

Commentary: Funding Quantitative Easing to Target Inflation

by Laura Veldkamp

There are three channels through which quantitative easing affects the economy: It changes the size of the bank's liabilities; it changes the bank's mix of assets, and it changes market participants' expectations of future monetary policy actions. Previous studies have mainly explored the importance of the mix of assets on the Federal Reserve balance sheet.¹ The assets the Federal Reserve acquired through quantitative easing were mostly agency debt, mortgage-backed securities and long-term treasury bonds. By buying these assets, quantitative easing propped up their price, reduced yields and in some cases, unfroze markets where trading had largely ground to a halt. In return for these assets, the Federal Reserve paid for them by issuing liabilities. These liabilities are central bank reserves, which are essentially overnight government debt, issued by the Federal Reserve. While many papers have explored the effects on mortgage-backed security and long-term treasury markets, Ricardo Reis' paper focuses instead on the liabilities, or funding, side. He explores the consequences of the explosion of reserve issuance required to fund all these asset purchases. Specifically, how does the abundance of reserves matter for monetary policy?

The context for this discussion is that the market for reserves was dramatically altered by policies adopted after the 2007-08 financial crisis. Prior to the failure of Lehman Brothers in September 2008, the total amount of central bank aggregate reserves in the U.S. was about \$10 billion. More importantly, excess reserves, those held by banks above and beyond what are required by bank reserve requirements, were less than \$2 billion. By the end of 2015, excess reserves had ballooned to \$2.3 trillion (see Figure 1). In other words, the market for central bank reserves experienced a 1000-fold increase.

Reis describes a model of how monetary policy works when central bank reserves are abundant. He uses that model to argue that going forward, it is not the quantity of reserves that will govern inflation but instead the interest rate paid on those reserves that matters. I will first reinterpret his theory and discuss its strengths and weaknesses. A central premise of Reis' analysis is the assumption that the central bank is issuing and member banks are holding large quantities of riskless assets, in excess of what reserve requirements mandate. He presents abundant evidence to back this up. But this premise itself raises a key question: Why are banks holding all this liquidity? It is not just banks. Non-financial firms and even households are all holding record amounts of cash and liquid assets at record low returns. Exploring the reasons for continued liquidity hoarding and the resulting low riskless rates leads us to consider the role of expectations. This note explores the third role of quantitative easing, its role in shaping market participants' expectations. Understanding the role of expectations leads to a re-examination of Reis' main question: What are the set of tools the Federal Reserve can use to conduct effective monetary policy, in the wake of quantitative easing?

Reserves are the New Money

Many macro textbooks teach money and banking to students by describing how the Federal Reserve's open market operations changed the supply of money and moved the interest rate. Central bank reserves were not part of the story. Today, management of central bank reserves are a central part of the debate about monetary policy and monetary transmission.

¹ Seminal work in this area is Gertler and Karadi (2011) and Gertler and Karadi (2013).

