

September 12, 2011

**Possible Approaches to Providing Monetary Accommodation:
Reinvestment Maturity Extension Program, SOMA Portfolio Maturity Extension Program,
and Long-Maturity LSAP¹**

1. Introduction

This memo discusses three options that the Committee could consider should it wish to provide additional monetary policy accommodation—a reinvestment maturity extension program (RMEP), a SOMA portfolio maturity extension program (MEP), and a long-maturity LSAP program (LSAP). Under all of these programs, the Committee would direct the purchase of long-term Treasury securities—those with remaining maturities of six years or more—in order to put downward pressure on longer-term interest rates. In the RMEP, the Committee would instruct the Desk to purchase long-term Treasury securities with the proceeds of principal payments on agency securities. Under the MEP, the Committee would instruct the Desk to purchase \$400 billion of long-term securities while at the same time selling \$400 billion of the Treasury securities in the SOMA portfolio with remaining maturities of three years or less. Under the long-maturity LSAP, the Committee would direct the Desk to purchase \$1 trillion of Treasury securities with maturities across the yield curve, but with roughly 60 percent of this total concentrated in long-maturity Treasuries.

The analysis below suggests that the MEP and long-maturity LSAP would have significant effects on interest rates and the economy relative to the baseline.² Both programs

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² Under the baseline, the Federal Reserve does not implement any further balance sheet programs. The size of the SOMA portfolio is maintained at the current level until mid-2013. At that point, the FOMC begins to redeem principal payments on its securities holdings. Outright sales of securities are assumed to begin at the beginning of 2014 at a pace sufficient to normalize the size of the balance sheet by mid-2016.

substantially reduce the quantity of ten-year Treasury equivalents—a common measure of the dollar value of duration risk—held by private investors. By reducing the quantity of ten-year equivalents and the supply of long-term securities in the market, both the MEP and the long-maturity LSAP would be expected to put significant downward pressure on term premiums.

While considerable uncertainty surrounds such estimates, staff modeling suggests that the MEP and long-maturity LSAP would generate a near-term drop in ten-year term premiums of roughly 20 to 25 basis points, with the LSAP program having a slightly larger effect. However, investors already appear to be pricing in significant odds of a purchase program, likely reducing the effect on markets of announcing such a program at the upcoming meeting. The lower Treasury yields and reduced supply of Treasury securities would lead investors to shift to other assets and so would be expected to lead to a noticeable easing of financial conditions relative to the baseline.³

Relative to the August Tealbook baseline, FRB/US simulations suggest that by the end of 2013, the MEP and long-maturity LSAP would trim the unemployment rate by between $\frac{1}{4}$ and $\frac{1}{2}$ percentage point and boost core PCE inflation by about $\frac{1}{4}$ percentage point.⁴ By contrast, the interest rate effects of the RMEP are quite modest, amounting to under 10 basis points on longer-term yields, resulting in a slight reduction in the unemployment rate and little change in core PCE inflation. Of course, there are many dimensions of uncertainty surrounding the estimated effects. Standard sampling uncertainty exists, but there is substantial uncertainty as to whether the models being estimated accurately characterize the economy and financial markets, especially given the fact that the federal funds rate has not been at the zero lower bound before

³ See the discussion in Appendix 1. A more complete discussion of the methodology can be found in the memorandum, “Term Structure Modeling with Supply Factors and an Application to Maturity Extension Program Evaluation,” by Min Wei and Canlin Li, August 17, 2011.

⁴ Throughout this memo, the term “baseline” refers to the August Tealbook baseline projection, updated for a drop in interest rates through August 24, 2011.

this episode. As a result, although we present point estimates of the estimated effects in this memo, the confidence bands surrounding those point estimates are substantial and difficult to quantify.

The MEP and the LSAP would also have important implications for the Federal Reserve's balance sheet and income. Under both of these alternatives, the System Open Market Account (SOMA) portfolio would have a significantly longer average maturity, and under the long-maturity LSAP program, the balance sheet would be significantly larger for a number of years. As a result, passive redemptions would take longer to normalize the size of the balance sheet under both programs than under the baseline. Federal Reserve interest income would be boosted in the near term by the higher average yield on Federal Reserve securities holdings and, in the case of the LSAP, the larger size of securities holdings, and remittances to the Treasury would likewise be higher. Over the longer-term, after the size of the balance sheet normalizes, remittances to the Treasury are somewhat lower under the MEP and the LSAP programs relative to the baseline because interest income is depressed by holdings of long-term securities purchased in the current low yield environment.

2. Description of the Programs

Table 1 presents the key structural elements of the RMEP, the MEP, and the LSAP. Under all three options, we have assumed that the path for the federal funds rate is the same as that in the baseline for the August Tealbook, remaining near zero until August 2013. Under all three programs, Treasury securities maturing on any particular date are reinvested into new Treasury securities issued on those same dates following the Desk's usual practices.⁵ Under the

⁵ If the Federal Reserve shifted its rollovers into longer maturity issues at auctions, at least initially the Treasury would likely adjust by increasing the add-ons to its auctions to accommodate the change. As a result, such a step

RMEP, the Desk would shift the current reinvestment of principal payments for agency securities into long-term Treasuries. Under the MEP, the Desk would implement this same shift in the reinvestment strategy and would also purchase \$400 billion of long-term Treasury securities (par value) over a period of 9 months while selling a similar par amount of Treasury securities with remaining maturities of 6 months to 3 years.⁶ Under the long-maturity LSAP program, the Federal Reserve would again shift its reinvestments into long-term Treasuries and would also purchase \$1 trillion of Treasury securities with maturities across the curve over 12 months. There are no sales of short-term securities under this option, and compared to previous LSAP programs, the average maturity of securities purchased would be longer.

The RMEP and MEP would leave the size of the balance sheet and reserves largely unchanged in the near term. However, with a higher proportion of long-term securities in the SOMA portfolio, the pace of redemptions would be lower once they got underway, and thus the size of the balance sheet and level of reserves would run a bit higher than under the baseline for the RMEP and noticeably higher for the MEP. Under the long-maturity LSAP, the size of the balance sheet and reserves would increase by about \$1 trillion in the near term and then fall back gradually.

When the exit strategy begins, reinvestment of all maturing securities ceases under all scenarios. Under the MEP, the balance sheet shrinks slowly because of the long average maturity of the portfolio, and the size of the balance sheet normalizes in September 2017. Under

would not directly affect the maturity distribution of Treasuries held by the private sector and so would not directly reduce longer-term Treasury yields. Of course, if the Treasury were seeking to maintain a particular weighted average maturity of all debt outstanding, it might subsequently shift some of its issuance toward shorter maturities and that, in turn, might put downward pressure on longer-term yields.

⁶ Staff has also considered an alternative version of the MEP under which the effect on the level of reserve balances of the purchases of long-term securities would be offset by reverse repurchase agreements or term deposits rather than sales of Treasury securities with relatively short remaining maturities. The implications of that alternative for interest rates and the economy are very similar to those for the MEP considered here.

the LSAP, although the size of the balance sheet is initially larger than under the MEP, the average maturity of the portfolio is somewhat shorter, resulting in a faster pace of contraction. The normalization of the size of the balance sheet in this case occurs in January 2018, just four months later than under the MEP.

3. Financial Market and Economic Effects

As discussed in more detail in appendix 1, staff estimates of the interest rate effects of the RMEP, MEP, and long-maturity LSAP programs are based on a standard affine term structure model that incorporates the ten-year Treasury equivalents (scaled by nominal GDP) held by the private sector as an underlying yield curve factor.⁷ A projected path for total ten-year Treasury equivalents in the SOMA portfolio is constructed based on staff estimates, and alternative paths for Treasury ten-year equivalents are developed based on the structures of the three programs. The alternative paths are then used to compute the effects of the RMEP, MEP and long-maturity LSAP programs on Treasury term premiums relative to the baseline. In developing projected paths for Treasury debt at different maturities, the staff assumes that the Treasury will continue to implement its current plans to lengthen the average maturity of all publicly held debt over the projection period.⁸ This information can be used to calculate the ten-year equivalents in the entire stock of Treasury debt; a path for ten-year equivalents held by the private sector is then calculated as ten-year equivalents for the total stock of Treasury debt less the ten-year equivalents in the SOMA portfolio under the baseline and each alternative.

⁷ In this analysis, we do not account for any portion of the interest rate effect of these programs that might already be priced into current rates based on expectations of market participants. Similarly, we ignore any additional effect on rates that these programs may have as a signal about the future path of policy.

⁸ We assume that the effects of these changes in average maturity are already incorporated into market prices.

The model can be applied to evaluate the effects of the three potential asset purchase programs. In general, the model suggests that a reduction in ten-year equivalents held by the private sector tends to put downward pressure on longer-term yields relative to the baseline; intuitively, reducing the quantity of long-term securities in the market and the level of the interest rate risk borne by the private sector tends to put downward pressure on long-term yields.⁹ As shown in the top left panel of exhibit 1, all three programs reduce ten-year equivalents held by the private sector.¹⁰ The reduction in ten-year equivalents stemming from the RMEP is quite modest. The corresponding reductions in ten-year equivalents associated with the MEP and long-maturity LSAP program are much larger by comparison.¹¹

On net, as shown in the bottom panel, the sizable declines in ten-year equivalents under both the MEP and long-maturity LSAP programs result in significant reductions in ten-year Treasury term premiums, which decline about 20 and 25 basis points, respectively, in the near term relative to the baseline.¹² If policymakers wished to implement an LSAP with a much larger market effect, the model would suggest that LSAP purchases would need to be concentrated more heavily in longer-term securities or be even larger in size than is assumed here. However, larger purchases at longer maturities would run the risk of causing disruptions in market functioning. The reduction in ten-year equivalents associated with the MEP and long-maturity LSAP fades over time as the Federal Reserve's balance sheet is normalized. The results

⁹ We use the convention "private sector" for holdings outside of SOMA. That is, Treasury debt held by the public is the sum of SOMA holdings and private sector holdings.

¹⁰ The decline in private sector holdings of ten-year equivalents under these programs would be larger if the date for the beginning of the exit strategy were also pushed back relative to the baseline.

¹¹ The pattern of ten-year equivalents associated with the LSAP stems from the assumption that it invests a fraction of the \$1 trillion program total in fairly short-term securities. These securities mature relatively early in the projection period. So even though ten-year equivalents under the LSAP initially drop by considerably more than under the MEP, this difference diminishes over time and is reversed at longer horizons.

¹² As noted above, the actual announcement effects for a MEP or long-maturity LSAP would likely be smaller than these estimates because investors appear to have already priced in some odds that a program along these lines will be implemented.

for the MEP are broadly consistent with a recent study of the “Operation Twist” episode from the 1960s.¹³ Again, the effects of the RMEP are far smaller than those of the other two programs, reflecting its more modest size.

