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**Expanding Large-Scale Asset Purchases:
Effectiveness, Benefits, Risks, and Strategies**

Joseph Gagnon, David Lucca, Jonathan McCarthy, Julie Remache, and Jennifer Roush¹

Executive Summary

The Federal Reserve's programs to purchase \$100 billion of agency debt and \$500 billion of agency mortgage-backed securities (MBS) appear to have had a substantial impact, reducing mortgage rates and other long-term interest rates. The evidence also indicates that Federal Reserve communications concerning potential large-scale purchases of long-term Treasury securities had noticeable effects on long-term Treasury yields and yields on other long-term assets. Further evidence of the financial market effects of large-scale asset purchase programs surfaced in the United Kingdom late last week, when the Bank of England announced a program to buy £75 billion of mainly long-term government bonds over the next three months and both public-sector and private-sector long-term yields fell sharply.

Although this experience supports the view that central banks can push down long-term yields through large-scale asset purchases, it remains difficult to estimate the effect of a given volume of purchases on the full range of asset prices and yields and on overall economic activity. As discussed in a recent memo by Mauskopf and Reifschneider, our best estimate is that expanding the Federal Reserve's asset purchase programs by \$1 trillion would lower various long-term interest rates $\frac{3}{4}$ to 1 percentage point in the near term and would raise the level of real GDP relative to baseline by 2 percent after several years.² Although considerable uncertainty surrounds these estimates, it seems likely that such a policy could contribute to stabilizing output and inflation.

Building up a large volume of marketable long-term assets to provide macroeconomic stimulus in the near term would not threaten the Federal Reserve's ability to provide macroeconomic restraint in the future, but it would increase the challenges of doing so in the absence of new tools for managing Federal Reserve liabilities. In particular, if rapid sales of long-term assets were deemed necessary to tighten monetary conditions, it could place strains on the markets for these assets. Also, expanding the Federal Reserve's balance sheet through asset purchases would increase Federal Reserve, and overall government, net income in the near term at the cost of increasing the volatility of such income over time.

¹ Gagnon, Lucca, McCarthy, and Roush: Division of Monetary Affairs; Remache: Federal Reserve Bank of New York. Thanks to Sophia Allison, Chris Burke, Seth Carpenter, Alain Chaboud, Jim Clouse, Don Hammond, Andreas Lehnert, Brian Madigan, Steve Meyer, John Roberts, and Shane Sherlund for data, advice, and comments.

² See Eileen Mauskopf and Dave Reifschneider, "Economic Effects of Large-Scale Purchases of Long-Term Treasury Securities and Agency Debt and MBS," memorandum to FOMC, March 9, 2009.

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Given the current configuration of market interest rates and the staff's estimates of the relative macroeconomic effects of operations in different assets, purchases of MBS may be viewed as an attractive option. In light of the expected large wave of mortgage refinancing activity over the next few months, there may be a particular advantage to boosting significantly the Desk's authorization to purchase MBS. Such a strategy could be complemented by other measures to encourage the largest possible reduction in conforming mortgage rates. At some point, however, the benefit from further purchases of MBS could well diminish relative to the benefit of purchasing other assets such as Treasury securities. Moreover, given the high degree of uncertainty concerning the effects of different policies, it may be prudent to consider including a significant share of Treasury securities in any further expansion of purchases.

Effects on Market Yields

Considerable evidence indicates that yields on long-term bonds are affected by changes in supply. Federal Reserve purchases of long-term debt should have an effect on market yields comparable to the effect of an exogenous reduction in supply. The magnitude of this effect cannot be precisely estimated, but it seems clear that very large purchases are required to have economically meaningful effects. The evidence also suggests that purchases of one class of long-term debt generally lower yields on other classes of long-term debt. However, the size of these spillovers is even less well estimated than the size of the direct effects. In recent weeks, the correlations of changes in yields on different classes of long-term debt have declined somewhat relative to their long-run averages, suggesting the possibility that spillovers on yields across asset classes may be smaller than normal. However, yields across asset classes have exhibited strong comovements in response to recent central bank communications regarding asset purchase plans.

Previous Studies

The December 2008 note by Cabana et al. surveyed previously existing studies of the effects of shifts in the supply of bonds on bond yields.³ These studies focused on the market for U.S. Treasury securities. The empirical results that appear most plausible suggest that Federal Reserve purchases of \$500 billion of long-term Treasury securities (roughly 10 percent of Treasury debt held by the public as of mid-2008)⁴ would lower long-term Treasury yields 20 to 100 basis points.⁵ A few studies also suggested that such purchases would lower high-grade corporate bond yields, but they did not explore this effect thoroughly. None of the studies examined the effects of Treasury purchases on

³ See Cabana, Forster, Frost, Gagnon, Hilton, Rodrigues, and Steinberg, "Purchases of Longer-Term Treasury Securities," note to FOMC, December 5, 2008.

⁴ The rapid growth of federal debt since last fall has pushed the stock of debt held by the public up to almost \$7 trillion, implying that a given dollar volume of Federal Reserve purchases would have a somewhat smaller estimated effect now than during mid-2008.

