward guidance is more effective when policy is constrained near its lower bound than in normal times (Campbell et al. 2019). Near the lower bound, it appears that forward guidance has an important effect on expected future policy rates up to two years ahead. Forward guidance on more distant horizons is likely to work only to the extent that markets believe the projected policy rate is

2. Bech and Malkhozov (2016), updated by us using the 2018 Annual Report of the Swiss National Bank, www.snb.ch/en/mmr/reference/annrep_2018_komplett/source/annrep_2018_komplett.en.pdf (accessed on November 3, 2019).

3. Prior to January 2019, the Riksbank had a rate of -0.6 percent on a smaller amount of fine-tuning operations and a penalty rate of -1.25 percent on a trivial amount of overnight deposits (data from Swedish Riksbank).

4. An ECB press release on September 12, 2019, states that the first tier of deposits, receiving an interest rate of 0 percent, will be set initially at up to six times the level of a bank's minimum reserve requirement. If all banks have deposits in excess of six times required reserves, nearly €800 billion of deposits would earn interest of 0 percent and the remaining €550 billion would earn interest of -0.5 percent (ECB Minimum Reserve and Liquidity Statistics for July 30, 2019). Creditworthy banks that initially had less than six times the minimum level of reserves ought to be able to borrow

at the negative overnight interbank rate and bring their zero interest reserves up to this level. The press release is available at www.ecb.europa.eu/press/pr/date/2019/html/ecb.pr190912_2-a0b47cd62a.en.html (accessed on November 3, 2019).

consistent with expected future economic conditions and the central bank's mandated objectives.

Quantitative Easing

Quantitative easing (QE) consists of large-scale purchases of bonds and other unconventional assets aimed at raising their prices and reducing long-term interest rates. Numerous studies broadly agree that QE bond purchases reduce long-term bond yields (surveyed in Gagnon 2016, Bhattarai and Neely 2018).⁵ Most researchers attribute the bulk of these effects to reductions in the term premium embedded in bond yields, but some argue that QE also may reduce expected future short-term interest rates by giving central banks an incentive to keep future policy rates low in order to avoid losses on their bond portfolios (Christensen and Rudebusch 2016).⁶

There is no evidence of diminishing returns to QE, at least as long as bond yields remain above the perceived lower bound on short-term rates. But some of the estimates of the effects of the first QE programs announced during the depths of the Great Recession may have been boosted by a market-calming effect that is unique to periods of financial stress.

In Germany and Japan, large QE programs have succeeded in reducing bond yields below zero at maturities from 1 year to 10 years and more. Research shows that bond yields appear to be bounded from below by market views of the lower bound on short-term rates (Grisse, Krogstrup, and Schumacher 2017). Indeed, in every country with negative bond yields, the long-term yield did not fall below zero before the policy rate was set below zero. If market participants believe that the central bank will never reduce short-term rates below, say, -0.75 percent, then no amount of QE can push long-term bond yields below -0.75 percent because holding short-term bills will always dominate holding bonds with a yield below that level.

It is possible to conduct QE in assets other than safe government bonds. The Fed bought a large amount of agency mortgage-backed securities (MBS) that, although guaranteed by a government agency, included prepayment risk that is not in Treasury securities. Other central banks included corporate bonds and covered bonds (mortgage bonds guaranteed

by banks) in their QE purchases, but always in relatively small amounts. Purchasing these riskier bonds can reduce risk spreads and ease credit conditions. In the United States, the market for agency MBS is roughly half as large as that for Treasury securities, enabling MBS purchases to be a significant component of QE. In other countries, however, the market for private bonds is typically much smaller than that for government bonds, making this channel relatively less important. Moreover, yields on private bonds are subject to the effective lower bound described above.

Another channel for QE is through low-cost loans from the central bank to the commercial banks. Lending at rates below the central bank's deposit rate effectively constitutes a subsidy to private banks that probably should be treated as fiscal policy rather than monetary policy. So far, central banks have not been willing to set rates on their loans below the lowest rates on their deposits, and the uptake of low-cost loans has been significant but much smaller than the volume of QE bond purchases.⁷ Moreover, it appears that the main effect of these programs is to offset the margin suppression from negative rates and other factors that make some banks more reluctant to lend than usual, thereby restoring some of the normal effects of low risk-free yields on borrowing throughout the economy (Altavilla, Canova, and Ciccarelli 2016).

A way to avoid the effective lower bound is to conduct QE in equities and real estate, which have no fixed principal value and thus no upper price limit. QE raises the prices of these assets, thus reducing the cost of equity finance and increasing household wealth. The Hong Kong Monetary Authority employed such purchases to excellent effect in 1998 (Bayoumi and Gagnon 2018).

QE in risky assets raises concerns about the potential for future losses that would reduce seigniorage revenues to the government.⁸ This seems to raise a fiscal dimension to

5. A few skeptical studies have logical and/or data errors that render their conclusions invalid.

6. Bond yields are conventionally said to be the sum of two components: the average level of expected future short-term rates over the life of the bond and the term premium, which compensates for the risk of price fluctuations in long-term bonds. If investors value the certainty of the return they will receive from holding a bond to maturity and are less concerned about short-term price fluctuations, the term premium may be negative.