As discussed in Appendix 1 and shown in the right hand panels of exhibit 1, these estimates suggest that the effects for the MEP and long-maturity LSAP on ten year yields would be larger than those of the \$600 billion LSAP program that began in November 2010.¹⁴ The total amount purchased under the \$600 billion program was smaller than the long-maturity LSAP discussed here, and the earlier LSAP program invested primarily in securities with maturities ranging between 2 and 10 years. As a result, the reduction in ten-year equivalents associated with the earlier LSAP is noticeably smaller than the reduction in ten-year equivalents associated with both the MEP and long-maturity LSAP.

Based on the estimated interest rate effects of the three options considered here, the FRB/US model was used to simulate the macroeconomic impact of these programs. Exhibit 2 plots paths for selected variables. The MEP and long-maturity LSAP programs lower long-term

¹³ See Eric Swanson, “Let’s Twist Again: A High-Frequency Event-Study Analysis of Operation Twist and Its Implications for QE2,” *Brookings Papers on Economic Activity*, forthcoming. Swanson shows that the effects on the public’s holdings of Treasury securities generated by “Operation Twist,” which was implemented by the Federal Reserve and the Treasury in 1961, were comparable to those of the Federal Reserve’s recent LSAP 2 program. He estimates that the effect of Operation Twist was to reduce the ten-year yield by approximately 15 basis points, while it likely put upward pressure on short-term rates.

¹⁴ There are a number of ways to compare the likely effects of the MEP to those of the second large-scale asset purchase program (LSAP 2). First, the staff model outlined in the appendix projects that the MEP would reduce the 10-year Treasury yield by about 20 basis points and raise the 2-year Treasury yield by about 5 basis points. By contrast, that model indicates that LSAP 2 would have been expected to reduce 10-year yields nearly 15 basis points and leave 2-year yields roughly unchanged. All else equal, these estimates would (in the context of the FRB/US model) suggest a larger impact of the MEP on output, employment, and inflation over time, but such judgments depend importantly on the predicted effects of interest rates at various maturities on spending and so are subject to considerable uncertainty. Alternatively, one could compare to the staff projections of the possible effects of LSAP 2 on financial markets presented in the October 2010 Tealbook. Those projections, which were based on estimates of the results of the first round of asset purchases contained in Gagnon et al. (2011), suggested that the purchases would trim longer-term yields by about 20 basis points, with associated effects on the prices of other assets. Krishnamurthy and Vissing-Jorgenson (2011) provide an *ex post* assessment of the effects of the second asset purchase program that appear to be roughly in line with these projections. Taken together, this evidence suggests that MEP is likely to have economic effects that are broadly similar to those of LSAP 2.

interest rates by similar amounts and the macro effects of these programs are nearly identical. Both programs trim the unemployment rate by about ¼ to 1/2 percentage point by late 2013. In addition, the two programs boost core PCE inflation by about 1/4 percentage point from 2012 to 2016. Under all scenarios, however, core inflation remains consistently at or below levels that the Committee sees as consistent with its dual mandate. The macroeconomic effects of the RMEP program are very small.¹⁵

4. Balance Sheet and Income Projections

As shown in the top left panel of exhibit 3, under the MEP (the blue dashed line) and the RMEP (the red dotted line), the SOMA portfolio remains roughly constant at \$2.6 trillion through the end of 2012; under the LSAP (the green dashed line), total SOMA assets increase to around \$3.6 trillion in late 2012, after the additional \$1 trillion of Treasury securities are purchased. The path of the federal funds rate is the same as in the baseline from the August Tealbook, lifting off from the effective lower bound in August 2013, and that path determines the timing of the exit strategy: Six months prior to the first increase in the target federal funds rate, reinvestment of the proceeds from maturing and prepaying securities (both Treasury and agency securities) stops; and six months after the first increase in the federal funds rate, sales of agency securities commence. SOMA MBS holdings are projected to prepay more quickly in the MEP and the LSAP scenarios because of the lower path for longer-term interest rates.

Under each of the programs, the average maturity of SOMA holdings of Treasury securities is longer, so the normalization of the size of the balance sheet through redemptions

¹⁵ These simulations assume that the federal funds rate is held at the baseline assumption through 2015 before following the prescriptions of the outcome-based rule; if monetary policy instead followed the policy rule from the start of the projection period, the macroeconomic effects would be much smaller because the liftoff of the federal funds rate would occur earlier than is assumed here.

takes longer than under the baseline. For the RMEP, the lag is modest, but for the MEP and the LSAP, the balance sheet takes an additional fifteen to nineteen months to return to a normal size compared to the Tealbook baseline. Because of this effect, even though the balance sheet does not expand under the MEP, it ends up being nearly \$500 billion larger after several years compared to the baseline case. Some of the estimated effect of these programs arises from this larger expected size of the balance sheet.

Under each scenario, once the size of the balance sheet is normalized, open market operations are conducted to accommodate increases in currency and Reserve Bank capital to maintain reserve balances at \$25 billion and to renormalize the composition of the Treasury portfolio. These operations are also used to return the composition of the portfolio's Treasury holdings to a proportion of one-third bills and two-thirds coupons. At the end of the projection period, total assets are the same across all scenarios, although the maturity composition differs.

As outlined in exhibit 4, the RMEP would have only modest effects on Federal Reserve income compared to the baseline, but the effects would be substantial for the MEP and the LSAP. The balance sheet under both the MEP and the LSAP remains larger for a longer period of time, and SOMA holdings under both programs have a higher weighted average yield; as a result, interest income is higher than in the baseline.¹⁶ This higher interest income is projected to boost Federal Reserve net income and remittances to the Treasury for four years. In 2015 and later, remittances are projected to fall below those in the baseline because, in the baseline, the portfolio starts to accumulate recently issued securities with a higher yield, on average, by that

¹⁶ The yield on the SOMA portfolio reflects two components of the securities in the portfolio, the coupon on the securities and the net amortized premiums on those securities. A higher coupon generates higher interest income, but the amortization of the premium will offset to some degree that interest income. In general, the higher coupon securities also have a higher premium associated with them. The yields reported in this memo reflect interest income net of amortized premiums.

time. In addition, interest expense in the MEP, and even more so for the long-maturity LSAP, increases by somewhat more than in the baseline when short-term rates rise because the level of reserve balances is larger in those two scenarios. Capital losses that are realized from the sale of agency securities under these scenarios are similar to those realized under the baseline. For both the MEP and the LSAP, unrealized gains on the portfolio in the near term are projected to be larger than under the baseline, because the additional accommodation is assumed to lower interest rates, boosting the value of the SOMA portfolio. Over time, however, the longer duration of the portfolio and its greater size results in much larger unrealized losses than in the baseline as interest rates eventually rise.

On balance, the cumulative amount of remittances to Treasury over the period shown is about unchanged from the baseline under both the MEP and the LSAP, as the higher remittances in coming years are offset by lower remittances in the latter years. Moreover, the portfolio has a greater degree of interest rate risk under both the MEP and the LSAP program, as discussed in the next section. Additional detail on balance sheet and income projections for each of the alternatives discussed is provided in Appendix 3.

5. Risks to Federal Reserve Income: Alternative Interest Rate Scenario

All three options considered in this memo would increase the interest rate risk in the SOMA portfolio. To gauge the potential risks surrounding the forecasts for Federal Reserve income, the staff considered the implications of an alternative interest rate scenario. Under this scenario, we assume that the Committee raises the federal funds rate six months earlier than in the August Tealbook baseline and longer-term rates are assumed to be as much as 175 basis points higher. Results for the exit strategy remains tied to the raising of the funds rate, so the

earlier rise in the funds rate implies that reinvestments are stopped earlier and agency securities sales are begun earlier than under the baseline¹⁷. The adverse interest rate scenario has the effect of lowering Federal Reserve income under the baseline as well as under the alternatives discussed here. The MEP and the LSAP are more affected, largely because both result in a level of reserve balances that is much larger at the time when interest rates are assumed to be higher. This fact results in significantly higher interest expense.

In the baseline incorporating the adverse interest rate path, the more rapid assumed exit results in a smaller SOMA portfolio and therefore less interest income than under the previous projections (see exhibit 5). Based on the higher assumed path of the federal funds rate, even with a smaller level of reserve balances, there is additional interest expense associated with all interest-bearing liabilities. Moreover, as agency securities are sold, realized losses are larger because of the higher level of interest rates. On net, remittances to the Treasury are significantly lower under the adverse interest rate scenario for a couple of years. For the RMEP, the results are similar to the baseline with the adverse interest rate scenario, but Federal Reserve income is generally a bit lower.

For the MEP and the LSAP, under the alternative interest rate scenario, Federal Reserve income is noticeably reduced (see exhibit 6). The larger size of the balance sheet under these scenarios means that interest expense is noticeably higher than under the baseline, and with higher interest rates, this effect is amplified. The higher interest expense significantly reduces remittances to the Treasury as soon as 2013. By 2015, the interest expense more than offsets the interest income on the portfolio, and remittances to the Treasury are halted. The larger level of

¹⁷ The timing conventions are not identical under the alternative scenario. Redemptions begin three months before the federal funds liftoff instead of six. This change is made to avoid redeeming securities at the same time that purchases are being completed under the LSAP.

reserve balances under the LSAP means that this effect is larger, and remittances to the Treasury are suspended until 2018 under the LSAP as opposed to 2017 under the MEP. Given these operating losses, the Federal Reserve records a “deferred credit asset” under both scenarios in the years that remittances are suspended. This deferred credit asset reflects the amount of future earnings that the Federal Reserve will have to withhold to offset prior losses and peaks at about \$20 billion under the MEP in 2016 but reaches about \$60 billion under the LSAP. Under either scenario, however, as interest expense falls with lower reserve balances and interest income recovers, net income pays down the deferred credit asset and remittances to the Treasury resume. The adverse interest rate scenario also results in a larger unrealized loss position of the SOMA portfolio under each of the scenarios. The unrealized losses are largest for the MEP and LSAP programs, reaching a total of nearly \$300 billion in 2015.

6. Technical Considerations

As noted above, the magnitude of purchases of long-term securities and the associated effects on the composition of private sector portfolios are primarily responsible for the effects of the programs on yields and related economic outcomes. Several technical considerations may bear on the Committee’s decisions regarding the structure of any of the programs discussed.

Response of Treasury Debt Issuance

When calibrating the effects of strategies that involve sales and redemptions of Treasury securities, one has to take into account Treasury debt issuance practices. When a Treasury security matures, the Treasury of course needs to replace that funding by issuing a new security. If the Desk has sold the SOMA holdings of that issue or is redeeming its holdings, the Treasury will have to issue more of the security to the public. It will likely refund that debt at maturities

across the yield curve, implying that the private sector will have to hold more duration risk, partially offsetting the impact of the MEP. These effects are similar to those associated with redemptions of Treasury securities from the SOMA portfolio that will occur in the exit strategy; in this case, longer-term rates are boosted because the public will hold more duration risk. In effect, near-term sales of short-term securities under the MEP might be thought of as largely equivalent to accelerated redemptions in terms of effects on market rates. These considerations are incorporated in the estimated yield effects presented above.