⁵ The studies typically focused on changes in the shares of long-term and short-term Treasury securities held by the public. Federal Reserve purchases of long-term Treasury securities financed by increasing bank reserves should have a similar impact on long-term yields because bank reserves have a yield and maturity similar to the shortest-term Treasury securities.

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mortgage rates or yields on mortgage-backed securities (MBS), and none studied the effects of operations in private debt markets. However, in the literature, models in which changes in the supply of long-term Treasury debt affect Treasury yields imply that changes in the supply of long-term private securities would affect private yields.

The appendix to this memo presents a summary of a recent staff study of the likely effects of purchases of long-term Treasury securities on Treasury yields. Using two different techniques, this study finds evidence that a reduction in the supply of long-term Treasury securities held by the public reduces their yields. These results are consistent with those reported by Cabana, et al. However, the results are based on much smaller shocks than those being considered in this memo, and they are based on very short-term changes in market yields.

Event Studies of Recent Federal Reserve Communications

Market responses to recent Federal Reserve communications concerning potential purchases of agency debt, agency MBS, and longer-term Treasury securities provide some indication of the views of market participants about the effects of these programs on bond yields. In an efficient market, news about future expected rates of return should have an immediate effect on the price of a long-term asset. As these Federal Reserve programs are expected to be implemented in the near future, the immediate response to the news in an efficient market would represent a very high fraction of the expected movement in yields. However, because the communications did not provide precise information on the magnitudes, and in some cases the likelihood, of purchases, and because market functioning appears far from efficient at present, it is not possible to translate the market responses into reliable estimates of the ultimate effects of specific actions. Furthermore, we cannot be sure that other factors did not affect the observed movements in yields following these communications.

On November 25, 2008, the Federal Reserve announced that it would purchase “up to” \$100 billion in agency debt securities and \$500 billion in agency MBS “over several quarters.” On the day of announcement, agency 10-year debt yields dropped about 60 basis points, current coupon yields on agency MBS dropped nearly 45 basis points,⁶ the 10-year Treasury yield (off the run) fell 21 basis points, and high-grade corporate bond yields fell around 20 basis points, despite economic data releases that came in either better than expected (consumer confidence) or equal to expectations (preliminary third-quarter GDP).⁷ (See first column of Table 1.) For comparison, since 1991, the standard deviation of the daily change in the 10-year Treasury yield is about 6 basis points.

⁶ All MBS yields presented in this note are current coupon yields not adjusted for the value of the prepayment option.

⁷ Fleming, Klagge, Rodrigues, and Vickery, “Evaluation of the Federal Reserve’s Agency MBS and Agency Debt Purchase Program,” Federal Reserve Bank of New York (3/11/2009 draft) provides a more thorough analysis of yield movements in the mortgage-related markets since November 25.

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On the afternoon of December 1, 2008, Chairman Bernanke stated in a speech that the Federal Reserve was considering purchasing longer-term Treasury securities in “substantial quantities.” Because the speech was delivered in the afternoon, we examine the two-day change in yields to allow for any lagged responses. The 10-year Treasury rate fell 24 basis points by the end of the next day and other long-term rates fell as much or more.⁸ For comparison, the standard deviation of the two-day change in the 10-year Treasury yield is about 8 basis points.

Table 1. Yield Effects of Federal Reserve Announcements (changes in basis points from previous close)				
	Nov. 25	Dec. 1-2	Dec. 16-17	Jan. 28-29
Treasury 10-Y	-21	-24	-35	26
Swap 10-Y	-33	-24	-54	5
FNMA 10-Y	-60	-52	-39	27
FNMA MBS 30-Y	-44	-24	-23	43
Corp. AA 10-Y	-27	-30	-46	23
Corp. BBB 10-Y	-16	-21	-29	13

The FOMC statement released on December 16, 2008, indicated that the Federal Reserve “stands ready to expand its purchases” of MBS and confirmed the Chairman’s earlier indication that it was considering large-scale purchases of longer-term Treasury securities. Despite a weaker-than-expected housing starts data release on the morning of December 16, Treasury yields had not dropped on net by the time of the FOMC statement. Yields dropped sharply after the release of the statement and continued to drop the following day (which had no significant data releases). To some extent these declines reflected the setting of a lower-than-expected range for the federal funds rate. However, the fact that yield declines were larger for 10-year Treasuries than for 2-year Treasuries suggests either that the long-term asset purchase language was an important factor or that participants marked down their expectations for the federal funds rate substantially at horizons far longer than 2 years out. As shown in Table 1, private yields declined roughly as much as long-term Treasury yields over these two days.

On January 28, 2009, the FOMC statement indicated little change in the policy stance from December. Reportedly, market participants had attached some positive probability to the announcement of a program to purchase longer-term Treasury securities. The 10-year Treasury yield rose after the statement and on the following day. Other private yields also rose, in some cases by more than Treasury yields. Economic data releases on January 29 were considerably weaker than expected (initial jobless claims, durable goods orders, and new home sales), making the rise in yields all the more striking.

