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The Efficacy of Large-Scale Asset Purchases When the Short-Term Interest Rate Is at Its Effective Lower Bound

ABSTRACT The Federal Reserve on net purchased almost \$4 trillion in additional securities between March 2009 and December 2014. Although the initial announcements of these policies were associated with dramatic market reactions, these responses were soon reversed. The overall market reaction to news surprises from the Federal Reserve over this period was increases, not decreases, in interest rates. It is hard to disentangle the effects of the purchases themselves from new information about economic fundamentals. My conclusion is that it is difficult to estimate accurately what large-scale asset purchases accomplished, but the magnitude of the effect is likely smaller than commonly believed.

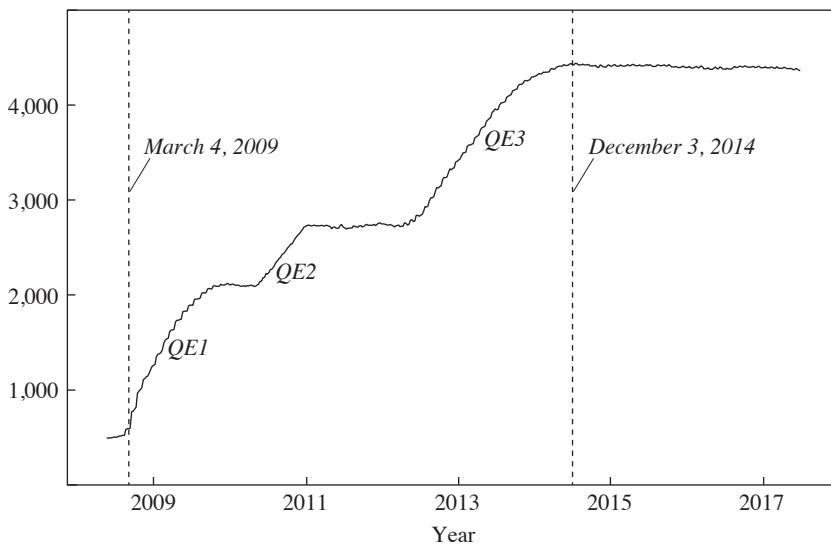
The traditional instrument of monetary policy is the short-term interest rate, which was stuck near zero in a number of the world's largest economies over much of the last decade. Central banks in the United States, Europe, and Japan purchased many trillions of dollars in securities in an effort to provide the stimulus that their traditional policy instrument could not. The U.S. Federal Reserve increased its holdings of Treasury securities, mortgage-backed securities, and agency debt from under \$600 billion at the start of March 2009 to over \$4.4 trillion by the end of 2014 (see figure 1). What did these large-scale asset purchases (LSAPs) accomplish?

Many standard macroeconomic and finance models predict that LSAPs would not affect any nominal or real variable of interest if the traditional policy rate is at its effective lower bound (ELB). If being at the ELB means

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Figure 1. Federal Reserve Holdings of Securities, November 19, 2008, to December 27, 2017^a

Billions of dollars



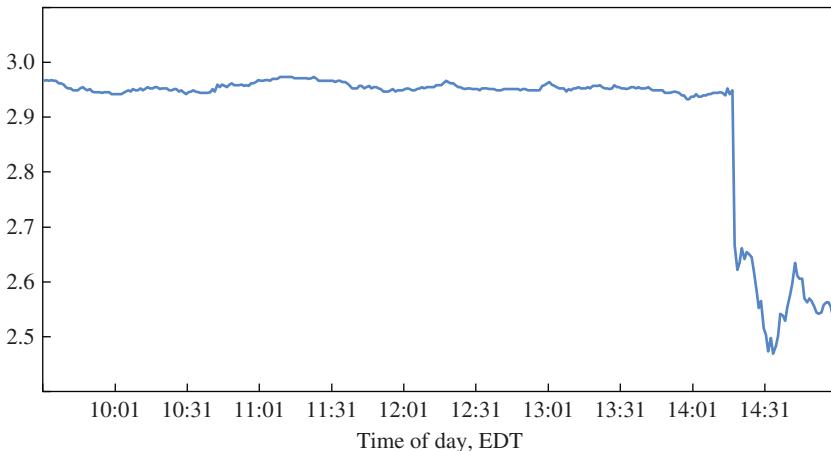
Source: Federal Reserve Statistical Release H.4.1.