Market Functioning Considerations

Upon conclusion of the purchases under the MEP and long-maturity LSAP, the SOMA portfolio will hold roughly 40 percent of all Treasury securities outstanding with a remaining maturity of 6 years or more. A significantly larger program in these maturities or a more rapid pace of purchases than discussed in this memo might lead to some deterioration in Treasury market liquidity. For example, at the very end of the asset purchase program that began in November 2010 (and included \$600 billion of purchases over a period of seven and a half months), offer-to-cover ratios in purchase operations began to decline somewhat, and the Desk purchased greater amounts of on-the-run securities as off-the-run securities became less available in the market. Stretching the purchases under the MEP and long-maturity LSAP programs over longer time periods would reduce the probability of such problems.

Alternative Maturity Distribution

Concentrating purchases of securities at maturities of six years or longer could cause that sector of the yield curve to become dislocated from other market rates, reducing the intended effects of the program. More generally, there is a risk that our assumption regarding investors'

reaction to purchases is incorrect and that there are substantial preferred habitat effects. If this were so, the effects of the MEP could boost rates at maturities of three years or so – a common length for some consumer loans such as for autos – and the boost to aggregate demand could be less than we expect. Indeed, the drop in long-term rates and increase in shorter-term rates following the release of the August employment report might be viewed as evidence of this type of effect; market participants attributed the twist in the yield curve that day to increased expectations that the Federal Reserve would implement a program like the MEP.¹⁸

Given these issues, the Committee could consider using the broader maturity distribution of assets purchased in previous asset purchase programs rather than the narrower distribution assumed above. Our current estimates, however, suggest that in order for the broader maturity distribution to achieve a similar reduction in the yield on the 10-year Treasury note as the programs described above, substantially larger purchases would be required. A longer time period would likely be needed to execute a larger purchase program, as well, because of the market liquidity considerations discussed above.

7. Policy Considerations

The discussion below summarizes some basic policy considerations associated with the three options discussed in this memo. In terms of estimated market and economic effects, the RMEP is the smallest of the three programs. Of course, the RMEP may have effects somewhat larger than those discussed above – at least for a time – if investors viewed the Committee’s decision to implement the RMEP as raising the odds that additional policy action in the form of the MEP, long-maturity LSAP, or some other program would be taken in the future. The

¹⁸ However, if the forward guidance in the FOMC statement continued to suggest that the federal funds rate was expected to remain at its current level until mid-2013, that would help anchor short-term rates, and 2 and 3 year rates might not increase much.

Committee might wish to implement the RMEP if it believes that additional policy stimulus is appropriate but would like to do so in a way that does not commit the Federal Reserve to a large-scale program at this time. Moreover, implementing the RMEP might be seen as a way of reinforcing the forward guidance in the Committee's August statement; that is, the purchase of long-term Treasuries might be viewed as a way of underscoring to investors that the Federal Reserve was likely to maintain very substantial monetary accommodation, with the funds rate path remaining exceptionally low at least until mid-2013. The RMEP has relatively modest effects on the size of the balance sheet and the level of reserves and, as a result, policymakers may believe that this program poses less of a risk than the larger programs that inflation expectations may become unanchored. In addition, the RMEP raises fewer potential complications for the exit strategy than the other options and has less of an effect on Federal Reserve income. Even if the Committee believed that a larger program could well ultimately be warranted, it might wish to begin with an RMEP in order to gain additional information on the effects of concentrating purchases in long-maturity Treasury securities. A potential risk in implementing the RMEP is that it may be perceived as a token, and largely ineffective, policy action and so undercut confidence in the ability of the Federal Reserve to address a significant deterioration in the economic outlook.

The MEP might be viewed as appropriate if policymakers concluded that the economic outlook is sufficiently weak to warrant committing to a sizable program at this time. With short-term rates at the effective zero bound, apparent limitations on fiscal policy, and a precarious situation in Europe with potential spillovers to global financial markets and the U.S. economy, the Committee might conclude that it is important to take significant action now both to boost the expected path of output and to trim the downside risks in the outlook. As noted above, the MEP

could have significant effects on market yields and economic outcomes. And policymakers may find attractive that the MEP largely offsets most of the balance sheet and reserve effects of the purchases of long-term securities through sales of short-term securities, and so may raise fewer concerns about the potential for higher expected and actual inflation. On the other hand, the effects of the MEP may be even more uncertain than those of earlier balance sheet programs. For example, the models employed by the staff to estimate the market and economic effects of the MEP point to a modest increase in short-term yields, but these estimates are quite uncertain and the estimates of the economic effects of the program could underplay the restraining effect of higher short-term rates on the economy. Finally, some policymakers may be concerned about the additional interest rate risk that the Federal Reserve would bear under this option.

The long-maturity LSAP might be preferred by policymakers who believe that a very large program is warranted by the deterioration in the economic outlook over recent months and would demonstrate the Federal Reserve's resolve to address the economic situation. As noted above, the economic effects of the LSAP are very similar to those for the MEP, but the LSAP could be structured to provide more stimulus if it were increased in size or if the investments were more heavily concentrated in long-maturity Treasuries. The Committee might have more confidence in the financial market effects of the LSAP relative to the MEP, since it is similar to the past Committee actions from which we judge the market effects. Moreover, although our calibration suggests that the effects of the LSAP and the MEP are similar, Committee members may worry that the MEP will have smaller effects because it is less well understood, appears more technical, and cannot be repeated even if further stimulus proved desirable (since almost all short-term securities will be sold). Even though the LSAP increases the size of the balance sheet and reserves very substantially, policymakers may believe that long-term inflation expectations

are unlikely to drift significantly higher given the current and expected slack in resource markets. Indeed, some participants may view the potential for some modest increase in inflation expectations as a positive factor if the ongoing weakness of the economy had increased their concerns about the risks of deflation. The Committee may also judge that it has the tools necessary to implement its exit strategy at the appropriate time even with the expansion in the balance sheet under this option. In particular, even though the size of the balance sheet will expand very significantly under this program, when redemptions of maturing securities begin, the portfolio shrinks rapidly. In addition, with a larger balance sheet, policymakers might conclude that sales of Treasury securities at some point in the exit process could be used to normalize the size of the balance sheet more promptly if economic circumstances indicate that such action is warranted.

However, some policymakers may see significant downsides to the long-maturity LSAP program that outweigh its relatively small effect on output and employment relative to the MEP. Such policymakers may be concerned that possible criticisms that the Federal Reserve is monetizing federal debt, even if unfounded, could undermine confidence in the Federal Reserve as well as Federal Reserve independence. The greater interest-rate risk born by the Federal Reserve, and the possibility of operating losses for a couple of years, could reinforce these concerns. Some might think that such a policy could lead to inflation expectations becoming unanchored over time if the public believed that a much larger balance sheet would complicate the eventual exit from policy accommodation. Indeed, some participants may be concerned that with another \$1 trillion of reserve balances, the draining tools that have been developed might not be sufficient to allow the Federal Reserve to drain the reserves that might be needed to tighten the relationship between the IOER rate and short-term market rates as planned.

For either the MEP or the LSAP, policymakers may wish to announce the programs in terms of purchases (and in the case of the MEP, sales) per month instead of the ultimate size as described in the foregoing discussion. Such a characterization might be preferable if it is seen as increasing the Committee's flexibility in adjusting the programs should economic conditions change during the execution of the program. In addition, given the concerns noted above about possible strains on market functioning and liquidity, the Committee may wish to adjust the pace of purchases if such strains were to develop.

Table 1: Key Elements of RMEP, MEP, and Long-maturity LSAP

Assumptions	RMEP	MEP	Long-maturity LSAP
Purchase long-term Treasury securities			
Amount of purchases	\$257 billion reinvestments	\$400 billion + \$290 billion reinvestments	\$1 trillion + \$290 billion reinvestments
Duration of purchases		9 months	12 months
First month of purchases		October 2011	October 2011
Last month of purchases		June 2012	September 2012
Offsetting Program			
	No offsetting program	Sell Treasury securities with short remaining maturity	No offsetting program
Duration of offset		9 months	
First month of offset		October 2011	
Last month of offset		June 2012	
Policy Effects	RMEP	MEP	Long-maturity LSAP
Total Assets			
Peak month	June 2011	June 2012	September 2012
Peak amount	\$2.87 trillion	\$2.90 trillion	\$3.96 trillion
December 2020	\$1.94 trillion	\$1.94 trillion	\$1.94 trillion
Reserve Balances			
Peak month	March 2012	March 2012	September 2012
Peak amount	\$1.67 trillion	\$1.71 trillion	\$2.74 trillion
Interest Rates			
Maximum 10-year term premium decline	7 bps	20 bps	24 bps

Appendix 1: Estimating the Term Premium Effects Associated with the RMEP, MEP, and Long-Maturity LSAP Programs

We quantify the term premium effects of the long-maturity LSAP and the maturity extension programs using a no-arbitrage term structure model, where the nominal short-term interest rate and investors' risk preferences are all assumed to be driven by three observable state variables, f_t , that follow a first-order VAR.¹⁹

$$f_{t+1} = c + \rho f_t + \Sigma \varepsilon_{t+1}, \quad (1)$$

The state variables include two yield curve factors—the level and the slope of the yield curve—and one supply factor—the amount of Treasury securities held by the private sector measured as ten-year equivalents normalized by nominal GDP.²⁰ Under standard assumptions, this model implies that the yield on an n -period zero coupon bond is a linear function of these state variables:

$$y_t^n = a_n + b_n f_t. \quad (2)$$

We estimate the model parameters using historical data on the three state variables and Treasury yields at various maturities.

We model the maturity extension and the long-maturity LSAP programs as generating shocks to the supply variable, which become known to the investors once the programs are announced:

$$\tilde{f}_t = \{f_t^y, \tilde{f}_t^s\}, \quad \tilde{f}_t^s = f_t^s + u_t, \quad (3)$$

where f_t^y and f_t^s denote the yield curve and the supply factors, respectively, and u_t denotes the shock values. To measure these shocks, we start by forming projections for total marketable Treasury debt outstanding and SOMA Treasury holdings under the baseline scenario as well as under the three alternative scenarios. Based on these projections, we can calculate the ten-year equivalents-to-GDP ratio of privately held Treasury securities for all four scenarios. Finally, the supply shocks are measured as the differences between estimates of the supply variable under each alternative scenario and under the baseline scenario. As shown in the upper left panel of exhibit 1, the three programs are expected to reduce the ten-year equivalents-to-GDP ratio of privately held Treasury securities by about 1¼ to 6½ percentage points compared to the baseline scenario. Despite its much larger size, the LSAP has only a slightly larger effect on the ten-year equivalents because a significant share of purchases under the program is concentrated in shorter-term securities.

¹⁹ A more complete discussion of the methodology can be found in the memorandum, “Term Structure Modeling with Supply Factors and an Application to Maturity Exchange Program Evaluation,” by Min Wei and Canlin Li, August 17, 2011.

²⁰ The 10-year equivalents measure converts the par amount of a fixed-income portfolio into the par amount of on-the-run 10-year Treasury securities with the same par amount times duration: 10-year equivalent par value = dollar par amount times average portfolio duration / duration of 10-year on-the-run Treasury note.