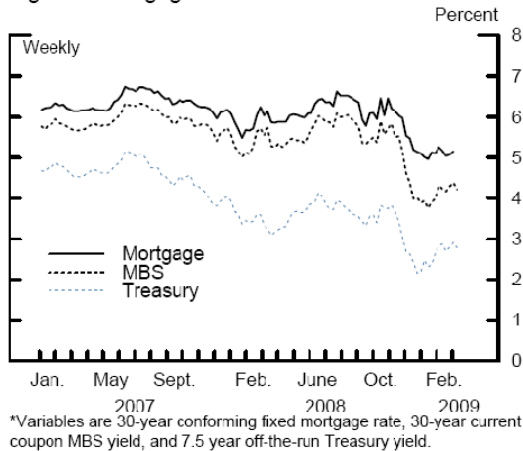
A major objective of the Federal Reserve’s purchases of agency debt and MBS is to lower primary mortgage rates. The stickiness of primary mortgage rates makes them

⁸ The ISM index came in lower than expected on the morning of December 1, but on-the-run Treasury yields did not fall immediately after the ISM release, whereas they declined 12 basis points in the 30 minutes after the text of the speech was released. There were no significant data releases on December 2.

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unsuitable candidates for short-term event studies such as those reported in Table 1. Nevertheless, the overall rate movements of the past few months suggest that most of the effects on secondary mortgage rates (that is, the effects on MBS yields) have passed through to primary mortgage rates. As Figure 1 shows, conforming 30-year fixed

Figure 1. Mortgage Market Rates



(primary) mortgage rates did not fall as much as MBS yields in December and January, but they also did not rise with MBS yields in February. On balance, primary mortgage rates declined almost 100 basis points between mid-November and early March, compared with a 125 basis point decline in secondary mortgage rates. The increase in the spread between primary and secondary mortgage rates will be discussed further below. Note that the spread between MBS and Treasury yields, which had been quite large for most of 2008, has declined in recent weeks to a level only moderately greater than the

historical average.⁹

Long-term Treasury yields have risen roughly 75 basis points since late December. Market commentators have generally pointed to the huge increase in expected future Treasury issuance as the primary cause of this run-up in yields. A substantial portion of future new issuance is expected to be in maturities greater than two or three years. Overall, this behavior is consistent with the other evidence presented here that the supply of longer-term Treasury securities is an important factor affecting Treasury yields.

An Event Study of the Recent Bank of England Announcement

On March 5, 2009, the Bank of England announced that it would purchase £75 billion of debt securities—primarily sterling Treasury securities with remaining maturities between 5 and 25 years—over the next three months. The program size is just over 10 percent of the value of U.K. Treasury securities held by the public.¹⁰ Long-term yields fell sharply that day and continued to decline the following day. Over the two-day period, 10-year sterling Treasury yields declined 58 basis points, AA corporate bond yields fell 50 basis points, BBB corporate bond yields fell 58 basis points, and 10-year swap rates fell 26 basis points.

⁹ The spread to the on-the-run Treasury yield is still elevated, reflecting the widening of the off-the-run/on-the-run spread in Treasury yields in recent months.

¹⁰ The surprise component of the program is less than £75 billion because the program encompasses a previously announced £50 billion program to buy corporate debt. However, at the same time as the Bank of England’s announcement, the U.K. Treasury stated that it had authorized the Bank to expand its program up to £150 billion, which may have created expectations for additional purchases in coming quarters.

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Some Cautions from Correlations

In order for Federal Reserve purchases of long-term Treasury securities to significantly reduce private interest rates (and for purchases of private securities to significantly reduce Treasury rates) investors must view these financial assets as close substitutes. The presumption in much of the existing literature that long-term high-grade private debt is a close substitute for long-term Treasury securities is based on the close correlations between holding returns on these securities. Table 2 shows that weekly changes in yields on these instruments have been highly correlated historically (column 1).¹¹ However, these correlations are much lower since the onset of financial turbulence in 2007 (column 2) and over the last few months (column 3), although they remain positive and statistically significant.

Table 2. Correlations of Weekly Changes in Treasury Yields with Private Yields			
	10/98 – 7/07	8/07 – 3/09	9/08 – 3/09
Mortgage	0.84	0.61	0.53
FN MBS	0.91	0.76	0.76
Corp. AA	0.95	0.65	0.67
Corp. BB	0.91	0.58	0.54
Swaps	0.93	0.92	0.94
Note: 10-year maturities except for mortgage-related assets, which have 30-year maturities.			

The decline in correlations may imply that Federal Reserve purchases of one class of assets will have less spillover into yields on other classes than in normal times. However, if these markets have become more segmented, then the effect of purchases on yields of the class being purchased should have increased correspondingly. This reasoning suggests that a given volume of purchases can still have the same effect on all yields if the purchases are divided among all of the asset classes. Of

course, the Federal Reserve does not have statutory authority to purchase some important classes of long-term debt such as corporate bonds.