a. QE = quantitative easing. Sum of Federal Reserve holdings of Treasury securities, mortgage-backed securities, and agency debt, plus unamortized premiums less unamortized discounts, Wednesday values, in billions of dollars.

that further increases in the monetary base would yield essentially zero marginal liquidity benefits to a holder of the monetary base, purchasing any asset with the newly created base should not change the price of any state-contingent claims, and so should have zero effect on asset prices or spending decisions in many models (Eggertsson and Woodford 2003). Richer models allow for the possibility of some effects. For example, buying long-term assets may commit the fiscal or monetary authority to a different state-contingent path for distortionary taxes or inflation (Hamilton and Wu 2012; Eggertsson and Proulx 2016). Or if some assets confer unique benefits on certain institutions—for example, as collateral for repurchase agreements or to satisfy capital requirements—there could also be real effects from altering the supply of these special assets (Woodford 2012; Caballero and Farhi 2017). Real effects can also arise in models where some individuals are unable to hold certain assets (Cúrdia and Woodford 2011; Gertler and Karadi 2011; Chen, Cúrdia, and Ferrero 2012; Greenwood and Vayanos 2014). Granting the potential relevance of such mechanisms, the

Figure 2. The Interest Rate on a 10-Year U.S. Treasury Security on March 18, 2009^a

Interest rate



Source: Cboe DataShop (n.d.).

a. Calculated as 10 times the price of the $^{\wedge}\text{TNX}$ futures contract based on the 10-year Treasury constant-maturity rate each minute during March 18, 2009.

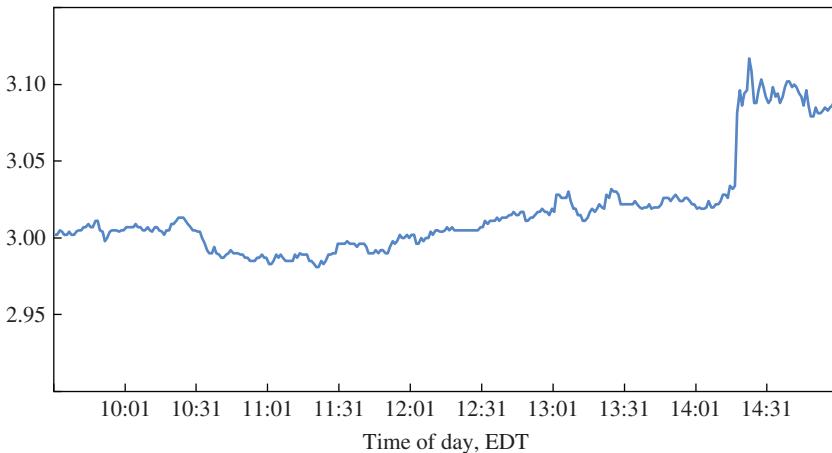
magnitude of the effect that can be achieved by LSAPs is very much an empirical question.

Figure 2 plots some dramatic evidence that might seem to settle this issue. The graph shows the interest rate on a 10-year U.S. Treasury security each minute of the day on March 18, 2009. At 2:15 p.m. EDT on that day, the Federal Open Market Committee (FOMC) issued a statement announcing its intention to purchase up to an additional \$1.15 trillion in mortgage-backed securities, long-term Treasury securities, and agency debt beyond the purchases announced previously. Within minutes of this announcement, the long-term Treasury rate fell by 50 basis points. It would be impossible to argue that the cause of this decline was something other than the Fed's announcement. When one adds this together with a few other dramatic moves—such as the 20-basis-point drop on November 25, 2008, when the Fed announced its initial intention to purchase up to \$600 billion in mortgage-backed securities and agency debt—it seems one can make a strong case that the first quantitative easing (QE1), as the first phase of LSAPs came to be called, may have lowered long-term yields by 100 basis points or more.