We extend the no-arbitrage term structure model to incorporate these shocks as follows. By assumption, all three options considered in the memo eventually cause Treasury holdings by the private sector to return to its baseline path, so that supply shocks disappear and bond yields follow the standard formula (2) at a sufficiently distant horizon T . Bond yields for period $T-1$ can then be derived from the basic pricing relation that the price of an n -period bond today should equal the discounted, risk-adjusted expected value of the price of an $(n-1)$ -period bond next period.²¹ Applying this pricing equation recursively backward allows one to derive the bond pricing formulae in an economy with deterministic supply shocks.

$$\tilde{y}_t^n = \tilde{a}_{n,t} + b_n \tilde{f}_t, \quad (4)$$

Finally, we measure the effects of the two programs on long-term interest rates as the difference between the bond yields implied by Equation (4) and those implied by the standard formula (2):

$$\tilde{y}_t^n - y_t^n = b_n^s u_t + \sum_{i=1}^{T-t} \frac{n-i}{n} b_{n-i}^s (u_{t+i} - \rho^{ss} u_{t+i-1}) \quad (5)$$

where b_n^s denotes the loadings of yields on supply factors and ρ^{ss} denotes the autoregressive matrix of supply variables. This measure captures the cumulative effect of supply shocks on yields over the life of the bond. The bottom left panel of exhibit 1 plots the estimates for the ten-year maturity. The RMEP is estimated to reduce ten-year Treasury yields by about 6½ basis points upon announcement, while the MEP and the LSAP are estimated to reduce ten-year Treasury yields by about 20 and 25 basis points, respectively; these effects are expected to dissipate over time to near zero by the end of the projection period.²²

As a comparison, the same methodology can be used to evaluate the Federal Reserve's LSAP 2 implemented between November 2010 and June 2011. As shown in the panels to the right in exhibit 1, this program is estimated to have reduced the ten-year equivalents-to-GDP ratio of private Treasury holdings by up to 2¾ percentage points, respectively, relative to a baseline scenario of no purchases;²³ it is also estimated to have lowered the 10-year Treasury yield by about 13 basis points when it was first announced. This estimate is smaller than that reported in the October 2010 Tealbook,²⁴ which was based on a model in which yields are affected by the

²¹ This analysis assumes discount bonds. Par coupon bonds would have a shorter duration, and so the effect is likely to be somewhat smaller.

²² By the end of the projection period in 2020, the paths have not yet converged. It is likely that they would do so in a linear fashion in the years following the end of the projection period.

²³ The projections for total Treasury debt and nominal GDP under both scenarios are from the October 2010 Tealbook. We assume the difference in ten-year equivalents between the two scenarios shrinks linearly to zero by the end of the projection period.

²⁴ See DEDO box, "Alternative SOMA Portfolio Assumptions," which assumes an interest rate effect of 30-40 basis points per \$1 trillion purchased, or about 20 basis points for the \$600 billion program.

amount but not the duration of private Treasury coupon holdings. This estimated effect is also roughly half of that reported for the MEP and the LSAP. Both observations can be explained by the fact that both the amount and duration of purchases determine the size of interest rate effects in our current model. Under LSAP 2, the Desk purchased securities with an average maturity close to that of outstanding Treasuries and therefore generated a smaller reduction in the ten-year equivalents held by private investors than under the MEP and the LSAP.

Appendix 2: Detailed Assumptions on Balance Sheet and Income Projections

This appendix provides details about the calculations made by Board staff behind the projections in this memo. However, estimates presented in this memo reflect the combined results of models developed independently by Board and New York staff.

1. SOMA Portfolio Holdings

a. Treasury Securities

SOMA Treasury holdings are assumed to evolve through a combination of outright purchases and the rollover of maturing securities at Treasury auctions. The proceeds from maturing securities are reinvested at rates consistent with the Tealbook rate path. Outright operations are simulated by distributing purchases across various maturity buckets. Prices for securities in each maturity bucket are generated from an interest rate path that is consistent with each scenario.

For the coupons on Treasury securities, we rely on the average coupon on outstanding Treasury debt as reported in the *Monthly Statement of the Public Debt*.²⁵ For those Treasury securities that will be auctioned in the future, coupon rates are estimated from staff projections of future interest rates. For purchases over the next year, we allocate purchases into the maturity bucket distribution reported in Table 1 and assign the associated coupon to those newly acquired holdings.²⁶

Maturity Bucket	6	7	8	9	10	11	12	13	14	15	16
Coupon (percent)	2.7	3.3	3.1	3.4	4.8	6.4	7.5	6.8	6.4	6.3	5.5
Maturity Bucket	17	18	19	20-22	23	24	25	26	27	28	29
Coupon (percent)	5.7	5.9	5.4	N/A	4.5	4.6	4.8	4.1	4.3	4.3	4.1

b. Agency Securities

The agency MBS portfolio is assumed to evolve due to a combination of prepayments and asset sales. A path of forecasted prepayments is generated based upon an interest rate path for each

²⁵ We calculate the average interest rate by maturity, weighted by the par value of available-for-purchase securities.

²⁶ This distribution is based on the remaining maturity of the securities, and, as a result, the distribution shifts each year as the outstanding securities become a year closer to maturity.

scenario, using the model of one of the program's investment managers. As noted below, sales of agency debt and mortgage-backed securities begin approximately six months after the first increase in the federal funds rate and last for five years. Given the maturity schedule for agency debt securities, the volume of sales necessary to reduce holdings of these securities to zero over the five year period is minimal.

2. Balance Sheet Assumptions

- a. Under the baseline, principal payments from Treasury securities continue to be reinvested until February 2013.
- b. Principal payments from agency MBS and agency debt securities continue to be reinvested in longer-term Treasury securities until February 2013.
- c. The Federal Reserve begins to sell agency MBS and agency debt securities in February 2014, roughly six months after the assumed date of the first increase in the target federal funds rate. Holdings of agency securities are reduced over five years and reach zero by January 2019.
- d. For agency MBS, the rate of prepayment is based on estimates of housing market factors from one of the program's investment managers and interest rate projections from the alternatives. The projected rate of prepayment is sensitive to these underlying assumptions. The amount of prepayments varies across scenarios.
- e. We make the simplifying assumption that all discount window lending over the projection period will be primary credit. We assume that the primary credit falls to zero by the end of 2011 and that the primary credit rate is 75 basis points over this period.
- f. The assets held by TALF LLC remain at about \$1.0 billion through 2014 before declining to zero the following year. Assets held by TALF LLC consist of investments of commitment fees collected by the LLC and the U.S. Treasury's initial funding. In this projection, the LLC does not purchase any asset-backed securities received by the Federal Reserve Bank of New York in connection with a decision of a borrower to not repay a TALF loan.
- g. The assets held by Maiden Lane LLC and Maiden Lane III LLC decline gradually over time. The assets of Maiden Lane II LLC are assumed to be constant at their level as of July 31, 2011 until the process to sell the assets in the LLC's portfolio resumes after the first increase in the target federal funds rate. At this point, the asset sales resume and holdings gradually fall to zero by June 2014.
- h. In all scenarios, a minimum level of \$25 billion is set for reserve balances. To maintain reserve balances at this level, first Treasury bills are purchased. Purchases of bills continue until these securities comprise one-third of the Federal Reserve's total Treasury security holdings—about the average level prior to the crisis. Once this level is reached, the Federal Reserve buys notes and bonds in addition to bills to maintain an approximate composition of the portfolio of one-third bills and two-thirds coupon securities. The choice of \$25 billion is

arbitrary; if a higher level were chosen, balance sheet normalization and other aspects of these projections would be shifted accordingly.

- i. Federal Reserve notes in circulation grow in line with the staff forecast for money stock currency through the last quarter of 2012. Afterwards, Federal Reserve notes in circulation grow at the same rate as nominal GDP, as projected in the extended Tealbook projection.
- j. The U.S. Treasury's General Account (TGA) follows the staff forecast through December 2011.²⁷ Then, the TGA slowly drops back to its historical target level of \$5 billion by March 2012 as it is assumed that the Treasury will implement a new cash management system and invest funds in excess of \$5 billion. The TGA remains constant at \$5 billion over the remainder of the forecast period.
- k. Given the large degree of uncertainty over the timing and extent of future increases in the debt ceiling, we maintain the Supplementary Financing Account (SFA) balance at its current level of zero throughout the forecast. Changing this assumption would imply a dollar-for-dollar offset in the level of reserve balances but no other change in the balance sheet projections.
- l. Federal Reserve capital grows 15 percent per year, in line with the average rate of the past ten years.
- m. In general, increases in the level of Federal Reserve assets are matched by higher levels of reserve balances. Increases in the levels of liability items, such as Federal Reserve notes in circulation or other liabilities, or increases in the level of Reserve Bank capital, drain reserve balances. When increases in these liability or capital items would otherwise cause reserve balances to fall below \$25 billion, purchases of Treasury securities are assumed in order to maintain that level of reserve balances.
- n. In general, Federal Reserve net income, after allowing for operating expenses, dividends, and retaining surplus equal to capital paid in, is remitted to the Treasury. A liability on the Federal Reserve's balance sheet of the accrued earnings is reported as "Interest on Federal Reserve notes due to U.S. Treasury." In the event that a Federal Reserve Bank's earnings fall short of the amount necessary to cover operating costs, pay dividends, and equate surplus to capital paid-in, a "deferred credit asset" is recorded, by effectively making the liability item of interest due to the Treasury a negative number. This "deferred credit asset" is recorded in lieu of reducing the Reserve Bank's capital. Remittances to the Treasury are suspended, and future positive net income is used to pay down this deferred credit asset. After this asset has been reduced to zero, remittances to the Treasury resume.

²⁷ The staff forecast for end-of-month U.S. Treasury operating cash balances includes forecasts of both the TGA and balances associated with the U.S. Treasury's Tax and Loan program. Because balances associated with the Tax and Loan program are only \$2 billion, for the time being, this forecast is a good proxy for the level of TGA balances.

3. Interest Income

a. SOMA Interest Income

The SOMA portfolio consists of four types of securities: agency debt, agency mortgage-backed securities (MBS), Treasury bills, and Treasury coupon securities.

The average coupon on the portfolio of agency debt and MBS is essentially fixed at its current average coupon for simplicity. This assumption implies that sales and prepayments are a weighted share of existing securities. As a result, income from these securities at any given date is just the stock outstanding at that point in time multiplied by the current average coupon.

