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Central bank announcements of asset purchases and the impact on global financial and commodity markets

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We present evidence on the effects of large-scale asset purchases by the Federal Reserve and the Bank of England since 2008. We show that announcements about these purchases led to lower long-term interest rates and depreciations of the U.S. dollar and the British pound on announcement days, while commodity prices generally declined despite this more stimulative financial environment. We suggest that LSAP announcements likely involved signaling effects about future growth that led investors to downgrade their U.S. growth forecasts lowering long-term US yields, depreciating the value of the U.S. dollar, and triggering a decline in commodity prices. Moreover, our analysis illustrates the importance of controlling for market expectations when assessing these effects. We find that positive U.S. monetary surprises led to declines in commodity prices, even as long-term interest rates fell and the U.S. dollar depreciated. In contrast, on days of negative U.S. monetary surprises, i.e. when markets evidently believed that monetary policy was less stimulatory than expected, long-term yields, the value of the dollar, and commodity prices all tended to increase.

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1. Introduction

The financial crisis that started in the summer of 2007 led to the worst U.S. recession since the Great Depression and monetary policymakers responded by implementing unprecedented programs to stabilize financial markets and restore economic growth. By the end of 2008 the U.S. Federal Reserve had lowered the federal funds rate to near zero and communicated its intention to keep the rate low for an

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extended period. Constrained by the zero lower bound on nominal interest rates, the Federal Reserve also engaged in “unconventional” monetary policy, including the large-scale purchases of mortgage-backed securities and debt issued by Fannie Mae, Freddie Mac, and Ginnie Mae, in addition to buying longer-term Treasury securities. These actions led to a ballooning of the Federal Reserve’s balance sheet which jumped to nearly \$3 trillion by mid-2011, from \$800 billion at the start of the crisis.

The financial crisis was clearly not confined to the United States and quickly traveled to Europe where central banks also introduced extraordinary measures to contain its effects. As in the United States, the Bank of England (BOE) initially lowered its policy rate and in March 2009, when the policy rate reached 0.5 percent, the Bank’s Monetary Policy Committee announced that it would start buying public and private assets, as well as gilt Treasury securities. As in the United States, the Bank of England’s asset-purchase program has been financed by the issuance of central bank reserves, leading to a sharp increase in its balance sheet. More recently, in the fall 2010, the Bank of Japan also announced a new asset-purchase program plan.

In this paper we present empirical evidence on the impact of these asset purchase programs on domestic as well as international financial asset prices in order to present a broad description of market reactions to announcements of large-scale asset purchases (LSAPs) by central banks in the midst of the recent financial crisis. More specifically, we study the joint reaction of long-term interest rates, exchange rates, and commodity prices. Commodity prices are forward-looking variables that in principal respond rapidly to worldwide economic news. In conjunction with the responses of other financial variables, they can help assess how market participants interpret new economic information.

To identify the market’s reaction to LSAP announcements by the Federal Reserve and the Bank of England we need to correctly date when the market first learned about the central banks’ intentions to intervene in financial markets. Starting with [Gagnon et al. \(2010\)](#), some papers have attempted to identify these announcements using central bank communications (see, for instance, [Neeley \(2010\)](#) and [Krishnamurthy and Vissing-Jorgenson \(2011\)](#)). In the case of the Federal Reserve, statements by the Federal Open Market Committee (FOMC) and speeches by Chairman Bernanke that provide indications about the Federal Reserve’s intent to buy or sell assets in particular markets are typically used. Similar statements can also be exploited to identify news of large-scale asset purchases by the Bank of England. We follow an analogous strategy in this paper.

In addition to correctly dating when the news of asset purchases reached market participants, one also needs to control for market expectations when assessing the impact of the announcements on financial variables. To do so, we use the surprise component of monetary announcements constructed by [Wright \(2011\)](#) for the United States. Using high-frequency data and longer-term interest rate futures, [Wright \(2011\)](#) identifies a set of monetary policy surprises between 2008 and 2010, some of which are associated with news about LSAPs. For the U.K., we rely on the work of [Joyce et al. \(2010\)](#) who proxy market expectations using Reuters surveys of London City economists about their forecast of the total amount of asset purchases by the Bank of England.

We first show that U.S. asset purchase announcements generally brought about more stimulative financial conditions, lowering the 10-year U.S. Treasury yield and depreciating the dollar on days of LSAP announcements, particularly during the first round of the program (LSAP1) between November 2008 and the first half of 2010. These findings are consistent with those of [Gagnon et al. \(2010\)](#) and [Neeley \(2010\)](#). In our analysis, we also show that commodity prices tended to fall, on average, on announcement days, particularly during LSAP1. In particular, indices for energy prices and precious metals tended to decline significantly during this round of announcements. Our results suggest that market participants viewed LSAP announcements by the Federal Reserve as signaling lower future economic growth in the United States, which jointly lowered long-term interest rates, the value of the dollar, and commodity price on the days that policy news was released.

We find analogous results in the case of asset purchase announcements by the Bank of England. These announcements reduced U.K. interest rates and also depreciated the pound, similarly to the findings of [Joyce et al. \(2010\)](#), and had some, but relatively small, effects on commodity prices. Intuitively, economic developments in the U.K. economy should matter relatively less than those in the United States for global markets like commodities.

Our findings also show that the unconditional effects of LSAP1 on financial and commodity prices differ significantly from those following LSAP2. [Krishnamurthy and Vissing-Jorgenson \(2011\)](#) also

compare the effects of LSAP1 and LSAP2 on the 10-year Treasury rate and corporate bond rates, and find more muted effects under LSAP2. One explanation of these results is that the first round of asset purchases by the Federal Reserve occurred at a time when financial markets were deeply impaired and it is intuitive to think that they would have a larger effect on long-term interest rates than during LSAP2, which took place during a relatively more tranquil period.

However, once we control for market expectations at the time of announcements, our results indicate that LSAP2 announcements actually had a somewhat larger effect on the 10-year Treasury rate than did LSAP1 announcements. Specifically, we show that the effects of asset purchases on financial variables and commodity prices depend crucially on the sign of the monetary surprise. Positive surprises, associated with an easier monetary stance, tended to lead to declining long-term interest rates and *falling* commodity prices. In contrast, negative monetary surprises led to significant increases in long-term interest rates, but to flat or weak increases in commodity prices.

The remainder of the paper is organized as follows. In Section 2 we summarize the different channels through which asset prices may affect asset prices. In Section 3 we describe the data and methodology used in our analysis, including our designation of central bank announcement events and our approach to controlling for market expectations. The empirical results are reported in Section 4, where we examine the effects of LSAP announcements on long-term interest rates, exchange rates, and commodity prices. The last section concludes.

2. Transmission channels of effects of large-scale asset purchases

There are several channels through which central bank asset purchases may affect long-term interest rates. One channel works through the portfolio balance effects of central bank asset purchases that reduce the overall supply of longer-term securities available to investors. If some investors, such as pension funds or insurance companies, have a preference to hold longer-term securities, these “habitat” preferences make the yields on securities of different maturities partly depend on their relative supplies. As a result, central bank purchases that reduce the stock of long-term securities held by the private sector push up the price of these securities, lessen the term premium required to compensate investors to hold them, and hence lower long-term interest rates.¹

As second channel involves the beneficial market effects that asset purchases can have in times of stress by providing market liquidity. The greater involvement of a central bank in the market may improve market functioning and reduce the extra compensation (“liquidity premium”) that investors demand for buying assets that risk being more difficult to sell in the future. For example, the spreads between residential mortgage rates and U.S. Treasury yields rose to very high levels during the height of the financial crisis in late 2008, but fell markedly after the Fed announced its intention of buying agency mortgage-backed securities (MBS).

Lastly, asset purchase announcements may have signaling effects about the central bank's perception of economic conditions and about how it might be likely to react to future developments. Thus, an announcement that makes investors feel that conditions are worse than originally perceived or that heightens risk concerns may lead investors to increase their demand for Treasuries, lowering their yields. Alternatively, LSAPs may serve as a signal that the future path of short-term risk-free interest rates would remain low. Such an expectation of lower future short-term interest rates will lower long-term rates.²

¹ This channel is sometimes referred as the “duration” channel (e.g. Krishnamurthy and Vissing-Jorgensen, 2011), or the “term premium” channel. In a variant specification, Krishnamurthy and Vissing-Jorgensen (2011) assume that some investors have a habitat preference for long-term safe investments. In this case, LSAPs work by lowering the yields of bonds which are extremely safe, such as Treasuries or high-rate corporate bonds. Gagnon et al. (2010) argue that Fed announcements work primarily through the portfolio balance channel. Bauer and Rudebusch (2011) suggest that the signaling channel is equally important after controlling for term premia effects they derive from estimates of dynamic term structure models.

² Krishnamurthy and Vissing-Jorgensen (2011) discuss other transmission channels of asset purchases, involving the lowering of mortgage prepayment risk (if purchases involve mortgage back securities), the lowering of corporate default risk, or the raising of inflation expectations.

These longer-term interest rate effects of asset purchases being purchased may also spill over into the yields on other assets as the sellers of securities to the central bank use their new money balances to bid up the prices of other assets. In addition to influencing U.S. yields, LSAPs can affect international asset prices and exchange rates as well because of global capital market linkages. For example, a decline in U.S. interest rates would cause investors to reduce their portfolio share of U.S. securities in favor of foreign securities, pushing up the prices of those foreign assets. Because expected returns to international asset investments depend on both expected asset returns and expected exchange rate changes, exchange rates would be affected as well.

Asset purchases may also affect the demand for commodities. Monetary policy can affect commodity prices through several channels. For instance, if a central bank's purchases of long-term Treasury securities lower long-term interest rates through the portfolio balance channel, the resulting stimulus to aggregate demand can boost demand for all goods, including commodities.

The prices of storable commodities could also rise as interest rates fall because, by decreasing the cost of carrying inventories, lower rates stimulate inventory demand for commodities. Moreover, because most commodities are priced in U.S. dollars, the lower value of the dollar that frequently follows an easier monetary stance would tend to reduce the relative price of commodities for holders of other currencies, also increasing demand.

Finally, to the extent that commodity prices are relatively flexible, they may respond to economic developments more quickly than other goods prices. As a result, higher inflation expectations in the wake of looser U.S. monetary policy could be quickly reflected in the prices of commodities that are determined by forward-looking asset market considerations.

All of these transmission channels imply that, if LSAPs cause interest rates to fall, then commodity prices should rise. However, LSAPs might cause commodity prices to fall if the central bank announcements about monetary policy may have signaled that it perceives that economic conditions are weaker than previously thought. Alternatively, they may increase market worries about risk and make Treasury securities more desirable as safe-haven investments. Thus, an announcement that makes investors feel that conditions are worse than originally perceived or that heightens risk concerns may lead investors to increase their demand for Treasuries, lowering their yields. These concerns also could reduce investor demand for other assets, such as commodities, resulting in lower prices.

Conversely, if an announcement reduces concerns about risk, then both Treasury rates and commodity prices may rise. Hence, the effects of LSAP announcements could depend crucially on the state of the economy as well as investor sentiment about risk. The early decisions by the Federal Reserve to buy unconventional assets in the fall of 2008 and early 2009 were made during a period of acute financial turmoil and economic uncertainty. The impact of these announcements could very well have differed from the impact of announcements made in the second half of 2010, when financial turmoil had abated, the U.S. economy was stronger, and emerging markets were growing rapidly. Thus, we compare how commodity prices responded during both rounds of LSAP announcements.