However, it is then interesting to look at figure 3, which shows what happened after the Fed's subsequent meeting on April 29, 2009. The

Figure 3. The Interest Rate on a 10-Year U.S. Treasury Security on April 29, 2009^a

Interest rate



Source: Cboe DataShop (n.d.).

a. Calculated as 10 times the price of the ^TNX futures contract based on the 10-year Treasury constant-maturity rate each minute during April 29, 2009.

Fed did not announce any change in plans for LSAPs in this statement, and indeed confirmed its intention to continue conducting the purchases announced on March 18. Yet just as we are forced to conclude that something the Fed said on March 18 caused the 10-year yield to fall, it is equally clear that something the Fed said (or did not say) on April 29 caused the yield to jump up by almost 10 basis points. What was it?

Here was the assessment of William Sullivan, chief economist at JVB Financial Group, as quoted in the Reuters bond market wrap-up for that day (Reuters 2018):

Treasuries prices fell because the Fed's statement has been adjusted to confirm its observation that some "green shoots" of stability and potential improvement in the economic environment are evident. . . . Also, some observers perhaps thought that the Fed would be able to increase the amount of Treasury and mortgage-backed securities purchases over and above the amount they delineated at the March policy meeting. So it doesn't look as if they will increase the size of those purchase programs.

To the extent that Sullivan's second explanation is accurate—that the market was surprised not to see additional purchases beyond those that had been announced on March 18—it raises the possibility that the initial 50-basis-point drop on March 18 should not be interpreted as the effect

Table 1. Comparison of Federal Open Market Committee Statements on March 18 and April 29, 2009

<i>March 18 statement</i>	<i>April 29 statement</i>
Information received since the Federal Open Market Committee met in January indicates that the economy continues to contract.	Information received since the Federal Open Market Committee met in March indicates that the economy has continued to contract, though the pace of contraction appears to be somewhat slower.
Job losses, declining equity and housing wealth, and tight credit conditions have weighed on consumer sentiment and spending.	Household spending has shown signs of stabilizing but remains constrained by ongoing job losses, lower housing wealth, and tight credit.
Weaker sales prospects and difficulties in obtaining credit have led businesses to cut back on inventories and fixed investment. U.S. exports have slumped as a number of major trading partners have also fallen into recession.	Weak sales prospects and difficulties in obtaining credit have led businesses to cut back on inventories, fixed investment, and staffing
Although the near-term economic outlook is weak, the Committee anticipates that policy actions to stabilize financial markets and institutions, together with fiscal and monetary stimulus, will contribute to a gradual resumption of sustainable economic growth.	Although the economic outlook has improved modestly since the March meeting, partly reflecting some easing of financial market conditions, economic activity is likely to remain weak for a time. Nonetheless, the Committee continues to anticipate that policy actions to stabilize financial markets and institutions, fiscal and monetary stimulus, and market forces will contribute to a gradual resumption of sustainable economic growth in a context of price stability.

Source: Statements of the Federal Open Market Committee.

of the policy the Fed actually implemented, but rather as a potential effect of some policy that markets thought the Fed might implement, though in practice it did not actually do so. Sullivan's first interpretation—that the market was responding to the Fed's more optimistic assessment of economic fundamentals—was the primary factor cited in the rest of the Reuters news account. The April 29 statement made significant changes in the words that the Fed used to describe the economy. The Fed sounded considerably less pessimistic on April 29 than it had on March 18 (see table 1).

A market response to these improvements in the Fed's outlook could be interpreted in two different ways. One view maintains that the Fed's information about the economy is a strict subset of the market's. According to this view, the market knew the true condition of the economy, and it had