The average coupon on holdings of Treasury securities, by contrast, is not fixed. The return will be affected by redemptions and purchases. Three points are relevant. First, we calculate the average coupon of the remaining stock of these securities through the projection period using CUSIP-level data. Second, securities purchased in the secondary market also affect the average coupon of the Treasury securities holdings. We assume that these outright purchases of securities have a coupon that is determined by a weighted average of the coupons on eligible Treasury securities. The weights are determined by the amount of each security that is available for purchase after accounting for self-imposed limits on SOMA holdings. Third, we assume that the Federal Reserve continues to rollover maturing Treasury securities into new securities at auction, with the same maturity distribution as the current Treasury auction schedule. The coupon for securities purchased at auction is determined by the interest rate projections and the assumption that new securities are issued at par. Interest income from the Treasury holdings is then calculated as the stock of Treasury holdings multiplied by its average coupon less the amortization of net premiums, discussed below.

b. Amortization of Premiums and Discounts

We derive premiums for all scenarios and the Treasury security purchases associated with the reinvestment of the proceeds from principal repayments from agency securities by using the difference between the assumed coupon of the security being purchased and the corresponding current market interest rate, as given by the Tealbook.^{28,29}

Net premiums are linearly amortized over the expected life of the securities. In these calculations, a portion of the premium is amortized each year and, consistent with Federal Reserve accounting practices, this amortization reduces interest income.³⁰ Securities purchased at a discount are treated in an analogous way, and the amortization of the discount increases interest income.

²⁸ In any given quarter, we use the Tealbook's federal funds rate and 10-year Treasury yield to estimate a yield curve.

²⁹ Since, operationally, purchases of Treasury securities are made without regard to program, we assume that the shares of premiums associated with the \$400 billion in purchases in the MEP or the \$1 trillion of purchases in the LSAP program are proportional to the par value of these purchases.

³⁰ If the security is sold, the total unamortized premium associated with the security is accounted for in the capital gain (loss) line of the income statement in these projections.

As of July 30, 2011, the Federal Reserve had \$66 billion in net unamortized premiums on Treasury securities, \$4 billion on agency debt securities, and \$11 billion on MBS.

4. Interest Expense

The primary source of interest expense forecasted by the staff is interest paid on reserve balances. The interest expense is calculated using the projected federal funds rate in the appropriate time period.

5. Capital Gain (Loss)

Under Federal Reserve accounting rules, capital gains (losses) are only realized through asset sales. The analysis assumes that the quantities sold are a representative share of the total holdings, and so losses are proportional to the total loss position. Unrealized capital gains (losses) are calculated for the portfolio as a whole.

To obtain the unrealized gain (loss) of the SOMA portfolio, the market value of the portfolio under each option is calculated using a present value discounted cash flow approach. To derive discount factors, we use historical data to fit a zero-coupon curve at various maturities to the federal funds rate and the yield on the nominal ten-year note and estimate a zero-coupon curve in the future, based on this relationship as projected in each of the scenarios. The discount factors for MBS securities add an MBS term premium to the zero-coupon yields. The current coupon MBS to 10-year Treasury spread is assumed to move back to its historical level by the end of the projection period. The holdings of Treasury securities are discounted only with the zero-coupon rates. After calculating the market value, the par value of the securities and unamortized net premiums are subtracted from it to obtain the unrealized gain or loss on the portfolio.

6. Miscellaneous Items

We have made simplifying assumptions about other income items.

- a. Non-interest income from service income is in general small and so is set to zero in each year of the projection.
- b. Based on recent experience, we assume fixed annual operating expenses of \$6 billion per year.

Appendix 3: Detailed Discussion of Balance Sheet and Income Projections

Details for Reinvestment Maturity Extension Program

Under the RMEP, the Committee would announce that payments of principal on agency securities would be used to purchase Treasury securities with maturities of 6 years or longer, amounting to about \$260 billion in purchase by the first quarter of 2013. As shown in the top left panel of exhibit 3, the RMEP does not result in appreciable differences in SOMA holdings compared to the baseline, although assets and liabilities are a bit higher through 2016.

In terms of Federal Reserve income, the reinvestment into long-term securities tends to boost the average yield on the SOMA portfolio a bit relative to the baseline, increasing interest income somewhat. This higher interest income is only partially offset by slightly higher interest expense from the modestly higher level of reserve balances and results in a small boost to remittances to the Treasury over the next few years.

Details for Portfolio Maturity Extension Program

In the near term, under the MEP, the size of the SOMA portfolio is little changed. Purchases and sales of securities under the MEP are of equal par value, so by that metric, the value of SOMA assets will be the same in the near term. However, the purchase program would add a bit over \$50 billion in total assets on the Federal Reserve's balance sheet stemming from premiums on securities—that is, the difference between the purchase price of the securities and their par value. With current and projected market interest rates, the premiums on the long-term securities that are purchased would tend to be larger than the premiums on the shorter-term securities that are sold. As a result, net premiums on securities—an asset on the Federal Reserve's balance sheet—would rise, and reserve balances would rise by an equivalent amount.³¹ The Desk is also assumed to reinvest the proceeds from agency securities into long-term Treasury securities as in the RMEP, so total SOMA securities holdings remain at a constant par value, but the share of Treasury securities in the SOMA and their average maturity rise over the next 18 months.

As noted above, reserve balances rise slightly because the increase in net premium on securities, and during the exit strategy, when the portfolio is assumed to runoff passively, the longer average maturity of securities holdings results in a slower decline in the portfolio, leaving reserve balances further elevated relative to the baseline. As the balance sheet is normalized, reserve balances fall to their assumed steady-state level of \$25 billion by the end of 2017. As in the other scenarios, once the size of the balance sheet is normalized, open market operations are conducted to maintain reserve balances at \$25 billion and to renormalize the composition of the portfolio.

Relative to the August baseline, the MEP would boost both Federal Reserve income and remittances to the Treasury over next four years, as shown in exhibit 4. Currently, the average net yield on the SOMA Treasury portfolio is 2.5 percent. After the MEP is completed, the average yield would rise to 2.8 percent. Interest income peaks at about \$82 billion in 2012 and is

³¹ Of course, the Desk could continue to sell securities after the maturity extension purchases are completed in order to offset the effect of additional premiums on total assets. Doing so, however, would lower the par value of securities in the SOMA portfolio.

noticeably above that in the baseline. Interest expense would be somewhat higher under the maturity extension program than under the baseline because of the slower reduction in reserve balances; as a result, from 2012 until after the balance sheet is normalized in September 2017, interest expense is higher by as much as \$15 billion per year. Realized losses from sales of agency securities are little affected by the maturity extension program. In contrast, the assumed sales of shorter-term Treasury securities under this scenario lead to modest realized gains, which boost Federal Reserve income over the next year. On balance, remittances to the Treasury are elevated in the next few years and peak at just under \$75 billion in 2012, about \$10 billion higher than under the baseline. Remittances decline over the subsequent four years, but tend to remain at or above historical averages; the lowest projected annual remittance comes in 2016, when roughly \$15 billion is turned over to the Treasury, about \$10 billion less than in the baseline.

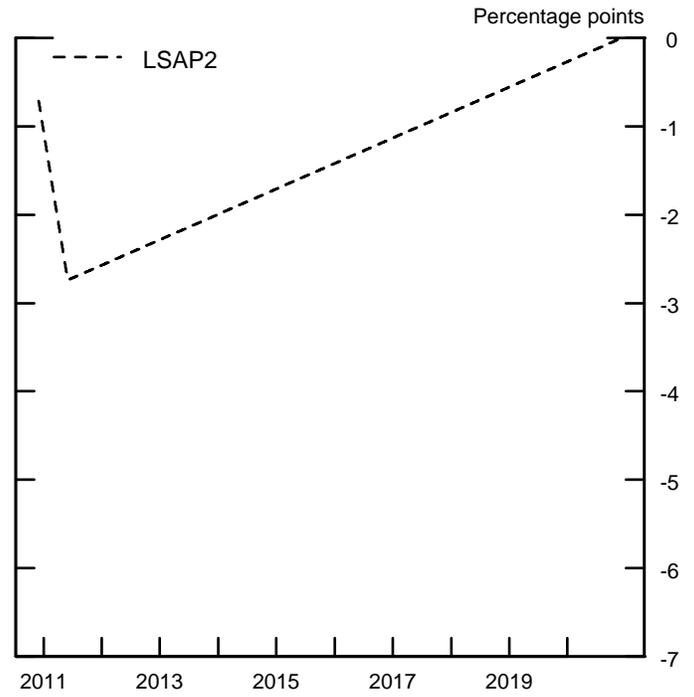
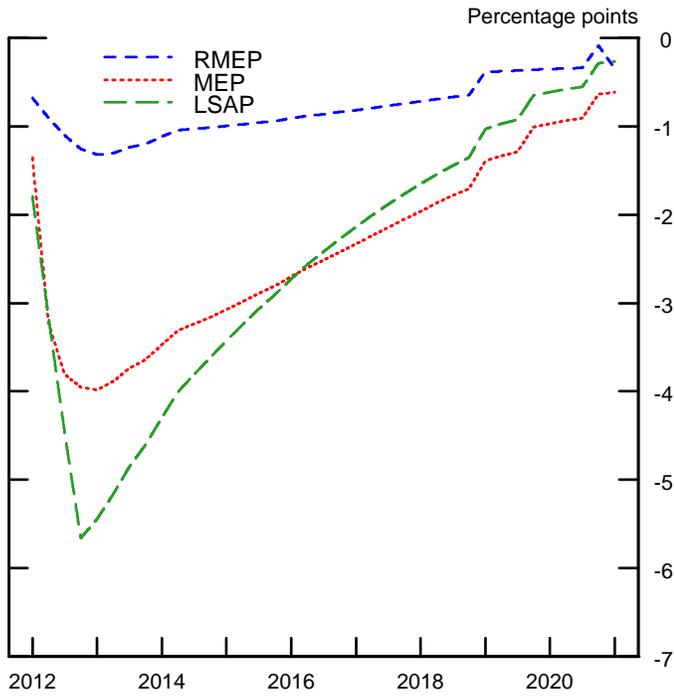
Details for Long-Maturity LSAP Program

Under the long-maturity LSAP program, total assets of the Federal Reserve rise by around \$1 trillion because of the additional purchases of securities. Both the size and average maturity of the SOMA portfolio are increased relative to the baseline, and as a result, the passive runoff of maturing securities that begins in 2013 only normalizes the size of the balance sheet by early 2018—about a year and a half later than under the baseline. Subsequently, as under the other scenarios, Treasury securities are purchased in order to leave reserve balances at \$25 billion and normalize the composition of the portfolio.

The large expansion of the LSAP program boosts interest income over the next several years by more than the baseline and the MEP. Because reserve balances are also noticeably higher under this option, interest expense is boosted, peaking at around \$40 billion in 2015. As shown in exhibit 4, remittances to the Treasury under the LSAP are roughly comparable to those under the MEP until 2015 when the larger interest expense under the LSAP results in smaller remittances for a couple of years. Remittances under this scenario fall to as low as \$10 billion before recovering.