7. In the euro area, targeted longer-term refinancing operations at negative rates totaled €760 billion at end-March 2017 and restarted in November 2019. This is about one quarter of cumulative QE bond purchases. In Japan, central bank loans to stimulate bank lending totaled ¥41 trillion as of September 2019, compared with cumulative bond purchases of more than ¥470 trillion (*ECB Economic Bulletin*, Issue 3/2017, Box 5; *ECB Economic Bulletin*, Issue 2/2019, "Taking Stock of the Eurosystem's Asset Purchase Program after the End of Net Asset Purchases"; Bank of Japan, *Loan Disbursement under the Fund-Provisioning Measure to Stimulate Bank Lending*, September 12, 2019; and Bank of Japan, *Financial Statements for the 134th Fiscal Year/Fiscal 2018*).

8. Central banks can lose money holding long-term government bonds if they later decide to increase their policy rates above the yield on the bonds they hold. But QE purchases of these bonds provide an offsetting benefit by reducing the government's interest burden and shielding it from future increases in short-term rates. To the extent that QE boosts economic activity, it also increases tax revenues.

QE. However, even conventional monetary policy based on the short-term interest rate has substantial fiscal impacts because it changes the cost of government borrowing. Thus, one should not rule out risky asset purchases simply because they have a fiscal impact.

More important are issues related to central bank ownership of corporations and commercial real estate. Even if central banks allocate their purchases across all firms according to their market capitalization, large-scale equity purchases might give central banks a controlling share in private firms. How would the central bank use its voting power? Would there be a political backlash to perceived nationalization? Would the stimulative effect of such purchases operate mainly through increases in the net worth of the wealthiest households, exacerbating the pronounced rise in inequality in recent decades?

Foreign Exchange Intervention

Central bank purchases of foreign assets, or foreign exchange intervention, operate primarily by depreciating the domestic currency, thus boosting net exports. If done as a swap of short-term risk-free assets in different currencies, the only effect is on the exchange rate between those currencies. In that case it is a zero-sum policy that shifts aggregate demand away from the country with the appreciating currency toward the country with the depreciating currency. Because of this beggar-thy-neighbor aspect, foreign exchange intervention is not appropriate in the event of a global slowdown. Indeed, the G-20 countries have pledged to avoid it.⁹

If done as a swap of central bank money for longer-term or risky assets in another currency, it may not be a purely zero-sum policy.¹⁰ The country with the appreciating currency would experience lower bond yields (unless its yields were already below zero) or higher equity prices that would boost domestic demand to offset some of the lost foreign demand. Still, it would seem to be a policy to be undertaken only with the explicit agreement of the country whose assets are being purchased (Bergsten and Gagnon 2017).

We choose not to include foreign exchange intervention as part of the available ammunition of the world's major central banks.

Raising Inflation Expectations

Higher expectations of future inflation reduce real interest rates. There is no meaningful limit to how high inflation can rise and thus how far real interest rates can be reduced. However, it seems unlikely that a central bank can raise

expected inflation very much when an economy is stuck in a recession with inflation below target. Extraordinary action might help, such as new legislation mandating a higher inflation target.¹¹ But even that might not be credible if it seemed a long time before inflation could increase or market participants feared that politicians would reverse their decision later.

The best time to raise inflation expectations is when the economy is fully recovered and inflation is at or above the current target. The most straightforward way is to raise the central bank's inflation target and set policy to put upward pressure on prices (Ball et al. 2016; Blanchard 2018; Andrade et al. 2019). A coordinated shift to higher inflation targets in several advanced economies might increase credibility and reduce unwanted exchange rate fluctuations compared with isolated attempts to raise inflation (Posen 2019).

If the equilibrium real rate of interest has fallen significantly, as many believe it has, standard macroeconomic models predict that the economy will spend substantial amounts of time at the effective lower bound on interest rates and inflation may linger below target. On average, inflation will be below target and market participants will come to expect inflation below target. Promising to offset these inflation shortfalls with periods above target can raise inflation expectations back to target. Researchers have proposed various policy rules that make up for inflation undershoots (Bernanke, Kiley, and Roberts 2019).

Raising the inflation target creates more ammunition for monetary policy than strategies that manage only to reduce undershooting.¹² However, the higher long-run inflation rate implied by an increase in the inflation target imposes greater economic costs as well (Bernanke 2017).¹³

Higher inflation expectations raise the scope for conventional monetary policy in the vicinity of the zero bound

11. The case of Japan is instructive. The newly appointed governor of the Bank of Japan, Haruhiko Kuroda, launched an aggressive QE campaign in April 2013, endorsed by the new Abe government, to achieve sustained inflation of 2 percent. Inflation expectations and core inflation both rose dramatically, but they leveled out well below 2 percent by late 2015. When the BOJ failed to take significant further steps in early 2016 (such as deeply negative interest rates or a major increase in purchases of equity and real estate), both inflation and inflation expectations collapsed (Ball et al. 2016, box 3.3).

12. In theory, rules based on returning to a fixed path of the price level can be powerful, but they require assumptions about the formation of expectations of future inflation that may not be valid. Rules based on the average inflation rate over several years are less powerful (Reifschneider and Wilcox 2019).