In proceeding, we emphasize that our main focus in the empirical analysis is measuring the directional responses of domestic and foreign asset prices to LSAPs, rather than identifying the exact channels through which these effects occur. Nevertheless, we argue that the configuration of asset price changes may be suggestive of the extent to which the signaling vs. the risk premium channel are at work.

3. Methodology

3.1. Central bank announcements of asset purchases

The narrative approach to identifying shocks has been influential in macroeconomics. In an early application of this methodology, [Romer and Romer \(1989\)](#) for instance created a dummy variable for periods when the Federal Reserve tightened policy to fight inflationary pressures based on their readings of Federal Reserve documents. They argued that monetary contractions had real effects by showing that increases in this newly-constructed variable had persistent and negative effects on output. [Ramey and Shapiro \(1998\)](#) use a similar strategy to identify fiscal shocks, conducting a reading

of the “news” (Business Week articles in this case) to determine when the public first learned about increases in military spending associated with exogenous military conflicts. Similarly, [Romer and Romer \(2010\)](#) identify fiscal shocks using presidential speeches or the Economic Reports of the President to determine the underlying motivations behind a change in fiscal policy, distinguishing between responses to cyclical changes in economic activity and more exogenous changes related to concerns about long-term growth. Both [Ramey and Shapiro \(1998\)](#) and [Romer and Romer \(2010\)](#) find significant effects of fiscal shocks on economic activity.

The approach taken in this paper is similar in spirit to those earlier papers in that it uses communications by central banks to identify “news” about their recent programs of asset purchases. We concentrate on the programs of the Federal Reserve and the Bank of England. These central banks both rapidly brought their policy rates to near zero percent and then used purchases of different assets as an additional policy tool.

Following the failure of Lehmann Brothers and the financial turmoil that ensued, the Federal Reserve announced the purchase of \$100 billion in Government-Sponsored Enterprise (GSE) debt and up to \$500 billion in mortgage-backed securities (MBS), to complement the effects of a near-zero-percent policy rate. Between November 2008 and November 2010, [Table 1](#) describes 10 announcements, either statements by the FOMC or speeches by Chairman Bernanke, further describing aspects of the asset-purchase program. The five announcements associated with the first round of the program, between November 2008 and November 2010, correspond to those used, for instance, by [Gagnon et al. \(2010\)](#) and [Neeley \(2010\)](#). We use five announcements for the second round of asset purchases, which the FOMC signaled in August 2010 by announcing that it would continue to rollover the Federal Reserve holdings of Treasury securities as they mature. These announcements are similar to those used by [Wright \(2011\)](#) and [Krishnamurthy and Vissing-Jorgenson \(2011\)](#).³

To determine news announcements of asset purchases by the Bank of England, we closely follow the work of [Joyce et al. \(2010\)](#). In February 2009, the Bank of England first signaled the possibility of conducting asset purchases in their monthly inflation report. In March 2009, the MPC lowered its policy rate to 0.5 percent and announced its intention to buy up to £75 billion in private and public assets, with the purchases likely to be concentrated in conventional bonds. Over the following year, the Bank of England expanded its program four times. [Table 2](#) lists the Bank of England announcements used in our empirical analysis.

3.2. The surprise content of monetary announcements

A well-known Wall Street adage says to buy on the rumor and sell on the news. In this context, determining what is the surprise content of news announcements becomes crucial to correctly identifying the direction and size of a given shock. For example, on November 3, 2010, the Federal Reserve formally implemented LSAP2 by announcing its plan to buy an additional \$600 billion in Treasury securities. However, the Federal Reserve’s intentions had been signaled well ahead of this announcement, through Chairman’s Bernanke Jackson Hole speech in late August 2010, for instance. By early November, market participants had therefore formed expectations of the possible size and composition of a new round of asset purchases by the Federal Reserve and their response to the November announcement clearly depended on these expectations. Understanding the surprise component of these announcements is important in order to understand how much of their effect on the day of the announcement was already priced in.

In the case of the U.S. LSAP announcements, we rely on [Wright \(2011\)](#) who uses intra-daily data on interest rate futures to construct a measure of Fed monetary policy shocks between 2008 and 2010. The shocks are constructed as the first principal component of the yield changes of two-, five-, ten-, and thirty-year U.S. bond futures from 15 min before a given Federal Reserve announcement until 1 h and 45 min after. This approach is akin to identification through heteroskedasticity in that at a high enough frequency the announcement is the only factor at work, with the variances of all other shocks being negligible. The last column of [Table 1](#) reports [Wright \(2011\)](#)’s calculation of the surprise associated with

³ A detailed description of the Federal Reserve asset-purchasing program is provided in [D’Amico and King \(2010\)](#).

Table 1

Federal reserve LSAP announcements.

Date	Round	Event	Description	monetary surprise
11/25/2008	1	Initial LSAP announcement	FOMC announces intended purchases of \$100 billion in GSE debt and up to \$500 billion in MBS.	0.8
12/1/2008	1	Bernanke speech	Chairman Bernanke says that the Fed could purchase long-term Treasuries.	0.8
12/16/2008	1	FOMC statement	FOMC first mentions possible purchase of long-term Treasuries.	2.2
1/28/2009	1	FOMC statement	FOMC says that it is ready to expand agency debt and MBS purchases, as well as to purchase long-term Treasuries.	−0.2
3/18/2009	1	FOMC statement	FOMC says it will purchase an additional \$750 billion in agency MBS, increase its purchases of agency debt by up to \$100 billion, and buy up to \$300 billion in long-term Treasuries.	3.4
8/10/2010	2	FOMC statement	FOMC states that it will continue to roll over the Federal Reserve holdings of Treasury securities as they mature.	0.6
8/27/2010	2	Bernanke Jackson Hole speech	Chairman Bernanke suggests that the FOMC is likely to buy longer-term securities.	−0.8
9/21/2010	2	FOMC statement	FOMC states that the Federal Reserve will continue to roll over its holdings of Treasury securities as they mature.	0.6
10/15/2010	2	Bernanke Speech		−0.2
11/3/2010	2	FOMC statement	FOMC states its intention to purchase \$600 billion more in longer-term Treasury securities by the end of the second quarter of 2011.	−0.1

Note: Surprise measure from Wright (2011).

our set of LSAP announcements, which we use in our empirical analysis below. The surprises are demeaned, scaled to have a standard deviation of 1, and are signed so that a positive surprise indicates falling yields.

The last column of Table 2 also reports the surprise component associated with the Bank of England announcements, which we take from Joyce et al. (2010) who used Reuters surveys of Citi economists'

Table 2

Bank of England LSAP announcements.

Date	Event description	Monetary surprise
2/11/2009	February <i>Inflation Report</i> and associated press conference give strong indication that quantitative easing (QE) asset purchases were likely.	1.8
3/5/2009	Monetary Policy Committee (MPC) announces that it would purchase £75 billion of assets over three months funded by central bank reserves, with conventional bonds likely to constitute the majority of purchases. Gilt purchases were to be restricted to bonds with a residual maturity of between 5 and 25 years.	1.8
5/7/2009	MPC announces that the amount of QE asset purchases would be extended by a further £50 billion to £125 billion.	−0.2
8/6/2009	MPC announces that the amount of QE asset purchases would be extended to £175 billion and that the buying range would be extended to gilts with a residual maturity greater than three years.	0.4
11/5/2009	MPC announces that the amount of QE asset purchases would be extended to £200 billion.	−0.1

Source: Joyce et al. (2010). Surprise measure constructed from Chart 12 in Joyce et al. (2010).

expectations about their forecast of the total amount of asset purchases by the Bank of England.⁴ As in Wright's analysis, the monetary surprise data for the BOE are demeaned and scaled to have a standard deviation of 1.

3.3. Financial variables and commodity prices

In our analysis, we use daily data on interest rates, exchange rates, and commodity prices. When comparing the magnitude of announcement day changes in these variables with changes for non-announcement days, our sample period spans January 2004 to July 2011, although some of our regressions are also run on subsamples of this period. For long-term interest rates, we use the ten-year government yields for the United States, the United Kingdom, Canada, Australia, Japan, and the euro area.⁵ We study the movements in the U.S. dollar against the euro, the yen, the Canadian and Australian dollars, as well as the British pound. These data were all obtained from Bloomberg.

We measure commodity price changes using S&P Goldman Sachs Commodity Indices (GSCI). To keep the analysis tractable, we use relatively broad commodity price indices tracking the overall movements in the prices of energy, industrial metals, precious metals, agricultural products, and livestock. One advantage of using the overall GSCI and its subindices is that they are deeply traded. The indices are constructed using commodities' futures prices, which are weighted based on world production, and only commodities with liquid futures markets are included in the indices. In our analysis, we use the GSCI spot price indices, which are constructed using the nearest dated futures prices.

Table 3 reports the weights of different commodities in the GSCI indices. The GSCI is heavily weighted toward energy with a weight of roughly 70 percent. Within the energy sector, oil (either crude or Brent) accounts for a third of the GSCI energy index's composition. Fig. 1 shows the behavior of the GSCI indices for energy (which tracks the movement in the overall GSCI index) and industrial metals since the beginning of 2004. The prices of energy and industrial metals rose considerable between the mid-2000s and the failure of Lehmann Brothers in September 2008, at which point commodity prices collapsed. Commodity prices then recovered quickly during 2009 and 2010, before stabilizing more recently.

Before turning to the analytical part of our study, we note that many financial commentators have argued that the Federal Reserve's asset purchases, particularly those under LSAP2, were a key driver behind the recent run-up in commodity prices. Fig. 1 suggests that a perhaps more dominant source of variations in commodity prices since the mid-2000s may be found in changes in world demand, which have gone hand-in-hand with changes in the prices of energy and industrial metals. Commodity prices declined sharply in the fall of 2008, as the financial crisis intensified and spread around the world, halting global growth. They bottomed out early in 2009 and have since been on an upward trajectory as world economic activity has recovered, driven largely by relatively fast growth in emerging market economies, such as those of China, India, and Brazil. Thus, an increase in the demand for commodities associated with the rebound in world economic activity since early 2009 is a likely major cause of the general increase in commodity prices. In fact, in the two months before August 10, 2010, when the Fed began the process of initiating the second round of LSAPs, commodity prices were already on the rise, with industrial metals increasing 14% and agricultural products 28%. The peaking and subsequent downturn of commodity prices in early 2011 may be associated with the recent global slowing of economic activity.

This interpretation of the determinants of recent commodity price behavior does not rule out the possibility that expansionary monetary policy in a large country such as the United States may also have contributed to the global rise in commodity prices. But as we shall show, the behavior of commodity prices, at least on announcement days, does not support this presumption; we find that commodity prices tended to fall in response to asset purchase announcements.

⁴ See Joyce et al. (2010), Chart 12.

⁵ The euroarea interest rate is a weighted average of individual European country Treasury rates constructed by Bloomberg, with Germany receiving the greatest weight.

Table 3
Components of the S&P Goldman Sachs commodity index.