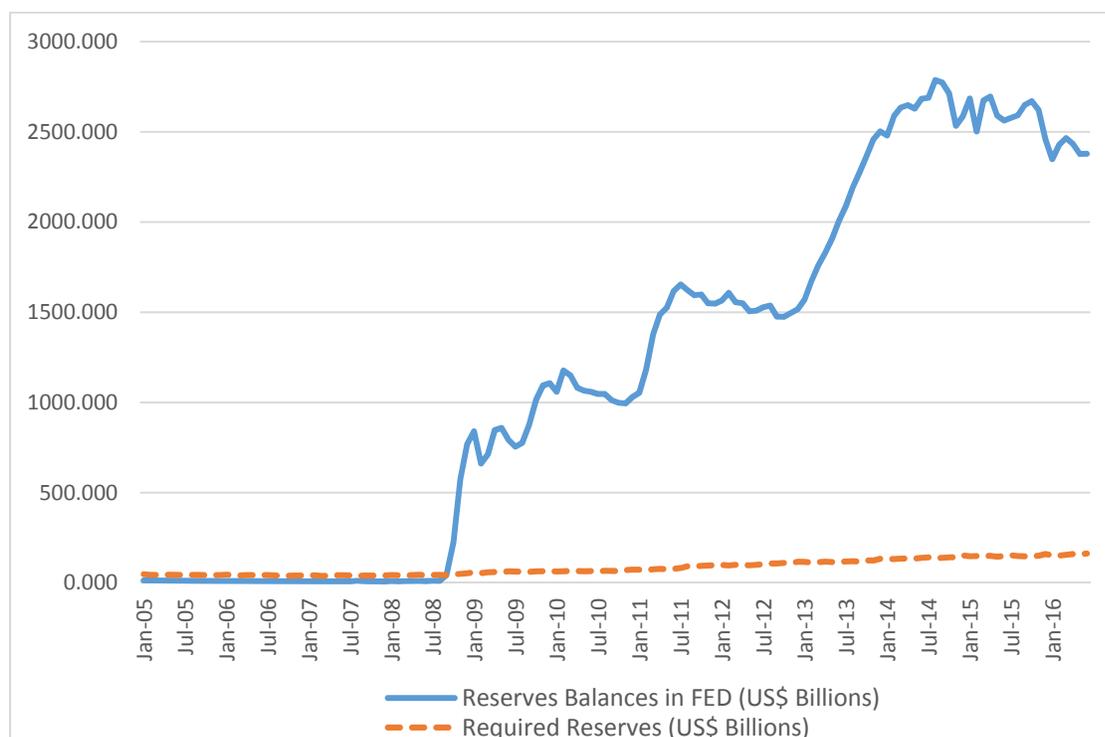


Figure 1: Reserves Balances in FED (US\$ Billions) and Required Reserves (US\$ Billions). 2005:2016. Source: FRED, Federal Reserve Bank of St. Louis.

They key to understanding reserves is to look at what happens in the federal funds market. This is where banks lend reserves to each other. Banks that have excess reserves lend to banks that need additional reserves to meet their reserve requirement. Before 2008, the Federal Reserve did not pay interest on reserves. Thus, banks were eager to lend out their extra reserves to other banks, who paid a rate of return to their lender known as the federal funds rate. After the bank got authorization to start paying interest on reserves, banks would be eager to lend reserves to other banks as long as the return, the federal funds rate, was greater than what the central bank paid them to hold the reserves themselves. In other words, the interest rate on reserves set a floor under the rate at which commercial banks will lend to anyone, including other banks.² Many important interest rates for retail borrowers are linked to these inter-bank lending rates. Because the interest rates indexed to inter-bank rates are an important mechanism for monetary policy transmission, it is important to understand what influences them.

Reis' theory is primarily about how the quantity of reserves affects the federal funds rate. He argues that the first round of quantitative easing fundamentally changed that relationship. Before 2008, the federal funds rate was consistently above the reserve rate, which was zero. Banks would pay a premium to borrow reserves from other banks that had excess because reserves were in short supply. If the

² In practice, this is not a floor under the Federal Funds rate. The Effective Federal Funds Rate is typically below the Interest on Excess Reserves paid by the Fed. The reason for this is that not all the institutions are eligible to earn interest on reserves held at the Federal Reserves. Non-eligible institutions, as government-sponsored enterprises (GSEs), are the principal lenders of federal funds, and they lend at a rate below the interest on reserves.

central bank issued more reserves, reserves would be in less short supply and the premium to borrow reserves, the federal funds rate, would fall. Conversely, shrinking the supply of reserves would increase the federal funds rate. Thus, changes in the quantity of reserves affected interest rates that retail borrowers faced and thus affect prices and real economic activity.

After the first round of quantitative easing in late-2008, the reserve rate fell and the interest rate on reserves was no longer required to be zero. The gap between the federal funds rate and the reserve rate shrunk. After 2008, Reis argues that the federal funds rate was hitting its lower bound.