13. L'Huillier and Schoenle (2019) argue that higher inflation targets cause prices to become less sticky, tilting the effects of monetary policy toward inflation and away from output. The evidence they present suggests that this effect is significant mainly for targets above 4 percent.

9. See, for example, www.g20.utoronto.ca/2018/2018-03-30-g20_finance_communique-en.pdf.

10. The Swiss National Bank's large-scale purchases of foreign assets include corporate bonds and equity (see 2018 Annual Report of the Swiss National Bank).

by an amount equal to the increase in inflation. Thus, a 1 percentage point increase in long-run expected inflation gives the central bank 1 percentage point of additional room to cut the policy rate in a recession.

Higher expected inflation also creates more room for QE to operate before long-term bond yields reach their lower bound, creating another important benefit of higher inflation expectations that has received little attention. For example, a 1 percentage point increase in long-run expected inflation should raise bond yields by an equal amount. As discussed below, policy rate cuts to fight recessions typically reduce the bond yield by around 40 percent of the reduction in the policy rate. After the central bank has cut its policy rate to the lower bound, the higher starting point leaves the bond yield 0.6 percentage point higher than otherwise, creating additional room to use forward guidance and QE to push it down. As discussed below, a 0.6 percentage point reduction in the 10-year yield provides roughly as much stimulus as a 1.4 percentage point cut in the short-term policy rate.

Taking account of the scope to reduce interest rates across the yield curve, a 1 percentage point rise in long-run expected inflation increases a central bank's ammunition by an amount equivalent to a 2.4 percentage point cut in the short-term policy rate.

The case for raising the inflation target either directly or indirectly through inflation averaging is strong. However, given the dubious credibility of attempting such a policy change in the midst of a recession, we do not include potential stimulus from raising expected inflation in our assessment of central bank ammunition.

Outright Transfers, or Helicopter Money

In Milton Friedman's (1969) classic thought experiment, a central bank drops dollar bills from a helicopter to be scooped up by passing citizens. If done in sufficiently large amounts, such a policy would surely result in greater spending, higher economic activity, and ultimately more inflation. In practice, helicopter money likely would take the form of checks mailed to individuals or funds deposited in household bank accounts.

No central bank has ever tried such a policy. In the United States, the Federal Reserve is not authorized to make direct transfers. The Bank of Japan has the ability to make transfers as needed to achieve its mandate of "price stability," but only with the prior approval of the prime minister, which introduces some political control over an otherwise independent central bank.¹⁴

14. Article 2 of the Bank of Japan Act states that the BOJ's primary objective is "achieving price stability." Article 43 states that the BOJ "may not conduct any business other than that specified by this Act as the business of the Bank;

The European Central Bank has few restrictions on actions it may take to achieve its mandate of price stability. According to Article 20 of the Statute of the European System of Central Banks and of the European Central Bank, "[t]he Governing Council may, by a majority of two thirds of the votes cast, decide upon the use of such other operational methods of monetary control as it sees fit, respecting Article 2" (which states that the ECB's "primary objective" is to "maintain price stability").¹⁵ The ECB has defined price stability as maintaining a rate of inflation "below, but close to, 2 percent over the medium term."¹⁶ If inflation threatens to fall significantly below 2 percent over the medium term and the ECB has reached the limit of useful reductions in interest rates, it would seem to be authorized to make outright transfers (Pisani-Ferry 2019). The ECB is explicitly barred from giving money to member governments, but there is no such prohibition on transfers to individuals.

Regardless of legal authority, helicopter money is a specific example of coordinated monetary and fiscal policy. The conventional definition of monetary policy is printing money to buy assets, whereas fiscal policy is selling assets (bonds) to spend money, cut taxes, or make transfers. Helicopter money is printing money to make transfers, a dollar-for-dollar combination of monetary and fiscal policy. Other possibilities include expansionary spending programs or tax cuts with an explicit promise by the central bank to buy all bonds needed to finance the expansion.

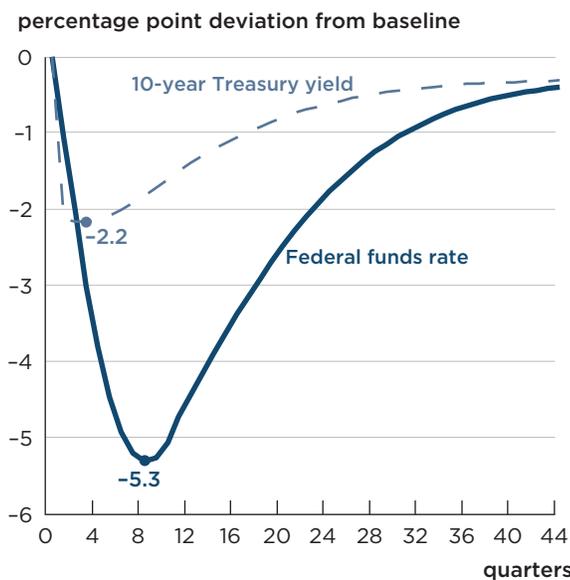
We support the use of fiscal policy to fight recessions when interest rates have reached their lower bound, including monetary-fiscal policies such as helicopter money. Indeed, when central banks have the power to issue helicopter money, failure to do so as required to achieve their mandates would violate their charters. Our calculation of how much scope exists for monetary policy excludes policies that require fiscal spending or transfers, but where such transfers are available, the scope for stimulative policy appears unlimited.

provided, however, that this shall not apply to the case where such business is necessary to achieve the Bank's purpose specified by this Act and the Bank has obtained authorization from the Minister of Finance and the Prime Minister." The BOJ's authority to purchase equities is also subject to this political approval. See www.japaneselawtranslation.go.jp/law/detail_main?re=01&vm=02&id=92 (accessed on October 22, 2019).