Commodities	Weights
Energy	69.2%
Crude oil	33.0%
Brent crude	16.4%
Unleaded gasoline	5.0%
Heating oil	5.0%
Gas oil	6.8%
Natural gas	3.0%
Agriculture	16.0%
Wheat	3.2%
Kansas Wheat	0.8%
Corn	4.7%
Soybeans	2.4%
Cotton	1.8%
Sugar	1.8%
Coffee	1.0%
Cocoa	0.3%
Industrial metals	7.6%
Aluminum	2.5%
Copper	3.4%
Lead	0.4%
Nickel	0.7%
Zinc	0.5%
Livestock	4.0%
Feeder cattle	0.4%
Live cattle	2.2%
Lean hogs	1.4%
Precious metals	3.3%
Gold	2.7%
Silver	0.5%

4. Empirical results

4.1. Financial market effects of asset purchase announcements

We start our analysis by reporting the daily movements in global long-term interest rates, exchange rates, and commodity prices on each announcement day, as well as the cumulative effect over all announcements by the Federal Reserve and Bank of England. Tables 4 and 5 report the results for each central bank, respectively.⁶ Our one-day window around each announcement event is intended to limit the possible “contamination” on the estimated asset price effects of LSAPs from other important news that could move prices.⁷ To allay this concern, Krishnamurthy and Vissing-Jorgensen (2011) use intraday trading volume data on U.S. 10-year Treasury bonds

⁶ Changes are measured using one-day windows, defined as the change in the closing price between the day of the announcement and the day prior. For some events it was necessary to make timing adjustments to properly align the effects of monetary announcements on foreign interest rate changes, e.g. the effects of afternoon Fed announcements on U.K., German, and Japanese interest rates were measured by changes on the following business day. Another possible timing problem that we do not address arises from the complication that the spot market for some commodities, including certain precious and base metals, is dominated by trading in London, which means that official fixing prices have less time to respond to daily developments in the United States due to the time difference.

⁷ The financial literature on event studies often uses longer windows to better capture possible anticipation effects. However, given that we will also control for expectations using Wright (2011) monetary surprises, we opted to work with a shorter window around the announcements.

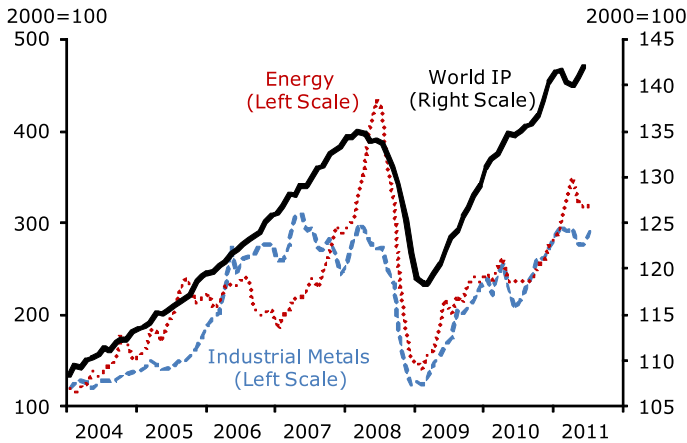


Fig. 1. Commodity prices and world industrial production.

to show that the U.S. LSAP announcements were the main news releases on those event days.⁸ To assess the significance of the reported changes, the tables also report “*p*-values,” defined as the fraction of daily changes during the period January 2004 to July 2011 that were larger in absolute value than the change on the reported event day.

Table 4, panel A indicates that financial markets reacted to announcements by the Federal Reserve by pushing global long-term interest rates down. The cumulative effect on the ten-year U.S. Treasury yield over all announcements was a decline of roughly 100 basis points. Yields on other long-term interest rates fell as well, by roughly 50–60 basis points, with the exception of Japanese government bond rates, which fell by a cumulative 23 basis points.⁹

Our estimates in Table 4 also show that, overall, long-term yields moved much more on days of LSAP1 announcements than on days of LSAP2 announcements. In the latter case, the daily movements in all long-term yields were small and not significantly different from zero. However, as we will discuss shortly, this differential effect across LSAP rounds disappears once we control for market expectations at the time of announcements.

A similar picture emerges for movements in the value of the dollar, as shown in Table 4, panel B. The value of the dollar fell cumulatively by roughly 3 percent to 8 percent against our set of currencies, with the fall against the Japanese yen being the most pronounced. These effects are broadly consistent with those of Neeley (2010), who however focuses only on LSAP1 announcements. Again, we find the daily currency movements to be accentuated on days of LSAP1 announcements compared to days of LSAP2 announcements.

Interestingly, Table 4, panel C documents that commodity prices tended to fall on days of LSAP announcements by the Federal Reserve. For instance, the GSCI energy price index declined by a cumulative 17 percent, while the price index for industrial metals declined nearly 7 percent. Moreover, the declines were not confined to demand-sensitive commodities, as the price index for precious metals lost a cumulative 12 percent. Thus, perhaps surprisingly, commodity prices fell despite the more stimulative financial environment brought about by the generalized decline in long-term yields and the depreciation of the U.S. dollar against major currencies. These findings

⁸ Of course, other economic news was released on some of the event days in our analysis. For example, on December 1, 2008, when Chairman Bernanke said the Federal Reserve might purchase long-term Treasuries, the Institute for Supply Management reported very weak order figures for the United States; weak data for the U.K. and China were also released.

⁹ These results are comparable to Gagnon et al. (2010) who measured a cumulative decline of 91 basis point for their baseline event set for LSAP1 of eight announcements with a one-day window, and Neeley (2010) who measured a total decline of 107 basis point for the same five announcements as in our LSAP1 sample using a two-day window. Our global interest rate effects are similar to those found by Neeley (2010) for LSAP1.

Table 4

Effects of US LSAP announcements on long-term interest rates, exchange rates, and commodity prices.

Panel A: Long-term interest rates								
	Event Dates	Surprise	US TB10	AUS TB10	CAN TB10	EUR TB10	JPN TB10	UK TB10
Fed LSAP1 dates	11/25/2008	0.8	−22 (0.01)	−7 (0.20)	−11 (0.03)	−8 (0.08)	−2 (0.37)	−7 (0.15)
	12/1/2008	0.8	−19 (0.01)	−19 (0.01)	−17 (0.00)	−12 (0.02)	−5 (0.08)	−18 (0.01)
	12/16/2008	2.2	−26 (0.00)	−12 (0.06)	−12 (0.01)	−15 (0.00)	−7 (0.02)	−17 (0.01)
	1/28/2009	−0.2	14 (0.04)	2 (0.70)	6 (0.17)	3 (0.49)	1 (0.71)	4 (0.32)
	3/18/2009	3.4	−47 (0.00)	−27 (0.00)	−22 (0.00)	−18 (0.00)	−4 (0.12)	−8 (0.10)
Fed LSAP2 dates	8/10/2010	0.6	−7 (0.23)	−6 (0.29)	−3 (0.45)	−11 (0.02)	−2 (0.39)	−11 (0.03)
	8/27/2010	−0.8	17 (0.02)	3 (0.58)	7 (0.12)	4 (0.29)	2 (0.43)	1 (0.73)
	9/21/2010	0.6	−13 (0.05)	−4 (0.44)	−4 (0.31)	−10 (0.03)	−2 (0.36)	−15 (0.01)
	10/15/2010	−0.2	5 (0.35)	7 (0.19)	3 (0.41)	8 (0.08)	−1 (0.83)	7 (0.16)
	11/3/2010	−0.1	−2 (0.76)	−2 (0.68)	0 (0.96)	−2 (0.55)	−3 (0.33)	−5 (0.30)
Fed LSAP1	Sum		−100 (0.01)	−62 (0.05)	−57 (0.02)	−49 (0.03)	−18 (0.17)	−45 (0.07)
	Avg		−20 (0.01)	−12 (0.05)	−11 (0.02)	−10 (0.03)	−4 (0.17)	−9 (0.07)
Fed LSAP2	Sum		1 (0.97)	−2 (0.94)	3 (0.87)	−12 (0.52)	−5 (0.62)	−22 (0.30)
	Avg		0 (0.97)	0 (0.94)	1 (0.87)	−2 (0.52)	−1 (0.62)	−4 (0.30)
All Fed LSAP	Sum		−99 (0.11)	−64 (0.24)	−54 (0.20)	−61 (0.14)	−23 (0.35)	−68 (0.15)
	Avg		−10 (0.11)	−6 (0.24)	−5 (0.20)	−6 (0.14)	−2 (0.35)	−7 (0.15)

Panel B: Exchange rates							
	Event dates	Surprise	AUS\$/	CAN\$/	EUR/	JPY/	GBP/
Fed LSAP1 dates	11/25/2008	0.75	0.7 (0.31)	−0.6 (0.31)	−0.8 (0.17)	−2.2 (0.01)	−1.9 (0.01)
	12/1/2008	0.84	2.3 (0.03)	0.7 (0.25)	0.6 (0.28)	−2.5 (0.01)	3.2 (0.00)
	12/16/2008	2.22	−3.7 (0.01)	−2.6 (0.00)	−2.3 (0.01)	−1.8 (0.02)	−1.8 (0.01)
	1/28/2009	−0.23	−0.7 (0.32)	−1.6 (0.03)	−0.1 (0.92)	1.4 (0.04)	−0.8 (0.16)
	3/18/2009	3.41	−2.2 (0.03)	−1.9 (0.02)	−3.5 (0.00)	−2.4 (0.01)	−1.7 (0.02)
Fed LSAP2 dates	8/10/2010	0.57	0.3 (0.64)	0.4 (0.45)	0.3 (0.53)	−0.6 (0.33)	0.2 (0.66)
	8/27/2010	−0.83	−1.4 (0.10)	−0.7 (0.25)	−0.3 (0.54)	0.9 (0.14)	0.0 (1.00)
	9/21/2010	0.61	−0.8 (0.27)	−0.1 (0.81)	−1.5 (0.03)	−0.7 (0.24)	−0.5 (0.39)
	10/15/2010	−0.21	0.3 (0.62)	0.6 (0.28)	0.8 (0.20)	0.0 (0.94)	0.1 (0.84)
	11/3/2010	−0.05	−0.7 (0.35)	−0.3 (0.59)	−0.7 (0.22)	0.5 (0.36)	−0.3 (0.64)
Fed LSAP1	Sum		−3.6 (0.33)	−5.9 (0.08)	−6.0 (0.07)	−7.5 (0.04)	−3.0 (0.29)
	Avg		−0.7 (0.33)	−1.2 (0.08)	−1.2 (0.07)	−1.5 (0.04)	−0.6 (0.29)
Fed LSAP2	Sum		−2.3 (0.52)	−0.1 (0.98)	−1.5 (0.58)	0.1 (0.95)	−0.4 (0.88)
	Avg		−0.5 (0.52)	0.0 (0.98)	−0.3 (0.58)	0.0 (0.95)	−0.1 (0.88)

(continued on next page)

Table 4 (continued)