Figure 2 illustrates how changes in the quantity of reserves, represented as horizontal shifts of the supply line, changed the federal funds rate in 2008. But once the federal funds rate hit its floor, the quantity of reserves no longer mattered for the federal funds rate. This situation represented by the 2015 supply curve is what Reis refers to as a market “saturated” with reserves.

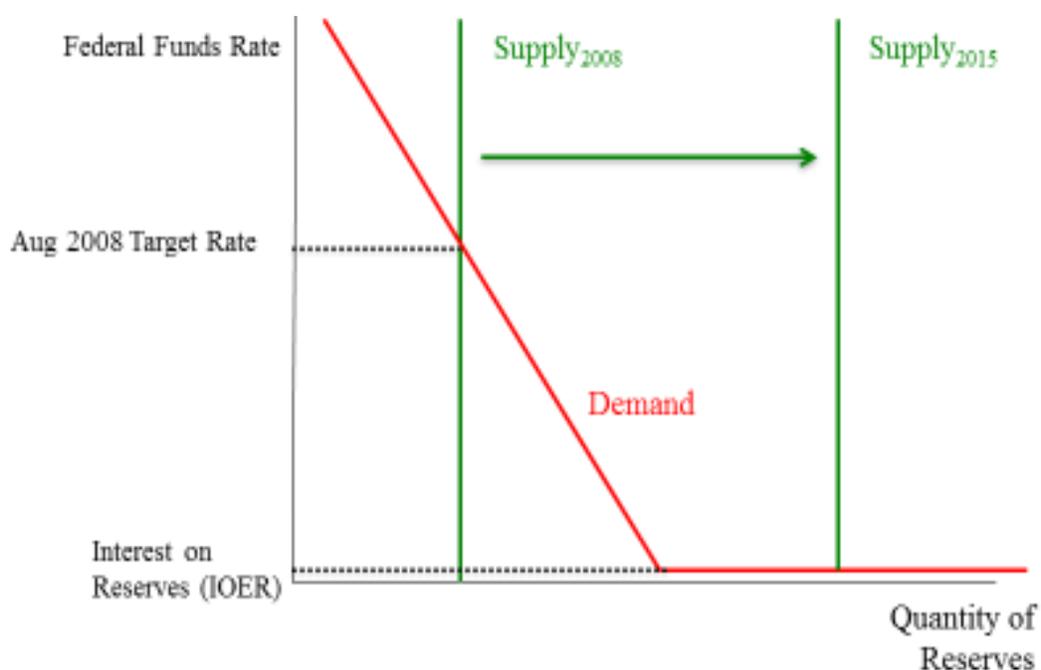


Figure 2: From 2008 to 2014, Quantitative Easing increased the supply of reserves by nearly \$3 trillion, shifting the supply curve far to the right along the reserve demand curve. Reserve demand is depicted as flat at the IOER rate because banks have no better alternative to holding reserves at that rate. Source: Cecchetti and Schoenholtz (2015a).

Reis raises one other issue in this environment, the issue of central bank solvency. What if, he speculates, the value of all the bank’s assets fell to zero? Would the central bank still be able to honor its liabilities? Would it be able to pay off all the reserves it has issued? Reis explores the possibility of default, or inflation as soft-default. He ultimately concludes that, despite the explosion of reserves, the U.S. is probably far from its default threshold. The caveat “probably” comes from the fact that these thresholds are very sensitive to the discount rate. Discount rates, particularly long-run ones, are tricky things to measure³.

³ Giglio, Maggiori and Stroebel (2015) discuss the challenges of measuring long-term discount rates.

A Tale of Two Markets

Reis' model involves two markets. The first market is the federal funds market, which we just sketched out above. The second market is the market between the central bank and member banks who swap a risky or long-term asset for reserves. This is the market that the previous literature focused on. What was being purchased in exchange for reserves and at what price? Reis doesn't want to focus here because it's been analyzed. Yet, this market is always lurking in the background because it is the source of the new reserves entering the system.