15. See www.ecb.europa.eu/ecb/legal/pdf/oj_c_2016_202_full_en_pro4.pdf (accessed on October 10, 2019).

16. See www.ecb.europa.eu/mopo/strategy/html/index_en.html (accessed on October 10, 2019). The ECB is also allowed to promote the "general economic policies" of the European Union as long as its actions are "without prejudice" to price stability.

Figure 1
Interest rate responses to a mild recessionary shock in the FRB/US model



Note: Figures are deviations from baseline paths in response to a recessionary shock comparable to the average of the 1990 and 2001 recessions using the simulation labeled “recession (unconstrained policy)” in figure 1 of Reifschneider and Wilcox (2019). Expectations in financial markets are model-consistent (perfect foresight) but elsewhere are based on the predictions of a vector autoregression model. Monetary policy responds to changes in economic conditions from baseline as prescribed by the balanced-approach rule without imposing any effective lower bound.

SCOPE FOR MONETARY POLICY TODAY

Definition of Scope

The scope for a central bank to fight a recession is defined as the distance between its current policy rate and the assumed lower bound of -0.5 percent plus the effect of using forward guidance and QE to push longer-term rates to their assumed lower bound expressed in terms of movements in the policy rate that would have a similar effect on output and inflation.

Our estimate of monetary scope does not attempt to quantify the potential use of policies that have yet to be tried to a significant extent and that may be politically controversial or outside the legal authority of some central banks. These include large-scale purchases of equity or real estate or foreign exchange, an increase in the inflation target either temporarily or permanently, and outright transfers to households (helicopter money).¹⁷

17. The decision to exclude these largely untested policy tools reflects our uncertainty about how to calibrate their effects and whether such tools are legally or politically feasible, not a judgement that such tools should not be used.

The responses of the US Federal Reserve to the mild to moderate recessions of 1990 and 2001 set the benchmark for our analysis. During and immediately after these recessions, the Fed cut its policy rate 5.25 and 5.50 percentage points, respectively.¹⁸ These responses are consistent with predictions of the Fed’s FRB/US model of the US economy, assuming the Fed follows the “balanced approach” policy rule that appears to have characterized Fed behavior from the early 1990s to 2008 (Reifschneider and Wilcox 2019).¹⁹

Figure 1 displays the behavior of the federal funds rate and the 10-year yield in the FRB/US model after a recessionary shock roughly equal to the average of the 1990 and 2001 recessions.²⁰ Relative to their levels in the absence of a shock, the federal funds rate declines 5.3 percentage points and the 10-year yield declines 2.2 percentage points. The 10-year yield declines faster than the funds rate because agents are assumed to immediately incorporate the future declines in the funds rate into the bond yield, whereas the funds rate declines more gradually as the recession deepens.

Because forward guidance and QE operate on longer-term bond yields, we would like to know how much of a reduction in the yield on a 10-year Treasury note would be needed to have a similar recession-fighting impact as the 5.3 percentage point cut in the policy rate implied by the balanced-approach rule, while holding constant the short-term interest rate.

In the FRB/US model, essentially all the effects of monetary policy operate through longer-term interest rates. Thus, any monetary policy action that reduces the 10-year yield 2.2 percentage points would have roughly the same effect on the economy as the cut in the funds rate shown in figure 1, whether short-term rates move or not. It follows that each 1 percentage point cut in the bond yield is equivalent to a 2.4 percentage point cut in the funds rate (because a 2.2 percentage point yield reduction is equivalent to a 5.3 percentage point funds rate cut).

18. The first recession started in July 1990 and ended in March 1991. The policy rate peaked in June 1990 and bottomed out in November 1992. The second recession started in March 2001 and ended in November 2001. The policy rate peaked before the recession started, in December 2000, and stopped declining in January 2002. However, from November 2002 through June 2003, it stepped down another 0.75 percentage point, which is included in our 5.50 percentage point estimate. Data are from Haver Analytics.

19. Arguably, even stronger responses to recessions might be optimal, but these would imply much larger and faster movements in policy interest rates than have been seen in the United States or elsewhere (Reifschneider 2016).

20. We thank David Reifschneider for helping us to understand the properties of FRB/US and sharing the simulation output described here.

The property of FRB/US that short-term interest rates have no effect on economic activity except through their impact on bond yields seems a bit extreme. At least some borrowers face payments linked to short-term rates, even if longer-term rates are more important. Thus, FRB/US may overestimate the macroeconomic effects of a decline in bond yields from forward guidance and QE that is not associated with a decline in short rates (Kiley 2014).