Panel B: Exchange rates								
	Event dates	Surprise	AU\$/	CA\$/	EUR/	JPY/	GBP/	
All Fed LSAPs	Sum		–5.8	–6.0	–7.5	–7.3	–3.4	
	Avg		–0.6	–0.6	–0.8	–0.7	–0.3	
			(0.41)	(0.30)	(0.22)	(0.23)	(0.53)	
Panel C: Commodity prices								
	Event Dates	Surprise	GSCI All	GSCI Agriculture	GSCI Energy	GSCI Indus. Metals	GSCI Livestock	GSCI Prec. Metals
Fed LSAP1 dates	11/25/2008	0.75	–4.5 (0.02)	–0.5 (0.73)	–6.3 (0.01)	–0.4 (0.77)	–0.3 (0.75)	0.0 (0.96)
	12/1/2008	0.84	–6.6 (0.00)	–4.5 (0.01)	–7.9 (0.01)	–1.9 (0.25)	–2.3 (0.02)	–5.6 (0.00)
	12/16/2008	2.22	–0.2 (0.89)	3.2 (0.05)	–1.1 (0.55)	–2.4 (0.16)	2.3 (0.02)	0.7 (0.48)
	1/28/2009	–0.23	1.5 (0.33)	1.2 (0.38)	1.9 (0.32)	1.2 (0.43)	0.4 (0.66)	–1.3 (0.26)
	3/18/2009	3.41	–1.7 (0.26)	–1.3 (0.33)	–1.9 (0.30)	–1.2 (0.45)	–0.2 (0.82)	–3.3 (0.03)
			(0.43)	(0.75)	(0.45)	(0.31)	(0.75)	(0.70)
Fed LSAP2 dates	8/10/2010	0.57	–1.2 (0.43)	–0.4 (0.75)	–1.4 (0.45)	–1.6 (0.31)	0.3 (0.75)	–0.4 (0.70)
	8/27/2010	–0.83	1.6 (0.29)	1.4 (0.32)	1.8 (0.33)	2.1 (0.20)	–0.7 (0.41)	0.0 (0.96)
	9/21/2010	0.61	–1.0 (0.48)	–0.7 (0.58)	–1.2 (0.51)	–1.0 (0.51)	–0.2 (0.82)	–0.5 (0.60)
	10/15/2010	–0.21	–1.4 (0.34)	–1.1 (0.41)	–1.9 (0.32)	–0.5 (0.72)	1.2 (0.19)	–0.4 (0.67)
	11/3/2010	–0.05	0.5 (0.72)	0.1 (0.92)	0.9 (0.60)	–1.0 (0.50)	–0.1 (0.86)	–1.5 (0.22)
			(0.14)	(0.77)	(0.12)	(0.55)	(0.98)	(0.13)
Fed LSAP1	Sum		–11.5	–1.9	–15.4	–4.7	–0.1	–9.5
	Avg		–2.3 (0.83)	–0.4 (0.92)	–3.1 (0.86)	–0.9 (0.77)	0.0 (0.91)	–1.9 (0.59)
Fed LSAP2	Sum		–1.5	–0.7	–1.6	–2.1	0.4	–2.8
	Avg		–0.3 (0.83)	–0.1 (0.92)	–0.3 (0.86)	–0.4 (0.77)	0.1 (0.91)	–0.6 (0.59)
All Fed LSAPs	Sum		–13.0	–2.6	–17.0	–6.8	0.4	–12.3
	Avg		–1.3 (0.38)	–0.3 (0.84)	–1.7 (0.36)	–0.7 (0.65)	0.0 (0.96)	–1.2 (0.29)

Note: Table shows changes between closing rates on the day of and the day before the event in basis points for interest rates and in log percentage points for exchange rates and commodity prices. For exchange rates, negative changes indicate depreciation of the dollar against the reference currency. “P-values” in parentheses denote the proportion of changes during the period January 2004 to July 2011 that were larger in absolute value than the reported change during the event.

Source: Bloomberg.

are consistent with [Glick and Leduc \(2011\)](#). As suggested there, a possible explanation is that market participants viewed LSAP announcements by the Federal Reserve as signaling lower future economic growth in the United States, which jointly lowered long-term interest rates, the value of the dollar, and commodity prices on the days the news were announced.

As reported in panel A of [Table 5](#), announcements by the Bank of England were also associated with declines in domestic long-term yields, by a cumulative 49 basis points.¹⁰ Interest rates in other countries fell as well, though the declines were negligible in magnitude. Correspondingly, the pound depreciated by 2–3 percentage points against other foreign currencies, including the U.S. dollar ([Table 5](#), panel B). Similarly to the case of the Federal Reserve announcements, commodity prices tended to fall with Bank of England announcements as well (see [Table 5](#), panel C), though the effects were generally much smaller, and dominated by a single event (March 5, 2009).

¹⁰ This result using our one-day window is comparable to that of [Joyce et al. \(2010, chart 10\)](#) using the same event sample. They find that the cumulative effect of BOE announcements roughly doubles to 100 basis points with a two-day window.

Table 5

Effects of BOE LSAP announcements on long-term interest rates, exchange rates, and commodity prices.

Panel A: Long-term interest rates							
	Event Dates	US TB10	AUS TB10	CAN TB10	EUR TB10	JPN TB10	UK TB10
BOE LSAP dates	2/11/2009	–6 (0.29)	–7 (0.21)	–5 (0.24)	–15 (0.00)	–5 (0.08)	–24 (0.00)
	3/5/2009	–16 (0.02)	–17 (0.01)	–10 (0.04)	–12 (0.02)	–2 (0.45)	–29 (0.00)
	5/7/2009	17 (0.02)	6 (0.24)	7 (0.10)	14 (0.01)	3 (0.22)	7 (0.12)
	8/6/2009	0 (0.91)	–2 (0.66)	–2 (0.54)	4 (0.37)	–1 (0.83)	–10 (0.06)
	11/5/2009	0 (0.98)	5 (0.31)	5 (0.21)	3 (0.49)	0 (0.86)	6 (0.18)
	Sum	–5	–14	–4	–7	–4	–49
BOE LSAP	Avg	–1 (0.86)	–3 (0.57)	–1 (0.81)	–1 (0.68)	–1 (0.72)	–10 (0.05)
Panel B: Exchange rates							
	Event Dates	AU\$/GBP	CA\$/GBP	EUR/GBP	JPY/GBP	\$/GBP	
BOE LSAP dates	2/11/2009	–1.27 (0.07)	–1.39 (0.04)	–0.95 (0.06)	–1.10 (0.14)	–1.00 (0.10)	
	3/5/2009	1.21 (0.09)	0.85 (0.18)	0.43 (0.33)	–1.65 (0.06)	–0.54 (0.35)	
	5/7/2009	–1.53 (0.04)	–0.46 (0.45)	–1.20 (0.03)	0.03 (0.96)	–0.78 (0.18)	
	8/6/2009	–1.08 (0.11)	–0.56 (0.37)	–0.80 (0.11)	–0.70 (0.29)	–1.22 (0.06)	
	11/5/2009	0.16 (0.77)	0.38 (0.53)	0.12 (0.77)	0.17 (0.77)	0.18 (0.74)	
	Sum	–2.51	–1.17	–2.41	–3.26	–3.37	
BOE LSAP	Avg	–0.50 (0.39)	–0.23 (0.69)	–0.48 (0.28)	–0.65 (0.32)	–0.67 (0.25)	
Panel C: Commodity prices							
	Event dates	GSCI All	GSCI Agriculture	GSCI Energy	GSCI Indus. Metals	GSCI Livestock	GSCI Prec. metals
BOE LSAP dates	2/11/2009	–0.3 (0.83)	–1.4 (0.31)	–0.2 (0.91)	–0.3 (0.82)	–0.4 (0.68)	3.2 (0.03)
	3/5/2009	–3.3 (0.06)	–1.7 (0.22)	–4.5 (0.05)	–1.8 (0.27)	–0.6 (0.49)	2.2 (0.09)
	5/7/2009	1.3 (0.39)	0.8 (0.53)	1.6 (0.39)	0.0 (0.97)	0.3 (0.73)	0.7 (0.50)
	8/6/2009	–1.1 (0.43)	–2.5 (0.10)	–0.6 (0.74)	–3.7 (0.05)	–1.9 (0.06)	–0.4 (0.69)
	11/5/2009	–1.0 (0.51)	–2.1 (0.14)	–0.9 (0.62)	–0.5 (0.75)	–0.5 (0.58)	0.2 (0.85)
	Sum	–4.4	–6.8	–4.5	–6.3	–3.0	6.0
BOE LSAP	Avg	–0.9 (0.54)	–1.4 (0.32)	–0.9 (0.61)	–1.3 (0.43)	–0.6 (0.48)	1.2 (0.30)

Note: Table shows changes between closing prices on the day of and the day before the event in basis points for interest rates and log percentages for exchange rates and commodity prices. “P-values” in parentheses denote the proportion of changes during the period January 2004 to July 2011 that were larger in absolute value than the change on the reported event.

Source: Bloomberg.

4.2. The surprise content of central bank announcements

So far we have looked simply at the daily movements in long-term interest rates, exchange rates, and commodity prices on days when central banks communicated information related to their asset-purchasing programs. We now look at the impact of those announcements after controlling for market expectations, as discussed in Section 3.2 above.

The first columns of Figs. 2 and 3 show the average daily change in long-term interest rates, exchange rates, and commodity prices following LSAP announcements in the United States and the United Kingdom, respectively. Consistent with the results in the previous section, Fig. 2 shows that on average long-term interest rates fell, the U.S. dollar depreciated, and commodity prices declined in response to the monetary announcements.

However, simply looking at the average daily changes in these variables fails to take into account the extent to which the announcements were expected by investors and their potential effects were already priced into market prices. The second column of Fig. 2 reports the average daily change in long-term interest rates, exchange rates, and commodity prices, following Federal Reserve LSAP announcements, but now conditional on whether the monetary surprises implicit in these announcements were positive (i.e. perceived as a loosening of policy); or negative (i.e. perceived as a tightening of policy).

Focusing first on Federal Reserve announcements, Fig. 2 clearly shows that ten-year interest rates globally fell following positive monetary surprises by the Federal Reserve, and rose following negative monetary surprises, as one would expect. (This pattern also exists when examining LSAP1 or LSAP2 separately.) Correspondingly, Fig. 2 also shows that the dollar depreciated more on event days with positive surprises than with negative surprises (the change in the value of the U.S. dollar relative to the Australian dollar is the exception).

Fig. 3 shows similar effects for the surprise component of monetary policy announcements by the Bank of England – rates fell with positive surprises and rose with negative surprises. Correspondingly, the pound depreciated relatively more against the yen, euro, and dollar on days with positive surprises.

Positive and negative monetary surprises also have differential effects on commodity prices in our sample. Fig. 2 shows that commodity prices fell, on average, following positive monetary surprises in the United States and rose otherwise. Commodity prices also fell following positive surprise announcements by the Bank of England, with the exception of precious metals, as shown in the last row of Fig. 3. (However, the figure doesn't indicate a clear pattern in response to negative surprise announcements in this case possibly due to the limited number of events.) Thus, positive monetary surprises that brought about a more expansionary monetary policy stance in the form of lower long-term interest rate also were accompanied by a fall in commodity prices.

4.3. Regression results

To look at these effects more formally, we separately regress daily changes in long-term interest rates, exchange rates, or commodity prices on a constant and our measure of U.S. and U.K. monetary surprises, as reported in Tables 1 and 2, while controlling for financial turmoil using the daily level of the VIX index.¹¹ (We also run alternative specifications by including dummy variables for different days associated with market disruptions, such as the collapse of Lehman Brothers, and found our results to be robust to this change.) We report results for the period of January 2004 to August 2011, though they are robust to the use of a shorter sample that starts in January 2008. We also report results when we differentiate between positive and negative monetary surprises in the regressions.

Not surprisingly, the R^2 levels in these regressions are all quite low, indicating that our explanatory variables account for only a small proportion of the overall variation in asset prices over the sample period. Nonetheless the sign, magnitude, and significance of the coefficients on the explanatory variables are informative about the changes in financial price on announcement event days in comparison to changes on non-announcement days over our sample period.

¹¹ The surprise variables are defined to have values of zero on all non-announcement days. Hence the constant in the regressions effectively measures the average asset price change in all such days. We enter the Fed and BOE monetary surprise variables simultaneously as explanatory variables in all regressions, with the exception of the exchange rate. The results are identical to entering these variables in separate regressions, since the announcement days from the two central banks do not overlap and have no persistent effects. We also estimated dynamic VAR specifications with lagged dependent variables, but generally found these variables to be insignificant.