When we include both markets in the picture, the one-market conclusions are not so clear. The one-market analysis tells us that when the quantity of reserves increases, the federal funds rate should fall. But now think about the decision to hold liquid, low-risk assets (including both reserves and credits in the federal funds market) versus holding riskier, high-return assets. As the quantity of low-risk assets increases, banks should be less willing to swap risky for riskless assets, unless riskless assets offer a higher return because they want to earn some return. Typically, an increase in supply on an asset class raises the required return of that class of assets, not the other way around.

The one-market logic, while commonly used and the basis of many textbook chapters, is sort of like saying that you should invest all your wealth in nickels because the return on pennies just fell. The multi-market reasoning asks: If the return on coins is low, why not hold something else, besides coins? While the idea of investing in pennies and nickels sounds silly, it is not so far from what banks are doing. They are holding vast quantities of assets that yield little more than pennies.

The broader question that this analysis raises is: Why are banks holding so much liquidity at such incredibly low rates of return? Unless we understand what it is that makes banks choose to hold reserves and similarly liquid assets, we cannot begin to talk about what they do when we change the price or quantity of those reserves.

Show Me the Money – Liquidity Hoarding Everywhere

One possible explanation for banks' holdings of liquid assets is that reserve requirements force them to. Reis carefully documents that this is not the case. The holdings of reserves far outstrip the requirements.

A second explanation is frequently advanced by bankers who want to highlight the burden of financial risk regulations. As Jamie Dimon, CEO of J.P. Morgan put it in his 2014 letter to shareholders, "Many people point out that the banks now hold \$2.7 trillion in "excess" reserves at the Federal Reserve ... But in the new world, these reserves are not "excess" sources of liquidity at all, as they are required to maintain a bank's liquidity coverage ratio⁴." Of course, the liquidity regulations don't require banks to hold this much in reserves, per se. However, the alternative to holding the reserves would be that Dimon and company would have to find about \$450 billion of high-quality liquid assets (i.e., treasuries) to use instead. The 50 basis points they earn at the Federal Reserve appear to be a better deal than what they would get from competing with the Chinese or other large banks for those treasuries. To banks struggling to meet liquidity requirements, low-risk liquid assets like reserves are not abundant. They are

⁴ Source: <https://www.jpmorganchase.com/corporate/annual-report/2014/ar-solid-strategy.htm>

scarce. The banks are willing to accept low interest rates on these reserves because they have a hard time getting their hands on other good substitutes. While regulatory requirements have undoubtedly fueled demand for liquid assets, that does not seem to be the whole story. A whole host of non-bank actors, who are not subject to capital markets, seem to be hoarding liquid assets as well.

Everyone is hoarding liquidity. This is not just central bank reserves, nor is it just banks or even those covered by Dodd-Frank. Firms, household, non-bank financial firms, they all demand lots more low-risk, liquid assets than ever before⁵.

Deloitte reports that non-financial companies listed in the S&P Global 1200 index are holding unspent cash at a level not seen since 2000⁶. In a 2009 study entitled “Why Are Corporations Holding So Much Cash?” Thomas Bates, Kathleen Kahle and René Stulz demonstrate that the increase in the cash-to-assets ratio of firms was related tightly to precautionary motives. Wealthy households are also hoarding liquidity. An American Express survey found that the wealthiest Americans saved 37 percent of earnings in cash or equally liquid assets, which is more than triple their savings rate in 2007⁷.