On the other hand, the FRB/US simulation implies a larger effect of the funds rate on the bond yield than actually occurred in either 1990 or 2001.²¹ This reflects the fact that the model was run assuming agents had perfect foresight of the future funds rate and that the term premium was fixed. If expectations are assumed to be backward-looking or the term premium is allowed to respond endogenously, the bond yield would decline by less. In that case, each percentage point cut in the bond yield would be equivalent to more than a 2.4 percentage point cut in the funds rate, and our estimate would be biased downward.

These upward and downward biases offset each other, and we are not sure which is more important. We stick with the rule of thumb that a 1 percentage point decline in the bond yield is equivalent to a 2.4 percentage point cut in the funds rate, while noting that there is uncertainty in both directions.

Failure to respond aggressively to a recessionary shock causes the economy to suffer high unemployment longer than otherwise, putting additional downward pressure on inflation and raising real interest rates. This gives rise to an important paradox: By preventing a central bank from responding fully to a large recessionary shock, the effective lower bound on interest rates reduces the potency of feasible policy rate cuts and QE. In other words, any given space for cutting short- and long-term interest rates will be less powerful the longer the economy is expected to linger at the effective lower bound on interest rates.

United States

The federal funds rate is currently near 1.6 percent.²² We assume that in the event of a recession, the Fed would cut the funds rate quickly to -0.5 percent. We do not assume policy rates below -0.5 percent because of concerns that deeper negative cuts would be less stimulative than cuts above

zero and we wish to be conservative. Thus, the Fed has 2.1 percentage points of room to cut short-term interest rates.

In addition, the Fed cut the funds rate 0.8 percentage point between early June and early November 2019 to a level 0.9 percentage point below the median projection of the “longer-run” funds rate by participants at the Fed’s September 2019 meeting.²³ To the extent that these recent cuts are aimed at fighting the risk of a recession, the Fed could be viewed as having 3 percentage points of room.

Market participants appear to doubt that the Fed would use negative rates, partly reflecting commentary by Fed officials.²⁴ However, if and when it becomes apparent that the Fed is running out of ammunition to fight an ongoing recession, the Fed is likely to reconsider its reluctance to use negative rates.

Based on the discussion in the previous subsection, a 2.1 percentage point cut in the policy rate at the beginning of a recession might be expected to reduce the 10-year bond yield 0.9 percentage point. However, at least part of the sharp decline in the 10-year yield in mid-2019 already reflects fears of a possible recession.²⁵ Thus, we assume that the 10-year yield would decline from its recent level of 1.7 percent to around 1 percent. We believe that a yield above 1 percent is more likely than a yield below 1, but we wish to be conservative in our assessment of the scope for policy ammunition.²⁶

23. See the projection materials available at www.federalreserve.gov/monetarypolicy.htm.

24. See the survey results in Enda Curran and Catarina Saraiva, “Central Banks Are Fast Running Out of Room for Further Rate Cuts,” Bloomberg, October 8, 2019, www.bloomberg.com/news/articles/2019-10-08/how-low-can-central-banks-go-poll-suggests-below-current-rates (accessed on November 3, 2019). In the press conference following the September 2019 Federal Open Market Committee meeting, Chair Jerome Powell was asked whether the Fed would consider using negative interest rates. He replied, “I just don’t think those will be at the top of our list.... I think we would look at using large-scale asset purchases and forward guidance.”

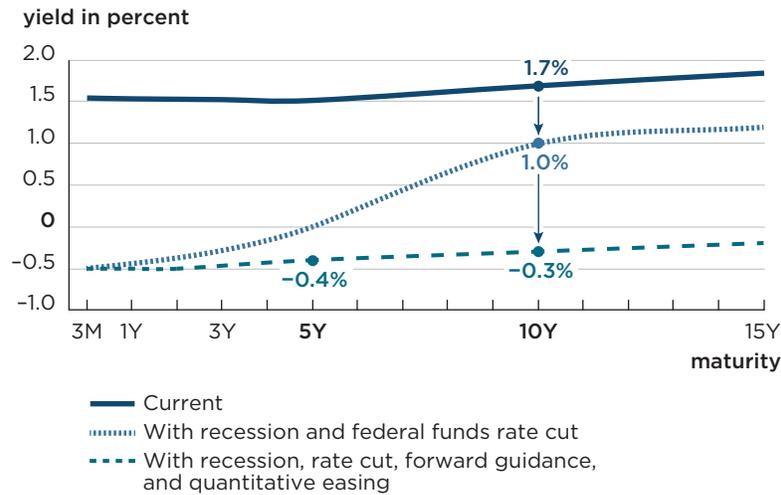
25. The main factors behind changing bond yields are changes in the expected long-run level of interest rates and in the medium-run economic outlook. Between October 2018 and October 2019, the 10-year yield fell 1.5 percentage points and the *Blue Chip Economic Indicators* survey of far-future 3-month T-bill rates fell 0.6 percentage point. Thus, growing fears of recession may explain up to 0.9 percentage point of the decline in the 10-year yield, of which about 0.3 percentage point may be associated with the policy rate cuts of June through October 2019.