Exhibit 1 Supply Shocks and Effects on Ten-Year Treasury Yields

Ten-Year Equivalents/GDP



Term Premium Effects

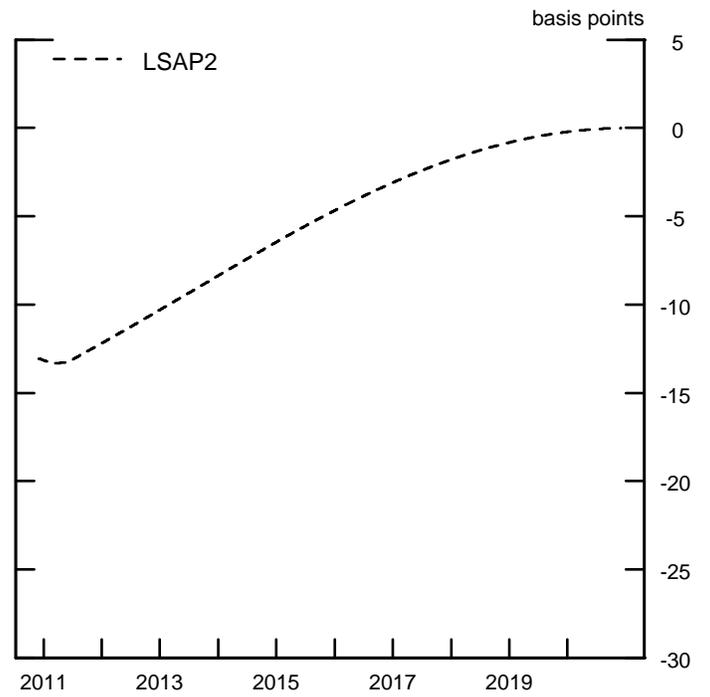
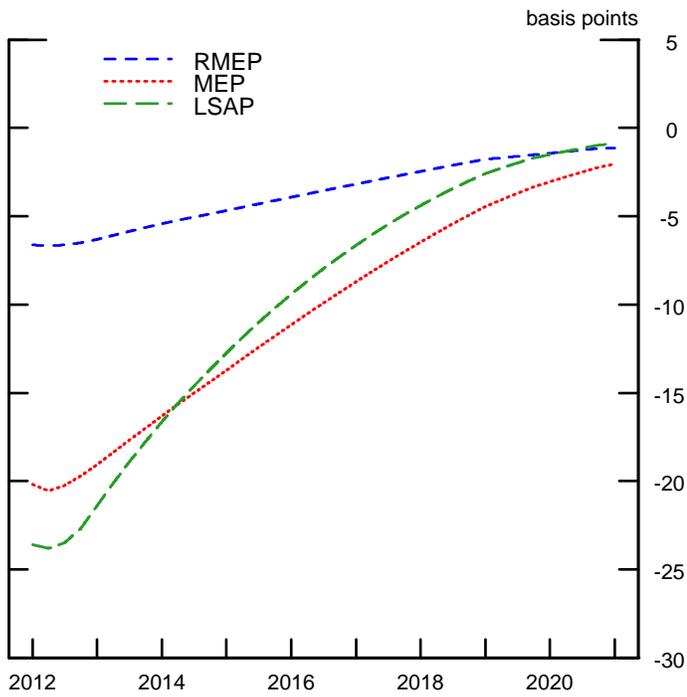


Exhibit 2 Macroeconomic Impact of Alternative Policies

— Aug Baseline - - - MEP
- - - RMEP - - - LSAP

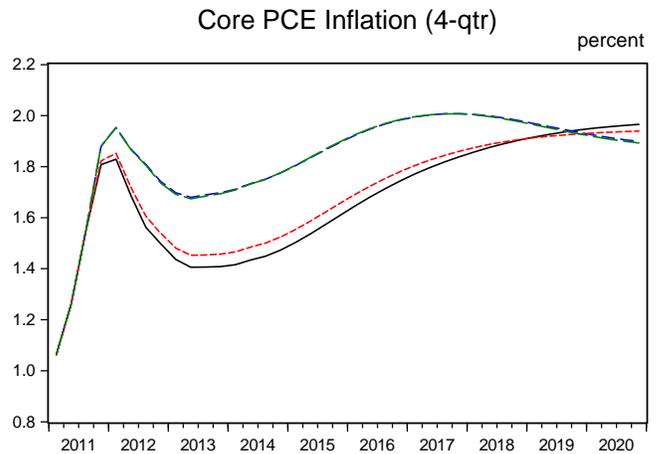
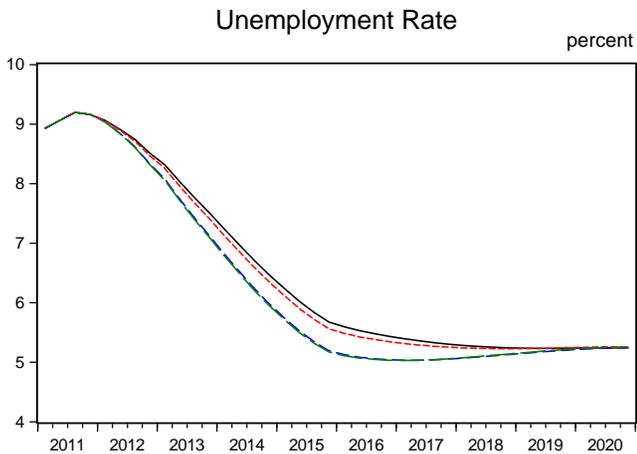
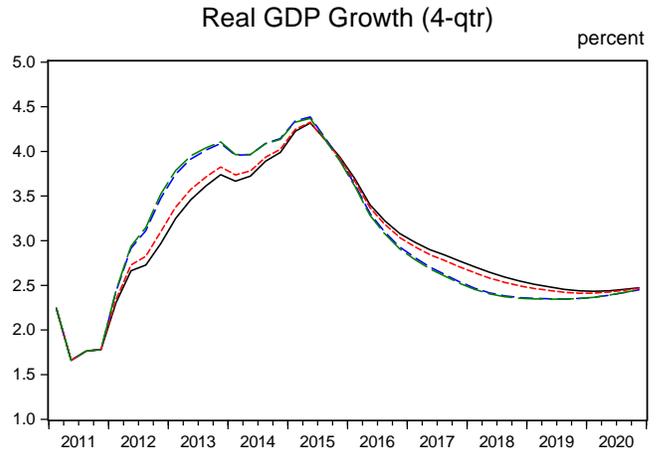
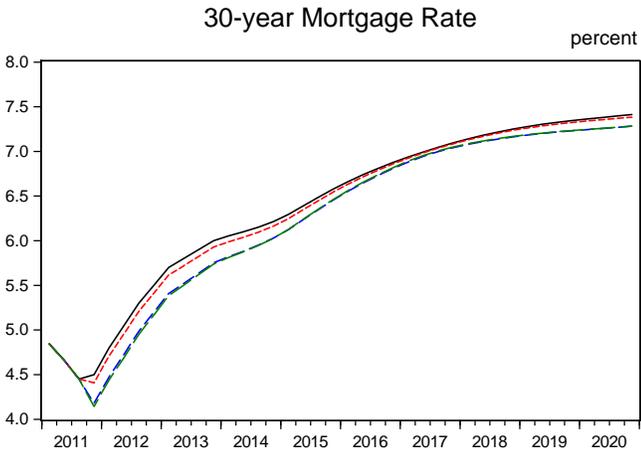
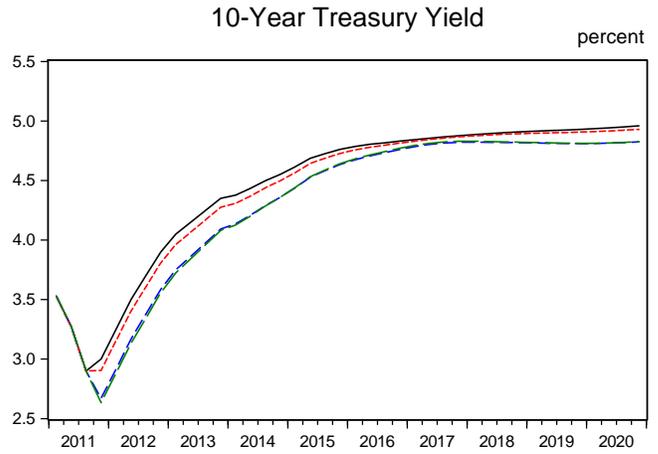
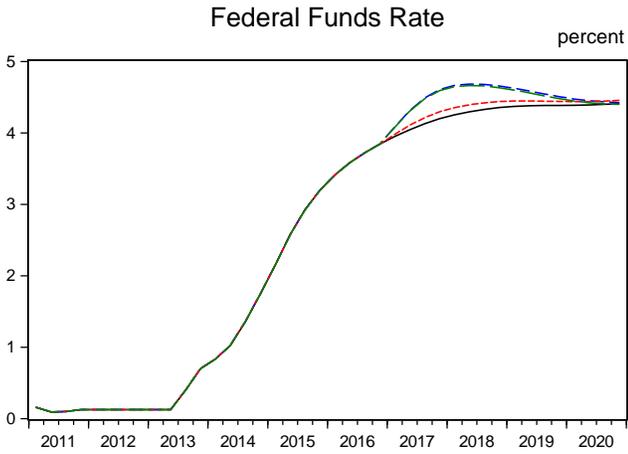
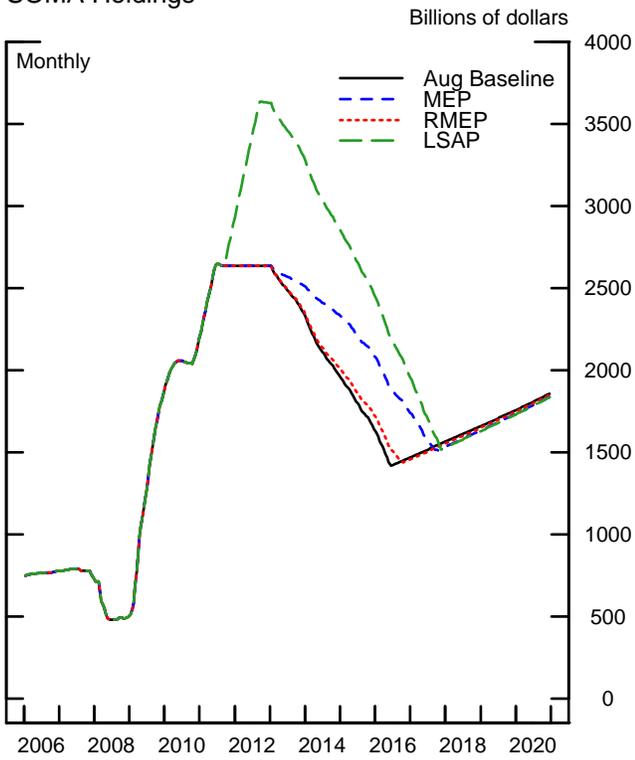
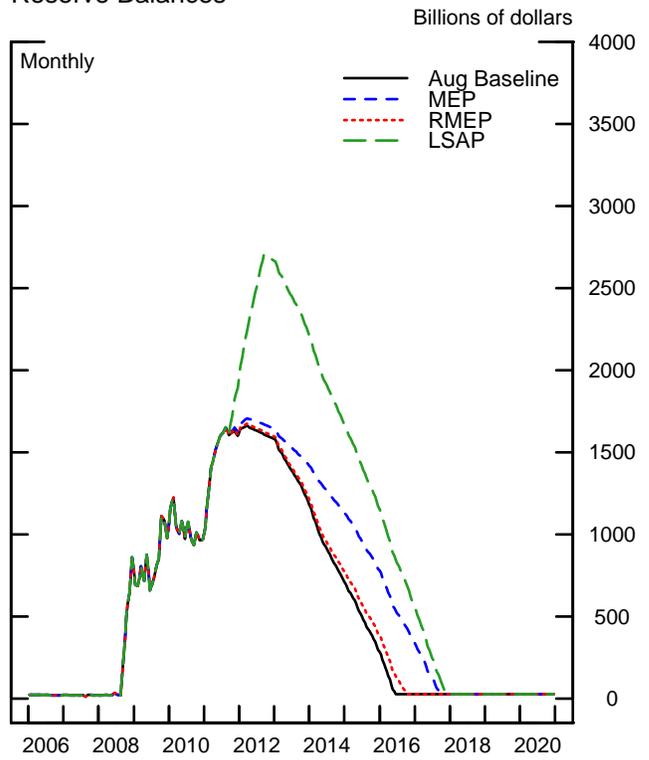