Another possible explanation for the decline in correlations is that the recent period has been characterized by an increase in the shocks that affect private versus public bond demand. Such shocks tend to move public and private yields in the opposite direction. Under this interpretation, the effects of Federal Reserve purchases of one asset on yields on other assets may be nearly the same as usual, even though the overall correlations have declined. Some support for this view is contained in Table 1, where it appears that shocks related to Federal Reserve purchase announcements had large spillovers across yields.

Economic Benefits of Ramping Up Purchases

The memo by Mauskopf and Reifschneider discusses the economic benefits of ramping up purchases of long-term assets in the current environment. Their assumptions about the interest rate effects of MBS and long-term Treasury purchases are broadly consistent with the evidence cited above. In the standard FRB/US model, both MBS and Treasury purchases boost real GDP, with a moderately larger effect from MBS purchases because they are assumed to lower private borrowing rates more. For either asset class, the transmission channels may extend to many sectors of the economy, although there are

¹¹ As long as default rates are low, correlations of holding returns are similar to correlations of yields.

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significant uncertainties about the magnitudes of these channels. The memo also discusses two channels of stimulative effects that are not captured by the FRB/US model: house prices and mortgage refinancing. MBS purchases should have a larger effect through these channels than Treasury purchases.

Table 3 in the Mauskopf and Reifschneider memo presents macroeconomic effects of a \$1 trillion purchase program (in addition to the previously announced \$600 billion) split equally between long-term Treasury securities and MBS. This program is assumed to subtract 1 percentage point from mortgage rates and $\frac{3}{4}$ percentage point from yields on long-term Treasury securities and corporate bonds. In the standard FRB/US model, the program is estimated to boost the level of real GDP about 2 percent after two years. Under the most optimistic scenario, GDP would be boosted 4 percent. Given that the staff projects the shortfall of GDP below potential by the end of 2010 at more than 8 percent, asset purchase programs would need to be quite large, perhaps \$2 to \$4 trillion, to fully address the slack in resource utilization.

Risks of Ramping Up Purchases

Purchasing large quantities of marketable long-term assets to ease monetary policy now would not endanger the Federal Reserve's ability to tighten policy later. However, it would increase the challenges of doing so in the absence of new tools for managing Federal Reserve liabilities. In particular, if rapid sales of long-term assets were deemed necessary to tighten monetary conditions, it could place strains on the markets for these assets. An expanded balance sheet raises expected net income for the Federal Reserve and the government as a whole, but it also raises the volatility of net income by increasing the Federal Reserve's leverage and exposure to interest rate risk.

Future Monetary Policy Flexibility

Large-scale asset purchases may be an important tool for achieving the Federal Reserve's dual mandate over the next few years given the binding constraint of the zero bound on short-term interest rates. However, it is also important that actions taken now do not threaten the FOMC's ability to achieve the dual mandate at some later date. In particular, the FOMC needs to retain the ability to raise market interest rates at all times going forward.

If the Federal Reserve were to obtain the authority to employ new tools to absorb reserve balances from the banking system, such as the ability to issue Federal Reserve bills or unimpeded use of the Treasury's Supplementary Financing Program, large holdings of long-term assets should not be an obstacle to raising short-term interest rates. In the absence of such new authority, it may be feasible to absorb reserves with an existing tool, reverse repos, using our long-term assets as collateral.¹² In principle, the

¹² Large-scale reverse repos of System holdings of Treasury securities, agency debt, and agency MBS can be conducted under existing authority, but require new business processes, including a review of the capacity of desk counterparties or a means of making the collateral available to ultimate investors in the

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Federal Reserve might be able drive up repo rates to a desired level even before reserve balances had returned to a low level; market arbitrage might cause interest rates on short-term Treasury securities to rise by an equivalent amount. However, these relationships have yet to be tested, and the effects of large-scale reverse repos on the capacity and functioning of the repo and bill markets are uncertain.

If the tools discussed above cannot be deployed on a large scale, large holdings of long-term assets necessitate high levels of reserve balances. The existing authority to pay interest on reserve balances is unlikely to be sufficient in the future to achieve any desired short-term market interest rate when the level of reserve balances is high. Last fall, during the first few weeks in which the Federal Reserve paid interest on reserve balances, short-term market interest rates were notably lower than the rate of interest on reserves. However, it is possible that banks needed time to learn about and adapt to the new regime, and that, in the future, arbitrage will prevent market interest rates from falling significantly below the rate on excess reserve balances so long as reserve balances do not exceed a moderately high level.

If the Federal Reserve found itself unable to raise short-term market interest rates at a time that it holds large quantities of long-term assets, it would still retain some ability to affect long-term interest rates by selling its assets directly.¹³ Long-term interest rates are generally viewed as having a more direct influence on economic activity than short-term rates, so it should be possible to achieve our objectives in this manner. However, we have little experience conducting monetary policy via long-term interest rates. The risk of policy error would be higher in such a scenario.

An expansion of large-scale asset purchases may lead some market participants to question whether the Federal Reserve would be willing or able to tighten monetary policy as needed to prevent excessive economic growth or high inflation in the future. Such concerns have the potential to push up inflation risk premiums and thereby raise the cost of longer-term credit for households and businesses. Effective communication of the Federal Reserve's objectives and the tools it has to achieve these objectives should be a high priority, particularly in light of the unprecedented nature of the programs being considered.