Velocity of M1

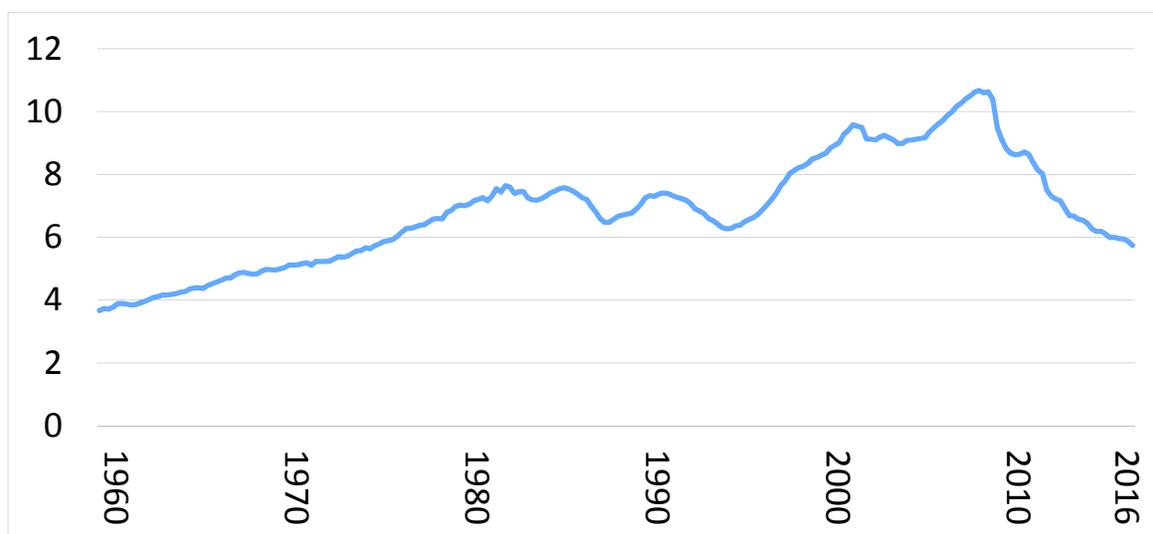


Figure 3: Evidence of Liquidity Hoarding: Low Velocity. Vertical axis is the velocity of M1, a measure of the frequency at which money and equally-liquid assets change hands. 1959:2016. Source: FRED, Federal Reserve Bank of St. Louis.

All this liquidity hoarding, much of it in cash and equally liquid assets shows up as low velocity. Velocity, or the rate at which money changes hands, has grown steadily over time, as technological progress makes withdrawals more convenient and allows consumers and firms to economize on liquid assets. In 2008, velocity plummeted. It fell to levels not seen since the 1970's. Of course, one explanation for low

⁵ For more on the shortage of safe assets and its economic consequences, see Caballero and Fahri (2014).

⁶ Source (gated): <https://www.ft.com/content/dc46d300-7937-11e3-91ac-00144feabdc0#axzz2r3SO5bVc>

⁷ Source: <http://www.cnbc.com/id/100935856>

M1 velocity is simply that opportunity cost of holding money versus treasuries is low. But equity returns are not low at all. Taken together, this evidence paints a broad picture of households and firms that could be making riskier, higher return investments and are instead choosing to hold cash.

This is why riskless interest rates are so low. Surely, some of the reason is that regulation forced financial institution to demand low-risk liquid assets. That strong demand drove up prices and drove down riskless returns. But financial firms aren't the only ones hoarding. Non-financial firms and wealthy households, who are not subject to any risk requirements are also hoarding liquidity. This points to the second important reason, which is precaution, uncertainty, or fear. The bottom line is that banks are not holding excess riskless assets because quantitative easing made the supply large or because the federal funds rate is low. They hold them in part because regulators forced them to and in part because fear made their demand for riskless securities strong.

The Risk and the Riskless

If we want to understand how the issuance of riskless assets affects the economy, we first need to understand what are the motivations for holding these riskless assets in the first place. Since many people, firms and banks are paying exorbitantly high prices for riskless assets, clearly, the motivation to hold riskless assets must be quite strong. The motivation to hold riskless assets is strongest when agents face large risks.

While many indicators show low volatility, suggesting a low-risk environment, there is evidence of continued, high tail risk in the economy. The SKEW index uses the prices of out-of-the money put options and a standard option-pricing formula to back out the implied probability of a negative return shock of two-standard-deviations or more. That implied probability, or "tail risk," rose dramatically during the financial crisis. In contrast to volatility indicators, the skew stayed high, and remains well above its pre-crisis level today.