Exhibit 3 Balance Sheet Projections

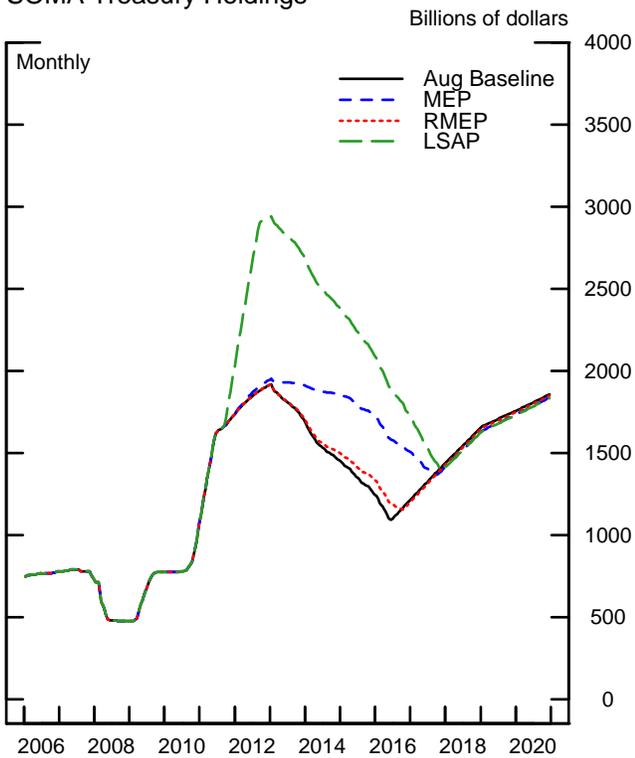
SOMA Holdings



Reserve Balances



SOMA Treasury Holdings



SOMA Agency MBS and Debt Holdings

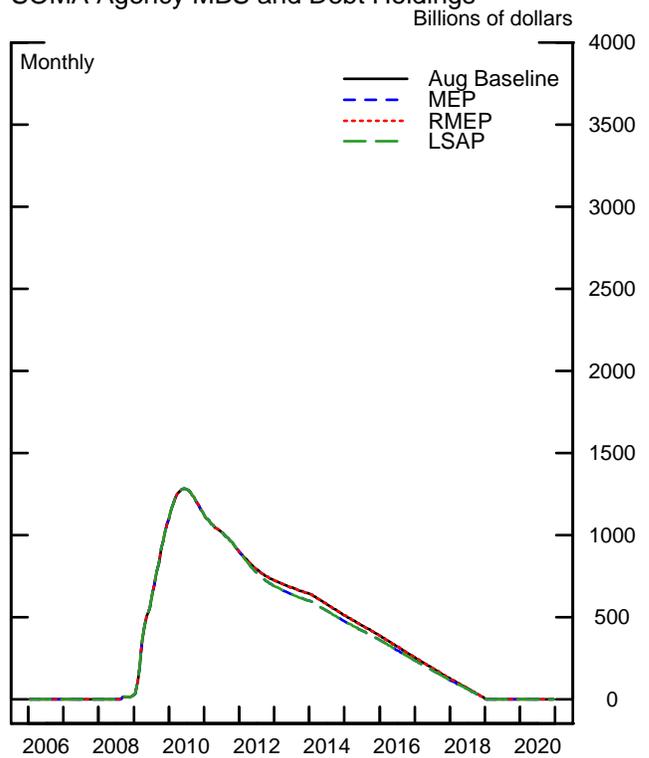
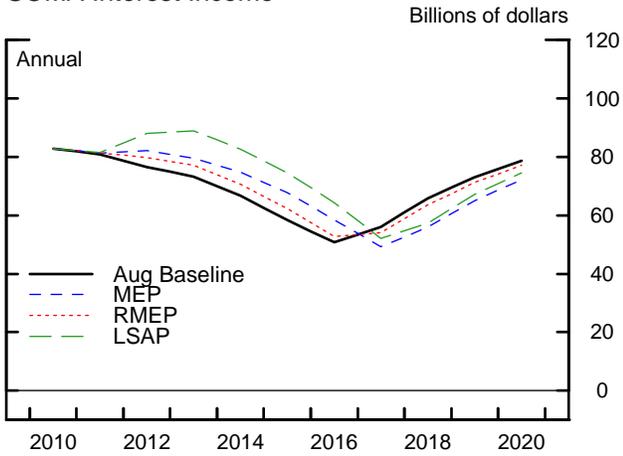
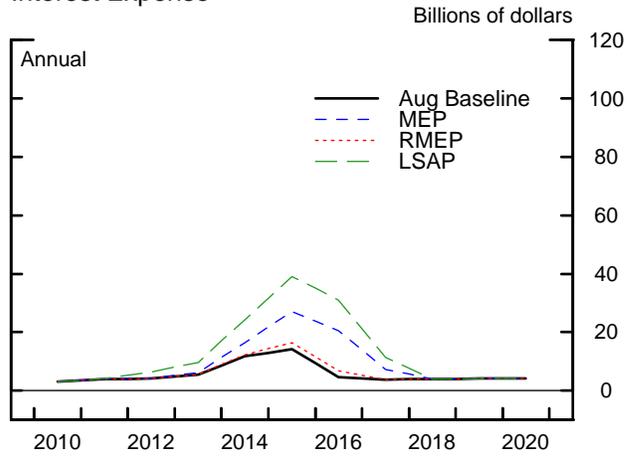