Federal Reserve Net Income

Even though income is not an objective of monetary policy, estimates of income effects may still be of interest to policymakers in their consideration of large-scale asset purchases. On balance, an expansion of long-term asset holdings seems likely to boost the net interest income of the Federal Reserve and also to increase the variability of net income.

repo market. Staff at the Federal Reserve Bank of New York are working on these processes and expect to have them ready later this year.

¹³ Selling enough long-term assets would return reserve balances to a low level and restore our ability to control short-term interest rates. However, if doing so seemed likely to push long-term yields above the level consistent with our policy objectives, the FOMC might prefer a more moderate pace of asset sales.

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Assets are purchased by expanding reserve balances, which currently carry an interest cost of 0.25 percent.¹⁴ Long-term Treasury securities yield 2 to 4 percent, depending on maturity. Agency debt yields are slightly above Treasury yields, and 30-year agency MBS yields are about 4¼ percent. Ignoring any effects on MBS yields, each \$1 trillion of MBS purchased thus raises Federal Reserve net income by \$40 billion per year.

Purchases of long-term Treasuries, agency direct obligations, and agency MBS pose minimal credit risk. However, purchasing these assets in large volumes has the potential to create more volatility in net income stemming from changes in interest rates. The Federal Reserve does not mark long-term assets in the SOMA portfolio to market values, so as long as these assets are held to maturity (or are prepaid) no capital loss will be realized.¹⁵ However, to the extent that holding a large volume of long-term assets necessitates carrying a large volume of interest-earning liabilities, future Federal Reserve net income is subject to increased interest rate risk. In the example raised above, the extra Federal Reserve net income from holding \$1 trillion of MBS would shrink to zero if the rate of interest on reserve balances (or on reverse repos) were to rise to 4¼ percent. Above that rate, net interest income on the portion of the portfolio representing MBS holdings would turn negative, although net income for the entire portfolio could remain positive given the seignorage attributable to currency.

Should the Federal Reserve decide to sell long-term assets prior to maturity, it might have to realize a loss on those assets if market interest rates had risen between the time of purchase and the time of sale. In the case of a large loss that exceeded income from other sources, the Federal Reserve would defer payments to the Treasury until the deficiency in the surplus account has been restored.

Leverage Ratio of Banks

The expansion of Federal Reserve programs over the past year has greatly increased the level of reserve balances held by the banking system, and these balances will increase further with the ongoing purchases of long-term assets.¹⁶ A high level of reserve balances in the banking system lowers the aggregate leverage ratio of banks.¹⁷ Any bank that feels constrained by a low leverage ratio because it is holding large reserve balances is likely to reduce borrowing in the federal funds market and/or reduce deposit interest rates in order to shrink its balance sheet and disgorge reserves. However, it is also possible that a bank might choose to raise its leverage ratio by shrinking its loan

¹⁴ To the extent that assets are funded through reverse repos, they will presumably have a similar marginal cost.

¹⁵ A loss can occur if there is a prepayment on an MBS for which the Federal Reserve paid more than face value. By focusing its purchases on newly issued MBS, which trade close to face value, the Federal Reserve can minimize this risk.

¹⁶ As discussed above, the System is working to establish the capacity to fund these assets using large-scale reverse repos, and other tools that might be authorized in the future include Fed bills and unimpeded use of the Treasury's Supplementary Financing Program.

¹⁷ The leverage ratio is defined as tier 1 capital to quarter-average assets excluding certain intangible assets.

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book rather than by reducing its reserve balances. Such a response would counteract some of the stimulative effect of the asset purchase program. As of now, a decline in leverage ratios attributable to elevated reserve holdings has not seemed to be a significant constraint on bank loan books.

Budgetary Considerations for the U.S. Government

As discussed above, large-scale asset purchases increase Federal Reserve net income and thus payments to the Treasury, at least initially. Any negative effect on income at a future date would be temporary—in the worst case it cannot persist for longer than the remaining lives of the assets. The net effect on the government budget in present value terms depends on the discounted sum of the stream of income or loss. Based on an extrapolation of the interest rate path in the Greenbook extended baseline and an assumed gradual reversion to historical yield spreads, long-term assets purchased in 2009 and 2010 would yield a substantial positive net return to the government in present discounted value. MBS, in particular, have positive net income in every future year. Ramping up purchases to push down current yields would have offsetting effects on the present discounted value of Federal Reserve net income: With interest paid on liabilities fixed near the zero bound, falling interest rates on assets would reduce our net interest margin. On the other hand, as long as asset yields remain significantly positive, the larger quantities held tend to increase overall revenues.