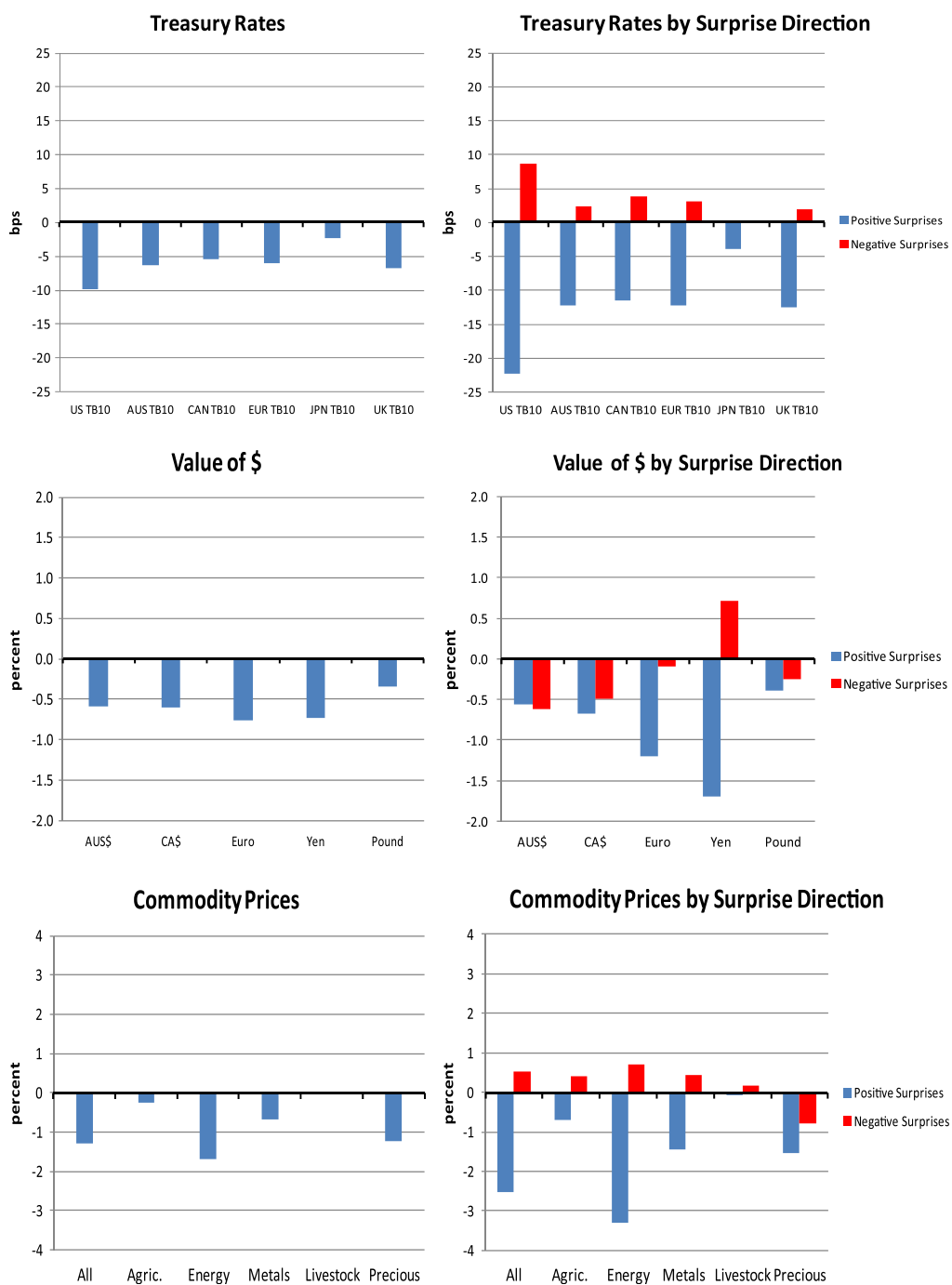


Fig. 2. Daily change effects of U.S. LSAP monetary announcements.

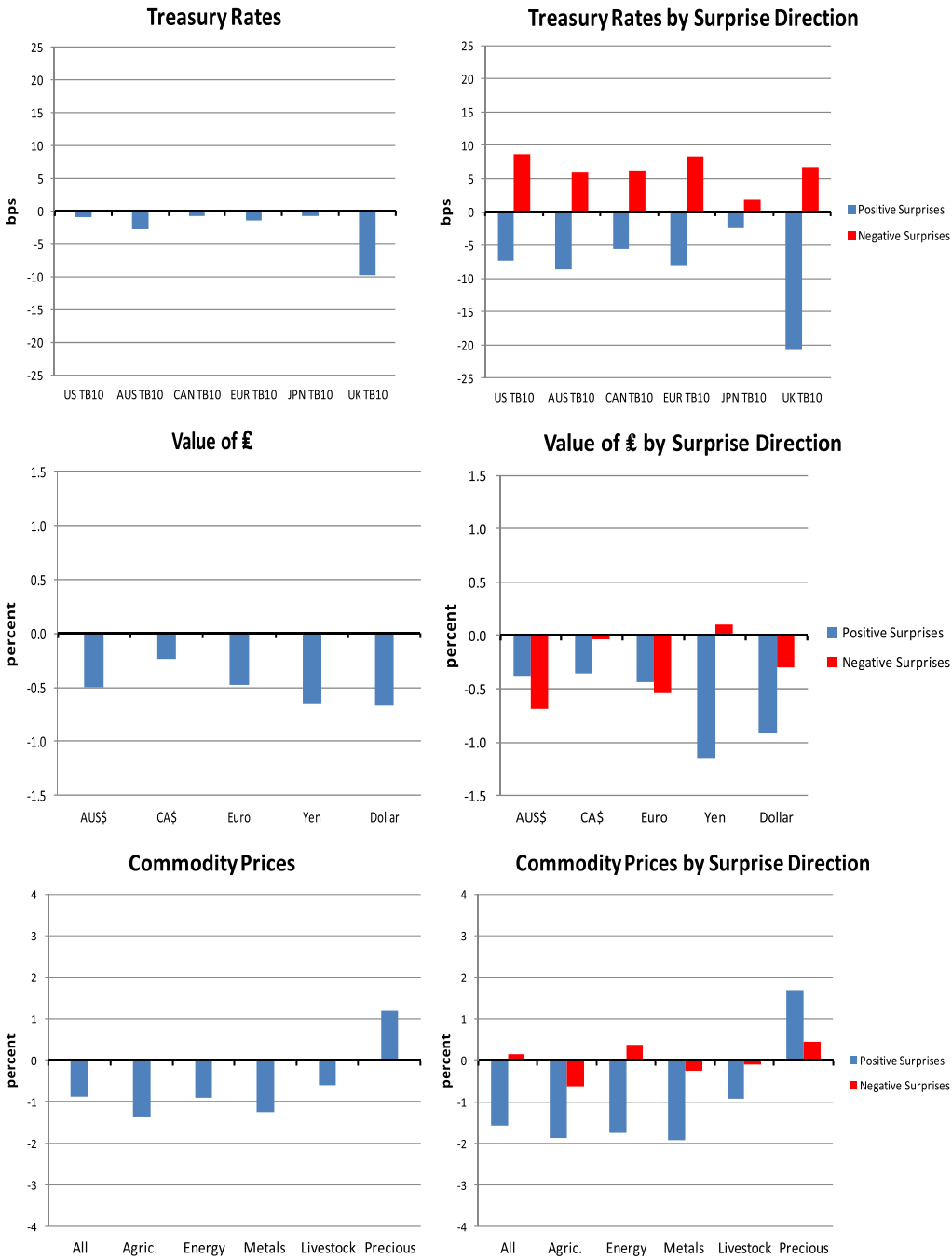


Fig. 3. Daily change effects of U.K. LSAP monetary announcements.

Table 6

Regression effects of monetary surprises on long-term interest rates.

Panel A: All events						
	US TB10	AUS TB10	CAN TB10	EU TB10	JPN TB10	UK TB10
LSAP Surprise	–14.230*** (1.479)	–7.318*** (1.387)	–6.878*** (1.030)	–6.274*** (0.975)	–1.990*** (0.624)	–5.073*** (1.116)
BOE LSAP Surprise	–6.067** (2.508)	–6.390*** (2.351)	–3.997** (1.747)	–7.217*** (1.653)	–1.831* (1.058)	–14.602*** (1.892)
VIX	–0.028** (0.014)	–0.028** (0.013)	–0.018* (0.010)	–0.024*** (0.009)	–0.009 (0.006)	–0.028*** (0.011)
Constant	0.542* (0.324)	0.527* (0.304)	0.291 (0.226)	0.434** (0.214)	0.157 (0.137)	0.517** (0.244)
Adjusted R^2	0.052	0.021	0.027	0.035	0.007	0.045
Panel B: All events distinguished by surprise direction						
	US TB10	AUS TB10	CAN TB10	EU TB10	JPN TB10	UK TB10
LSAP Positive surprise	–21.489*** (2.678)	–11.544*** (2.501)	–11.048*** (1.858)	–11.500*** (1.756)	–3.607*** (1.124)	–11.888*** (2.004)
LSAP Negative surprise	8.803*** (3.253)	2.684 (3.041)	4.042* (2.257)	3.279 (2.133)	0.056 (1.367)	2.121 (2.435)
BOE LSAP Positive surprise	–6.659* (3.764)	–8.098** (3.517)	–5.141** (2.612)	–7.384*** (2.468)	–2.249 (1.580)	–20.131*** (2.818)
BOE LSAP Negative surprise	8.954* (4.599)	6.17 (4.297)	6.484** (3.191)	8.585*** (3.015)	1.942 (1.931)	7.034** (3.442)
VIX	–0.030** (0.014)	–0.029** (0.013)	–0.018* (0.010)	–0.025*** (0.009)	–0.009 (0.006)	–0.027** (0.011)
Constant	0.559* (0.326)	0.542* (0.304)	0.293 (0.226)	0.442** (0.214)	0.157 (0.137)	0.502** (0.244)
Adjusted R^2	0.042	0.017	0.025	0.035	0.006	0.049
Hyp: LSAP Pos. Surp. = Neg. Surp. (P -value)	0.00	0.00	0.00	0.00	0.04	0.00
Hyp: BOE Pos. Surp. = Neg. Surp. (P -value)	0.01	0.01	0.00	0.00	0.09	0.00

Notes: Table reports coefficient estimates of OLS regressions of basis point change in interest rates on Fed and BOE LSAP surprises. Standard errors in parentheses below.

Significance levels: * 10%, **5%, ***1%.

Table 6, panel A shows that monetary surprises associated with LSAP announcements by the Federal Reserve or the Bank of England led to highly significant daily declines in domestic and foreign interest rates.¹² In the United States, a one standard deviation change in the magnitude of the monetary surprise lowered the ten-year U.S. Treasury yield by 14 basis points, while the ten-year U.K. interest rate fell by a similar magnitude following a monetary surprise in the United Kingdom. Other interest long-term interest rates fell by roughly 2 to 7 basis points.

In panel B of Table 6, we distinguish surprises by their sign.¹³ As Fig. 2 suggested, the results in Table 9 show that positive U.S. monetary surprises reduced the ten-year Treasury yield, while negative surprises raised it. Our results also indicate this effect to be roughly twice as large in absolute value following positive monetary surprises than in response to negative monetary surprises: when the surprise is positive, a one standard deviation change leads to a 21 basis point decline in the interest rate, while when the surprise is negative interest rates rise by 9 basis points. Other country's long-term interest rates were also more significantly affected following positive monetary surprises, particularly those in the United States.