Exhibit 4 Income Projections

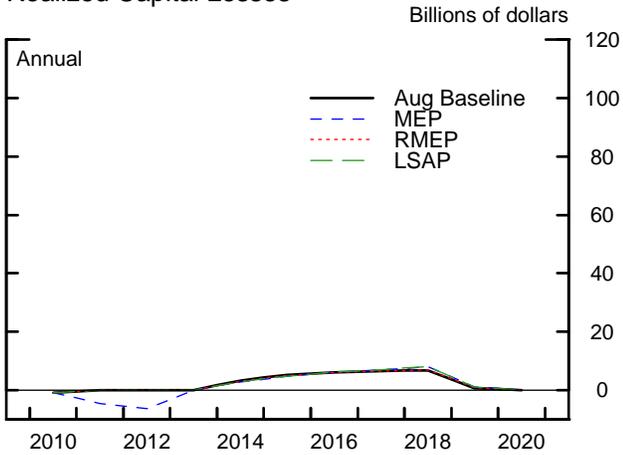
SOMA Interest Income



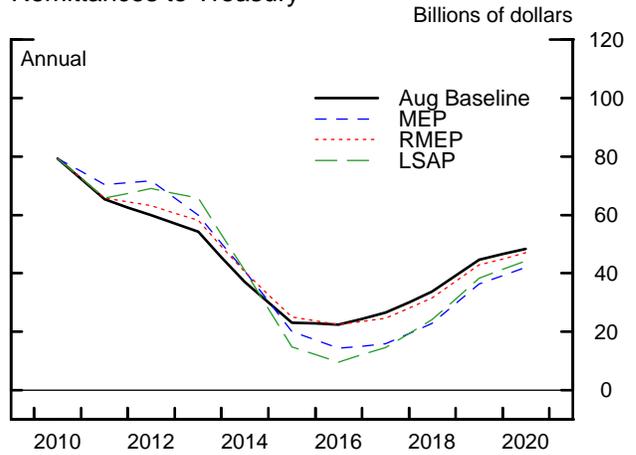
Interest Expense



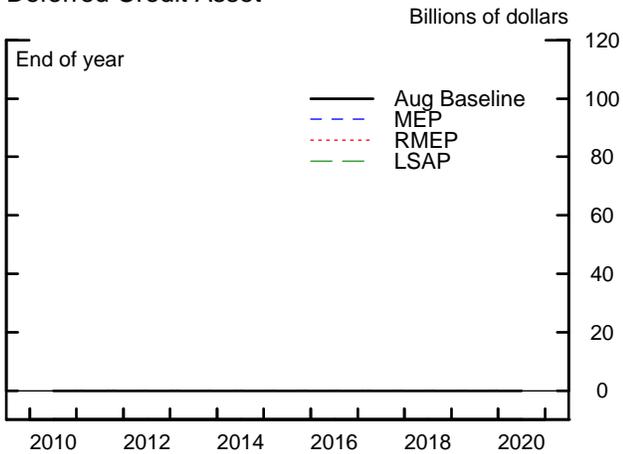
Realized Capital Losses



Remittances to Treasury



Deferred Credit Asset



Unrealized Gains/Losses

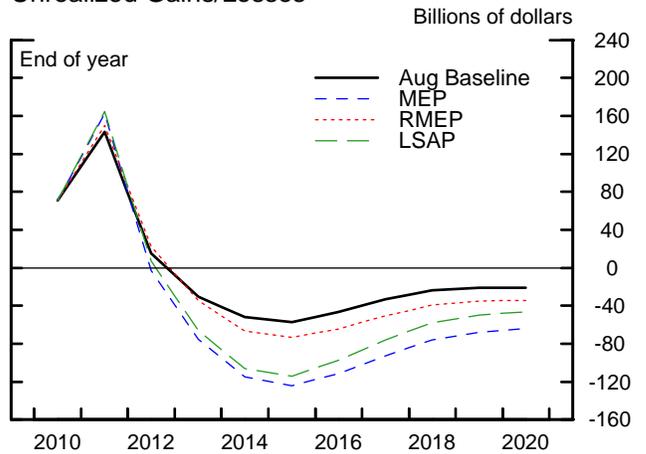
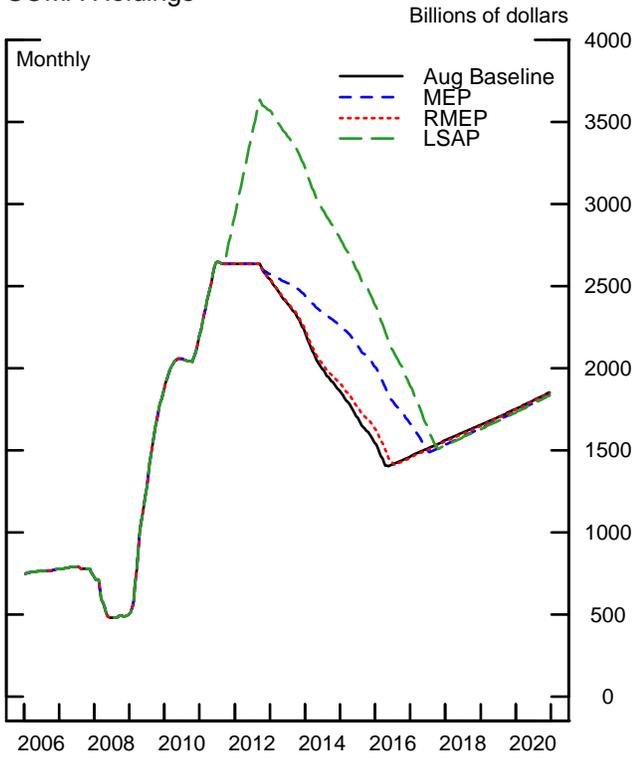
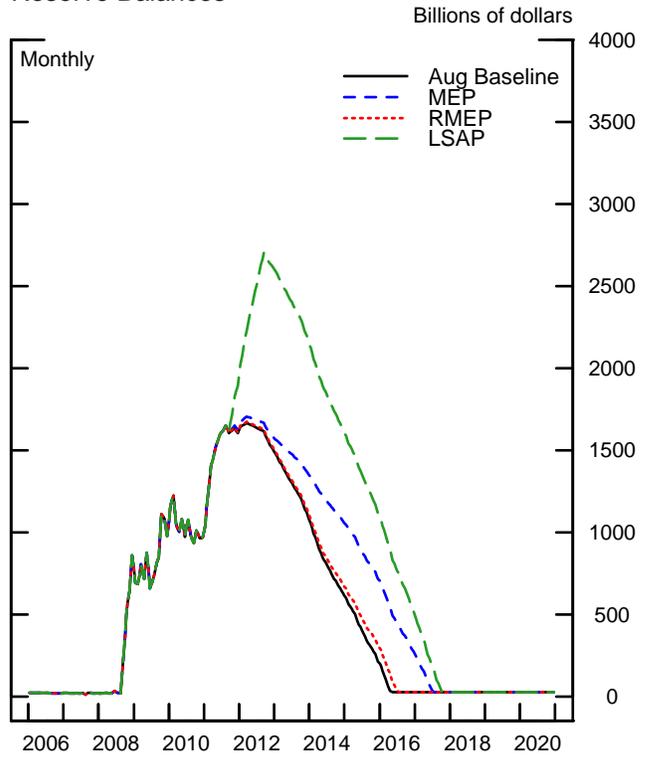


Exhibit 5 Balance Sheet Projections (Adverse Interest Rates)

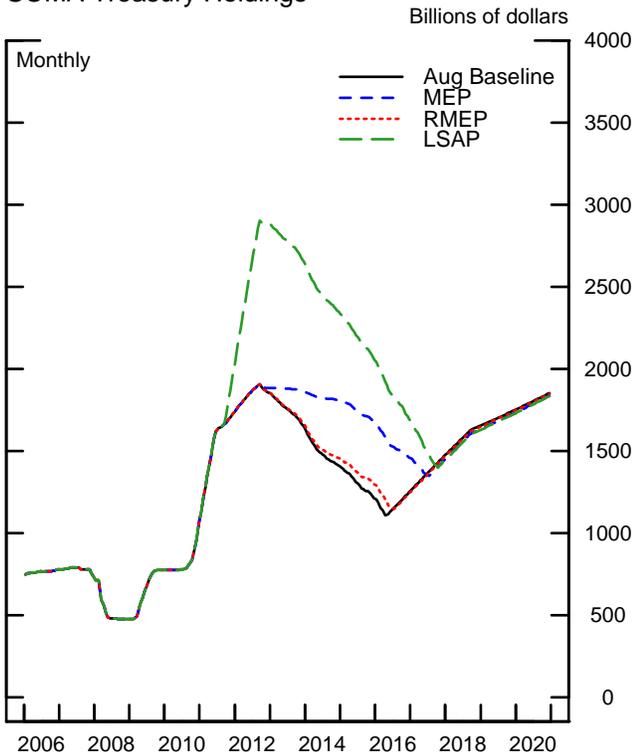
SOMA Holdings



Reserve Balances



SOMA Treasury Holdings



SOMA Agency MBS and Debt Holdings

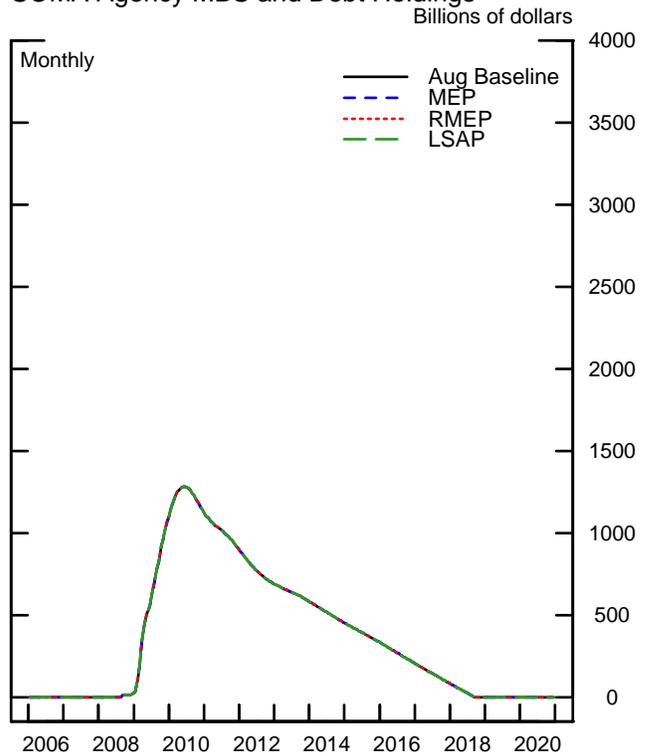
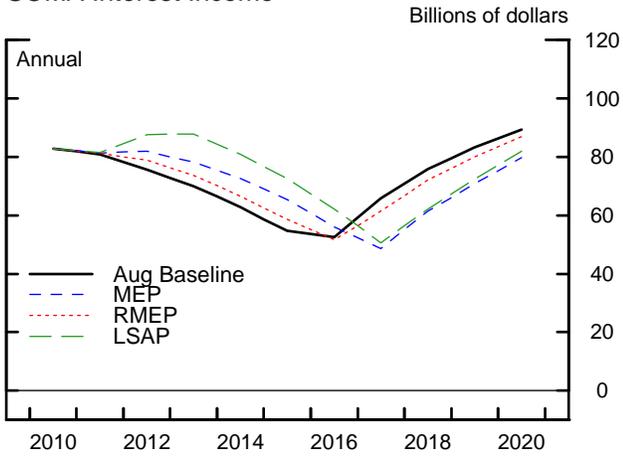
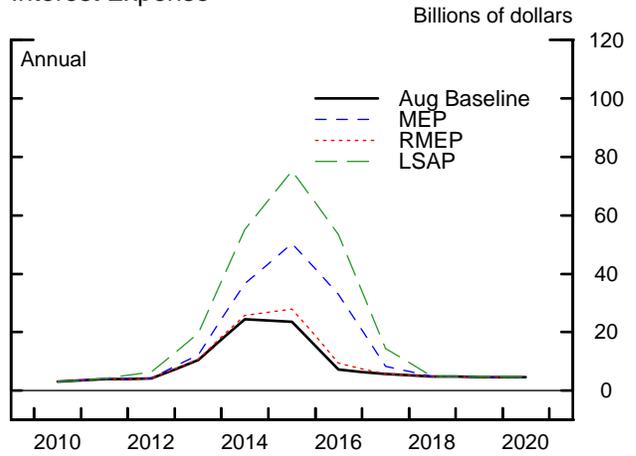


Exhibit 6 Income Projections
(Adverse Interest Rates)

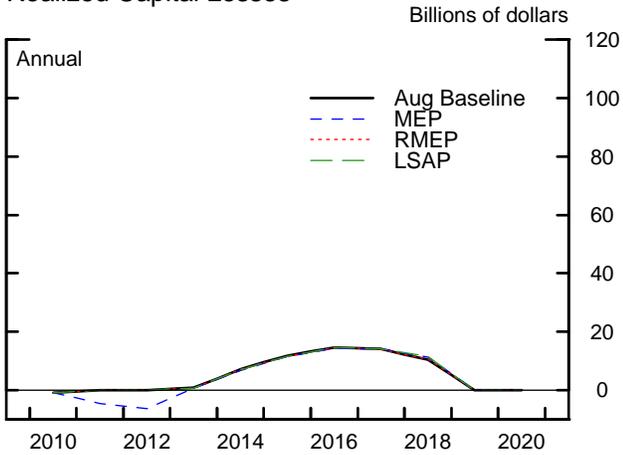
SOMA Interest Income



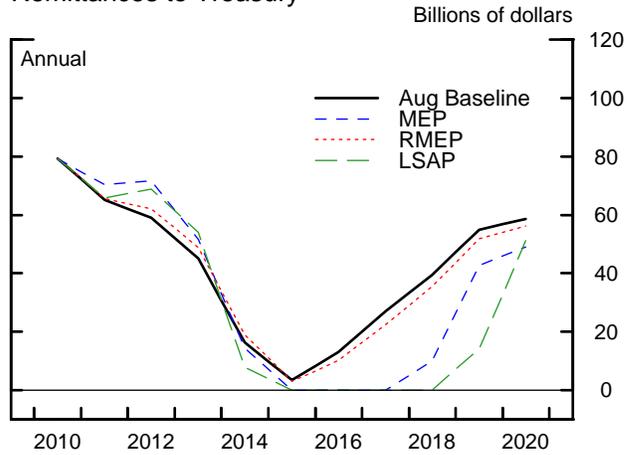
Interest Expense



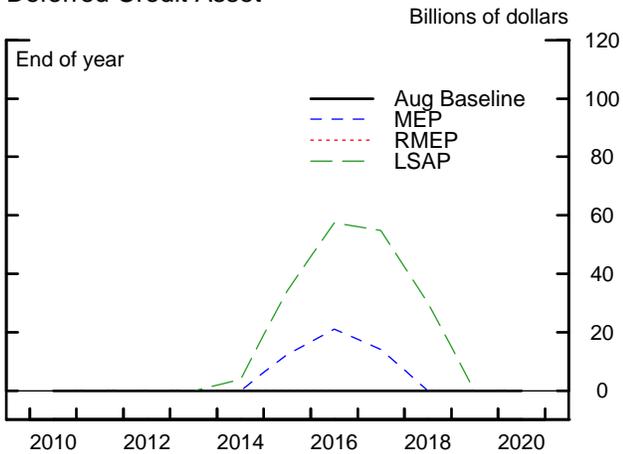
Realized Capital Losses



Remittances to Treasury



Deferred Credit Asset



Unrealized Gains/Losses