There are additional effects on the overall government budget, which generally appear to be positive for large-scale asset purchases. First, Federal Reserve purchases reduce interest expenses of the government.¹⁸ Second, by allowing homeowners to refinance their existing agency mortgages at a lower rate, Federal Reserve purchases reduce the risk of mortgage default to the agencies and thus reduce likely future capital outlays by the Treasury.¹⁹

Alternative Strategies

We consider two broad strategies for expanding long-term asset purchases, with an assumed value of \$1 trillion over and above the \$600 billion already committed. The first strategy focuses all purchases on agency MBS, reflecting the somewhat larger macroeconomic benefits of MBS purchases as presented in the memo by Mauskopf and Reifschneider. In addition, the expected boom in mortgage refinancing this year creates an extra advantage to purchasing MBS and driving down mortgage rates in the very near term. The second strategy splits purchases between MBS and Treasury securities, taking a more diversified stance that perhaps could be motivated by the high degree of

¹⁸ To the extent that purchases raise economic growth and expectations of inflation, they eventually may raise interest expenses, but presumably they would also raise tax revenues.

¹⁹ To the extent that non-agency-backed mortgages are refinanced into agency mortgages, the aggregate credit risk to the government goes up. However, the staff estimates that, even at current interest rates, most borrowers with non-agency mortgages would benefit from refinancing into an agency mortgage (although many are unable to do so because their loan-to-value ratios are too high or their credit scores too low), so that a further decline in mortgage rates would have only a small effect on the total guarantee book of the agencies.

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uncertainty concerning the macroeconomic effects of each instrument. The relatively small size of the market for Treasury securities with maturities over five years suggests that relatively more of the program should be devoted to agency MBS. However, one alternative would be to focus purchases on medium-term Treasuries, possibly in combination with a communication strategy designed to push down expectations of future short-term interest rates over the next few years.

The final subsection considers steps that could be taken to help ensure that reductions in MBS yields are passed through as much as possible to primary mortgage rates.

Concentrate on Purchases of Agency MBS

As discussed by Mauskopf and Reifschneider, the staff's best estimate is that \$500 billion of MBS purchases will stimulate a moderately greater increase in real GDP after two or three years than \$500 billion in purchases of long-term Treasury securities. This result derives from the assumption that MBS yields will decline more under the former strategy than the latter, reflecting both a greater own-yield effect of purchases and the view that, with MBS spreads still somewhat higher than normal, there is more scope to lower MBS yields.²⁰ Because private interest rates have a greater direct effect on spending than Treasury rates, programs that drive down private rates more than Treasury rates are estimated to have a more potent effect on economic activity than equal-sized programs that lower Treasury rates more than private rates.

If the FOMC were to conclude that a substantial further reduction in the mortgage rate in coming months would be useful to achieve its monetary policy objectives, there could be a considerable benefit to doing it now. The staff currently anticipates that the recent decline in mortgage rates and the administration's new mortgage refinance program will cause a surge of mortgage originations in coming weeks and months that will translate into an equivalent surge in agency MBS issuance.²¹ The resources that will be devoted to the planned refinancing plan will have been largely wasted if homeowners face another large drop in mortgage rates and embark on another refinancing boom just a few months later.

Moreover, there is a risk that the expected burst of MBS issuance could drive MBS yields up significantly in the absence of larger Federal Reserve purchases. In January and February, the Desk's purchases of \$80 billion per month appear to have roughly equaled the amount of newly issued agency MBS. It is possible that this very large ratio of Desk purchases to new supply may have temporarily pushed MBS yields below the longer-term levels consistent with the announced size of the Federal Reserve

²⁰ Indeed, the spread of MBS yields over Treasuries has declined noticeably since the announcement of the MBS program, although it remains higher than its historical average. These estimates assume that conforming mortgage rates will decline by as much as MBS yields. Strategies to help prevent a widening of the spread between mortgage rates and MBS yields are discussed below.

²¹ There is a lag of about 2 to 4 months between a new mortgage application and the earliest date the loan can appear in a newly issued MBS.

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program. Even if yields are not much below equilibrium now, the refinancing boom could push them above equilibrium for several months as the market struggles to adjust to increased new issuance.²² By concentrating an expansion of long-term asset purchases into MBS, and by providing the Desk substantial flexibility on the timing of these purchases so it can respond to the refinancings as they materialize, the FOMC would be able to provide the greatest benefits to household borrowers.

A More Balanced Approach

In light of the substantial uncertainty surrounding estimates of the effects of large-scale asset purchases, the FOMC may wish to embark on a more balanced approach. Such an approach would not put excessive reliance on any one channel of transmission. Given the statutory limitations placed on open market purchases, the main alternative instruments are Treasury securities, agency debt, and agency MBS.

As discussed above, a given volume of MBS purchases is assumed to lower MBS yields by more than the same volume of Treasury purchases is assumed to lower Treasury yields. However, this assumption is conditioned on starting from a situation in which MBS yield spreads over Treasuries are unusually high. The existing Federal Reserve MBS purchase program has already reduced these spreads considerably. It is reasonable to suppose that subsequent expansions of MBS purchases will have successively less of an extra impact on MBS yields. In other words, there may be diminishing returns to ever larger purchases of MBS. If some private assets, such as high-grade corporate bonds, are closer substitutes to long-term Treasury securities than to MBS, then there could be a point at which the marginal benefit of purchases of Treasuries or agency debt may become larger than the marginal benefit of MBS purchases.²³ Also, when purchased at very low interest rates, the duration of MBS is likely to be very long, which increases the risk to the government budget from subsequent increases in interest rates.