¹² Note that our procedure does not guarantee that a positive monetary surprise will lower U.S. long-term interest rates. While the surprise component of the monetary announcements is measured as the first principal component of yield changes in interest rate futures around a tight window bracketing the announcements, the dependent variables are measured at a lower (daily) frequency, including long-term interest rates. Moreover, while changes in expectations (as captured by the monetary surprises) may affect changes in long-term interest rates, other factors such as risk and term premia may also have an influence, possibly in the opposite direction. So, overall, a particular movement in our monetary surprises doesn't necessarily imply a similar movement in long-term interest rates.

¹³ We do that by interacting the surprise variable with dummies for positive and negative changes.

Table 7

Regression effects of U.S. monetary surprises on exchange rates.

Panel A: All events					
	AU\$/	CA\$/	Euro/	Yen/	GBP/
LSAP surprise	−0.711*** (0.224)	−0.631*** (0.158)	−0.939*** (0.152)	−0.873*** (0.158)	−0.493*** (0.147)
VIX	0.008*** (0.002)	0.007*** (0.001)	0.003* (0.001)	−0.004*** (0.001)	0.006*** (0.001)
Constant	−0.182*** (0.049)	−0.149*** (0.035)	−0.062* (0.033)	0.079** (0.035)	−0.112*** (0.032)
Adjusted R ²	0.011	0.016	0.019	0.021	0.012
Panel B: All events distinguished by surprise direction					
	AU\$/	CA\$/	Euro/	Yen/	GBP/
LSAP Positive surprise	−0.732* (0.404)	−0.818*** (0.285)	−1.252*** (0.274)	−1.581*** (0.284)	−0.529** (0.265)
LSAP Negative surprise	−0.641 (0.490)	−0.511 (0.346)	−0.096 (0.333)	0.752** (0.345)	−0.275 (0.322)
VIX	0.008*** (0.002)	0.007*** (0.001)	0.003* (0.001)	−0.004*** (0.001)	0.005*** (0.001)
Constant	−0.179*** (0.049)	−0.148*** (0.035)	−0.061* (0.033)	0.075** (0.035)	−0.110*** (0.032)
Adjusted R ²	0.007	0.012	0.01	0.023	0.008
Hyp: LSAP Pos. Surp. = Neg. Surp. (<i>P</i> -value)	0.89	0.49	0.01	0.00	0.54

Notes: Table reports coefficient estimates of OLS regressions of (log) percent change of exchange rate on Fed LSAP surprises. Standard errors in parentheses below. Significance levels: * 10%, **5%, ***1%.

Consistent with falling interest rates, Table 7, panel A shows that monetary surprises in the United States led to a lower value of the U.S. dollar against all foreign currencies, with all effects significant at better than 1 percent. Moreover, as indicated in panel B of Table 7, these effects largely come from the impact of positive monetary surprises; negative surprises had much less

Table 8

Regression effects of U.K. monetary surprises on exchange rates.

Panel A: All events					
	AU\$/£	CA\$/£	Euro/£	Yen/GBP	\$/£
BOE LSAP Surprise	−0.06 (0.311)	−0.174 (0.260)	−0.104 (0.205)	−0.633* (0.344)	−0.397 (0.250)
VIX	0.002 (0.002)	0.001 (0.001)	−0.003*** (0.001)	−0.010*** (0.002)	−0.005*** (0.001)
Constant	−0.067* (0.040)	−0.036 (0.033)	0.055** (0.026)	0.192*** (0.044)	0.102*** (0.032)
Adjusted R ²	0	−0.001	0.003	0.016	0.007
Panel B: All Events distinguished by surprise direction					
	AU\$/£	CA\$/£	Euro/£	Yen/£	\$/£
BOE LSAP Positive surprise	−0.41 (0.464)	−0.368 (0.388)	−0.373 (0.306)	−0.937* (0.514)	−0.827** (0.373)
BOE LSAP Negative surprise	−0.689 (0.567)	−0.034 (0.474)	−0.503 (0.374)	0.201 (0.628)	−0.262 (0.455)
VIX	0.002 (0.002)	0.001 (0.001)	−0.003*** (0.001)	−0.010*** (0.002)	−0.005*** (0.001)
Constant	−0.069* (0.040)	−0.036 (0.033)	0.054** (0.026)	0.193*** (0.044)	0.101*** (0.032)
Adjusted R ²	0.001	−0.001	0.004	0.015	0.008
Hyp: BOE Pos. Surp. = Neg. Surp. (<i>P</i> -value)	0.70	0.58	0.79	0.16	0.34

Notes: Table reports coefficient estimates of OLS regressions of (log) percent change of exchange rate on BOE LSAP surprises. Standard errors in parentheses below. Significance levels: * 10%, **5%, ***1%.

Table 9

Regression effects of monetary surprises on commodity prices.

Panel A: All events						
	GSCI All	GSCI Agr	GSCI En	GSCI IndMt	GSCI PrMt	GSCI LvStk
LSAP Surprise	−0.768** (0.388)	−0.123 (0.350)	−1.027** (0.485)	−0.607 (0.413)	−0.767** (0.307)	0.176 (0.212)
BOE LSAP Surprise	−0.842 (0.657)	−0.908 (0.593)	−1.066 (0.822)	−0.56 (0.700)	1.403*** (0.520)	−0.312 (0.360)
VIX	−0.017*** (0.004)	−0.007** (0.003)	−0.020*** (0.005)	−0.017*** (0.004)	−0.002 (0.003)	−0.005** (0.002)
Constant	0.398*** (0.085)	0.182** (0.077)	0.469*** (0.106)	0.400*** (0.090)	0.113* (0.067)	0.123*** (0.046)
Adjusted R^2	0.014	0.002	0.013	0.011	0.006	0.002
Panel B: All events distinguished by surprise direction						
	GSCI All	GSCI Agr	GSCI En	GSCI IndMt	GSCI PrMt	GSCI LvStk
LSAP Positive surprise	−2.198*** (0.698)	−0.602 (0.630)	−2.901*** (0.872)	−1.085 (0.743)	−1.580*** (0.553)	0.015 (0.382)
LSAP Negative surprise	0.565 (0.847)	0.377 (0.765)	0.739 (1.059)	0.488 (0.903)	−0.867 (0.671)	0.179 (0.464)
BOE LSAP Positive surprise	−1.311 (0.980)	−1.787** (0.885)	−1.427 (1.226)	−1.641 (1.045)	1.628** (0.777)	−0.872 (0.537)
BOE LSAP Negative surprise	0.235 (1.198)	−0.624 (1.081)	0.48 (1.498)	−0.149 (1.276)	0.372 (0.949)	−0.087 (0.657)
VIX	−0.016*** (0.004)	−0.006* (0.003)	−0.019*** (0.005)	−0.017*** (0.004)	−0.001 (0.003)	−0.004** (0.002)
Constant	0.388*** (0.085)	0.176** (0.077)	0.457*** (0.106)	0.395*** (0.090)	0.105 (0.067)	0.119** (0.047)
Adjusted R^2	0.016	0.003	0.016	0.011	0.005	0.002
Hyp: LSAP Pos. Surp. = Neg. Surp. (P -value)	0.01	0.32	0.01	0.18	0.41	0.78
Hyp: BOE Pos. Surp. = Neg. Surp. (P -value)	0.32	0.40	0.32	0.37	0.30	0.35

Notes: Table reports coefficient estimates of OLS regressions of (log) percent change of commodity prices on Fed and BOE LSAP surprises.

Standard errors in parentheses below. Significance levels: * 10%, **5%, ***1%.

significant effects, except for the yen-dollar exchange rate. In contrast, we do not find that monetary surprises in the United Kingdom had a significant effect on the value of the British currency, though the point estimates indicate that the pound tended to depreciate against all currencies (see panel A of Table 8). However, this is due to aggregating positive and negative monetary surprises. Indeed, panel B shows that positive monetary surprises depreciated the British pound against the U.S. dollar and the yen.

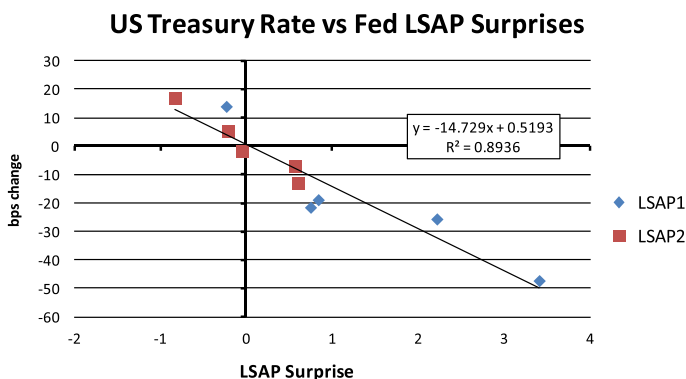
We report similar regression results for commodity prices in Table 9. The top panel indicates that commodity prices fell following U.S. monetary surprises, with the effect being significant for energy prices and precious metals, with the price indices for these two categories falling roughly 1 percent. (The overall GSCI also fell significantly since it is mostly driven by movements in energy prices.) In contrast, monetary surprises in the United Kingdom had a positive and significant effect only on the price index for precious metals. Other commodity prices tended to fall, though not significantly so.

As in the case of long-term interest rates, we find in panel B of Table 9 that positive U.S. monetary announcements had a more pronounced effects on commodity prices than negative surprises. Again, positive surprises led to significant declines in the price indices of energy and precious metals. In contrast, commodity prices rose following negative surprises, though the effects are less precisely estimated than those following positive monetary surprises.

4.4. LSAP1 vs. LSAP2

We conclude this section with a closer examination of the differential effects of LSAP1 and LSAP2 announcements by the Federal Reserve. In Section 4.1 we concluded that the effects of LSAP1 on asset

Panel A: United States



Panel B: United Kingdom

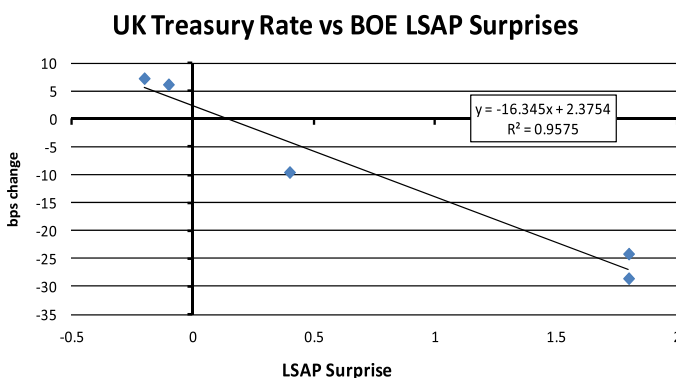


Fig. 4. Effects of monetary surprises on long-term Treasury Rates. Panel A: United States. Panel B: United Kingdom.

prices were much larger than those under LSAP2; this accords with the view of many other researchers (e.g. Krishnamurthy and Vissing-Jorgensen (2011)). We subsequently emphasized the importance of controlling for the surprise content of announcements in order to fully understand the direction and magnitude of the financial price responses.