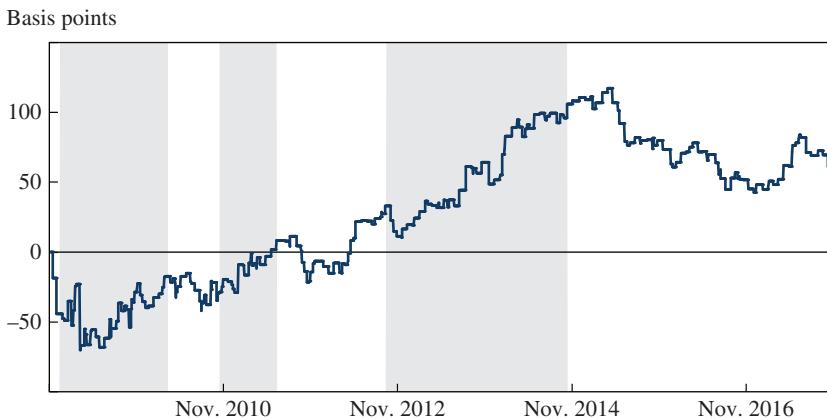
a guess about but did not know the Fed's assessment for sure. On learning that the Fed was more optimistic than anticipated, the market participants would revise their expectations of future monetary policy, now expecting perhaps fewer LSAPs or an earlier liftoff from the ELB. The second view is that the market and the Fed each has some information about the economy that the other does not have. According to this view, the release of the Fed's more optimistic assessment rationally leads to an upward revision of the market's forecast of economic fundamentals, and could lead to higher interest rates per this mechanism.

Direct comparisons of private forecasts with those of the Federal Reserve's Greenbook have demonstrated that the Fed has some information that is useful for forecasting output and inflation beyond what is known to the private sector (Romer and Romer 2000; Faust and Wright 2009). If the Fed knows some things that private analysts do not know, and private analysts know some things that the Fed does not know, the rational response of a private actor to the revelation of the Fed's economic assessment is to revise his or her own assessment (Melosi, forthcoming; Miranda-Agrippino and Ricco 2018). Much research has convincingly shown that this channel is an important component of the typical market response to Fed statements and actions. Jeffrey Campbell and others (2012) found that from 1994 to 2007, when the Fed announced an interest rate that was higher than the market anticipated, this was associated with a move to *lower* forecasts of unemployment and *higher* forecasts of inflation in the Blue Chip consensus forecast, exactly the opposite of what is predicted by the first view (the Fed is going to be more contractionary than anticipated) and exactly what is predicted by the second view (the economy is in better shape than people thought). Emi Nakamura and Jón Steinsson (2018) confirmed this finding in a careful analysis of high-frequency data through 2014. Additional evidence in support of this view has been provided by Silvia Miranda-Agrippino and Giovanni Ricco (2018) and by Aemit Lakdawala and Matthew Schaffer (2018).

If information that the economy was in better shape than many private analysts had previously concluded was indeed one factor driving rates up on April 29, 2009, we also need to allow the possibility that the Fed's negative economic assessment, and not just the LSAPs, were factors driving rates down on March 18. To the extent that is the case, it would mean that the 50-basis-point drop observed on March 18 is an overestimate of the effect of LSAPs themselves on the long-term rate.

It is even more telling to note the scale of the vertical axis in figures 2 and 3. The 10-year rate began March 18 at 2.97 percent and began April 29

Figure 4. Cumulative Change in the 10-Year Yield of U.S. Treasury Securities on Fed Days, November 20, 2008–December 1, 2017^a



Source: Adapted by the author from the data set given by Greenlaw and others (2018).

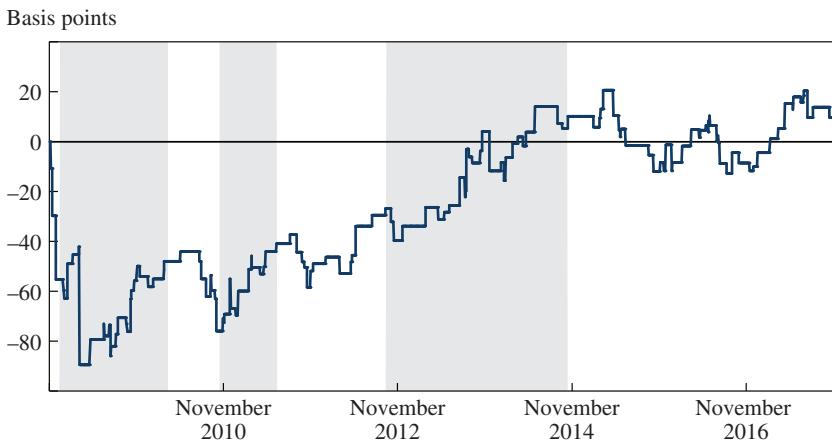
a. Shaded regions denote periods of bond purchases under QE1 (January 1, 2009–March 31, 2010), QE2 (November 3, 2010–June 30, 2011), and QE3 (October 1, 2012–October 29, 2014).