Overall, the benefits from significantly expanding Federal Reserve purchases of agency debt seem limited, although some modest expansion of the program should not be ruled out as a possible measure to alleviate market stress in the future. The launch of the \$100 billion program to purchase agency debt helped to improve the tone of the agency debt market, and currently agency debt yields are similar to yields on debt issued under the FDIC's Temporary Liquidity Guarantee Program. Additional purchases of agency debt are likely to have macroeconomic effects somewhere between those of Treasury purchases and MBS purchases, as their duration properties are similar to Treasuries but their perceived risk is similar to MBS. However, to the extent that agency debt purchases push down agency yields more than other yields, the shareholders of the agencies receive a windfall that would not be available to shareholders of other private corporations. Moreover, MBS purchases almost certainly have a larger effect on primary mortgage rates than purchases of agency debt because the financial characteristics of MBS are

²² Of course, the investors who receive prepayments from refinances may reinvest the proceeds in new MBS. But in the current stressed environment, and with notably lower yields on new MBS, the fraction who do so is uncertain.

²³ For example, corporate bonds and Treasury securities both have stable durations, unlike MBS.

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essentially identical to those of the mortgages themselves and because mortgage originators base their rates on MBS yields.

Treasury securities thus appear the main candidate for inclusion with MBS in an expansion of long-term asset purchases. An important consideration in determining the volume of Treasury purchases is the size of the outstanding stock of Treasury securities held by the public, excluding SOMA holdings. As of December 31, 2008, there were \$2.9 trillion of such securities with remaining maturity greater than one year. Of these, \$1.3 trillion had a remaining maturity greater than five years. Of course, these totals are growing rapidly at present, so the prospective available stock over the course of the next few years is much higher.

An alternative strategy for including Treasury purchases would be to target purchases at the medium maturities. Such a policy could be combined with enhanced communication about the Federal Reserve's intentions for the path of future short-term interest rates or possibly an explicit target for a Treasury yield at the two- or three-year maturity. For example, the FOMC could announce a target for the two-year Treasury yield of 50 basis points, down from the current rate of about 100 basis points.

Maximizing the Reduction in Primary Mortgage Rates

Under either of the above strategies, there are possible steps that could be considered to enhance the pass-through of lower agency MBS yields to conforming fixed mortgage rates.

Primary mortgage rates depend closely on yields on newly issued new-production MBS.²⁴ The Desk has focused the majority of its net purchases in new-production MBS.²⁵ Although purchases of seasoned MBS also exert a downward effect on mortgage rates to the extent that investors view new and seasoned MBS as substitutes, the effect is likely smaller.²⁶ The Desk's purchases of seasoned MBS have been aimed at improving market functioning and liquidity. However, to have the greatest impact on primary mortgage rates, increases in the rate of purchases would be most useful in new-production MBS.

Following an increase in the rate of MBS purchases by the Federal Reserve, several factors can limit the pass-through of lower MBS yields to primary mortgage rates. First, mortgage origination capacity has decreased and operational costs have increased because many mortgage originators have merged or closed, and the remaining firms have found short-term funding more expensive and difficult to obtain. Second, the reduction in capacity has increased lag times in processing applications; this implies that a longer

²⁴ At issuance, MBS can contain significant proportions of old loans, depending on the specific terms of the MBS contract. New-production MBS contain mainly recently originated loans.

²⁵ The Desk recently began operations in the "dollar roll" market, which involve matched purchases and forward sales to help fund dealer inventories. These do not create permanent net new holdings.

²⁶ An important difference between seasoned MBS and new issues, particularly at present, is that new issues have longer durations than seasoned securities.

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period is required over which to hedge rate risk.²⁷ Third, market volatility has increased, which increases the cost of rate hedging. Fourth, the agencies have increased their guarantee fees.²⁸ Together, these factors appear to have prevented primary rates from declining as much as secondary rates in December and January, leading to an unprecedented spike in the primary-secondary spread. This spread has narrowed in recent weeks, as applications declined, but it remains wider than it was before November 25. Moreover, it is likely that this spread will widen again if applications surge as expected under the administration's refinancing plan.

A number of steps could be considered to ameliorate pressures on the primary-secondary spread. First, the Federal Reserve possibly could provide warehouse financing to non-bank originators secured by their mortgage loan inventories. Second, the Federal Reserve possibly could sell put options on MBS to be delivered in the near future to lower the cost of rate-lock hedging for originators. Before pursuing either of these steps, consultation with the Legal Division would be needed to allow consideration whether and the extent to which they are within the legal authority granted to the System under the Federal Reserve Act. Third, a more unconventional step would be for the Federal Reserve to announce a desired target range for conforming fixed mortgage rates over a given horizon, say the next six or nine months. Such a strategy would give more certainty to all market participants, and it should damp volatility and lower costs of hedging. Given the capacity constraints in mortgage refinancing, announcing an extended period of low rates would ease the crush of homeowners trying to refinance at the same time. It might also have a significantly positive psychological impact on consumers. A major drawback of this approach is that it is not certain how much MBS the Federal Reserve would have to purchase. The elasticities employed by Mausekopf and Reifschneider imply that \$1 trillion split equally between MBS and Treasuries would achieve a target mortgage rate of about 4 percent, and somewhat less would be needed if the program purchased only MBS. However, the uncertainty around these estimates is very large. The staff projects that total mortgage originations in 2009 will be about \$3 trillion and that this number would likely increase by just under \$500 billion if the mortgage rate fell to 4 percent.²⁹ Thus, the scope for much larger purchases than \$1 trillion is substantial. Another drawback is the political risk that derives from explicitly linking home mortgage rates to Federal Reserve policy. Also, exiting from a strategy of targeting mortgage yields could be significantly more difficult than exiting from a strategy of purchasing specified quantities.