To highlight the relation between the magnitudes of the surprise and response of interest rates, Fig. 4 presents a scatter plot of U.S. monetary surprises and long-term interest rate changes for the ten event days of LSAP1 and LSAP2 together. The figure shows a negative relationship between interest rate changes and the surprise magnitude of U.S. announcement days, implying that the higher the surprise about monetary policy loosening, the greater the decline in the interest rate. Observe as well that LSAP1 and LSAP2 observations fit this relation equally well, though the monetary surprises under LSAP2 tended to be smaller and less positive. (The slope of the fitted line is statistically significant for all LSAP events together or for LSAP1 and LSAP2 separately.¹⁴).

In Table 10 we estimate regressions to compare the effects of the surprise component of Fed monetary policy announcements under both the LSAP1 and LSAP2 rounds on U.S. long-term interest rates. The results indicate that the effects under the two rounds were in fact fairly comparable, with that under LSAP2 actually being even slightly larger than under LSAP1. During LSAP2, monetary surprises raised interest rates by 19 basis points, on average, compared to only 14 basis points under LSAP1. Recall

¹⁴ We find a similar negative relationship between BOE surprises and the U.K. long-term interest rate.

Table 10

Regression effects of U.S. monetary surprises on long-term interest rates by LSAP round.

	US TB10	AUS TB10	CAN TB10	EU TB10	JPN TB10	UK TB10
LSAP1 Surprise	–13.822*** (1.540)	–7.346*** (1.445)	–6.825*** (1.073)	–5.746*** (1.018)	–1.913*** (0.649)	–4.410*** (1.177)
LSAP2 Surprise	–18.824*** (5.407)	–6.543 (5.073)	–7.246* (3.767)	–12.268*** (3.575)	–2.819 (2.281)	–12.205*** (4.132)
VIX	–0.031** (0.014)	–0.031** (0.013)	–0.019** (0.010)	–0.028*** (0.009)	–0.010* (0.006)	–0.035*** (0.011)
Constant	0.592* (0.324)	0.568* (0.304)	0.32 (0.226)	0.494** (0.214)	0.17 (0.137)	0.631** (0.248)
Adjusted R ²	0.049	0.017	0.025	0.027	0.006	0.017
LSAP1 Surprise	–13.815*** (1.538)	–7.343*** (1.444)	–6.822*** (1.073)	–5.745*** (1.018)	–1.913*** (0.650)	–4.409*** (1.177)
LSAP2 Surprise	–18.824*** (5.401)	–6.543 (5.072)	–7.246* (3.766)	–12.268*** (3.576)	–2.819 (2.281)	–12.205*** (4.133)
Other FOMC announcements	–9.159** (4.048)	–5.592 (3.801)	–3.5 (2.823)	–0.663 (2.680)	–1.266 (1.710)	–0.606 (3.098)
VIX	–0.032** (0.014)	–0.031** (0.013)	–0.020** (0.010)	–0.028*** (0.009)	–0.010* (0.006)	–0.035*** (0.011)
Constant	0.599* (0.324)	0.571* (0.304)	0.323 (0.226)	0.494** (0.214)	0.171 (0.137)	0.632** (0.248)
Adjusted R ²	0.051	0.017	0.025	0.027	0.006	0.017

Notes: Table reports coefficient estimates of OLS regressions of basis point change in interest rates on Fed LSAP1 and LSAP2 surprises. Standard errors in parentheses below. Significance levels: * 10%, **5%, ***1%.

that our surprise variable is measured in standardized units, so the coefficients in the regression have the interpretation of the basis point change in the interest rate in response to a one standard deviation unit increase in the magnitude of the monetary surprise. Thus, although the average magnitude of monetary surprises during the LSAP2 round of Fed announcements was lower than during the LSAP1 round, the proportional response to a given magnitude surprise was larger with LSAP2. In this sense the effects of announcements during the LSAP2 round were more “potent” than during LSAP1.

For comparison, we also include the effects of other Federal Reserve monetary policy announcements made after FOMC meetings since 2008 that were unrelated to LSAPs using additional data from Wright (2011).¹⁵ We find that these announcements also reduced U.S. interest rates, though by a smaller magnitude than did LSAPs.

4.5. Discussion

Our main results indicate that positive monetary surprises that led to a more expansionary stance in the United States and a depreciation of the U.S. dollar also lowered the price indices for energy and precious metals. In contrast, negative monetary surprises that brought about higher long-term interest rates, and thus a more restrictive monetary stance also tended to raise commodity prices, though the effect on commodity prices is less precisely estimated in this case.

Frankel (1986, 2006) points out a powerful link between real interest rates and real commodity prices in a Dornbusch-style overshooting model. In this theory, an easier monetary stance that brings about lower real interest rates also triggers an increase in commodity prices such that investors expect commodity price to decline in the future. In equilibrium, the low real interest rate is just sufficient to compensate investors for the expected depreciation (assuming other costs of carrying inventories, such as storage costs and any risk premium, are either constant or also low).

In our analysis above, we used *nominal* commodity prices and *nominal* interest rates. However, our results are little changed if instead we deflated these variables by the monthly consumer price inflation rate. (We deflate by the monthly CPI inflation rate, given the absence of inflation measure at a daily frequency).

¹⁵ These dates are 4/29/2009, 6/24/2009, 8/12/2009, 9/23/2009, 11/4/2009, 12/16/2009, 1/27/2010, 3/16/2010, 4/28/2010, 6/23/2010, 12/14/2010.

One possibility for the departure between the implications of Frankel's overshooting-style model and our results is variation in the risk premium at the daily frequency. Our results suggest that the risk premium would have risen sharply following positive U.S. monetary surprises, making it risky to acquire long positions in energy, industrial, and agricultural commodities, reducing demand and their price.

In addition, the theory may be missing the signaling aspect of Federal Reserve communication. For instance, to the extent that investors think the Federal Reserve has access to private information, LSAP announcements could also impact the economy by changing investors' beliefs about the underlying state of the economy. One interpretation of our results is that LSAP announcements led investors to downgrade their U.S. growth forecast, triggering a fall in long-term interest rates, a depreciation of the U.S. dollar, as well as a fall in commodity prices on announcement days.

4.6. Stock price responses and the signaling effect of LSAP announcements

If the financial markets interpreted the initial LSAP announcements as signaling a worsening of the economic outlook, we should also presumably observe a decline in stock prices on announcement days. In this section, we look at this evidence by looking at the effects of LSAP announcements on equity prices in the United States (S&P 500), the United Kingdom (FT All Shares), Canada (S&P/TSX), Australia (All Ordinaries), Japan (Nikkei 225), and Europe (Xetra Dax). Tables 11 and 12 detail the daily changes in those stock indices on LSAP announcements days.

Table 11

Effects of US LSAP announcements on stock prices.

	Event dates	Surprise	S&P 500	All ordinaries	S&P/TSX composite	Xetra Dax	Nikkei 225	FT All shares
Fed LSAP1 dates	11/25/2008 am	0.75	0.7 (0.42)	-2.7 (0.04)	0.0 (0.98)	0.1 (0.88)	-1.3 (0.30)	0.4 (0.59)
	12/1/2008	0.84	-9.4 (0.00)	-4.1 (0.01)	-9.8 (0.00)	3.07 (0.03)	-6.6 (0.01)	1.26 (0.19)
	12/16/2008	2.22	5.0 (0.01)	0.5 (0.55)	3.1 (0.03)	-0.5 (0.61)	0.5 (0.63)	0.4 (0.62)
	1/28/2009	-0.23	3.3 (0.03)	0.8 (0.37)	1.7 (0.11)	-2.0 (0.10)	1.8 (0.18)	-2.5 (0.05)
	3/18/2009	3.41	2.1 (0.09)	0.9 (0.31)	0.8 (0.35)	1.2 (0.28)	-0.3 (0.75)	0.4 (0.61)
			-0.6 (0.46)	-1.8 (0.08)	-0.2 (0.79)	-2.1 (0.09)	-2.7 (0.06)	-2.4 (0.05)
Fed LSAP2 dates	8/10/2010	0.57	1.6 (0.12)	1.8 (0.09)	1.9 (0.09)	0.7 (0.50)	1.7 (0.18)	0.9 (0.30)
	8/27/2010 am	-0.83	-0.3 (0.72)	0.2 (0.77)	-0.5 (0.54)	-1.1 (0.31)	-0.4 (0.71)	-0.5 (0.54)
	9/21/2010	0.61	0.2 (0.77)	-0.7 (0.39)	-0.1 (0.91)	0.6 (0.54)	0.0 (0.99)	-0.4 (0.61)
	10/15/2010 am	-0.21	0.4 (0.62)	0.5 (0.53)	-0.1 (0.91)	1.8 (0.14)	2.1 (0.12)	1.8 (0.09)
	11/3/2010	-0.05	1.7 (0.65)	-4.7 (0.29)	-4.2 (0.33)	1.9 (0.67)	-5.9 (0.34)	0.1 (0.99)
Fed LSAP1	Sum		1.7 (0.65)	-4.7 (0.29)	-4.2 (0.33)	1.9 (0.67)	-5.9 (0.34)	0.1 (0.99)
	Avg		0.3 (0.70)	-0.9 (0.98)	-0.8 (0.80)	0.4 (0.96)	-1.2 (0.88)	0.0 (0.89)
Fed LSAP2	Sum		1.4 (0.70)	-0.1 (0.98)	1.0 (0.80)	-0.2 (0.96)	0.8 (0.88)	-0.6 (0.89)
	Avg		0.3 (0.68)	0.0 (0.54)	0.2 (0.69)	0.0 (0.85)	0.2 (0.63)	-0.1 (0.95)
All Fed LSAPs	Sum		3.0 (0.68)	-4.8 (0.54)	-3.2 (0.69)	1.7 (0.85)	-5.2 (0.63)	-0.5 (0.95)
	Avg		0.3 (0.68)	-0.5 (0.54)	-0.3 (0.69)	0.2 (0.85)	-0.5 (0.63)	-0.1 (0.95)

Note: Table shows log changes between closing prices on the day of and the day before the event in percentage points. "P-values" in parentheses denote the proportion of changes during the period January 2004 to July 2011 that were larger in absolute value than the change on the reported event.

Note: S&P500, All Ordinaries, S&P/TSX, Xetra Dax, Nikkei 225, FT ALL Shares denote stock price indices for the U.S., Australia, Canada, Germany, Japan, and the U.K., respectively. Source: Bloomberg.