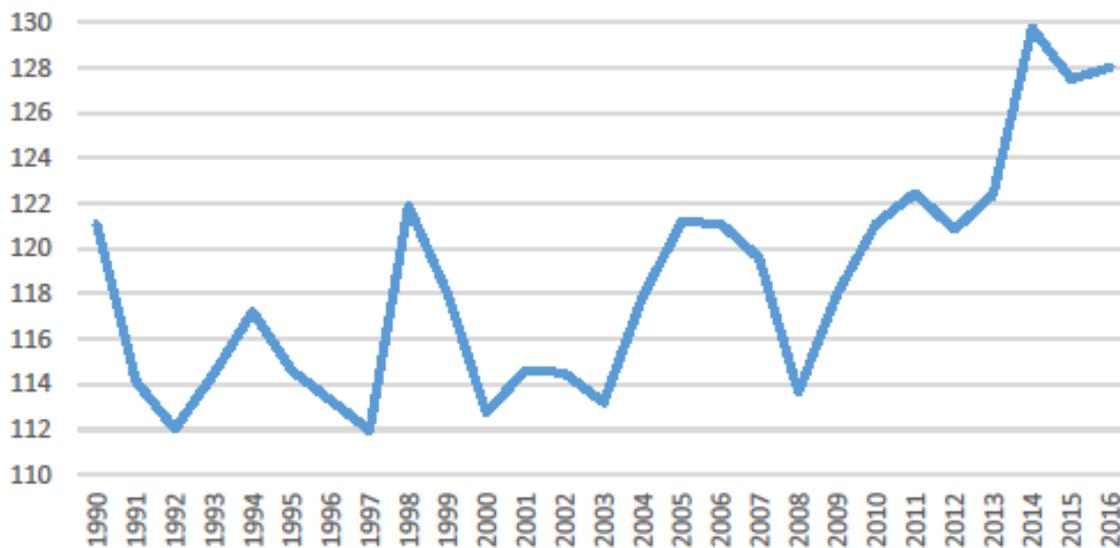


Figure 4: Tail Risk Remained High After the Crisis. Vertical axis is the skew index, a measure of the market price of tail risk on the S&P 500, constructed using option prices. Source: Chicago Board Options Exchange (CBOE). 1990:2016.

My work with Julian Kozlowski and Venky Venkateswaran explores the reasons for sustained, high tail risk and its consequences for real activity as well as financial market outcomes, such as low interest rates⁸. We argue that tail risk remained high after the financial crisis because agents learned that systemic failure of the financial system was possible. The essence of our argument is this: Imagine that each period, you choose how much to invest, and then you roll a die to see what the return on that investment is. After seeing many 1's, 2's, 3's, 4's, 5's and 6's, you have a good idea of what the probability of each of these outcomes is. Then, one day, you roll the die and -2 comes up. You had no idea a -2 was possible. The losses you face on your investment are large, but only last one round. Next roll, a 1-6 comes up and the -2 is not seen again. But after seeing -2, the knowledge that -2 is possible makes you more cautious. You take less risk. Long after the negative outlier event has passed, the knowledge that such events are possible means that tail risk remains high. In 2006, no one raised the possibility of financial crisis. The idea of a bank run on a U.S. bank sounded ridiculous. Today, banks, press and households ask repeatedly when the next crisis will arise⁹.

The consequences of heightened tail risk are large and pervasive. When we feed a capital return series into our model and let our agents learn from it, tail risk rises enough to explain the 12% difference between current U.S. output and the long-run trend, a phenomenon often called "secular stagnation." It can also reconcile low riskless rates and high equity prices. Faced with the prospect of a tail event, people want assets that retain their value, even in the face of such events. Demand for assets such as treasuries and reserves rises and yields are bid down.

This explanation for large holdings of reserves is consistent with GDP and employment data observed in the years following the crisis. It is also consistent with a modest increase in credit spreads, as firms de-leverage in the face of larger default risk and higher risk premia. Finally, it is consistent with high equity prices. This may be counter-intuitive since equities are risky and particularly exposed to tail risk. Greater tail risk does lower the value of equities. At the same time, equities are assets with long-maturities. When the riskless rate is low, future cash flows are discounted at a lower rate. Thus, the future payoffs that equities provide are valued more highly when the riskless rate is low. In our model, this discount rate overwhelms the loss in value from the increase in tail risk.