²⁷ Mortgage originators face interest rate risk when they provide a rate-lock agreement to new customers. The risk lasts as long as it takes to process the application and to package the loan into a new MBS.

²⁸ Freddie Mac recently announced it would rescind some of the increases for refinancings of mortgages that it already guarantees.

²⁹ These numbers differ somewhat from those presented in Mausekopf and Reifschneider because they refer to 2009 only and they include new purchase originations.

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Appendix: Two Estimates of Supply Effects on 10-Year Treasury Yields³⁰

An Event-Study Analysis of Treasury Issuance Shocks

Table 2 presents the results of a statistical analysis of the effects of Treasury auction announcements on yields of long-term Treasury securities. We regress the change in the 10-year on-the-run Treasury yield over a 45-minute window surrounding Treasury auction announcements on the unexpected change in the offering size. For each auction announcement, we calculate the surprise component from the offering amount anticipated by Wrightson ICAP, which is available in their market newsletter on the morning of each announcement day. Thus, the surprise data generally exclude information on changes in the expected fiscal outlook. The sample includes 67 auction announcements from February 1999 through February 2009, of which 24 had a non-zero surprise, and 12 had a surprise component greater than \$2 billion in absolute value. The estimates indicate that a \$1 billion surprise in the auctioned amount of the 10-year Treasury note raises the on-the-run yield around 0.2 to 0.3 basis point. If the yield response is linear, a \$500 billion purchase by the Federal Reserve would be expected to lower yields 100 to 150 basis points.³¹

Table 3. Effect of Issuance Surprises on 10-Year Treasury Yields (basis points)			
Sample	99-08	99-08	07-08
Issuance Surprise (\$b.)	0.21 (0.03)	0.21 (0.17)	0.29 (0.20)
Constant	0.13 (0.20)	0.05 (0.18)	-0.12 (0.33)
R ²	0.29	0.02	0.08
No. Obs.	67	65	19
Large Surprises?	Yes	No	No

The statistical fit and significance depend critically on the \$40 billion surprise reopening on October 8, 2008. Excluding this observation and one other large surprise reopening in 2001 leads to a very poor fit and an insignificant coefficient. However, the coefficient value remains similar whether or not the large surprises are included, as shown in the second column. Moreover, the coefficient estimate is relatively constant across samples (third column). An important consideration in interpreting these estimates is that announcement surprises tend to be associated with increases in future offering amounts, so that the market yield may be responding to larger long-run expected supply shocks than just the current supply shock. Thus, the estimated coefficient may overstate the effect of each \$1 billion in Federal Reserve purchases.

Estimating Demand Curves from Electronic Order Books

BrokerTec electronic trading data includes the entire order book of near continuous trading on the interdealer platform throughout each trading day. The order book provides information on the volumes that traders are willing to buy (or sell) at different price levels at any point in time, making it straightforward to trace out

³⁰ This appendix is based on a study by David Lucca, Jonathan McCarthy, and Jennifer Roush, titled “Estimating the Potential Effects of Long-Term Treasury Purchases,” Division of Monetary Affairs, March 6, 2009.

³¹ This estimate is at the high end of the range presented in Cabana, et al., but it should be noted that the Cabana, et al. range was based on a somewhat lower average maturity of securities purchased.

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instantaneous demand curve slopes. Because the demand curve shifts continuously, we focus on the slope of the demand curve averaged over time for each day. Our sample covers 11 months in 2005 and 2006. Assuming that the demand curves are linear, we can extrapolate to estimate the effect of a \$500 billion purchase order by the Federal Reserve. The demand slopes change from day to day, so the estimated effect varies from -10 to -150 basis points across days. Averaged across the entire sample, the effect is -27 basis points.

Because the size of potential Federal Reserve purchases is much larger than the typical buy order and because a buy order from the Federal Reserve may project different information to the private market than a private order, extrapolating these demand curves raises substantial uncertainties. It is likely that larger orders than historically observed would have even larger yield effects. On the other hand, the long-run effect might be considerably smaller than the impact effect because other market participants would have time to adjust their portfolios. Finally, the current stressed market conditions and strong safe haven demand for Treasuries may imply a more inelastic demand at present than in the estimation sample. If so, there would be a larger effect on Treasury yields for any given purchase by the Federal Reserve, although a smaller proportion of this yield effect would likely pass through to private yields.