26. To the extent that market participants anticipate the use of forward guidance and QE in the next recession, they are likely to push the 10-year yield even lower than this, but that lower yield is dependent on the Fed following through on the expected policies. The correct starting point for the calculation of Fed ammunition is where the yield would be in the absence of expected unconventional policy action.

21. Measured over the same months as the declines in the federal funds rate, the bond yield fell 1.6 percentage points in the 1990 recession and 1.9 percentage points in the 2001 recession. Other dating conventions yield both smaller and larger estimates.

22. Here and below, interest rate data refer to October 31, 2019, from Haver Analytics unless otherwise noted.

Figure 2
Government bond yields in the United States



Source: Data are as of October 31, 2019, from Haver Analytics. Recession scenarios are authors' illustrations.

The Fed would then need to engage in forward guidance and QE to reduce bond yields even further. If market participants expect that the Fed would never reduce the funds rate below -0.5 percent, then -0.5 percent would likely become an effective lower bound for bond yields at all maturities. Current yield curves in Europe support our view that negative bond yields would be possible in the United States. Given the one-way risk associated with holding a 10-year bond at the lowest possible level of short-term rates, we assume that 10-year yields would not fall below -0.3 percent, with 5-year yields perhaps as low as -0.4 percent.²⁷ Thus, we conclude that forward guidance and QE could reduce the 10-year yield a maximum of 1.3 percentage points, from 1 percent to -0.3 percent. The resulting yield curve is displayed in figure 2, along with the current yield curve and the yield curve that might be expected after short rates hit their lower bound but before adopting forward guidance and QE.

Based on the discussion in the previous subsection, using forward guidance and QE to reduce the 10-year yield 1.3 percentage points would have a stimulative effect on growth and employment comparable to that of a 3.1 percentage point cut in the short-term interest rate. The results of a recent study by economists at the Federal Reserve Board indicate that reducing the 10-year bond yield 1.3 percentage points would require total bond purchases of roughly \$6 trillion,

compared with \$3.5 trillion during 2009–14 (Chung et al. 2019).²⁸ Although some may view such a large expansion of QE as politically controversial, the alternative of prolonged high unemployment and disinflation is likely to be even more politically unpalatable. We note that the Bank of Japan has already expanded its balance sheet by a greater amount in proportion to GDP.

Altogether, the Fed has policy ammunition equivalent to a 5.2 percentage point cut in the short-term policy rate, or 6 percentage points taking into consideration cuts already effected in June through October 2019. Cuts of 5.2 to 5.5 percentage points are what the Fed used to fight the mild to moderate recessions of 1990 and 2001. Larger cuts would be appropriate in more severe recessions. For example, a cut of 10 percentage points would have been called for, if possible, in the Great Recession of 2008–09 (Chung et al. 2019).²⁹ Thus, the Fed has enough ammunition for a mild recession but not as much as would be desirable for a severe recession.

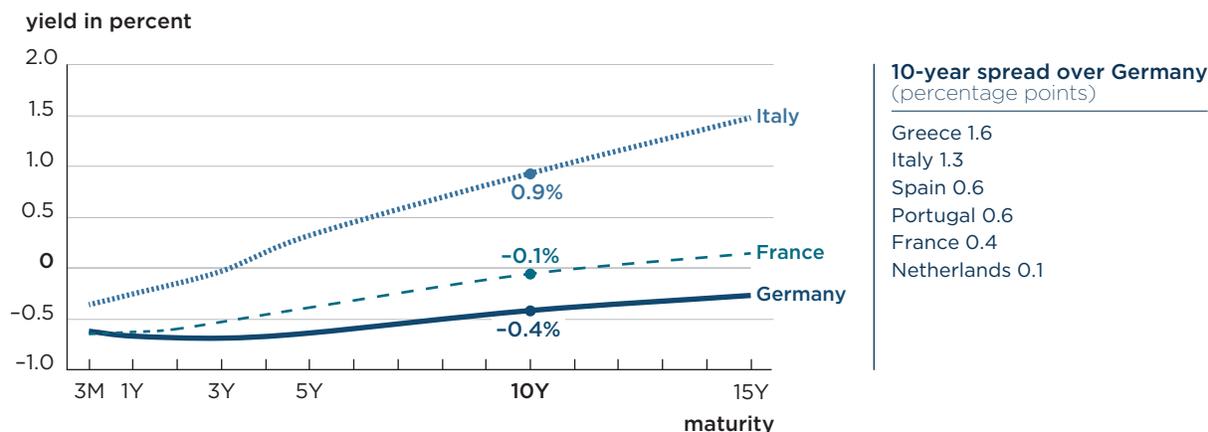
It bears noting that the above calculation of Fed policy ammunition depends importantly on the assumption that the Fed would cut rates below zero and push bond yields below zero. We believe that, faced with an unsatisfactory economic outlook, the Fed would choose to do whatever it

27. When bond yields rise, bond prices fall, inflicting losses on bondholders. Conversely, bondholders reap gains when bond yields fall. When the bond yield is at its lower bound, there is no possibility of any future gain; at that point the best outcome is no change and the only possible changes create a loss in value.

28. This conclusion is based on the simulation of QE purchases without any commitment to overshooting the inflation target at a later date. In that simulation, \$4 trillion in bond purchases pushed the 10-year yield down 0.9 percentage point.