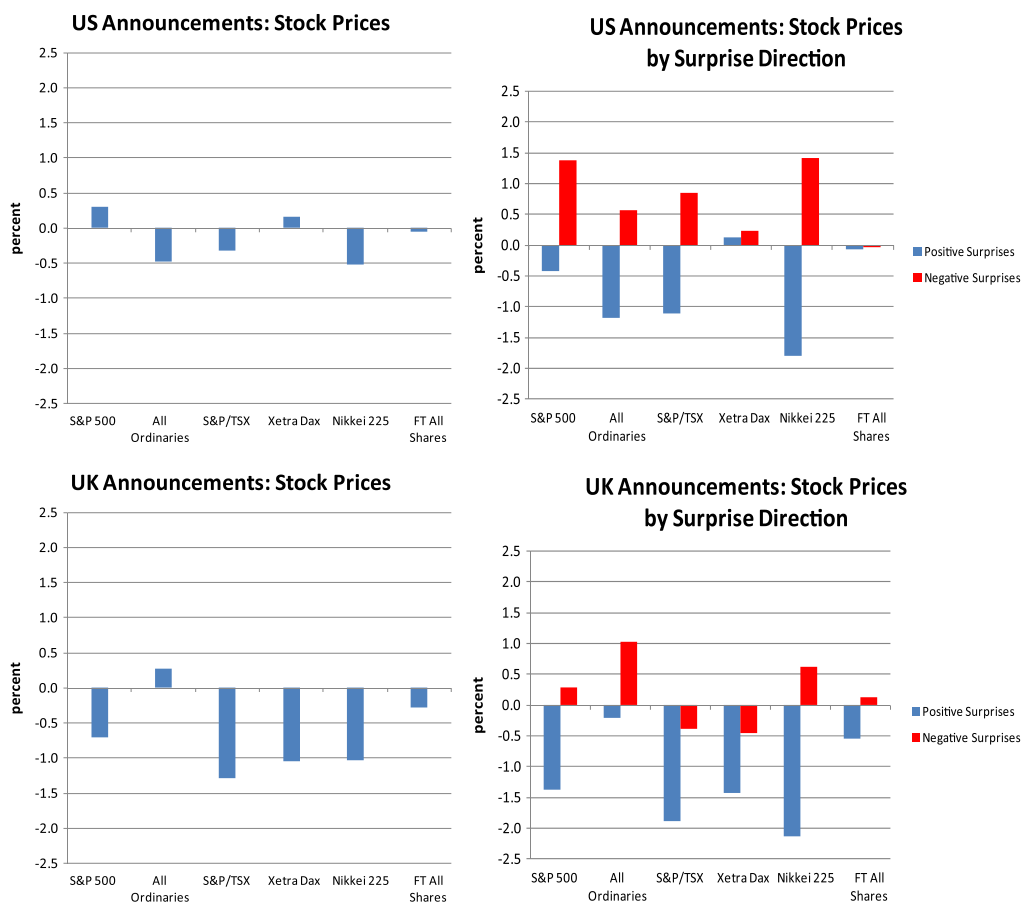
Table 12

Effects of BOE LSAP announcements on stock prices.

	Event dates	Surprise	S&P 500	All ordinaries	S&P/TSX composite	Xetra Dax	Nikkei 225	FT All shares
BOE LSAP dates	2/11/2009	1.80	0.8 (0.36)	1.2 (0.20)	−0.9 (0.31)	0.5 (0.56)	−3.1 (0.05)	0.4 (0.59)
	3/5/2009	1.80	−4.3 (0.02)	−1.2 (0.20)	−2.4 (0.05)	−5.2 (0.01)	−3.6 (0.03)	−3.1 (0.02)
	5/7/2009	−0.20	−1.3 (0.19)	0.2 (0.79)	−1.8 (0.10)	−1.6 (0.17)	0.5 (0.64)	−0.1 (0.92)
	8/6/2009	0.40	−0.6 (0.48)	−0.6 (0.43)	−2.3 (0.06)	0.3 (0.71)	0.2 (0.81)	1.0 (0.26)
	11/5/2009	−0.10	1.9 (0.10)	1.9 (0.08)	1.0 (0.28)	0.7 (0.49)	0.7 (0.51)	0.3 (0.69)
BOE LSAP	Sum		−3.5	1.4	−6.4	−5.2	−5.2	−1.4
	Avg		−0.7 (0.40)	0.3 (0.71)	−1.3 (0.18)	−1.0 (0.33)	−1.0 (0.40)	−0.3 (0.73)

Note: Table shows log changes between closing prices on the day of and the day before the event in percentage points. "P-values" in parentheses denote the proportion of changes during the period January 2004 to July 2011 that were larger in absolute value than the change on the reported event.

Note: S&P500, All Ordinaries, S&P/TSX, Xetra Dax, Nikkei 225, FT ALL Shares denote stock price indices for the U.S., Australia, Canada, Germany, Japan, and the U.K., respectively. Source: Bloomberg.

**Fig. 5.** Daily change effects of U.S. and U.K. LSAP monetary announcements on stock prices.

The first column of Fig. 5 first reports the results of the average daily movements in stock prices following LSAP announcements in either the United States or the United Kingdom. U.S. Equity prices rose on average following surprise LSAP announcements by the Federal Reserve, though they fell in other parts of the world, but for Australia. However, we find the increase in the S&P 500 to be relatively small at less than 0.5 percent. In contrast, announcements in the United Kingdom were followed by a fall in U.K. equity prices.

Following our approach above, we again find it important to look at surprise announcements and to distinguish between positive and negative surprises in studying their effects on stock prices. The second column of Fig. 5 shows that for both the Federal Reserve and the Bank of England, positive surprises tended to depress equity prices, while negative surprises tended to boost them. Our straightforward split of the data therefore provides some a priori support for the signaling effects of LSAP announcements.

We test this conjecture more formally in Table 13. In panel A, we report results from regressions of the daily changes in stock prices on all monetary surprises, while we distinguish between positive and negative surprises in panel B. The key finding is that when we differentiate between positive and negative surprises, we find that positive Federal Reserve surprise announcements reduced stock prices in four of six markets, though at only 10 percent significance or better in two cases. Bank of England surprise announcements reduced equity prices in five of six markets, though significantly in only two cases. Correspondingly, negative surprises were accompanied by rising stock prices in all markets in the case of Federal Reserve announcements, with the effect on the S&P 500 significant at 5percent, and in four of six markets in the case of Bank of England announcements, though none of these effects are statistically significant.

Because of the imprecision of our estimates the evidence from stock markets can be interpreted as only suggestive that LSAP announcements signaled more pessimistic economic conditions to market participants.

Table 13

Regression effects of monetary surprises on stock prices.

Panel A: All events						
	S&P 500	All Ord	S&P TSX	DAX	Nikkei 225	FT ALL
LSAP Surprise	0.600* (0.310)	−0.044 (0.258)	0.102 (0.292)	0.36 (0.314)	−0.337 (0.369)	0.236 (0.280)
BOE LSAP Surprise	−0.734 (0.526)	0.122 (0.438)	−0.78 (0.495)	−0.947* (0.533)	−1.551** (0.625)	−0.466 (0.475)
VIX	−0.017*** (0.003)	−0.015*** (0.002)	−0.016*** (0.003)	−0.017*** (0.003)	−0.018*** (0.004)	−0.014*** (0.003)
Constant	0.362*** (0.068)	0.327*** (0.057)	0.342*** (0.065)	0.367*** (0.069)	0.367*** (0.083)	0.285*** (0.062)
Adjusted R ²	0.019	0.019	0.017	0.018	0.018	0.013
Panel B: All events distinguished by surprise direction						
	S&P 500	All Ord	S&P TSX	DAX	Nikkei 225	FT ALL
LSAP Positive surprise	−0.012 (0.559)	−0.853* (0.464)	−0.769 (0.525)	0.515 (0.567)	−1.379** (0.664)	0.251 (0.505)
LSAP Negative surprise	1.462** (0.679)	0.658 (0.564)	0.91 (0.638)	0.321 (0.688)	1.538* (0.806)	0.038 (0.613)
BOE LSAP Positive surprise	−1.044 (0.785)	0.039 (0.653)	−1.606** (0.738)	−1.106 (0.797)	−1.798* (0.933)	−0.285 (0.709)
BOE LSAP Negative surprise	0.435 (0.959)	1.132 (0.797)	−0.273 (0.901)	−0.315 (0.973)	0.769 (1.140)	0.239 (0.867)
VIX	−0.017*** (0.003)	−0.015*** (0.002)	−0.015*** (0.003)	−0.017*** (0.003)	−0.018*** (0.004)	−0.014*** (0.003)
Constant	0.354*** (0.068)	0.319*** (0.057)	0.331*** (0.065)	0.369*** (0.070)	0.363*** (0.083)	0.287*** (0.062)
Adjusted R ²	0.019	0.022	0.02	0.017	0.02	0.011
Hyp: LSAP Pos. Surp. = Neg. Surp. (<i>P</i> -value)	0.09	0.04	0.04	0.83	0.01	0.79
Hyp: BOE Pos. Surp. = Neg. Surp. (<i>P</i> -value)	0.23	0.29	0.25	0.53	0.08	0.64

Note: S&P500, All Ordinaries, S&P/TSX, Xetra Dax, Nikkei 225, FT ALL Shares denote stock price indices for the U.S., Australia, Canada, Germany, Japan, and the U.K., respectively.

5. Conclusion

The financial crisis and the global slowdown that ensued led many central banks to use unconventional tools to conduct monetary policy, as short-term policy rates were rapidly brought down to near zero percent. In this paper, we analyzed the impact of one such policy, the purchases of longer-term assets, by the Federal Reserve and the Bank of England on long-term interest rate, exchange rates, and commodity prices. We find that on days when information about those programs was announced, long-term interest rates fell globally and the value of the dollar or the pound depreciated.

The Federal Reserve's program of large-scale asset purchases, particularly since the summer of 2010, has been blamed for fueling the rise in commodity prices through an overly expansionary monetary policy. Although our approach is designed to address commodity-price movements at a very high frequency, it nonetheless suggests that on days of LSAP announcements by the Federal Reserve commodity prices, particularly energy prices, fell. Surprisingly, commodity prices fell more following positive U.S. monetary surprises that also led to lower long-term U.S. interest rates. We suggest that LSAP announcements likely involved signaling effects about future growth that led investors to downgrade their U.S. growth forecasts lowering long-term US yields, depreciating the value of the U.S. dollar, and triggering a decline in commodity prices. The responses of equity prices to monetary surprises provide some additional support for this view. More precisely isolating the effects directly associated with large-scale asset purchases from the signaling effect about future growth is an interesting and challenging issue that we leave for future work.

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References

- Bauer, M., Rudebusch, G., 2011. The Signaling Channel for Federal Reserve Bond Purchases. Federal Reserve Bank of San Francisco Working Paper 2011–21, September.
- D'Amico, S., King, T.B., 2010. Flow and Stock Effects of Large Scale Asset Purchases. Federal Reserve Board Finance and Economics Discussion Paper 2010–52.
- Frankel, J., 1986. Expectations and commodity price dynamics: the Overshooting Model. *American Journal of Agricultural Economics* 68 (2), 344–348.
- Frankel, J., 2006. The Effect of Monetary Policy on Real Commodity Prices. NBER Working Paper 12713.
- Gagnon, J.E., Raskin, M., Remache, J., Sack, B.P., 2010. Large-scale Asset Purchases by the Federal Reserve: Did They Work?. Federal Reserve Bank of New York Staff Report No. 441.
- Glick, R., Leduc, S., 2011. Are Large-scale Asset-purchases Fueling the Rise in Commodity Prices?. Federal Reserve Bank of San Francisco Economic Letter. 2011–10, April 4.
- Joyce, M., Lasaoa, A., Stevens, I., Tong, M., 2010. The Financial Market Impact of Quantitative Easing. Bank of England Working Paper No. 393.
- Krishnamurthy, A., Vissing-Jorgensen, A., 2011. The Effects of Quantitative Easing on Interest Rates. Working Paper, Northwestern University, (Kellogg School of Business).
- Neeley, C., 2010. The Large-Scale Asset Purchases Had Large International Effects. Federal Reserve Bank of St. Louis Working Paper 2010–018C.
- Ramey, V.A., Shapiro, M.D., 1998. Costly capital reallocation and the effects of government spending. *Carnegie-Rochester Conference Series on Public Policy* 48, 145–194.
- Romer, C.D., Romer, D.H., 1989. Does monetary policy matter? A new test in the spirit of Friedman and Schwartz. *NBER Macroeconomics Annual* 4, 121–170.
- Romer, C.D., Romer, D.H., 2010. The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks. *American Economic Review* 100 (3), 763–801.
- Wright, J.H., 2011. What Does Monetary Policy Do to Long-term Interest Rates at the Zero Lower Bound?. NBER Working Paper 17154.