at 3.00 percent. Thus some sort of news arriving after the March 18 meeting and before the April 29 meeting led to a complete reversal of the dramatic drop of 50 basis points on March 18. And by the end of April 29, the rate was significantly higher than it had started out before the March 18 announcement. Was this information arriving between March 19 and April 28 news about what the Fed was going to do, or news about other fundamentals that matter for bond prices?

A recent paper by David Greenlaw and others (2018) used two approaches to try to answer this question. Their first approach was to note the date of every single FOMC meeting, release of minutes, or speech by the Fed chair about the economy or monetary policy. They called these “Fed Days.” Figure 4 plots the cumulative change in the 10-year rate coming only on Fed Days from November 20, 2008, to December 1, 2017.¹ After some dramatic initial drops, the overall movement of the market on Fed Days subsequent to March 18, 2009, was up for the remainder of the bond

1. This figure is adapted from exhibit 4.2 in Greenlaw and others (2018). The latter begins November 1, 2018, whereas figure 4 begins November 20, 2018, just before the first announcement of QE1 on November 25. Note that November 25 is not included in the definition of “Fed Days” because it was not the date of an FOMC meeting, minutes release, or Fed speech, but rather took the form of an unscheduled Fed announcement.

Figure 5. Cumulative Change in the 10-Year Yield of U.S. Treasury Securities on Reuters Fed News Days, November 20, 2008–December 1, 2017^a



Source: Adapted by the author from the data set given by Greenlaw and others (2018).

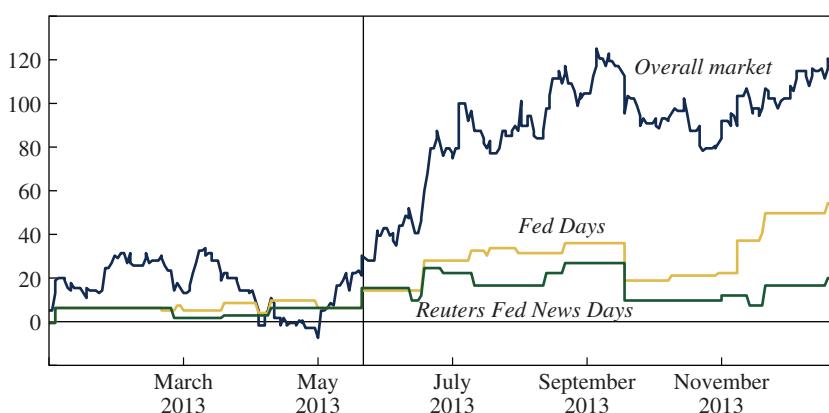
a. Shaded regions denote periods of bond purchases under QE1 (January 1, 2009–March 31, 2010), QE2 (November 3, 2010–June 30, 2011), and QE3 (October 1, 2012–October 29, 2014).

purchases of QE1, a period during which the Fed was intending that its LSAP would help hold rates down. The overall market move on Fed Days during both QE2 and QE3 was also unquestionably up, not down.

The second approach taken by Greenlaw and others (2018) was to look at every day when the 10-year yield changed by more than 1 standard deviation and study the Reuters bond market wrap-up for that day. If Reuters described news about the Fed as the primary driver of bond prices on that day, it was designated a “Reuters Fed News Day.” If Reuters listed the Fed as one of two contributing factors, the day was given a weight of $\frac{1}{2}$. Figure 5 plots the cumulative change in the 10-year rate on Reuters Fed News Days. By including a larger set of days than considered in figure 4 on which there was information released to the market about Fed policy, these suggest a bigger role for Fed announcements in bringing rates down in the fall of 2008. But the conclusion remains that the overall effect of news from the Fed after March 18 and throughout QE2 and QE3 was to drive interest rates higher.