29. This result is based on a policy rule that responds faster to recessions but reaches about the same overall level of cuts as the balanced-approach rule.

Figure 3
Government bond yields in the euro area



Source: Data are as of October 31, 2019, from Haver Analytics.

could usefully do. However, if the Fed were to choose not to cut rates below zero, it would have only 1.6 percentage points of room to cut short rates, and the stimulus from forward guidance and QE would be reduced to the equivalent of 2.4 percentage points, for total ammunition worth 4 percentage points.

Euro Area

The European Central Bank charges -0.5 percent on marginal deposits of banks and the euro overnight interbank average (EONIA) rate is -0.5 percent. In a recent survey, market economists said the lower bound on ECB rate cuts is likely to be around -0.75 percent.³⁰ But the additional stimulus from a cut to that level would be small.

The ECB is also using forward guidance and quantitative easing to a substantial extent. In September 2019, it committed to keeping its policy rates low “until it has seen the inflation outlook robustly converge to a level sufficiently close to, but below, 2 percent within its projection horizon, and such convergence has been consistently reflected in underlying inflation dynamics.”³¹ It also resumed asset purchases in November for “as long as necessary,” ending only shortly before it is ready to begin raising its policy rates, and reinvesting all principal payments for an extended period thereafter.

German government bonds have negative yields across the maturity spectrum, including -0.4 percent on 10-year

bonds (see figure 3). The most highly rated corporate bonds in Europe have yields near zero.³² There is only a modest scope for further monetary ease in safe assets. This leaves few avenues for additional monetary easing, and they each face steep challenges.³³

The ECB could push down yields on peripheral government bonds, notably those of Italy. Italian 10-year yields are 1.3 percentage points higher than those of Germany. Other countries also have yields that could be pushed down toward Germany’s. We assume that the stimulative effect on the euro area economy of reducing a member country’s bond yield is proportional to that member’s share of euro area GDP. Reducing all members’ bond yields to the level of Germany would lower the weighted average bond yield in the euro area by 0.4 percentage point.³⁴ Applying the previous results for the United States to the euro area, a 0.4 percentage point reduction in the average 10-year bond yield would provide roughly as much stimulus as a 1 percentage point cut in the policy rate.

It is not clear whether even this modest degree of policy ease is feasible. The ECB currently chooses to purchase government bonds roughly in proportion to its capital key.³⁵

30. Curran and Saraiva, op. cit.

31. See September 12, 2019 monetary policy decision at www.ecb.europa.eu/press/pr/date/2019/html/ecb.mp190912-08de50b4d2.en.html (accessed on November 3, 2019).

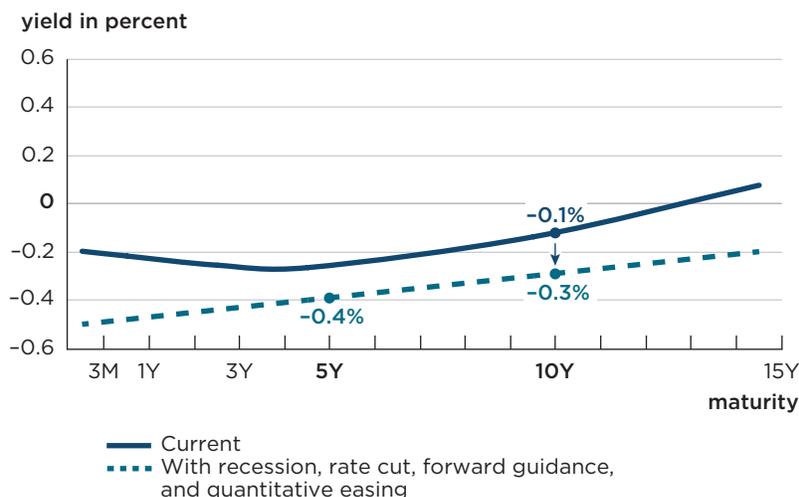
32. The S&P Eurozone AAA Corporate Bond Index had a yield to maturity of 0.13 percent as of October 30, 2019.

33. The market for low-rated corporate bonds in Europe is too small to be a significant policy channel.

34. This calculation is based on October 31 yields from Bloomberg and 2018 GDP from the April 2019 *World Economic Outlook* database from the International Monetary Fund.

35. The capital key reflects each government’s contribution to the ECB’s capital account and is based on population and GDP.

Figure 4
Government bond yields in Japan



Source: Data are as of October 31, 2019, from Haver Analytics. Recession scenario is authors' illustration.

If it continues with this practice, the ECB cannot limit its purchases to bonds with the highest yields. Germany has the largest share of the capital key, so its bonds would need to be purchased in the greatest amounts despite having the lowest yields. But there is little German government debt that is not already held by various government agencies, both inside and outside Europe, or by banks to meet regulatory requirements.³⁶ Purchasing enough Italian bonds to eliminate the yield spread might require purchasing so many German bonds that it would cause harm to investors who are required to hold German bonds for contractual or regulatory purposes. These investors could face deeply negative yields or be forced to violate their contractual or regulatory obligations.