Quantitative Easing and Qualitative Expectations

I have argued that banks' extensive holdings of central bank reserves are driven not by supply, not by the low return on other riskless assets, but by regulation and fear. Banks, firms and investors all fear another financial collapse and try to protect themselves by holding riskless, highly-liquid assets. Risk regulators, trying to prevent systemic collapse require them to do the same. If this is the reason for the excess reserve puzzle, what does this imply about the effects of changing the quantity or the return on reserves?

⁸ See Kolowski, Veldkamp and Venkateswaran (2016).

⁹ Examples from the press include the Huffington Post (Oct.6, 2013) "[Y]ears after U.S. investment bank Lehman Brothers collapsed, triggering a global financial crisis and shattering confidence worldwide, ... 'The attitude toward risk is permanently reset.' A flight to safety on such a global scale is unprecedented since the end of World War II." More recently, a July 9, 2016 L.A. Times headline reads: "Another financial crisis? Soaring global debt since 2008 raises risk as world economy sputters." An example of bankers making a similar claim comes again from Dimon's 2014 letter to shareholders: "[T]here will be another crisis, and its impact will be felt by the financial markets."

In most respects, I agree with Ricardo Reis about the conclusions, even if we differ on the reasons for them. If banks desperately want to, or are required to hold liquid assets, then changing the supply of reserves or of other safe assets won't stimulate lending. Does this mean that risks and the resulting regulations put banks in so much of a bind that the monetary transmission mechanism is defunct?

Since a key reason for holding reserves is the perception, or the belief, that future economic risks are high, a key question is how monetary policies affect that perception. Reis' evidence on inflation expectations shows that the first quantitative easing program had a large effect on beliefs about future inflation, but subsequent programs did not. Reis argues that this is because the reserves market was not saturated the first time. Another possibility is that the first time the central bank ever used reserves to buy risky assets from banks, it was a surprise. Surprises that move beliefs about what is possible have long-lived effects. As Cecchetti and Schoenholtz put it, "Clear, early and compelling policy actions matter because they lower term premia and the path of expected future policy rates when the potential impact is greatest."¹⁰

What this means for the efficacy of quantitative easing is that it is not as important what the bank does as how it does it. Slightly changing the quantity of reserves, or acting gradually so as not to surprise markets, these are unlikely to shift expectations. Given the shortage of low-risk, high-quality capital, these are likely to be held by banks for the foreseeable future. The transmission of liquidity from central bank to member banks to firms and households is stymied by fear. The fear of a financial crisis causes banks to hold those liquid assets, rather than passing them on in the form of loans. Banks that are scared are not effective conduits for monetary policy, of any kind. That is the real challenge. To attack that fear, one must be bold. Replace total transparency with expectations management. Implement the unexpected. Some of Reis' proposals would indeed be unexpected. Some may protest that new actions create policy uncertainty. But uncertain times require bold actions to calm fears. By their nature, unexpected events change our view about what we should expect in the future. The economy rolled the dice and an unexpected event came up. Now we know such events are possible. Can the Federal Reserve convince us that the negative face has been erased from the economy's dice?

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Many discussions, including this one so far, have put regulation and monetary transmission at odds. But what if there are two factors inhibiting transmission – regulation and fear? It raises the possibility that perhaps effective, convincing and salient regulation might be a complement to monetary transmission, if it can remove the fear of future economic collapse.

Just like the financial crisis shocked investors and taught them to be cautious, future policy – either monetary or prudential -- would have to shock banks, firms, or entrepreneurs and embolden them to part with some of their safe assets and once again, embrace a prudent amount of risk.

¹⁰ See Stephen G. Cecchetti and Kermit L. Schoenholtz, "How the Fed will tighten," August 10, 2015, www.moneyandbanking.com.

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