Another event that many people consider convincing evidence of the importance of LSAPs came on May 22, 2013, when Fed chair Ben Bernanke suggested in congressional testimony that the Fed might slow the rate of monthly net bond purchases within the next three FOMC meetings.

Figure 6. Cumulative Change in the 10-Year Yield (in Basis Points) of U.S. Treasury Securities, January 1, 2013–December 31, 2013



Source: Greenlaw and others (2018, exhibit 5.3).

Note: The vertical line is at May 21, the day before Bernanke's warning.

The 10-year yield rose 11 basis points that day, a development that subsequently came to be referred to as the “Taper Tantrum.” But this was the only change in May that either of the methodologies used by Greenlaw and others (2018) would associate with news from the Fed. Notwithstanding, the rate was up overall 45 basis points in May (figure 6). The key factors identified by Reuters as driving yields higher in May included a strong employment report on May 3 and favorable housing and consumer sentiment data released on May 28.

It is also worth noting the market’s nonresponse to the Fed’s more recent decision to begin reducing the size of its balance sheet. Greenlaw and others (2018) noted that both the Blue Chip consensus and the primary dealer survey in January 2017 were anticipating that the Fed would not begin reducing its balance sheet until June 2018. These surveys expected that total Fed assets would still be \$3.8 trillion to \$4.0 trillion by the end of 2019. The actual shrinkage began in October 2017, three quarters earlier than the market initially expected, and announced a target balance sheet for the end of 2019 of \$3.6 trillion. Significant information arrived during 2017 that the Fed was going to contract sooner and faster than many expected. But it is difficult to identify any significant market reaction to this. Greenlaw and others described this as the “Shrinkage Shrug.”

These observations raise doubts not just about the magnitude of the effects of LSAPs but also about the whole strategy of identifying the

effects of monetary policy using high-frequency event studies, which has become the dominant approach in empirical economic research. The Fed's announcements in November and December 2008 and March 2009 came at times when news of a deteriorating economy was arriving from multiple sources. Investors (and the Fed) were trying to sort out exactly what it all meant. Bond prices would be particularly sensitive to the Fed's assessment of economic fundamentals in this setting. Likewise, in April 2009 and May 2013, investors had already been seeing a number of more favorable indicators, and accordingly may have responded more strongly to optimistic assessments from the Fed.

The idea behind high-frequency identification is that one can measure the isolated contribution of each source of news by the market response within a narrow window of the first release of this news. Consider taking this view to its logical conclusion. Equity futures tumbled 5 percent within hours after Donald Trump was predicted to win the 2016 presidential election in the evening of November 8, only to regain it all by noon the next day. According to the strict event study methodology, the interpretation would have to be that Trump's election did indeed take 5 percent off the value of U.S. corporations, but that some other shock within hours added this amount back. A more natural interpretation is that there are limits to investors' ability to understand, within minutes, all the implications of untested and unclear policies (Wolfers and Zitzewitz 2018). Moreover, the Fed's announcements reveal not just actions that it is going to take but also its best assessment of economic fundamentals. The Fed's assessment can be important information for me for purposes of refining my own assessment of economic fundamentals. Separating the contributions of these two factors is challenging.

Let me emphasize what I am *not* concluding from these observations. I have been discussing only the effects of the Fed's LSAP programs and their huge expansion initiated in March 2009. This does not say anything about the efficacy of the Fed's emergency lending facilities implemented in the fall of 2008 (and mostly phased out by the end of 2009). Evidence from the idiosyncratic responses of different banks and money market funds to the lending facilities suggests that these programs may well have had beneficial effects (for example, Duygan-Bump and others 2013). Nor am I suggesting that LSAPs had no effects on bond prices. As noted above, figure 2 makes such a claim difficult to defend. But I do conclude that it is very hard to accurately estimate the magnitude of exactly what LSAPs accomplished, and that the magnitude of their true effects is likely to be smaller than many central banks believe.

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