The ECB also limits its purchases to 33 percent of any individual bond and 25 percent of any bond with a collective action clause to avoid having a potential veto on collective actions by bondholders. Since Germany's share in the capital key is larger than its share of outstanding debt and the ECB already owns a large amount of German debt from past QE, the ECB would need to relax these limits if it continues to allocate purchases in proportion to the capital key.

The ECB Governing Council could choose not to follow the capital key or relax its self-imposed per-issue restrictions, but doing so might give rise to legal and political challenges. The European Court of Justice cited these features of ECB

policy in its rulings upholding the legality of Outright Monetary Transfers and the Asset Purchase Program (QE).³⁷

Beyond the legal and market considerations, there would be vehement political opposition from those who would argue that it is an unfair violation of the spirit of the Maastricht Treaty for the ECB to equalize borrowing costs between profligate Italy and frugal Germany.

The other options are for the ECB to buy corporate equity or to make direct transfers to households. There is no upper bound on equity prices and thus no apparent limit to how much stimulus could be applied in that manner. Similarly, outright transfers would doubtless boost spending. As discussed above, these novel approaches would be controversial and daunting. Nevertheless, the ECB should use all tools at its disposal as needed to achieve its principal mandate of price stability.

Japan

The Bank of Japan has a three-tiered reserve deposit system, in which the first tier receives a positive interest rate of 0.1 percent, the middle tier 0 percent, and the third or marginal tier -0.1 percent. The overnight interbank (call) rate is 0.0 percent. Japanese government bonds have negative yields across the maturity spectrum, including -0.1 percent on 10-year bonds (see figure 4). Beginning in 2013, the BOJ purchased large amounts of long-term government bonds (QE). Since 2016, it has followed a policy of "yield curve

36. As reported by the *Financial Times*, www.ft.com/content/da406fe8-ca8b-11e9-af4-3669401ba76f.

37. The press releases of the court decisions can be found at <https://curia.europa.eu/jcms/upload/docs/application/pdf/2015-01/cp150002en.pdf> and <https://curia.europa.eu/jcms/upload/docs/application/pdf/2018-12/cp180192en.pdf>.

control” in which its bond purchases are targeted at keeping the 10-year government bond yield near 0 percent.³⁸

Based on the experiences of some European countries, the BOJ could lower its policy rate to –0.5 percent, a reduction of 0.4 percentage point. Such a move would allow QE to push bond yields about 0.2 percentage point lower as well, to –0.4 percent for the 5-year yield and –0.3 percent for the 10-year yield. But the cumulative monetary stimulus from such moves would be worth less than 1 percentage point in equivalent cuts to the policy rate.

Subject to approval by the prime minister, the BOJ has the same options as the ECB to buy corporate equity or to make direct transfers to households. The BOJ is purchasing equities to a minor extent, about 1 percent of GDP each year. It currently holds 5 percent of total Japanese equities outstanding, worth the equivalent of 5 percent of GDP.³⁹ Much larger purchases would be needed to have a significant stimulative effect. As discussed above, buying equity or making direct transfers raises serious economic and political concerns, but such concerns do not obviously outweigh the costs of inaction and failure to achieve the BOJ’s inflation goals.

CONCLUSION

Central banks in the three largest advanced economies have only limited ammunition to fight a recession, should one start in the near term, based on the types of actions that have already been taken to a significant extent. These actions

include setting short-term policy rates below zero and using forward guidance and QE to push down longer-term yields on risk-free bonds.

The Federal Reserve has the most ammunition of this group. If a recession were to hit the US economy now, the Fed would be able to deliver monetary stimulus equivalent to a cut in the short-term policy interest rate of about 5 percentage points. This is sufficient to fight a mild recession but not a severe one.

The ECB has no easily usable ammunition left. It has set the policy rate about as low as is likely to be helpful. It has also pushed yields on the safest long-term bonds about as low as practical. If it could get over legal and political objections, it could reduce yields on peripheral government bonds to German levels, but this would be worth the equivalent of only about a 1 percentage point cut in the policy rate.

The BOJ has room to push rates a bit more negative, but this space is worth less than 1 percentage point in equivalent cuts in the policy rate.

Both the ECB and the BOJ have the options of large-scale purchases of corporate equity or direct transfers to households. The Fed does not have either of these options. The economic and political side effects of massive equity purchases are daunting. More aggressive fiscal policy, including central bank transfers where possible, is likely to be a more useful approach to fighting the next recession.

An important implication of our analysis is that raising expected inflation before a recession hits has a much larger benefit than has been widely recognized. A higher long-run inflation rate gives central banks more room to not only cut their policy rates but also use forward guidance and QE to reduce longer-term rates. Each 1 percentage point increase in long-run inflation raises a central bank’s monetary ammunition by the equivalent of 2 to 2.5 percentage points of room to cut the policy rate.

38. See, for example, the BOJ Statement on Monetary Policy of September 19, 2019, at www.boj.or.jp/en/announcements/release_2019/k190919a.pdf.

39. The BOJ holds a trivial amount of real estate investment trusts, 0.1 percent of GDP, and a small amount of corporate bonds, 0.5 percent of GDP. Data are from Bank of Japan, Haver Analytics, and authors’ calculations.

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